WOODSIDE
NATURAL GAS

OCEANWAY
SECURE ENERGY

Australian Natural Gas for California • A project of Woodside Natural Gas Inc.

Project Presentation and Question/Answer Session

February 22, 2007
LNG Working Group
Hercules, CA

Disclaimer and Important Notice

WOODSIDE NATURAL GAS

This presentation contains forward looking statements that are subject to risk factors associated with oil and gas businesses. It is believed that the expectations reflected in these statements are reasonable but they may be affected by a variety of variables and changes in underlying assumptions which could cause actual results or trends to differ materially, including but not limited to: price fluctuations, actual demand, currency fluctuations, drilling and production results, reserve estimates, loss of market, industry competition, environmental risks, physical risks, legislative, fiscal and regulatory developments, economic and financial market conditions in various countries and regions, political risks, project delay or advancement, approvals and cost estimates.

References to “Woodside” may be references to Woodside Petroleum Ltd. or its applicable subsidiaries.

Objective and Agenda

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Objective:

- Provide an OceanWay Secure Energy Project update to LNG Working Group

Agenda:

- Welcome, introduction
- Project Objectives and Context
- RLNGC, STS, SPMs, Metocean, Safety and Security
- System Design, Vaporization, & Air Emissions
- Pipelines, Beach Crossing, Onshore Facilities & Tie-ins
- Wrap-up

Project Objectives and Context

Project Objectives (1)

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- Provide an economically viable project.
- Provide a market outlet on the West Coast of the United States for Woodside's natural gas reserves.
- Locate the single point mooring (SPM) buoys far enough offshore to provide a safe separation from land and have minimal visual impact on onshore observers.
- Locate the DWP to minimize the health, safety, environmental and social impacts.
- Select the natural gas pipeline onshore tie-in point/s to minimize the cumulative impact and the need for upgrades to the existing natural gas distribution infrastructure.
- Utilize an LNG vaporization system on the Regasification LNG Carriers (RLNGC) that minimizes air emissions and avoids using sea water.
- Be the best of competing proposals for supplying natural gas from a California perspective.
- Minimize safety concerns and terrorist exposures.
- Consider a list of options that are credible and sufficiently wide to capture the best project possible.

Project Objectives (2)

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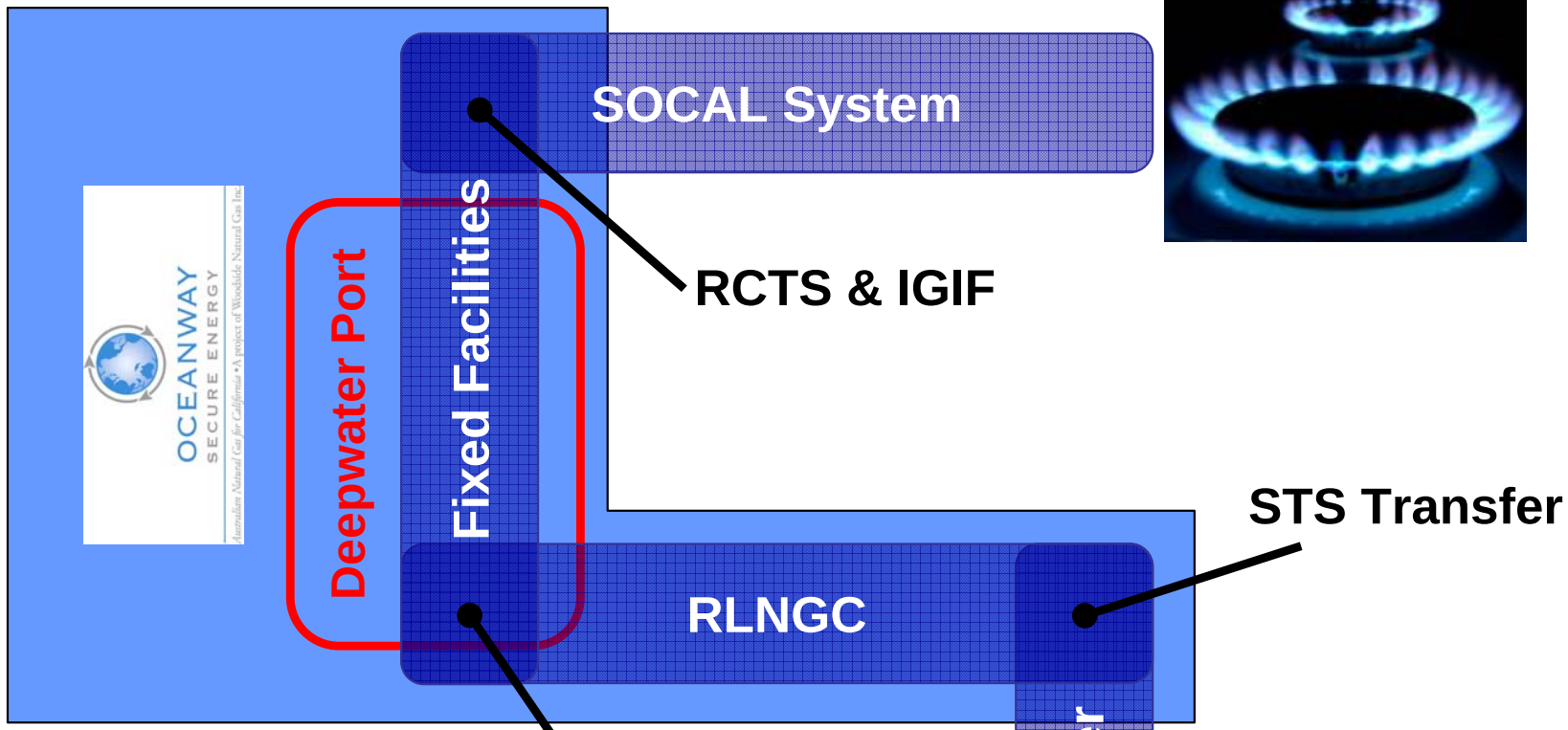
- Present clear, credible justifications for the selection of the proposed project options and the rejection of the other options.
- Minimize the life cycle cost of the DWP and gas delivery facilities.
- Maximize the DWP capacity to deliver natural gas to the gas grid.
- Provide an acceptable, reliable supply of gas to consumers.
- Operate the DWP and associated gas delivery facilities for 40 years.
- Provide the RLNGCs with the capability of receiving LNG Carriers (LNGCs) with storage capacities from 138,000 m^3 to 216,000 m^3.
- Comply with Woodside's health, safety and environmental policies, procedures and standards and be acceptable to the U.S. regulatory agencies.
- Supply gas meeting SCG's pressure, temperature and gas quality specifications at the Receiving and Custody Transfer Station (RCTS).
- Utilize the best available proven technology.


OCEANWAY
SECURE ENERGY
Deepwater Port
Fixed Facilities
SOCAL System
RCTS & IGIF
RLNGC
SPMs
STS Transfer
LNG Carrier
LNG Production
LNG Loading

RLNGC, STS, SPMs, Metocean, Safety and Security

RLNGC Operating Modes

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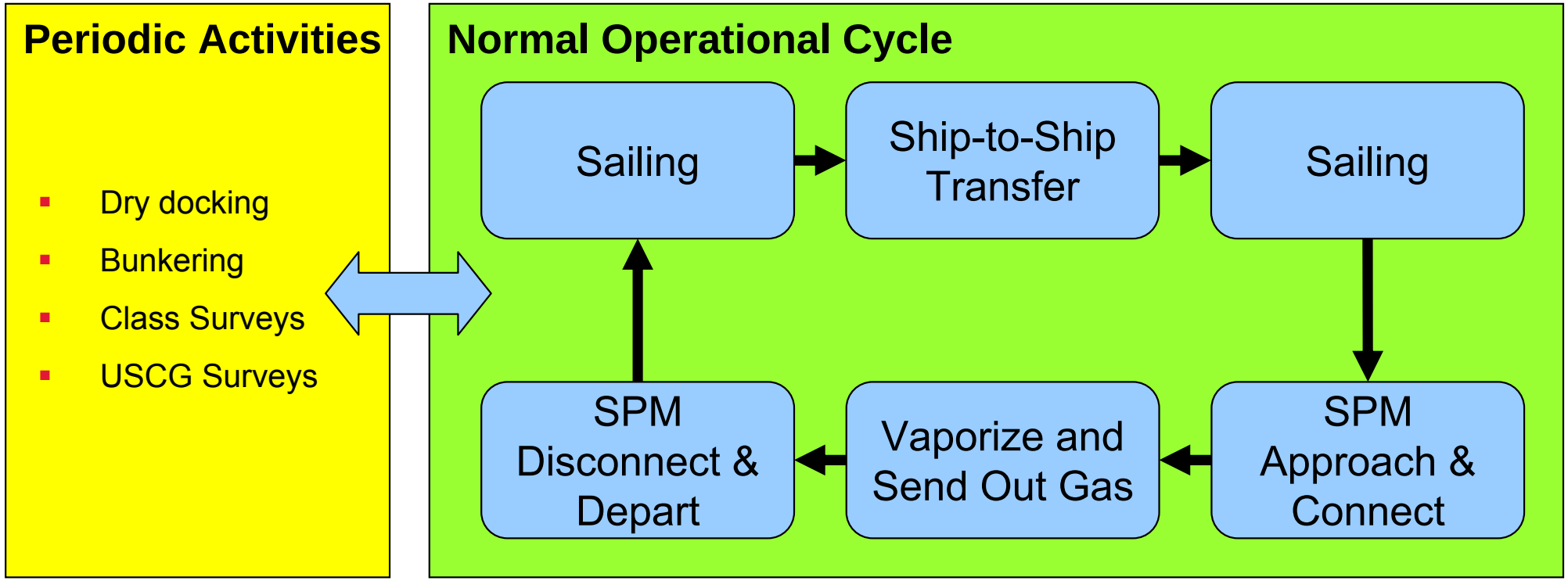

RLNGC Specifications (1)

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Objective: Enhance a conventional LNGC design to include additional functional requirements

- Class notation:
  - + 1A1 TANKER FOR LNG E0 GAS FUELLED BIS PLUS-2 TMON F-AMC NAUT-AW CLEAN NAUTICUS (NEWBUILDING) STL REGAS COAT
- Helideck
- 40 year fatigue life
- Propulsion System:
  - Dual Fuel Diesel Electric (DFDE) power generation with SCRs:
    - Common power for regas and propulsion Twin screw, fixed pitch propellers
    - Max speed achievable for given installed power
  - Twin screw, twin rudders with thrusters
  - Manoeuvrability requirements:
    - Able to connect/disconnect to the buoy without tug assistance.
    - Heading control (minimise rolling) while on the buoy
    - Still controllable with single point of failure (STS, connection to buoy, etc.)
    - Capable of controlling mooring during STS operation
    - Able to provide heading control of both RLNGC + LNGC during cargo transfer

RLNGC Specifications (2)

