2022 APGA Annual Convention and Exhibition

Channel Island Bridge Pipeline Replacement Project

John Rutherford, Project Manager, HDI Lucas

Disclaimer

All the information included in this presentation is true and accurate to the best of the authors' knowledge.

Information provided in this presentation should not be assumed to be “technical or engineering” advice.

No liability is assumed by HDI Lucas for losses suffered by any person or organisation relying directly or indirectly on information provided in this presentation.

Views expressed in this presentation are the views of the author individually and does not necessarily reflect the view of HDI Lucas.

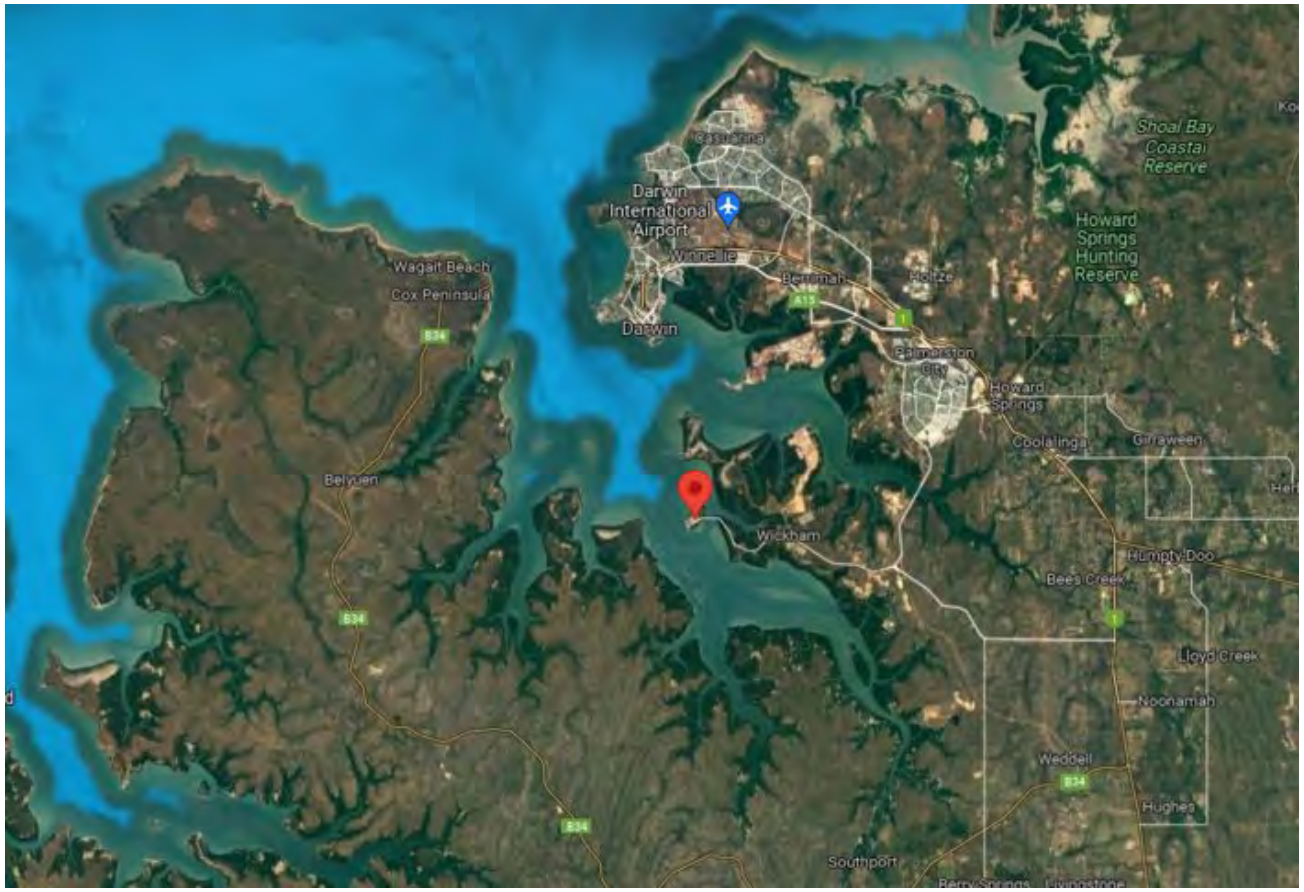
Agenda

1. **Introduction** – History of Channel Island and Scope
2. **HDD Crossing** – Geotechnical Data and Routing
3. **HDD Crossing** – Drilling Strategy & Tooling
4. **HDD Installation**
5. **Facilities and Tie-ins**
6. **Key Learnings and Conclusion**
7. **Questions**

History of Channel Island

Channel Island - Australia's History

- First quarantine facility in the Northern Territory – 1914
- Leprosarium - 1931
- Settlement abandoned - 1955
- Territory Generation Power Station – 1986 – Largest Power Station NT
- Coral reef
- Heritage Listed sites – Coral Reef & Leprosarium



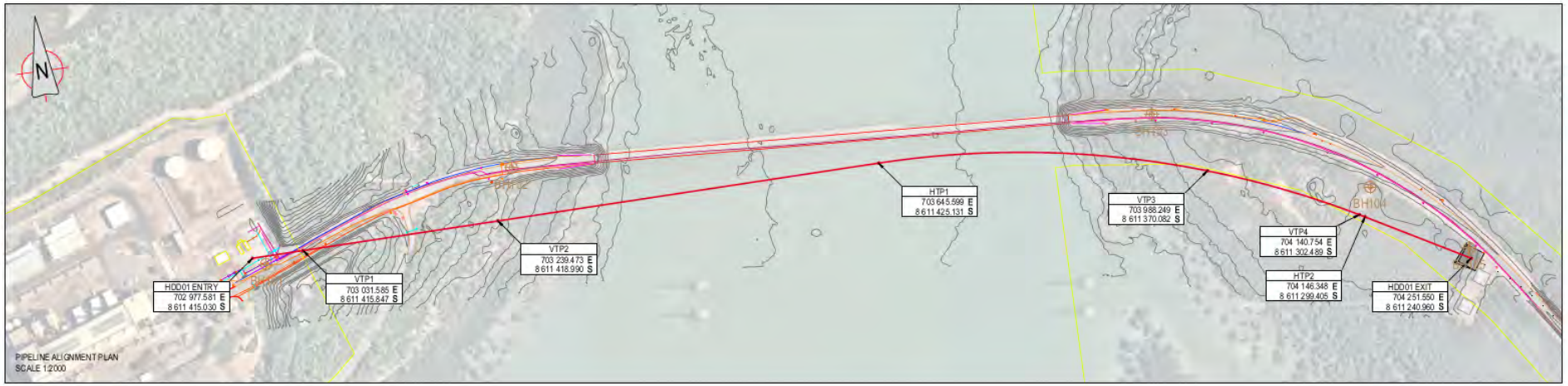
Scope

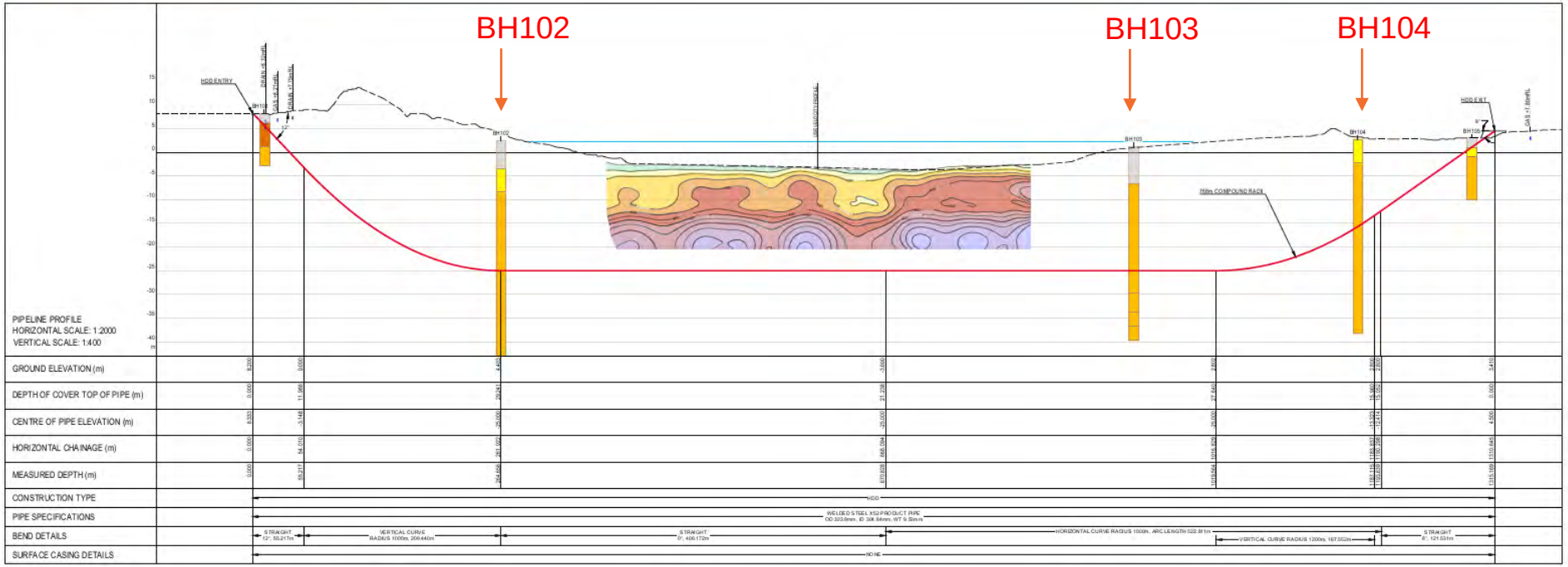
Channel Island – Scope of Works

- 1300m HDD Crossing of a new DN300 Pipeline Section;
- HDD tie in at the entry point with CIMS (Channel Island Meter Station);
- Installation & tie-in of pig launching facility at DCG (Darwin City Gate);
- Installation & tie-in of pig receiving facility at CIMS;
- Abandonment of the DN200 pipeline currently attached to the Channel Island Bridge;
- Capping remaining abandoned pipeline sections under Channel Island Road; and
- Final hot tap tie-in to existing Channel Island Spurline.