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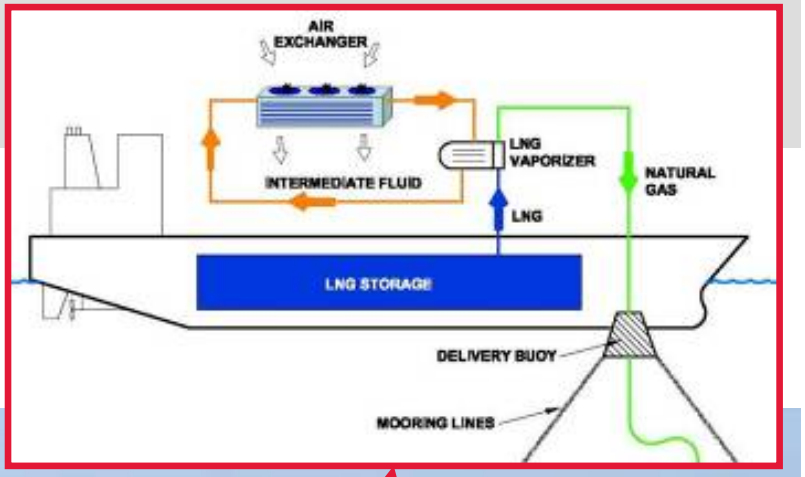
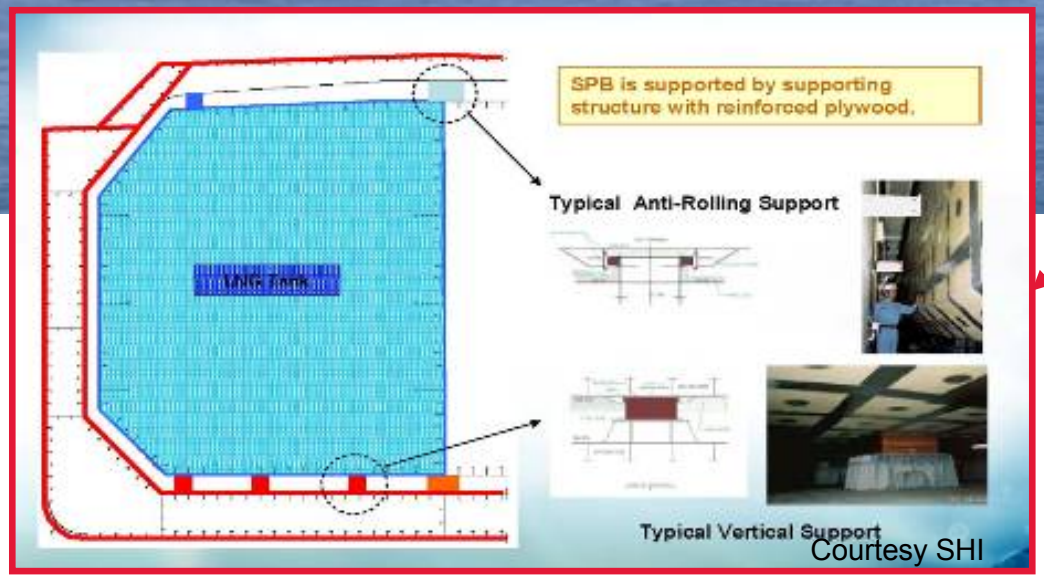
- STS Transfer:
  - Capable of receiving LNG at sea from 138k to 216k LNGCs:
  - Fendering equipment provided by Lightering Support Vessel (LSV), or davit mounted fenders on RLNGC
  - LNG transfer rates: 10,000m^3/hr (nominal) and 12,000m^3/hr (max.)
  - Man-riding crane for personnel transfer
- LNG Containment:
  - 220,000m^3 LNG storage (gross)
  - Sloshing tolerant tanks (SPB as basis) to allow:
    - RLNG to regas in 100-year return conditions
    - Transit DWP ←→ STS transfer location with unrestricted filling levels
    - Allow cargo transfer at sea
- Regasification equipment
- Normal complement around 40 persons (max 50 persons)
- SPM and offloading requirements:
  - Operate in 100-year return conditions
  - Connect in 4.5m H_s
- Fuel oil stored in double hull tanks





Courtesy SHI

Courtesy APL

RLNGC Water Usage at DWP

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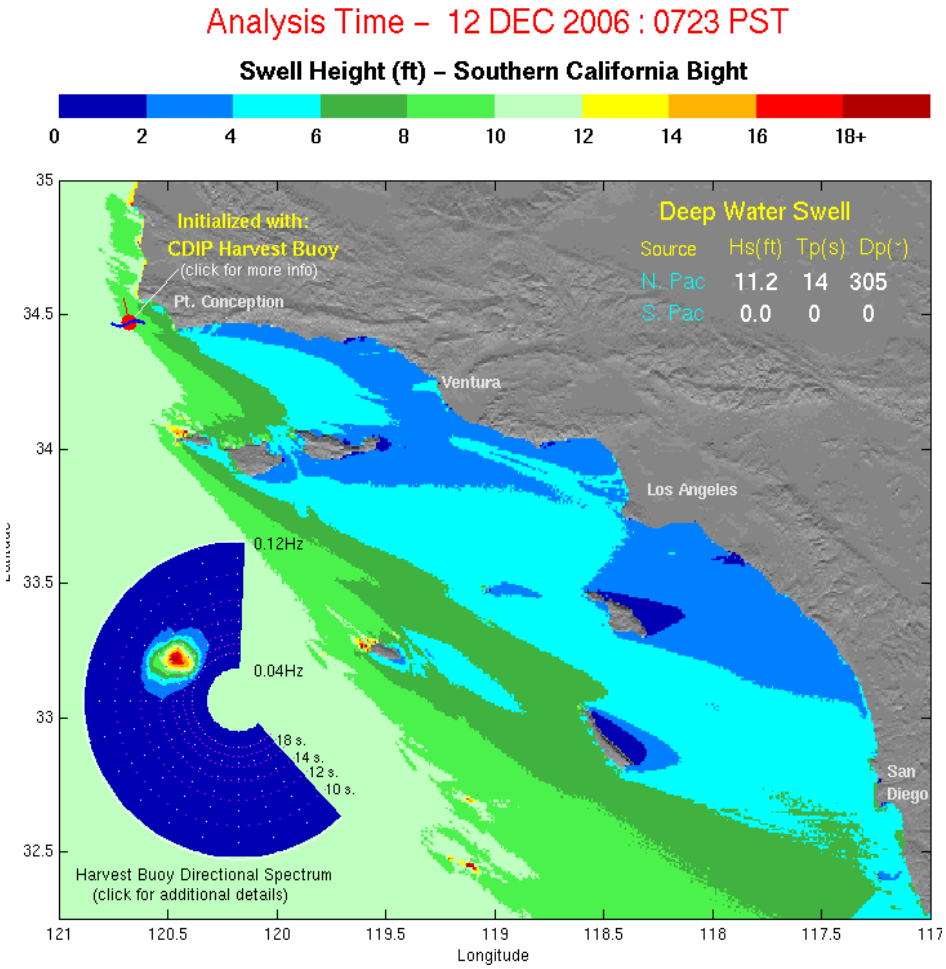
- No water discharge while connected to DWP:
  - Condensed water collected and directed to ballast tanks
  - Closed loop system for engine cooling
  - Treated black and grey water directed to holding tanks
  - Rain water directed to holding tanks (storm events rain will run overboard)
- Water intake
  - Ballast (minimise or eliminate)
  - Freshwater maker:
    - Max rate: 9,500 gallons/day (35m^3/day)
  - Seachests designed to minimise impact
    - 25mm diameter
    - ≤ 0.5'/second flow rate

Metocean Data – DWP Site



100 year site conditions

- Swell: Hs = 9.0m, Tp = 17s
- Wind (10min @ 10m): 21.2m/s
- Surface current: 0.9m/s

Typical conditions near site:

- 94% of year Hs < 2.0m
- 99.8% of year Hs < 4.0m
- 93% of year winds < 8m/s
- 99% of year current < 0.5m/s

STS Transfer Locations

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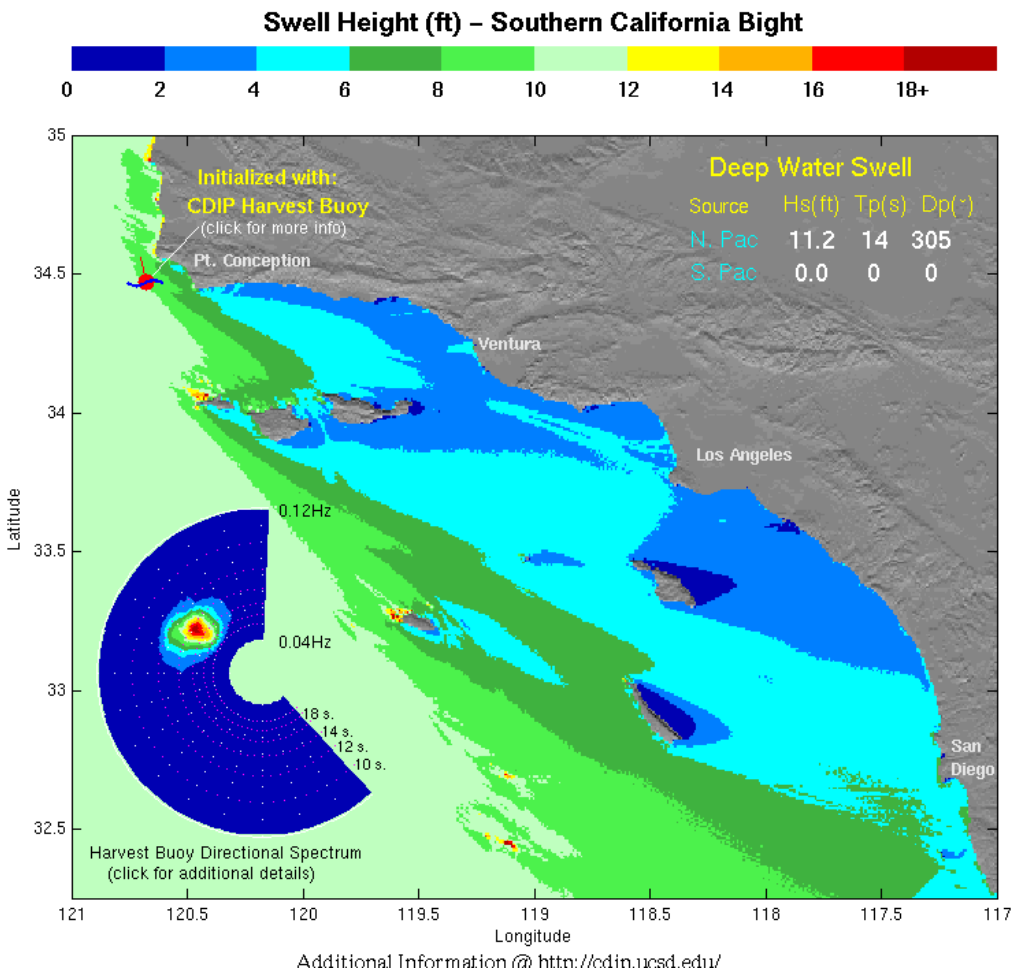