HDD Crossing

Plan and Profile





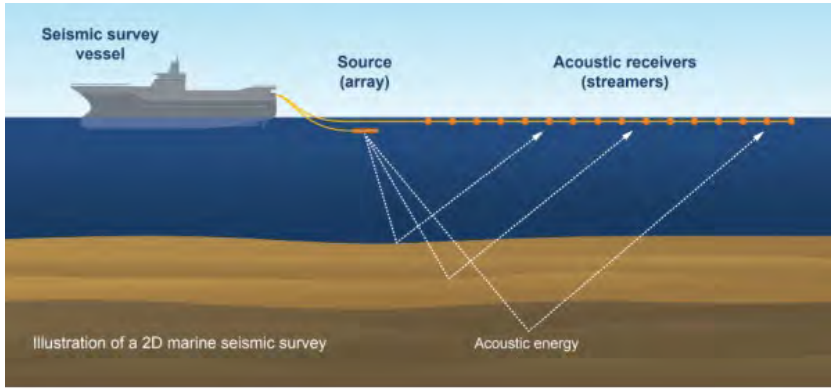
HDD Crossing

2015 Geophysical Investigation

- USR – Seismic Refraction Survey

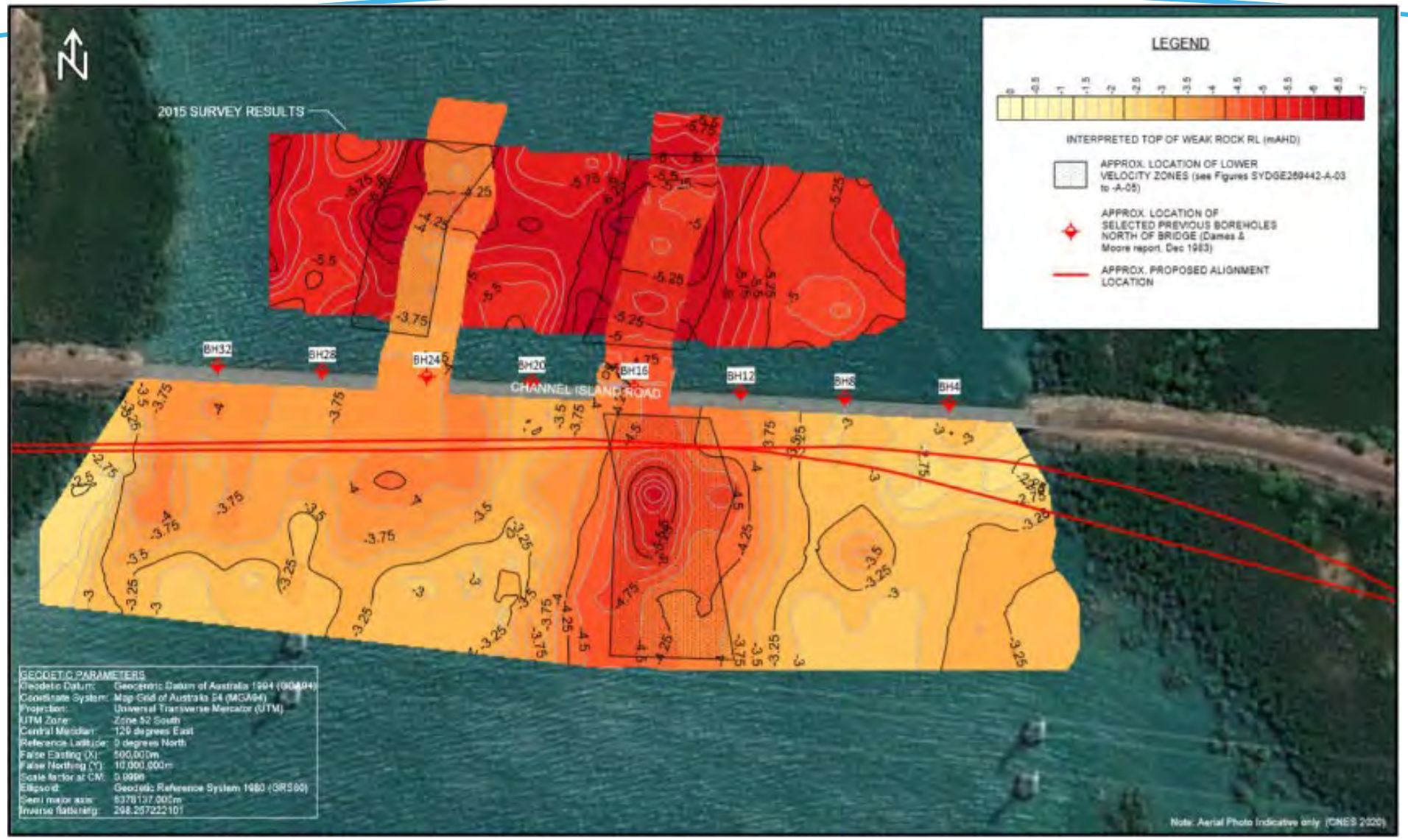
2020 Geophysical Investigation

- Single Beam Electrosounding
- Continuous Seismic Profiling (CSP) – seismic reflections
- Underwater Seismic refraction (USR)

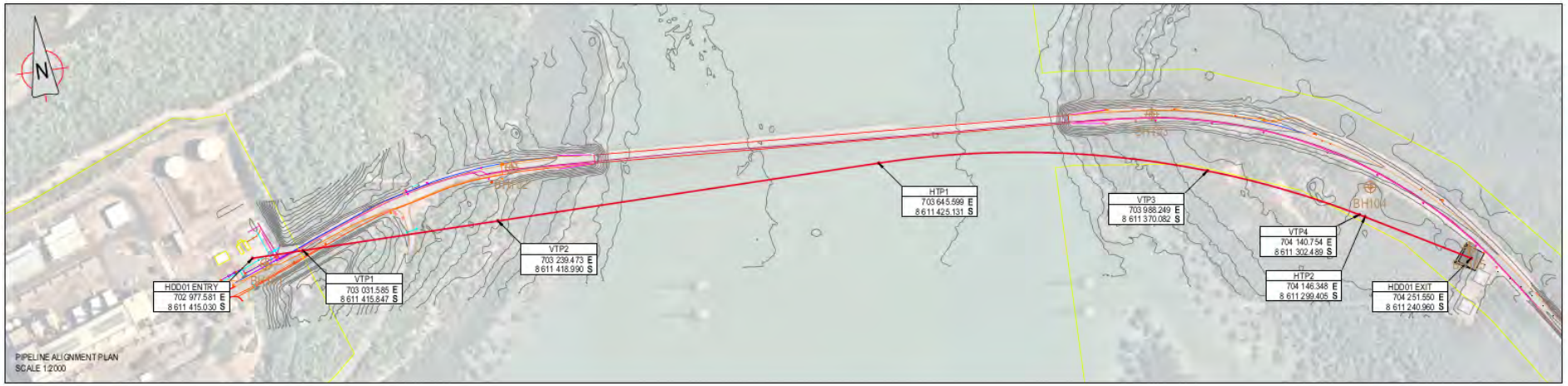


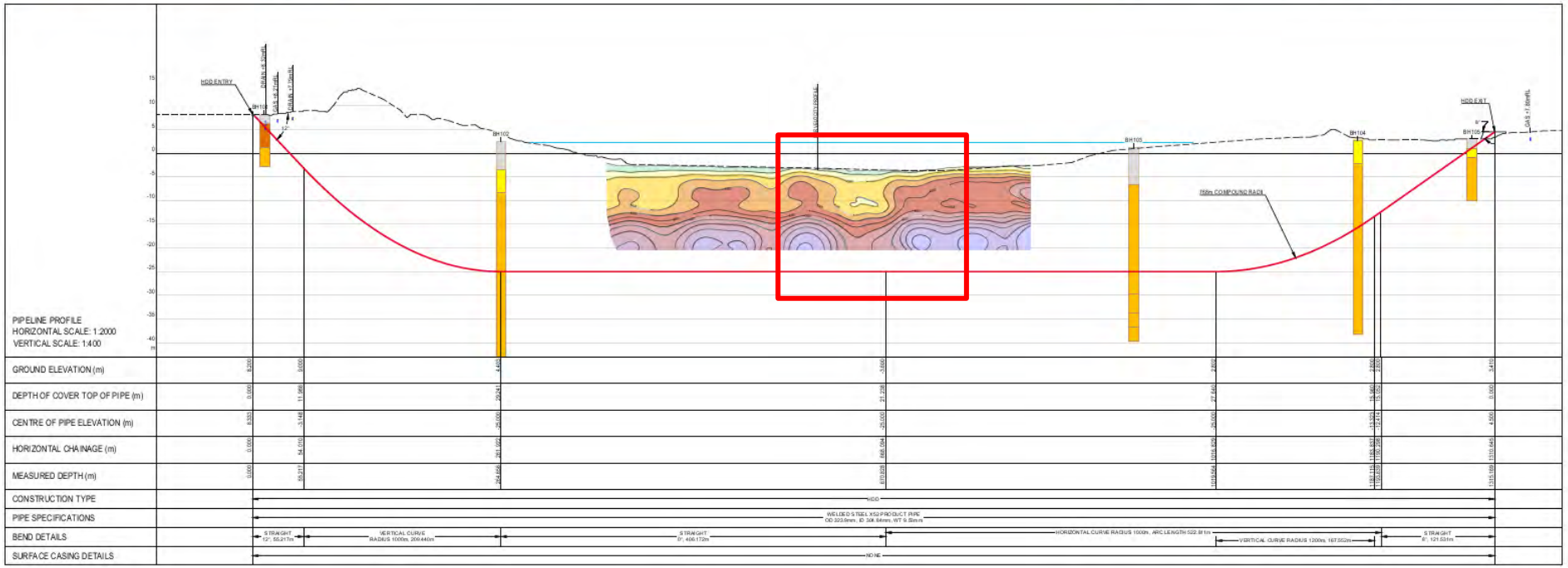
https://www.nopsema.gov.au/offshore-industry/environmental-management/marine-seismic-surveys