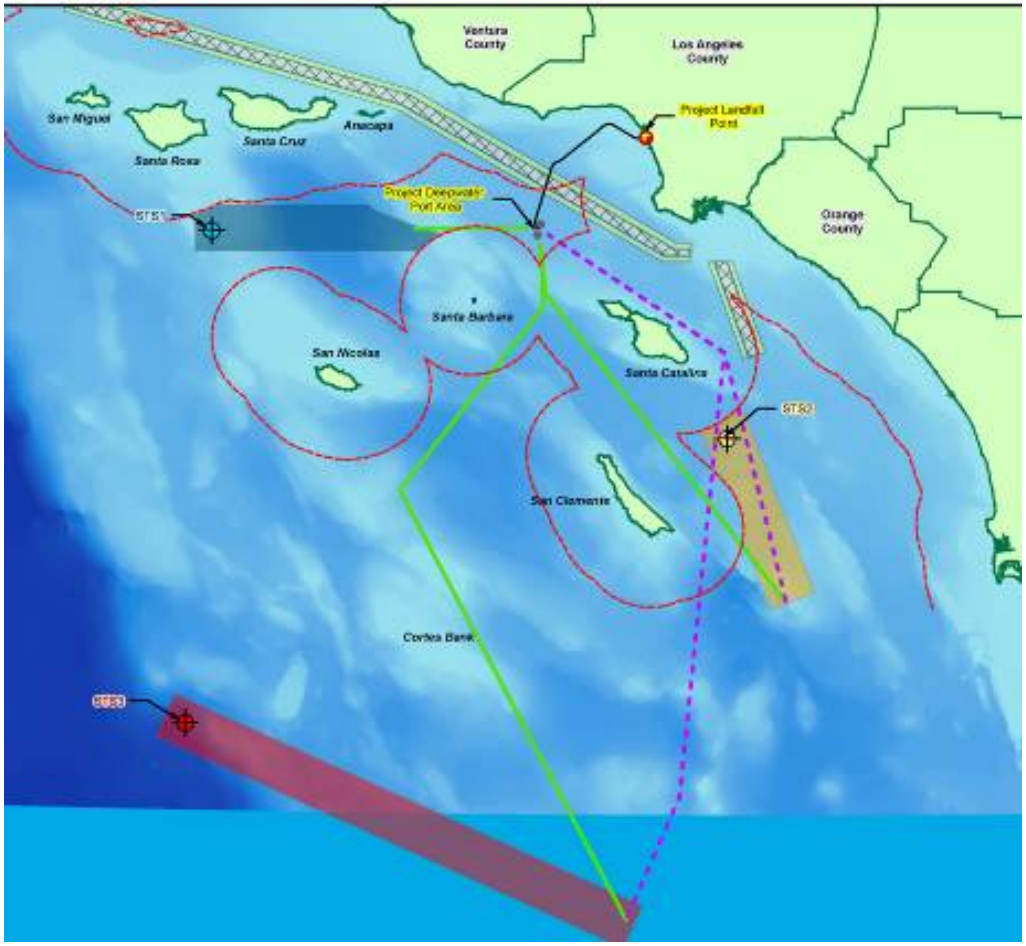

Mooring System

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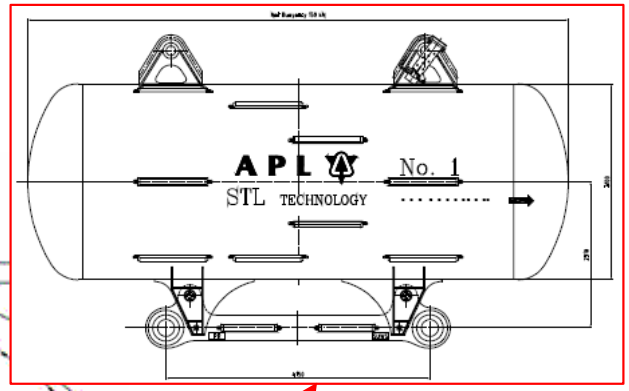
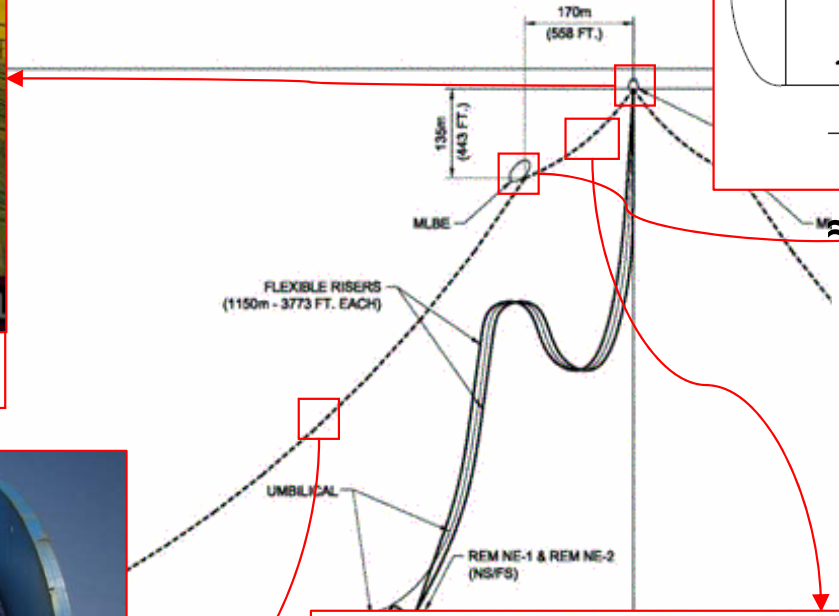
≈ Ø30’ x 30’



≈ 30’ x 15’



≈ Ø7.3”

epth

on in 10

≈ 33” x 18.5” x Ø5.5” / link

Safety and Security

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Safety:

- Designed using a Safety Case methodology / Formal Safety Assessment
  - HAZID completed and MAEs identified
- RLNGC:
  - Designed, built and operated according to Class and IMO requirements
- DWP:
  - Designed, built and operated according to Class and USCG requirements.
- Ship collision risks for DWP and STS operations are very low
- LNG dispersion analysis:
  - 2 tank rupture will not impact other RLNGC or TSS at 5% LFL

Security:

- Security and Vulnerability Assessment (SVA) conducted using CARVER method
- Conclusion:
  - RLNGC and DWP are not considered overly attractive targets
- Preliminary Facility and Ship Security Plans developed.

SPM Safety Zones

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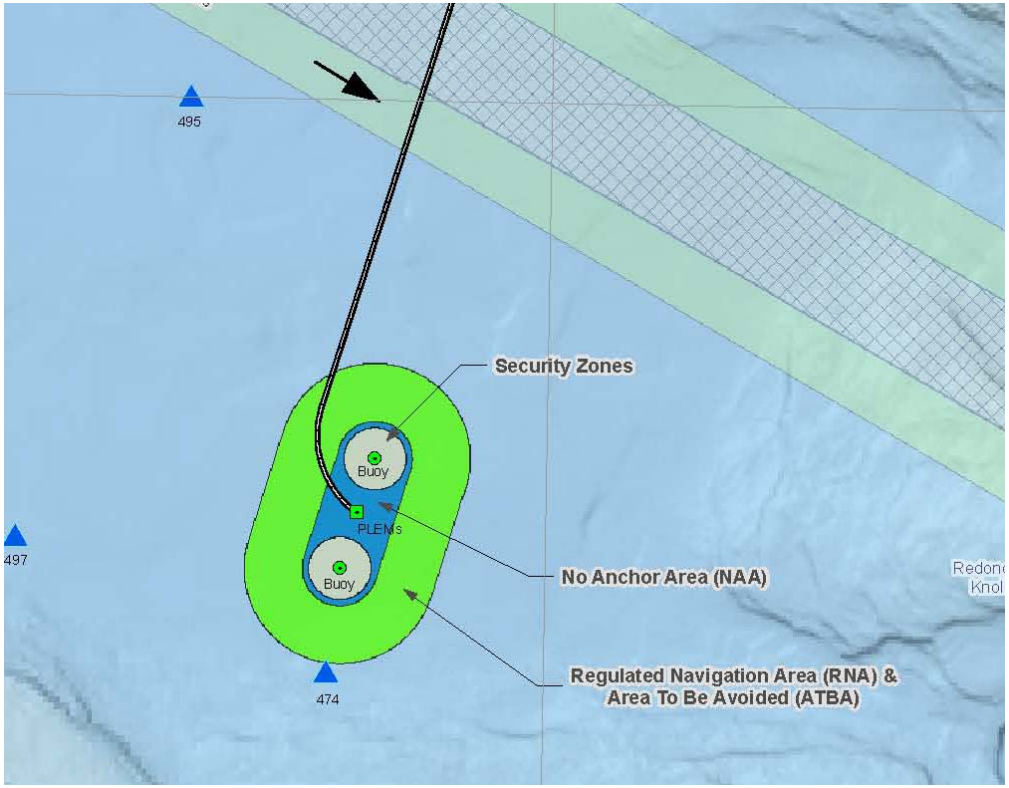

Regulated Navigation Area (RNA) / Area to be Avoided (ATBA):

- 1.5NM radius
- Enclosed area ≈ 11,500 acres

No Anchor Area (NAA):

- Equivalent to anchor radius ≈ 0.6NM
- Total enclosed area ≈ 2,950 acres
- 3,000ft water and so not applicable

Safety/Security Zone:

- Vessel length + 500 yards + 10% mooring offset ≈ 0.54NM
- Total enclosed area ≈ 1550 acres

- No permanent security enforcement vessel required.
- RLNGC can monitor themselves (ISPS Code) and adjacent SPM
- DWP within Point Fermin radar range

System Design, Vaporization, & Air Emissions

Gas Delivery System Overview

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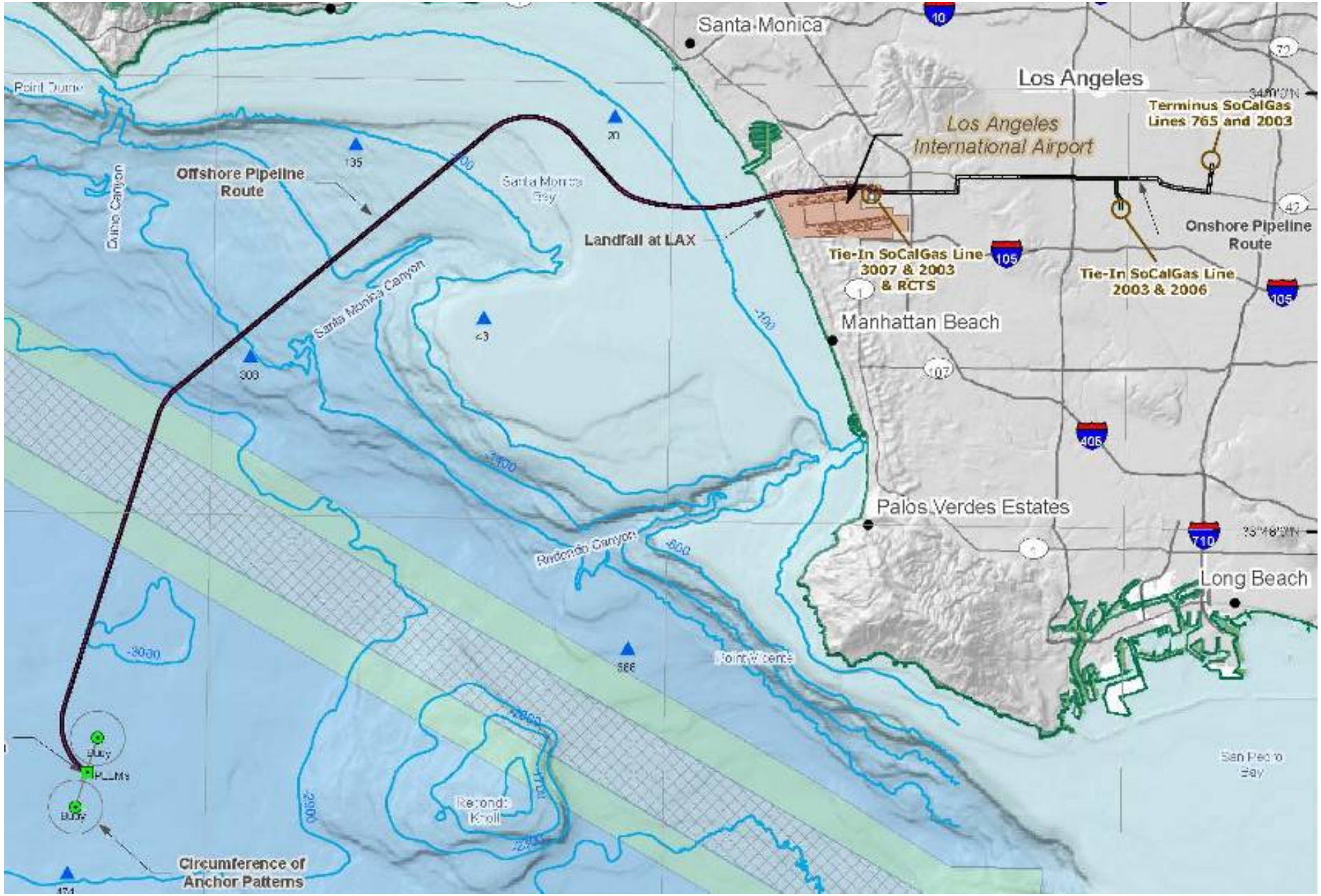

Gas Delivery System Components

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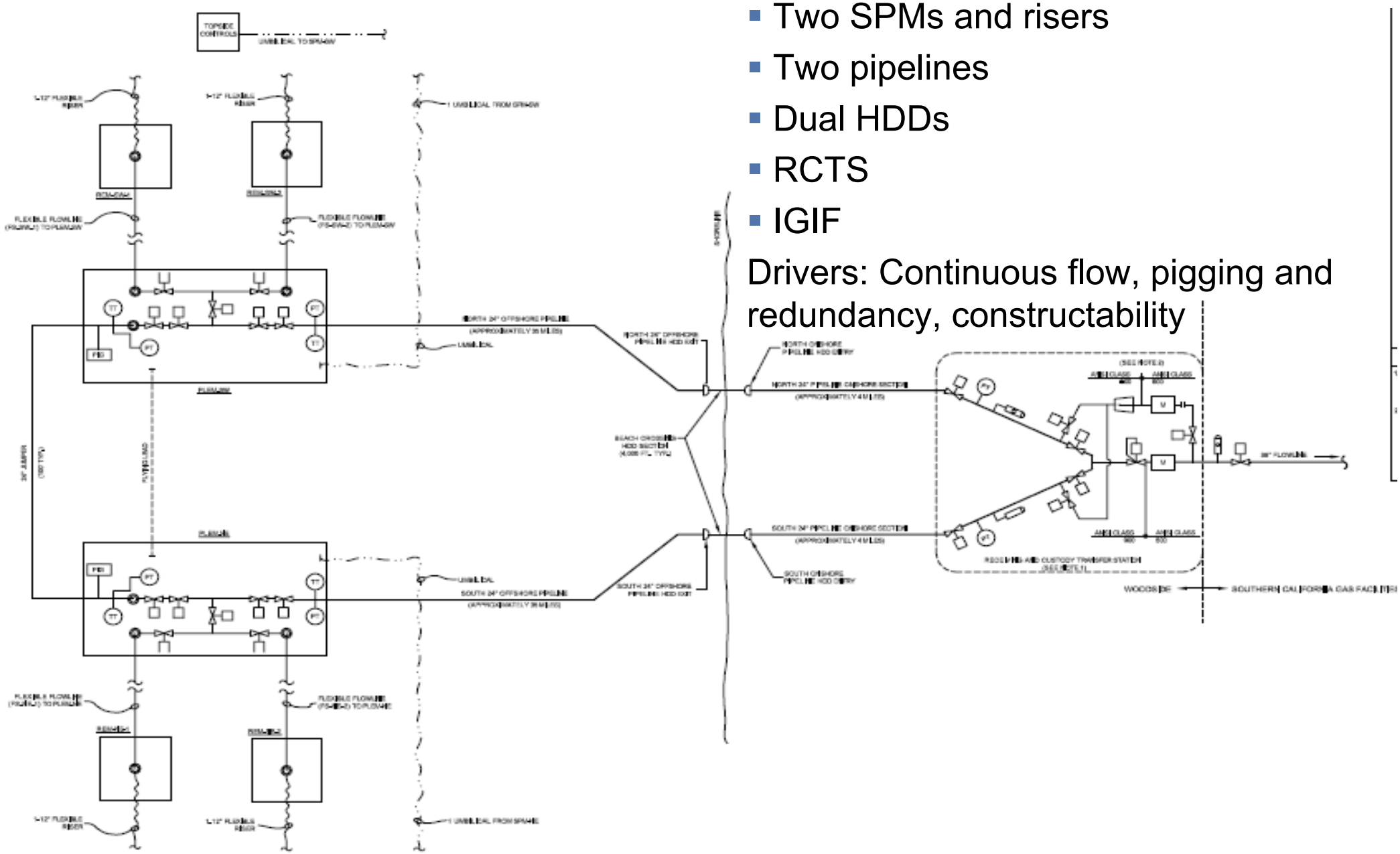

- Two SPMs and risers
- Two pipelines
- Dual HDDs
- RCTS
- IGIF

Drivers: Continuous flow, pigging and redundancy, constructability

SOURCE: J.P. KENNY

System Design

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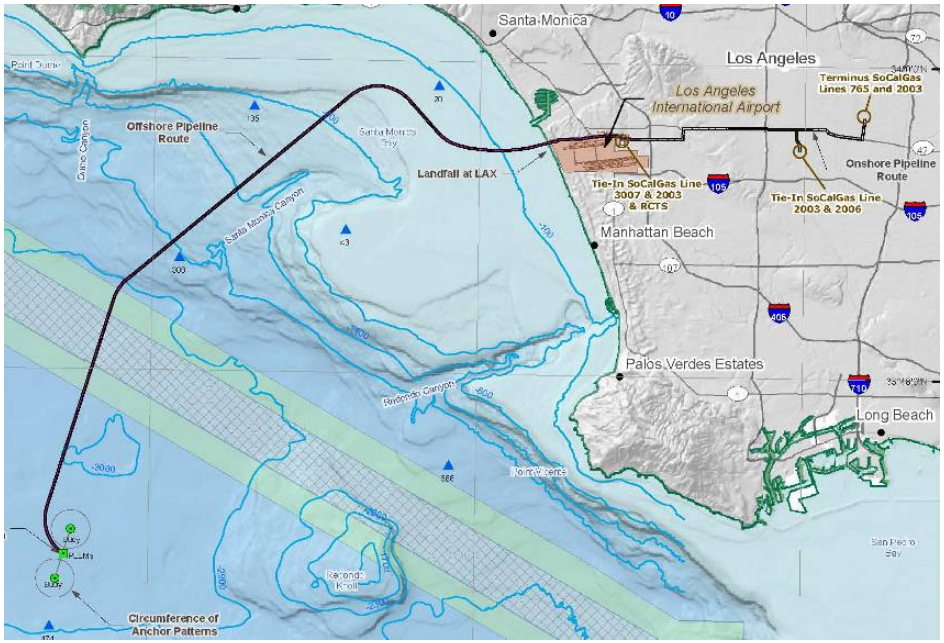
Basis of Design

System/Component Capacity

- RLNGC
  - 1.1 bcfd each; peak
  - Normal operations
    - 100 mmscfd to 1.1 bcfd
- Gas Delivery System
  - Peak capacity – 1.6 bcfd
- Staged development
  - 0.4 bcfd annualized (stage 1)
  - 0.9 bcfd annualized (final stage)
  - Intermediate stages (uncertain)



Vaporization (Process)

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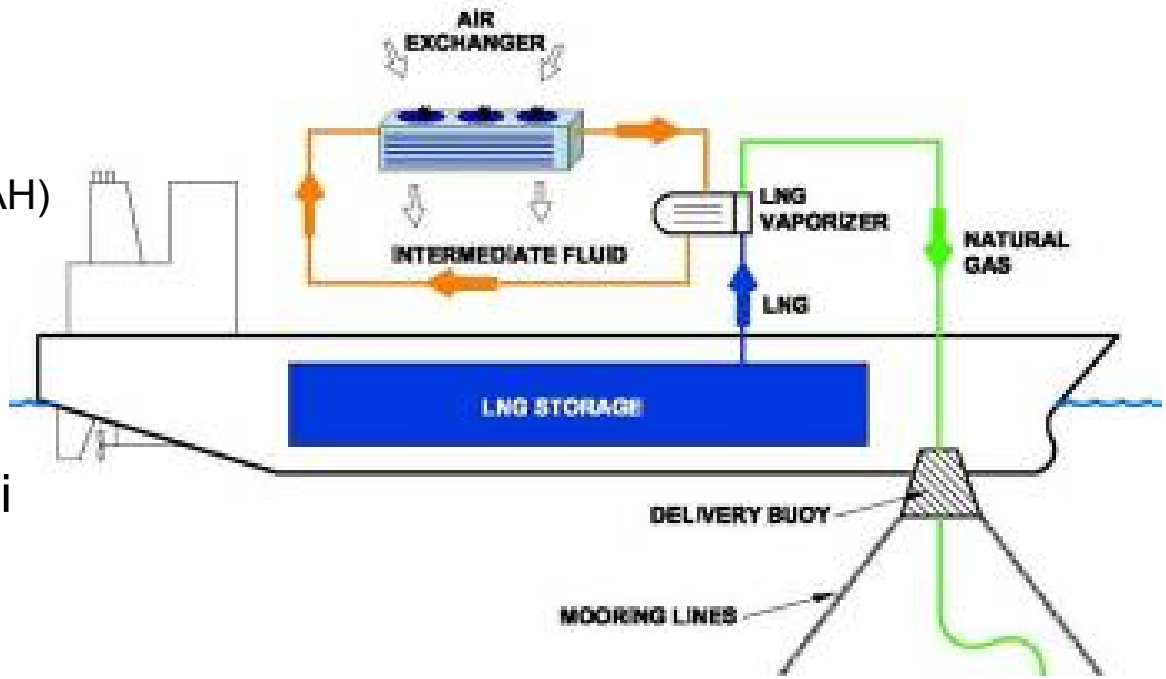
- Regasification
  - Intermediate Fluid Vaporiser
    - Forced Draft Air Heaters (IFV-FDAH)
  - Send out capacity:
    - Peak rate: 1.1bcfd
    - Nominal rate: 0.1 – 1.1
    - Pressure:124bar / 1800 psi
  - Metering
  - Odorization
  - Condensed water collected and directed to ballast tanks (around 125m^3/hr)
  - Intermediate fluid drained to storage tanks in hull



Vaporization - Power Demand/Supply Mix

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- Dual Fuel Diesel Electric (DFDE) power generation:
  - Common power for regas and propulsion
  - Fuel: 99.4% natural gas + 0.6% MDO (15ppm sulphur content)
  - 3 x 12V50DF + 1 x 6L50DF (~40 MW)
  - N + 1 philosophy for regas mode
- Regasification Power Requirements:
  - Peak send out: 2 x 12V50DF ~ 22 MW
  - Connect and Disconnect: 1 x 6L50DF ~ 5.7 MW
  - Primary consumers
    - Pumps, Compressors, Fin fans
- Combined Heat and Power
  - Heat recovery from engines
  - Heat recovery from exhaust gas
  - Cold days (All engines in use)
    - approx. 5% of the year

Vaporization – Emission Control

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- Emissions control:
  - Selective Catalytic reducers (SCRs) or alternative that will reduce emissions (minimum):
    - 90% for NO_x
    - 70% for VOC
    - 70% for CO
    - 70% for PM_{10}
- BOG Management:
  - Normal BOG rate: 0.15% per day (average)
  - Excess BOG while connected is put into pipeline
  - Excess BOG while not connected is managed
  - GCU for emergency situations
- May need to de-pressurize pipelines through RLNGC
- Air Emissions Performance: one third of competing technologies.