Challenges – Low Velocity Profile



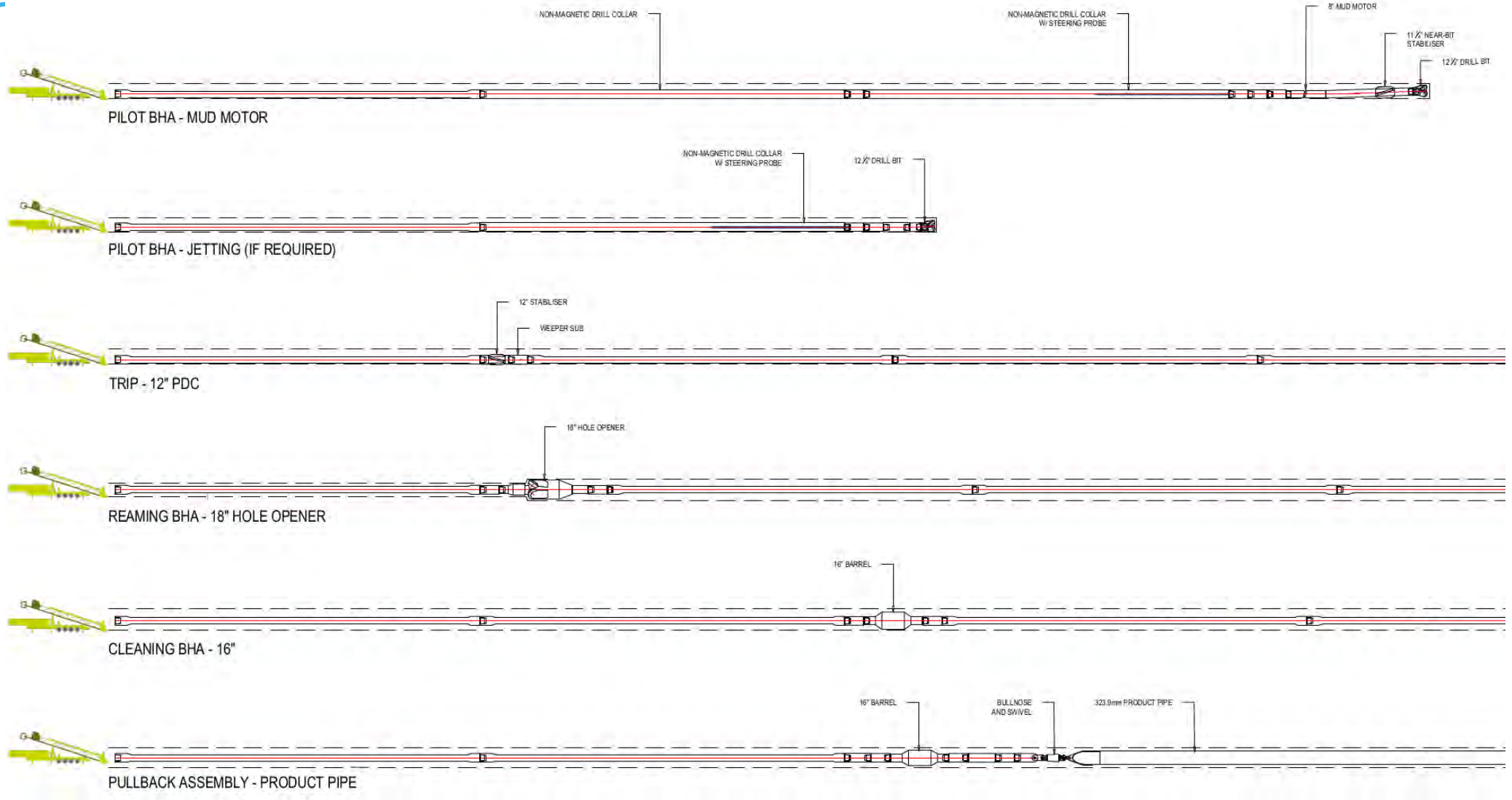
Plan and Profile





Channel Island - Video

Drilling Technique



Drilling Setup -> Pilot -> 12”

SITE SETUP

PREPARE SITE HARDSTAND. INSTALL HDD ANCHOR.
SET UP HDD EQUIPMENT AT ENTRY AND EXIT.