Pipelines, Beach Crossing, Onshore Facilities & Tie-ins

Fixed Facilities

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- Flexible Risers and Umbilicals
- Pipeline End Manifolds
- Subsea Pipelines
- Onshore Pipelines
- Receiving & Custody Transfer Station
- Inert Gas Injection Facility

Overall System Diagram

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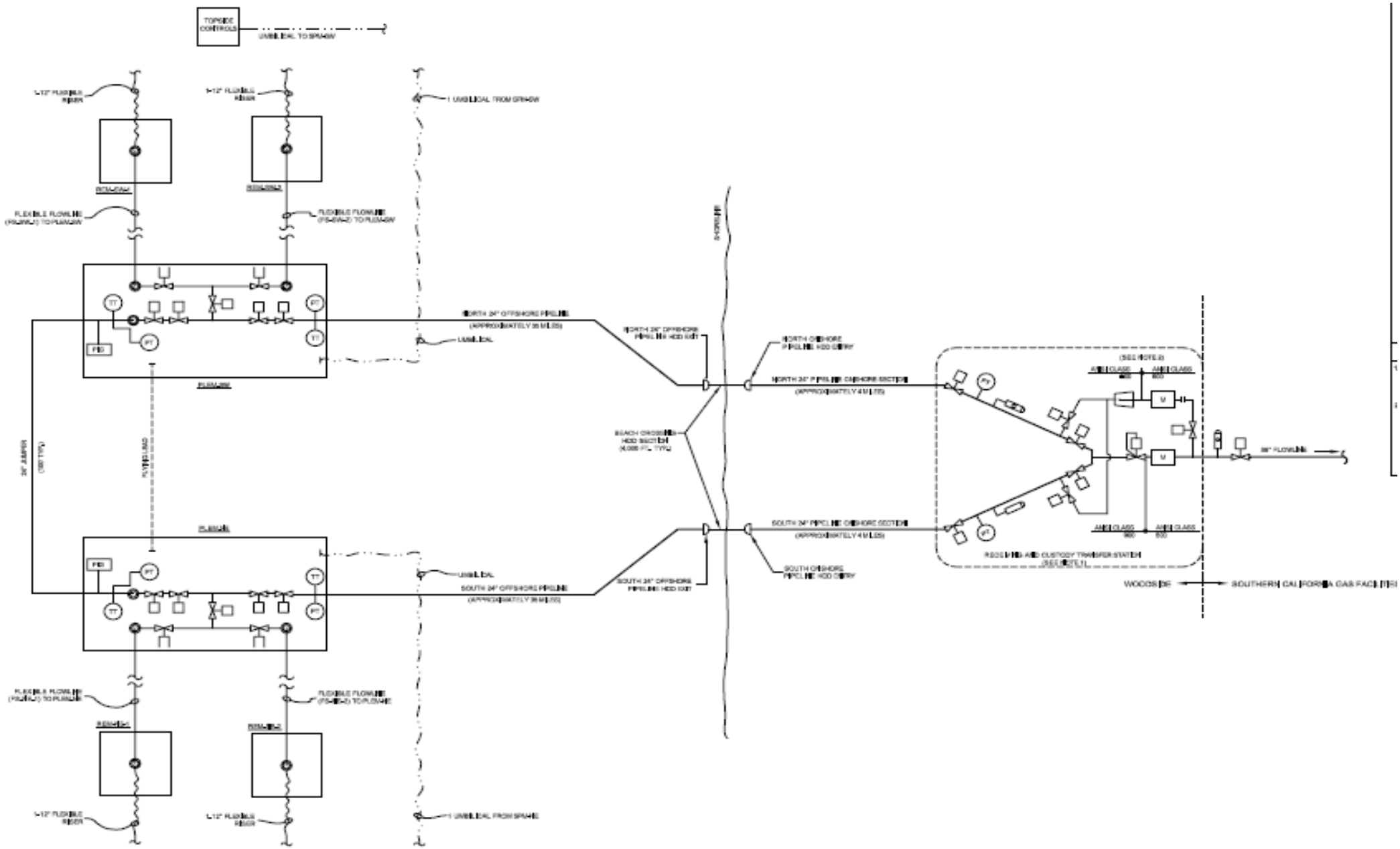

SOURCE:
J.P. KENNY

Risers and Umbilicals

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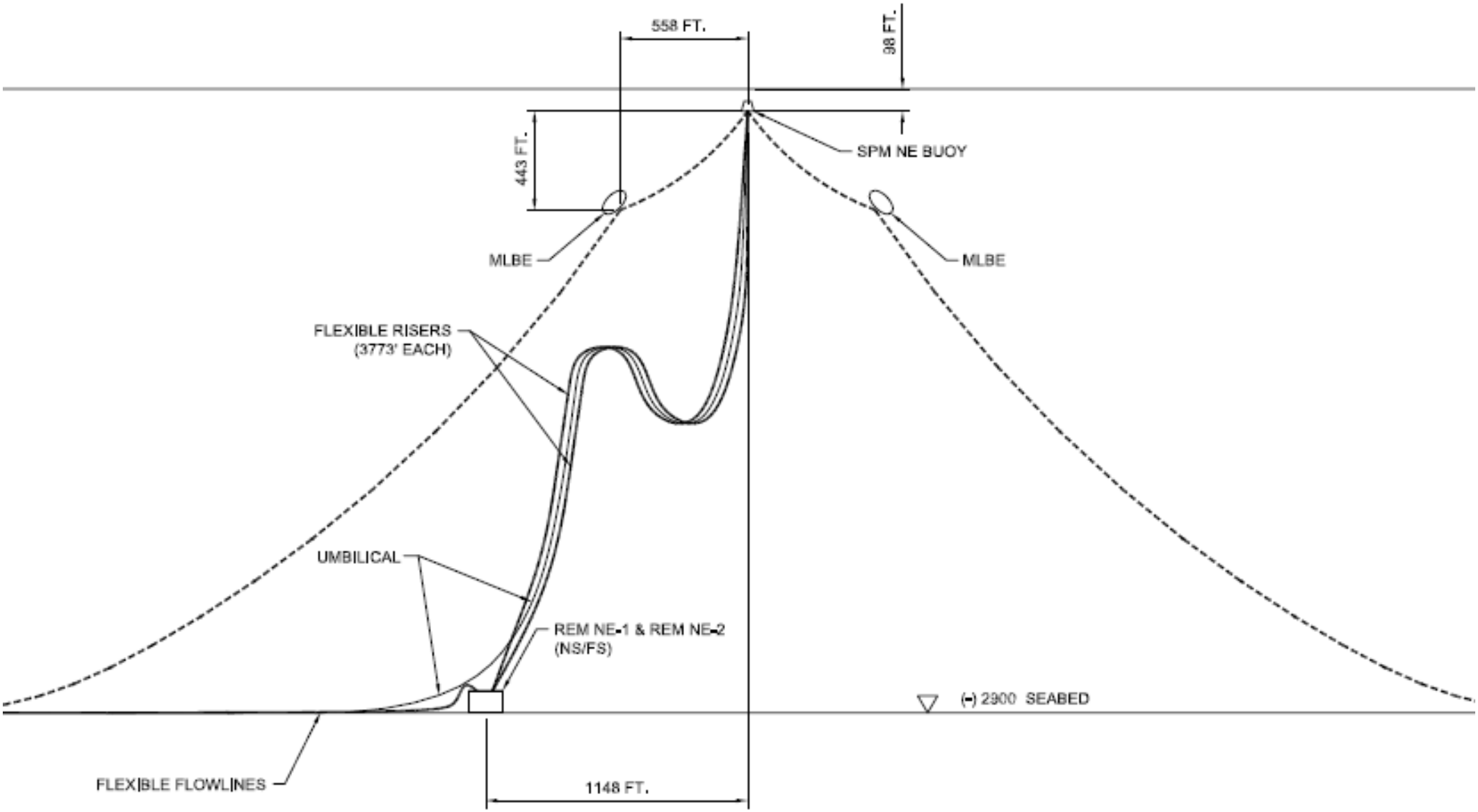

ELEVATION SPM BUOY NE

(ELEVATION SPM BUOY SW - SIMILAR OPPOSITE HAND)

PLEMs

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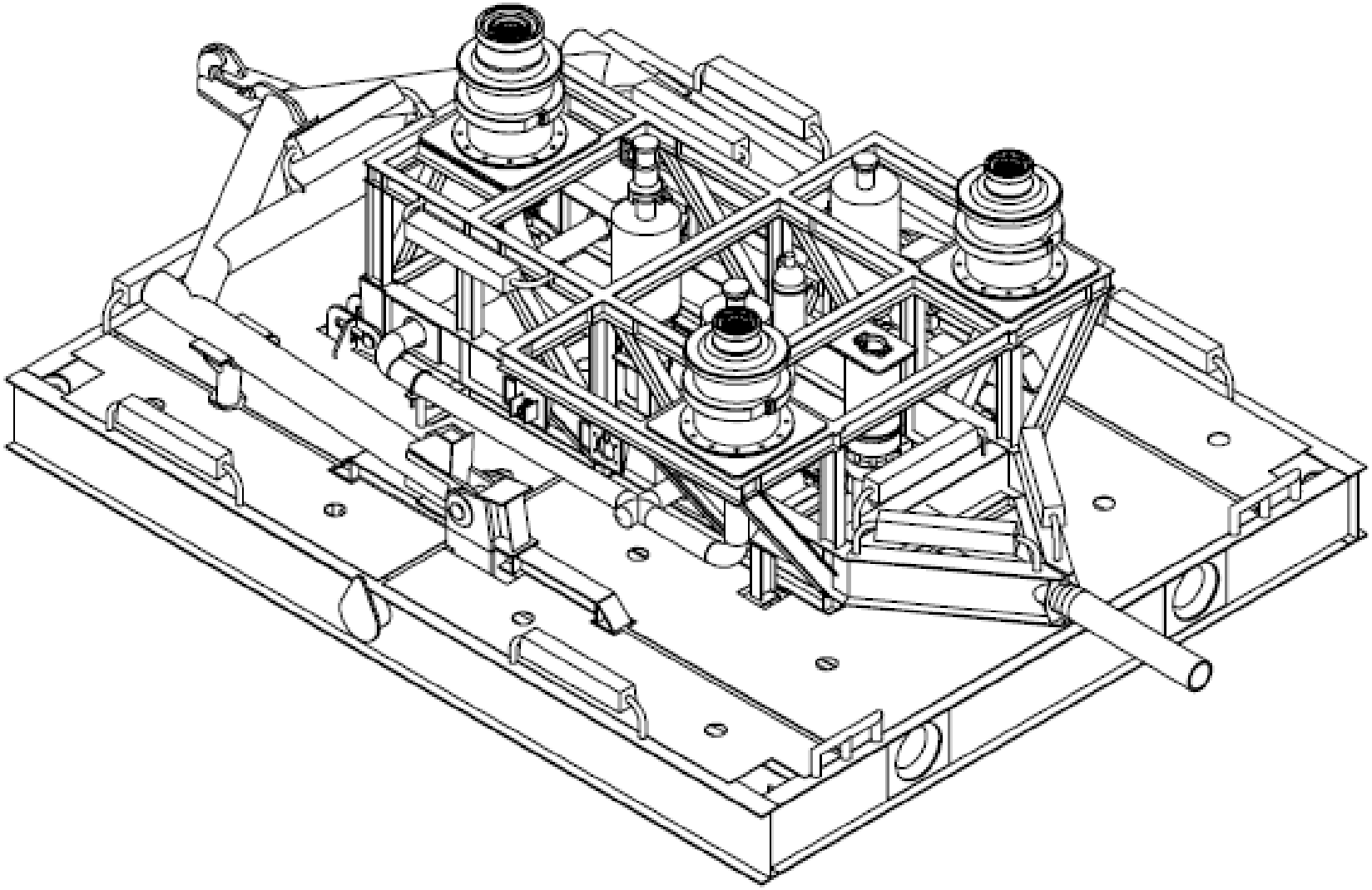