PILOT HOLE - MUD MOTOR

TOOL UP PILOT BHA ON RIG.
PILOT DRILL ALONG PROFILE FROM ENTRY TO EXIT.

ONCE BHA REACHES EXIT, BREAK DOWN PILOT BHA.
ESTABLISH OVERLAND MUD RETURN LINE.

TRIP - 12" PDC

TRIP DRILL PIPE FROM ENTRY TO EXIT.

MANAGE TAILSTRING, BREAK OFF EACH JOINT AND STORE IN PIPE RACKS OR ON PIPE TRAILERS.
REMOVE WIRELINE FROM CENTRE OF ALL PILOT DRILL PIPE.

Drilling Summary – 18” -> Cleaning -> Install

HDD Gyro Steering

PARATRACK GYRO MODULE

DRILL WITH CONFIDENCE

The ParaTrack Gyro Module (PGM) is a fiber-optic north seeking gyro fully manufactured in the USA specifically for the demands of Horizontal Directional Drilling.

Designed to offer the highest level of survey precision available in the industry, the ParaTrack Gyro Module further extends the capabilities of the world's most popular HDD guidance system.

With no impact from surrounding interference, pilot hole positional uncertainty is reduced, increasing the range between secondary verification checks while reducing drilling time and driving overall project costs down.

Prior to punch-out, bit position may be verified by a ParaTrack2 Guide Wire or Beacon Tracker, eliminating the risk of exceeding project tolerances.

FEATURES

- Fiber-optic north seeking gyro system
- Compatible with the entire ParaTrack line of guidance tools and accessories

BENEFITS

- Highest level of survey precision available
- Reliable even in high-vibration environments
- No specialized handling or personnel required

APPLICATIONS

- Surveying in densely populated urban areas
- Verification and correction of magnetic azimuth in long unguided sections

TECHNICAL SPECIFICATIONS

Outside Diameter	2.75 in (requires 3.5 in collar)
Length	Head to foot: 48 in (122 cm)
Weight	39 lbs (17.7 kg)
Electrical Connection	1-3/16 in, 12 tpi female (standard wet connect)
Internal Operating Temperature	32-158 °F (0-70 °C)
Pressure Rating	10,000 psi (690 bar)

SURVEY PRECISION

Inclination	+/- 0.02°
Azimuth	+/- 0.04°
Toolface	+/- 0.5°

COMPATIBLE WITH:

- ABIA: providing inclination measurements directly at the bit
- Pressure Module: providing annular and pipe pressures while drilling
- Beacon Tracker System: precision exit point verification with no surface wires

PARATRACK STEERING TOOL

PRECISION SURVEYING AND TRACKING

The ParaTrack Steering Tool is the heart of the Vector Magnetics suite of tools for the Horizontal Directional Driller. State of the art magnetic and gravity sensors in a lightweight yet rugged housing provide surveying and tracking in one compact package.

MAGNETIC TRACKING SOURCES INCLUDE:

- AC surface wires in loop or single-wire configuration
- Wires placed in a parallel bore
- Passive Magnetic Ranging to adjacent drillstrings for intersections
- The Beacon Tracker System, allowing for precision surface tracking without wires including otherwise blind shore departures and approaches

FEATURES

- Integrated survey and tracking package for the horizontal driller
- Precision tracking to external magnetic references

BENEFITS

- Compatible with a wide array of magnetic tracking sources
- Rugged, field-proven design
- Verifies VM and 3rd party gyro surveys

APPLICATIONS

- Steering, surveying, and borehole tracking
- Annular and drillpipe pressure monitoring (requires optional Pressure Module)

TECHNICAL SPECIFICATIONS

Outside Diameter	1.75 in (4.45 cm)
Length	Head to foot: 52.8 in (134 cm) Head to sensors: 41 in (104 cm)
Weight	19 lbs (8.6 kg)
Electrical Connection	1-3/16 in, 12 tpi female (standard wet connect)
Internal Operating Temperature	32-185 °F (0-85 °C)
Pressure Rating	17,000 psi (1200 bar)

SURVEY PRECISION

Inclination	+/- 0.02°
Azimuth	+/- 0.05°
Toolface	+/- 0.5°

OPTIONAL ADD-ONS:

- ABIA: providing inclination measurements directly at the bit
- Pressure Module: providing annular and pipe pressures while drilling
- ParaTrack Gyro Module: precision surveying under magnetic interference or at extended reach

AT-BIT INCLINATION ASSEMBLY

IMMEDIATE STEERING FEEDBACK

The At-Bit Inclination Assembly (ABIA) is a new addition to the growing line of Vector Magnetics HDD tools. Available as part of a rental motor or as a stand-alone bit sub, inclination at the bit can now be monitored directly - a first for the HDD industry.