Jumper between PLEMs

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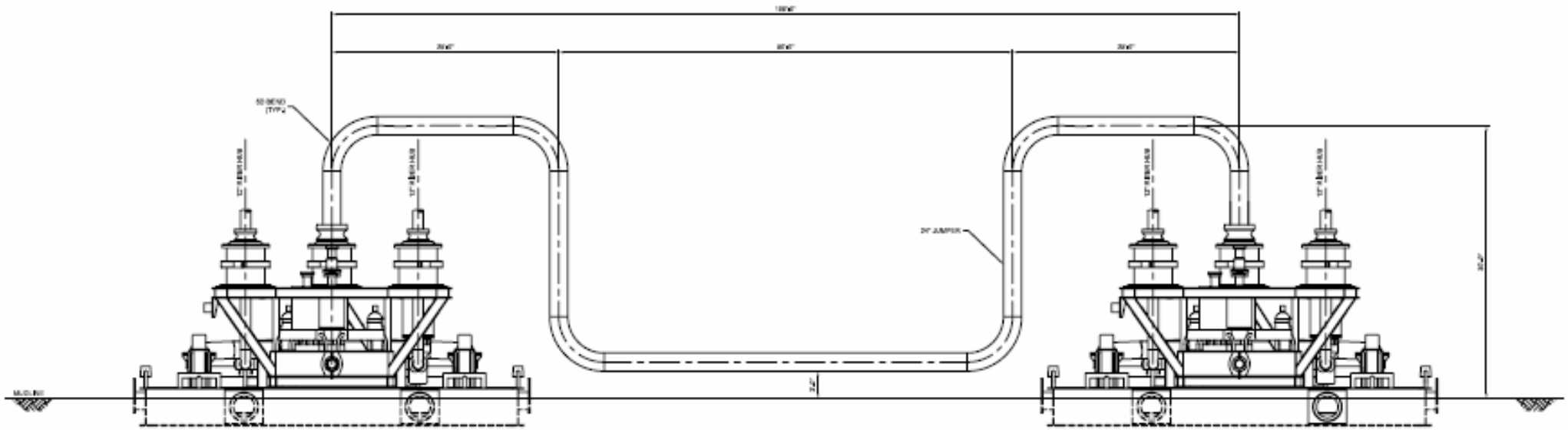

24" JUMPER CONFIGURATION

Subsea Pipelines

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- 2 x 24” pipelines
- 35-mile long x 200-foot wide ROW thru Federal waters and submerged lands of City of LA
- 100-foot separation between pipelines
- High strength carbon steel line pipe
- Regulations: 49 CFR 192
- Design Codes: ASME B31.8 and API RP 1111
- Corrosion coating
- Concrete weight coating
- Sacrificial bracelet anodes for CP

Subsea Pipeline Route

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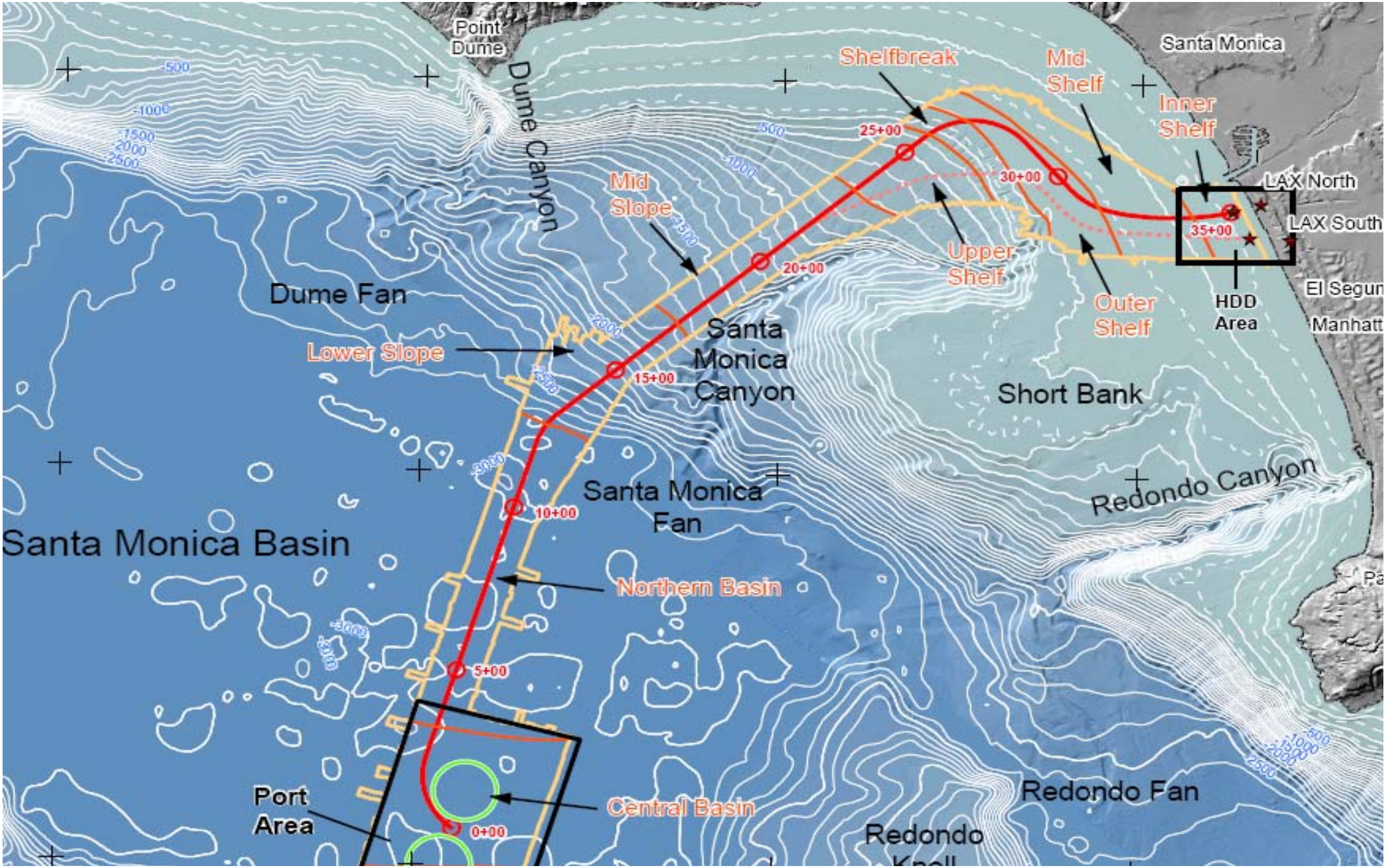

Hydrographic Surveys

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- Marine Geophysical Surveys:
  - Multibeam hydrographic survey,
  - Sidescan sonar survey,
  - Magnetometer survey of the Santa Monica Shelf, and
  - Seismic reflection (subbottom mapping) survey (along 490-foot (150-meter) trackline spacings) using:
    - A Chirp subbottom profiler and
    - A triple-plate, Boomer seismic source with multi-channel, digital GeoEel hydrophone array; and
- Marine Subsurface Exploration:
  - Geotechnical sampling with associated laboratory testing, including:
    - 75 Piston-core samples (to a maximum 10-foot penetration) in the deepwater Basin and on the Continental Slope, and
    - 16 Vibracore samples (to a maximum 10-foot penetration) on the Continental Shelf and Upper Continental Slope, and
  - 152 Cone Penetration Test (CPT) soundings, using the Seascout system, advanced to a maximum 26-foot penetration or refusal.

S-Lay Installation Method

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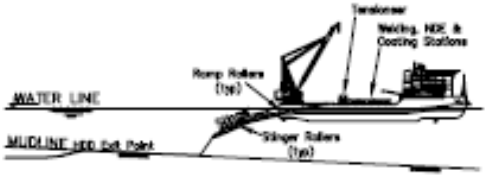
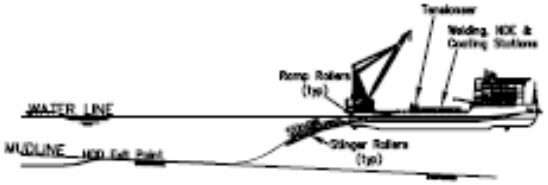
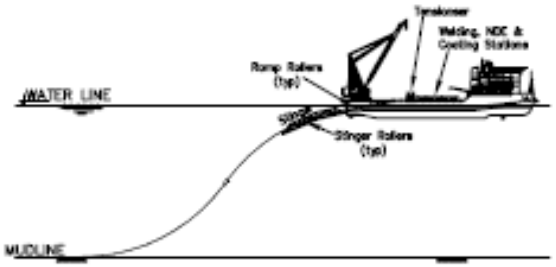


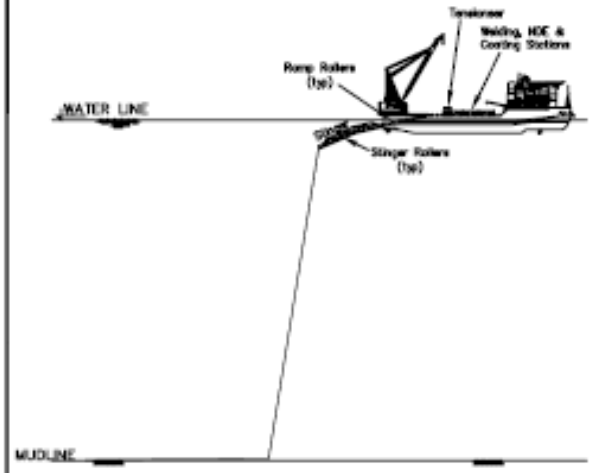
S-LAY PHASE 1
PICKUP HDD PIPELINE FOR TIE-IN TO OFFSHORE PIPELINE
Sketch # 85267-S01, 23/05/06



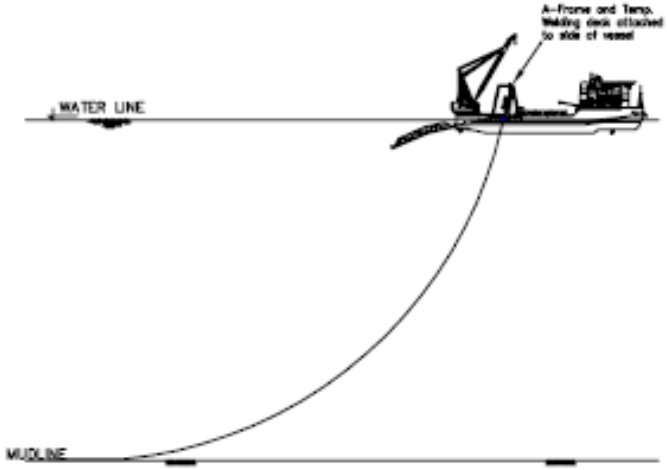
S-LAY PHASE 2
OFFSHORE PIPELINE IS WELDED TO THE HDD PIPELINE
AND START NORMAL PIPELAY
Sketch # 85267-S02, 23/05/06



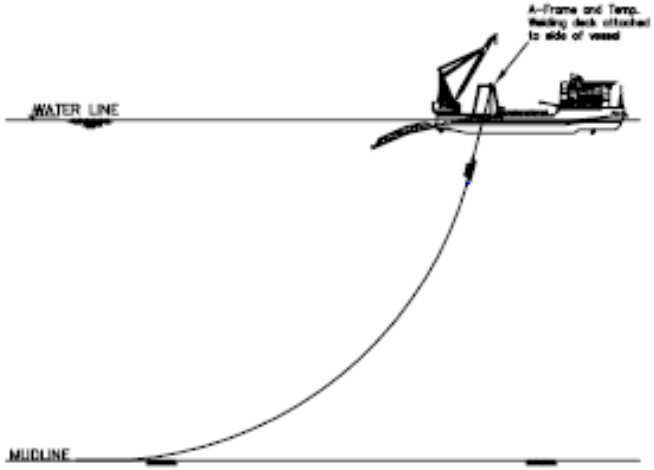
S-LAY PHASE 3
NORMAL PIPELAY FROM SHORE TO
DEEP WATER PLEM LOCATION
Sketch # 85267-S03, 23/05/06



S-LAY PHASE 4
LAY DOWN THE PIPELINE ON SEABED TEMPORARILY
Sketch # 85267-S04, 23/05/06



S-LAY PHASE 5
RECOVER PIPELINE TO SIDE OF VESSEL
AND WELD PLEM ONTO PIPELINE
Sketch # 85267-S05, 23/05/06



S-LAY PHASE 6
LOWERING PLEM TO SEABED FROM VESSEL SIDE
Sketch # 85267-S06, 23/05/06

Figure 3-3

S-LAY PIPELINE CONSTRUCTION

OceanWay Secure Energy

OCEANWAY ENSR AECOM

Beach Crossing
via Horizontal Directional Drill (HDD)

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- 48” x 390’ conductor
- 40” diameter HDD
- Forward thrust 30”casings
- Pull through of product pipelines
- 30-foot separation between pipelines

HDD

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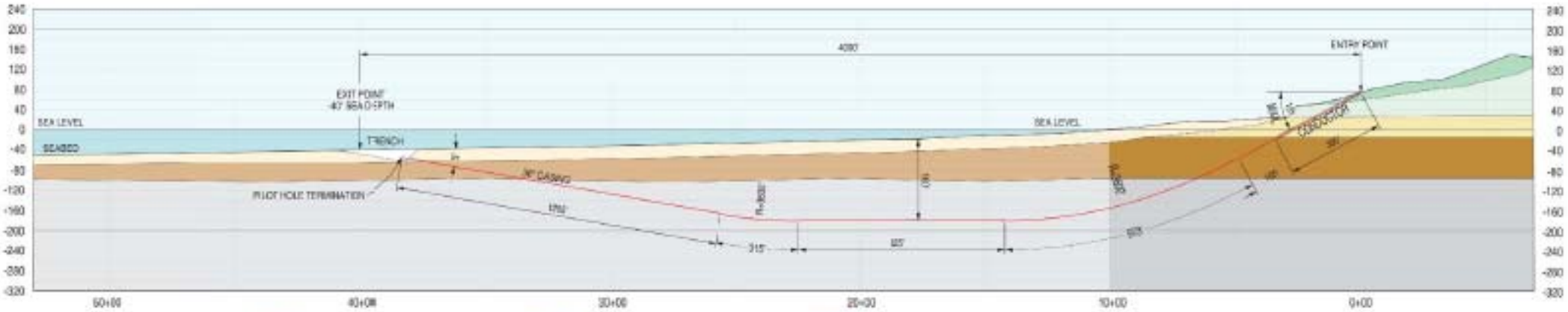

Onshore Geotechnical Investigation

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HDD Installation Sequence

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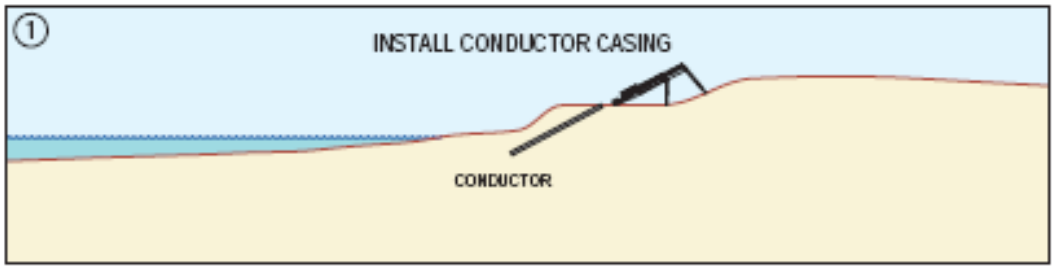
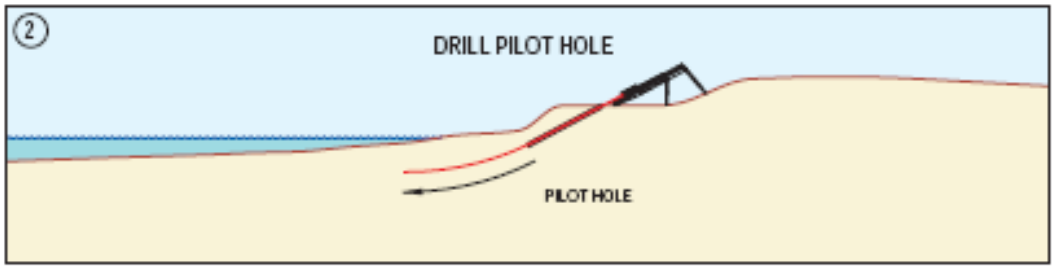
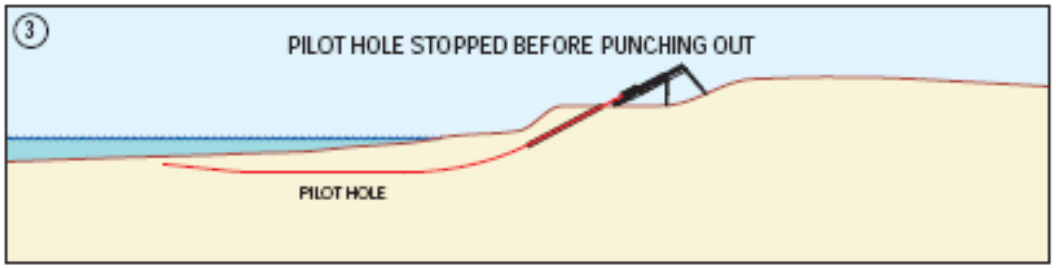
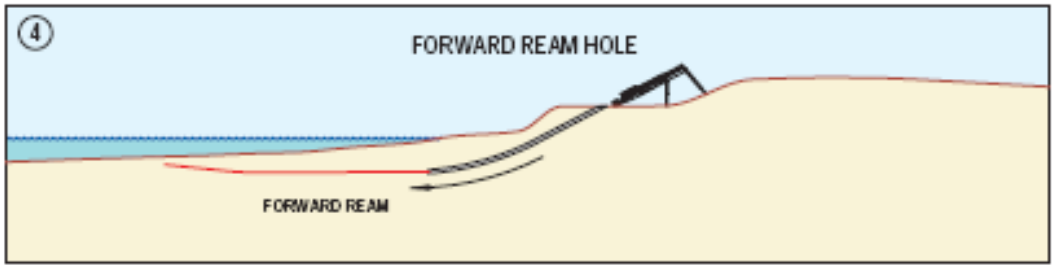
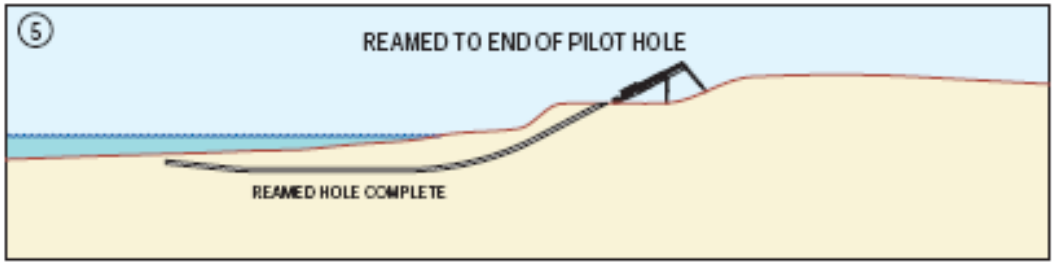
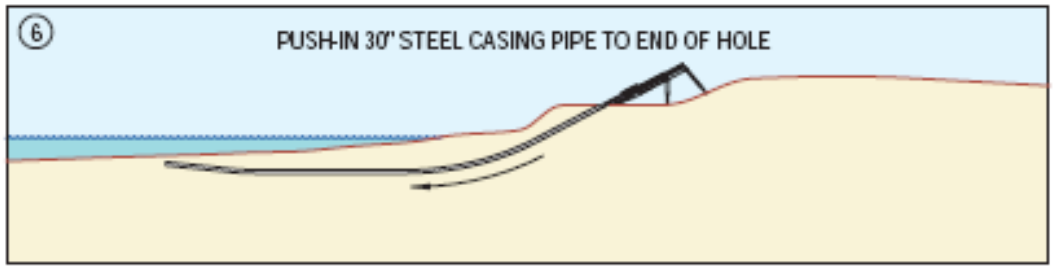


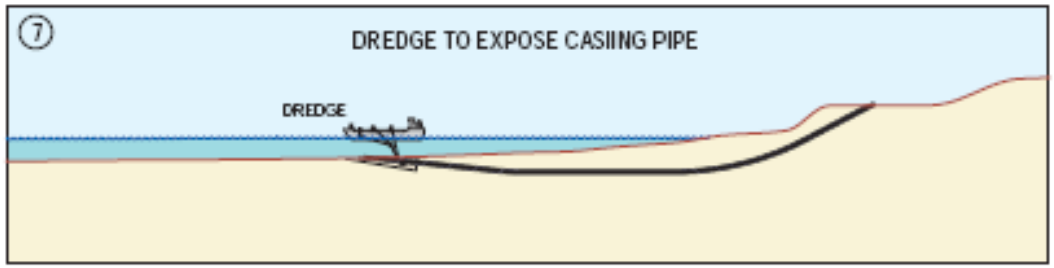


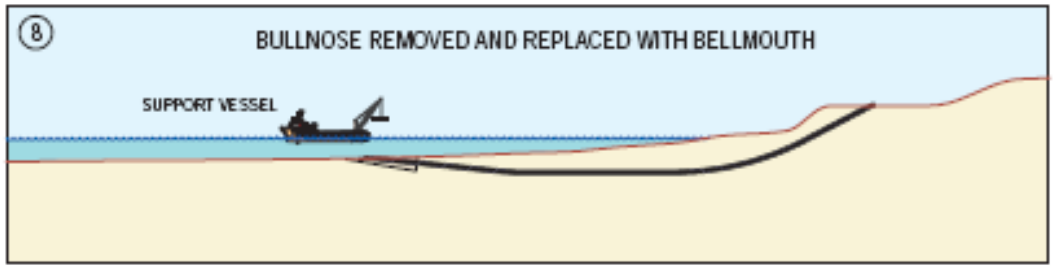


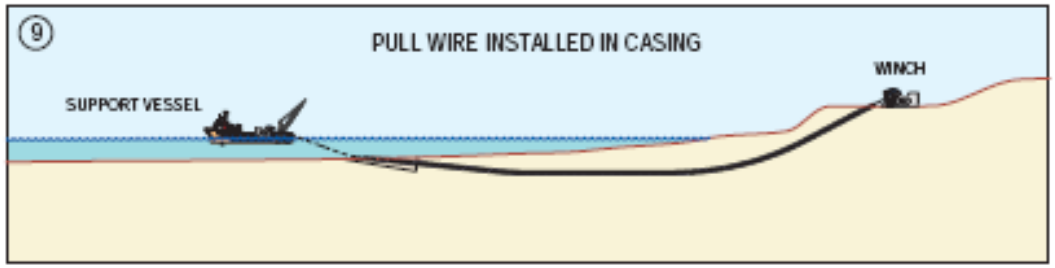


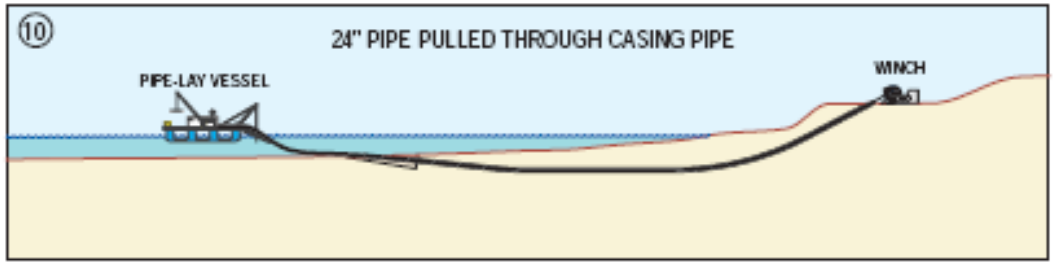












Onshore Pipelines

WOODSIDE NATURAL GAS

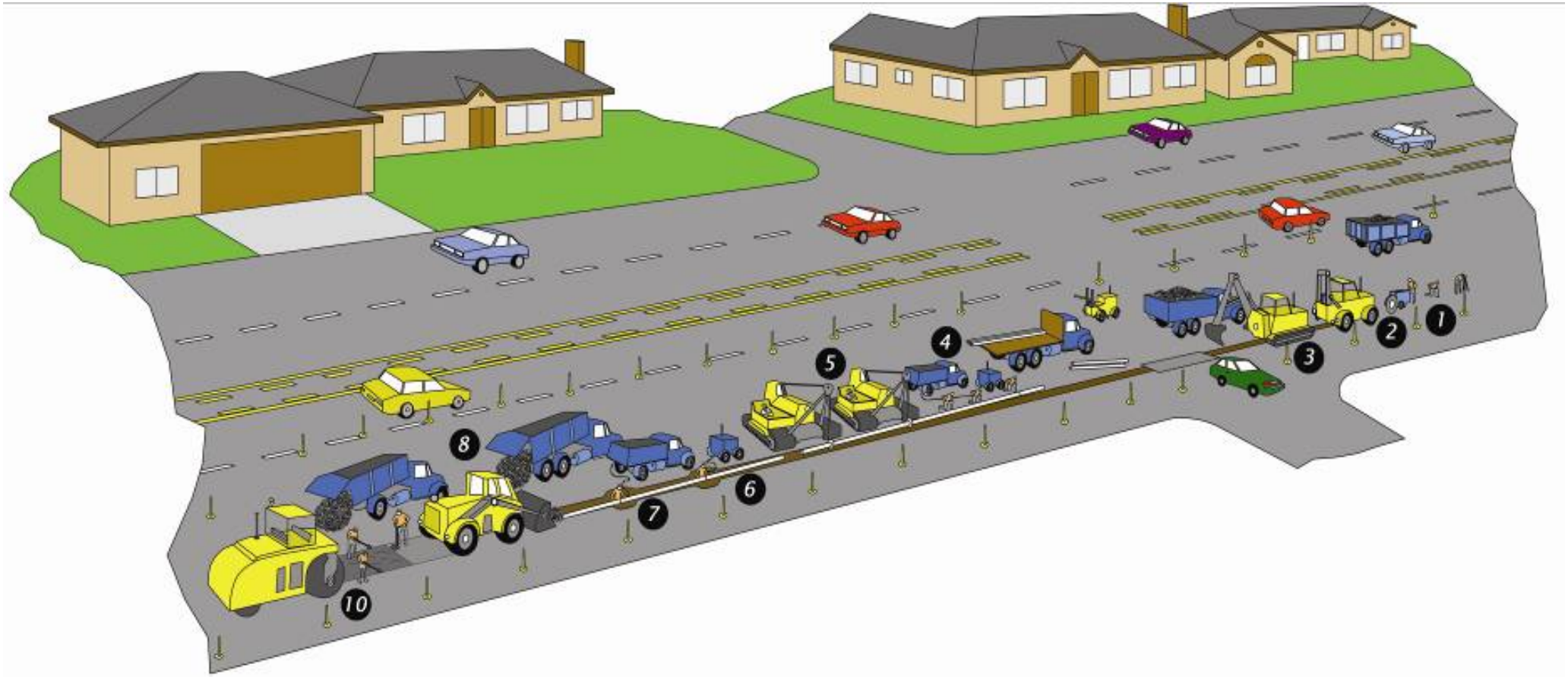
- 2 x 24” pipelines, common ditch, 3’ minimum cover in city streets
- 4-mile long ROW
- High strength carbon steel line pipe
- Regulations: 49 CFR 192 & CPUC GO112E
- Design Code: ASME B31.8
- Corrosion coating
- Impressed current cathodic protection system

Onshore Pipeline Route
Existing SoCal Gas Infrastructure & Proposed Upgrades

WOODSIDE NATURAL GAS

Pipeline Installation Sequence

WOODSIDE NATURAL GAS



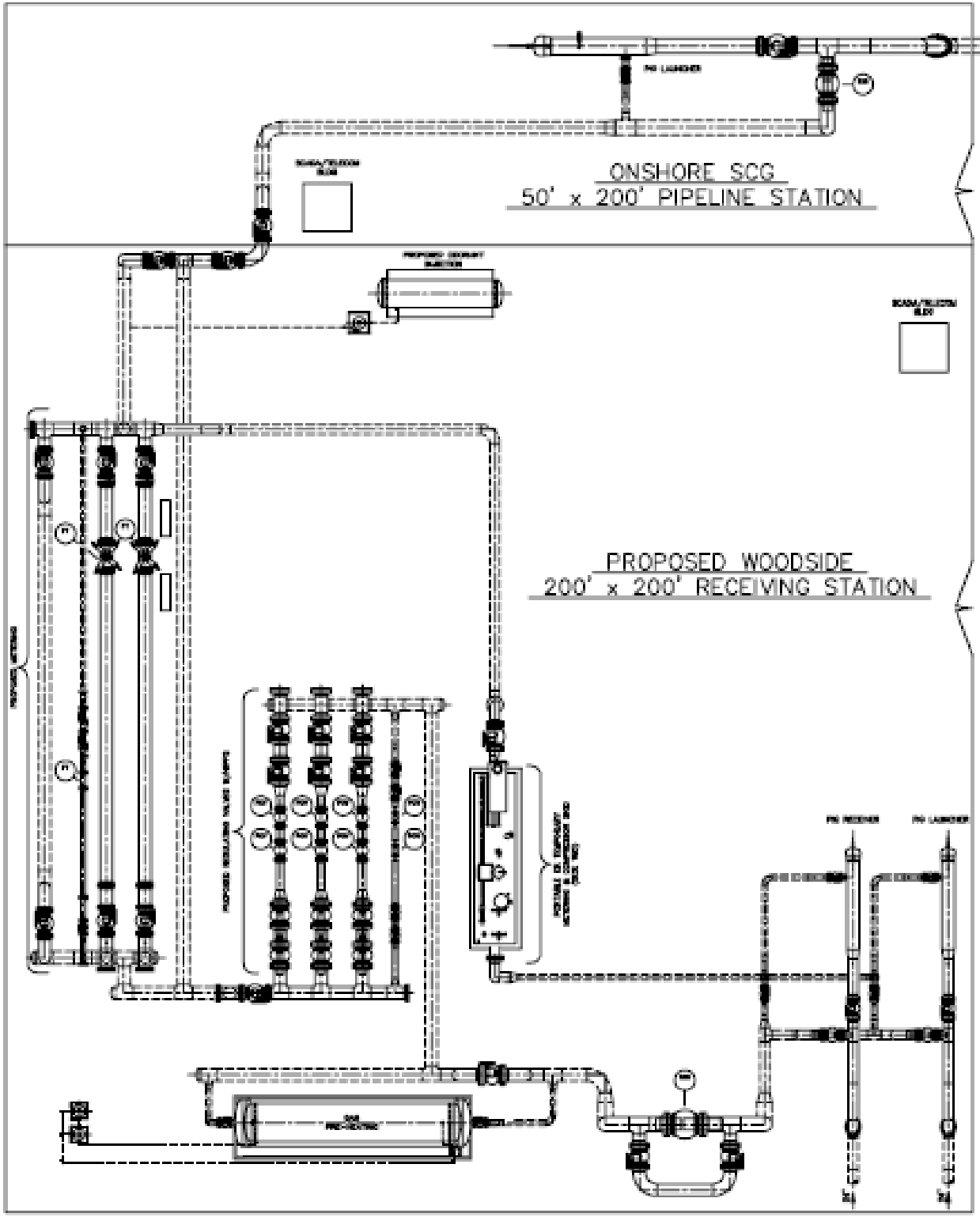
Receiving & Custody Transfer Station (RCTS)

WOODSIDE NATURAL GAS

- Pig launching and receiving
- Gas pre-heating
- Pressure regulation
- High Integrity Pressure Protection System
- Fiscal metering
- Odorization (backup only)
- Provision for nitrogen injection
- SCADA

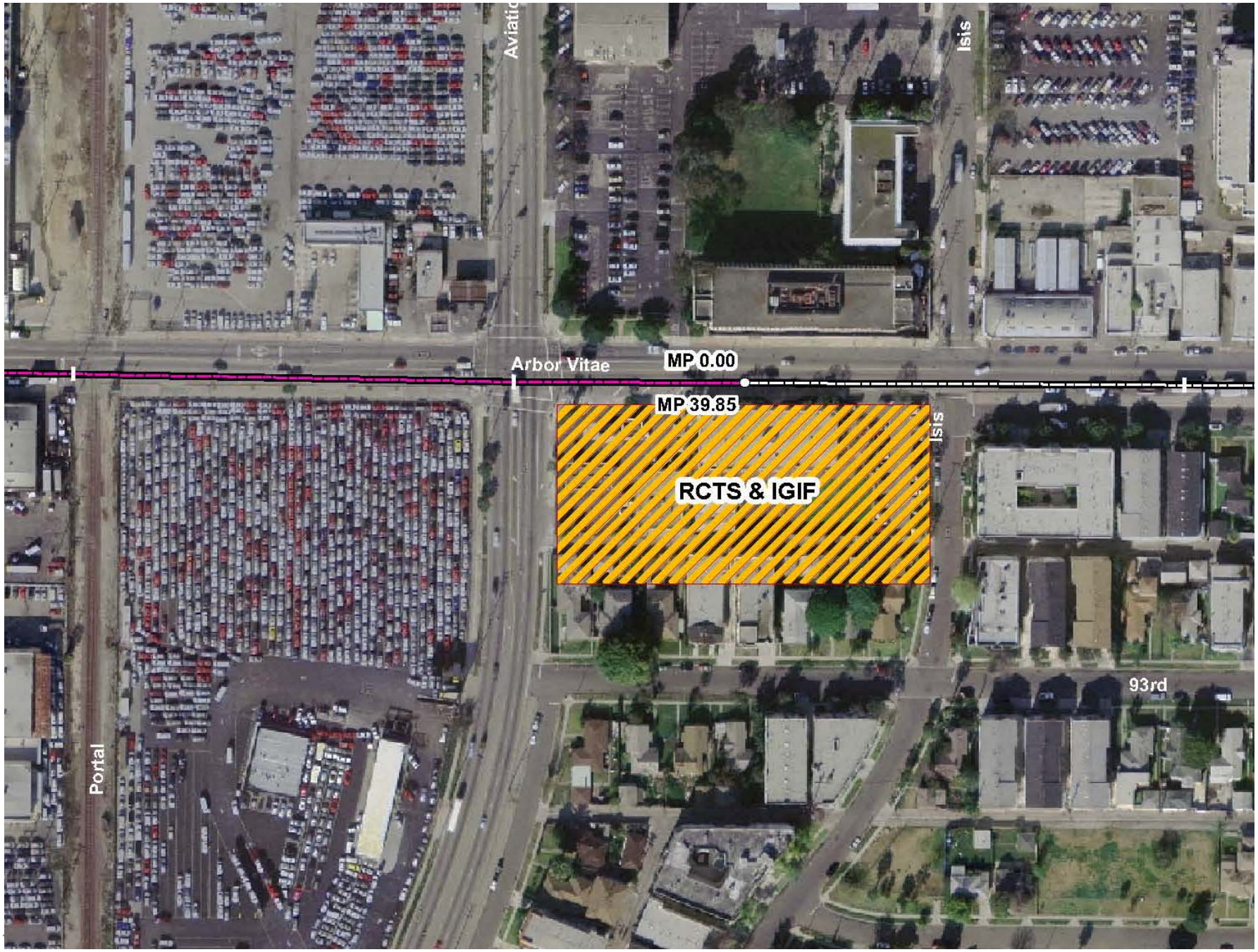
RCTS

WOODSIDE
NATURAL GAS



Manchester Square

WOODSIDE NATURAL GAS



Route Tour

WOODSIDE NATURAL GAS

Wrap-up and Actions