The ABIA reduces uncertainty regarding build/drop rates and allows the driller to see results immediately, without the several-rod delay of traditional survey tools.

Inclination is transmitted from the ABIA bit-sub via EM to the ParaTrack2 probe positioned normally in a non-magnetic drill collar. Drill-string inclination is monitored in RivCross software, where inclination trends at the bit can be compared to inclination at the probe, greatly assisting the surveyor in conditions with mixed substrates or when tight tolerances are required.

FEATURES

- Tri-axial digital accelerometer system
- Compatible with all common HDD pilot hole sizes

BENEFITS

- Immediate steering feedback
- Low impact on operations

APPLICATIONS

- Underground intersections
- Any project specifying tight radius tolerances

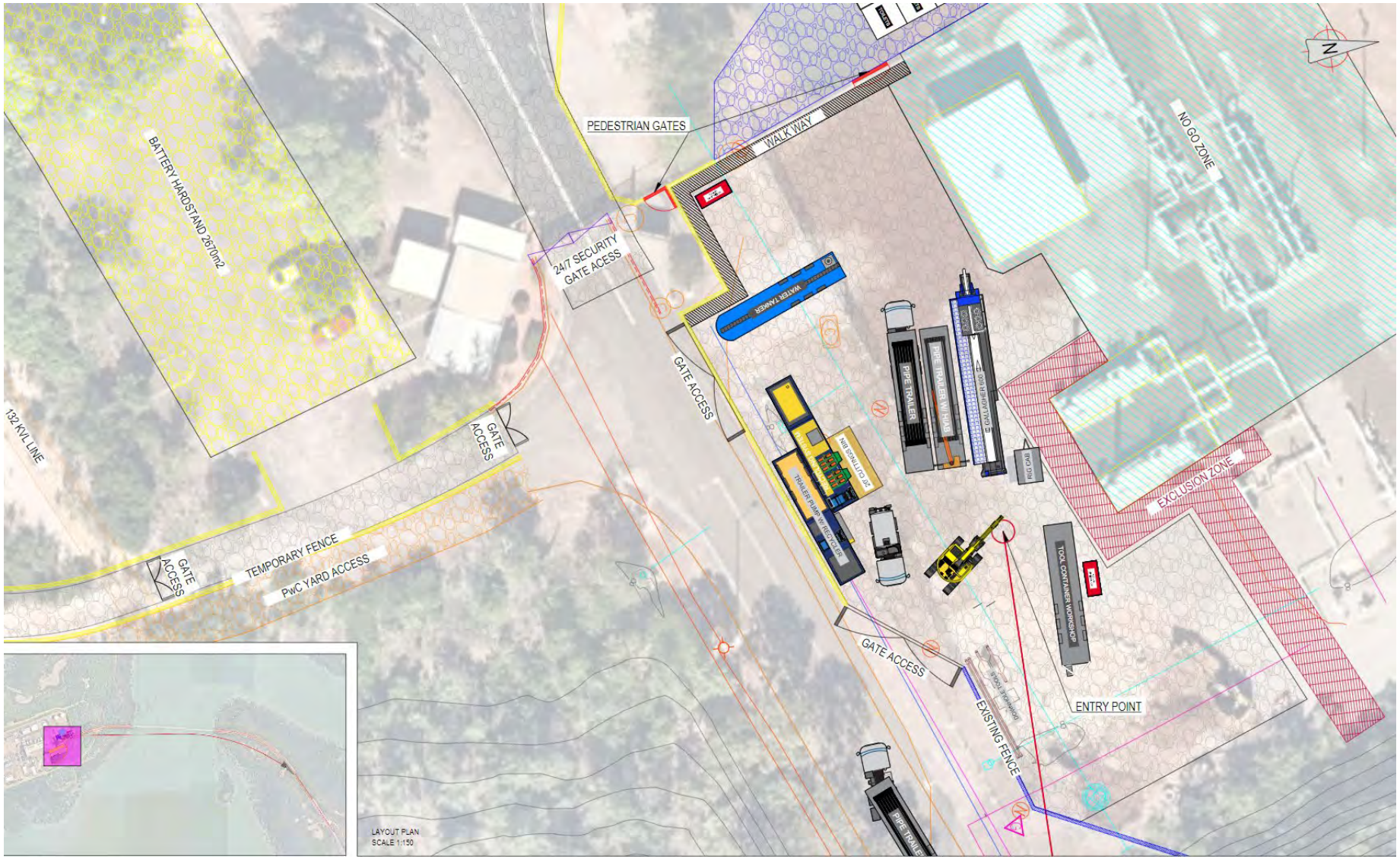
TECHNICAL SPECIFICATIONS

Outside Diameter	7.75, 8.5 in
Connection	6-5/8 in API reg pin x 6-5/8 in reg box (customization by request)
Length	8 in increase in bit-box length (motor) 21 in as sub (w/stand-alone motor)
Inclination Range	0-180°
Temperature Rating	32-140 °F (0-60 °C)
Pressure Rating	6,000 psi @22 °C (400 bar)
Survey Time	30 seconds
Battery Life	Number of shots: > 3,000 Downhole Standby: > 50 days Charging Time: 12 hours

SURVEY PRECISION

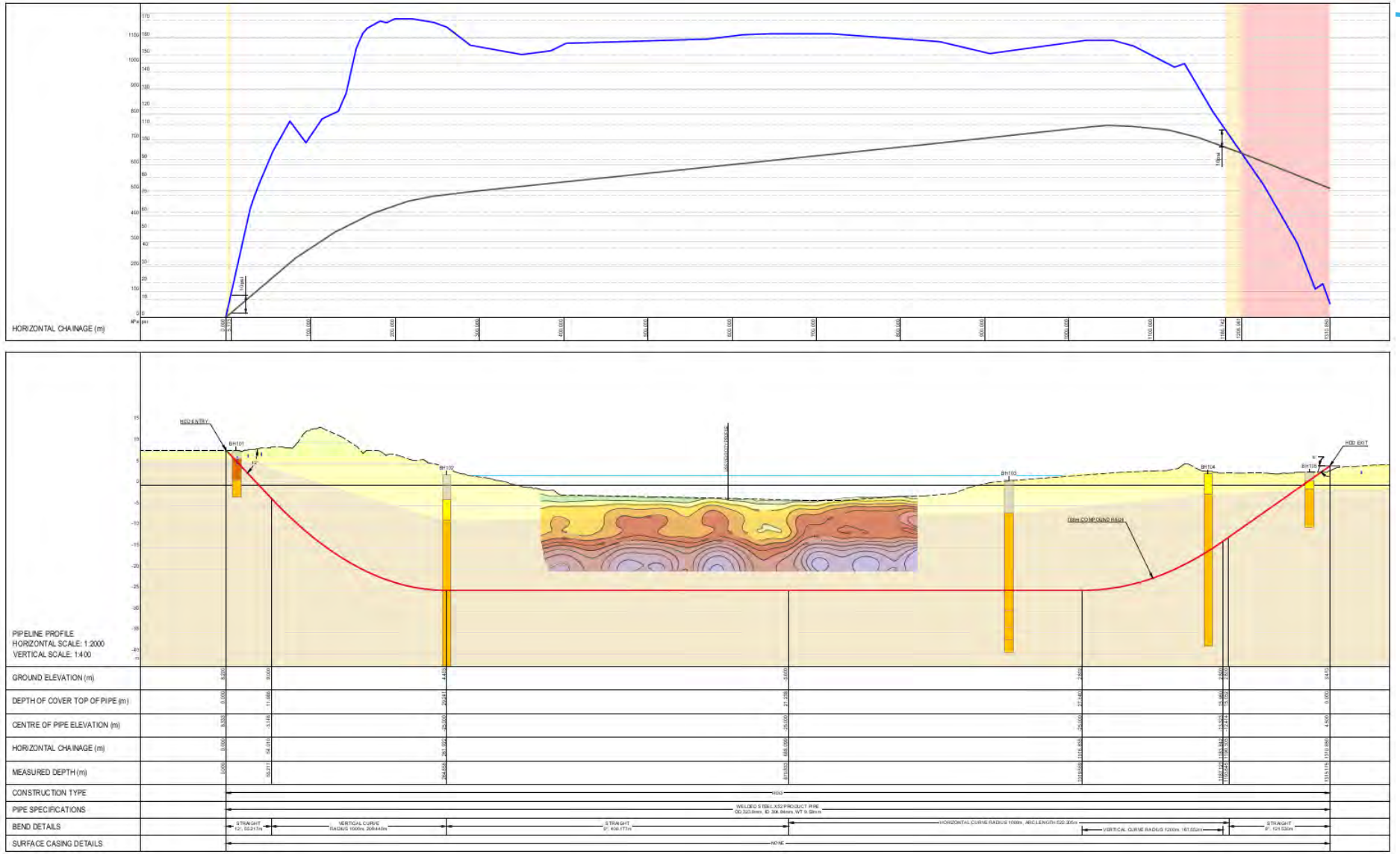
Inclination	+/- 0.15° (full roll) +/- 0.05° (single toolface)

Site Layout

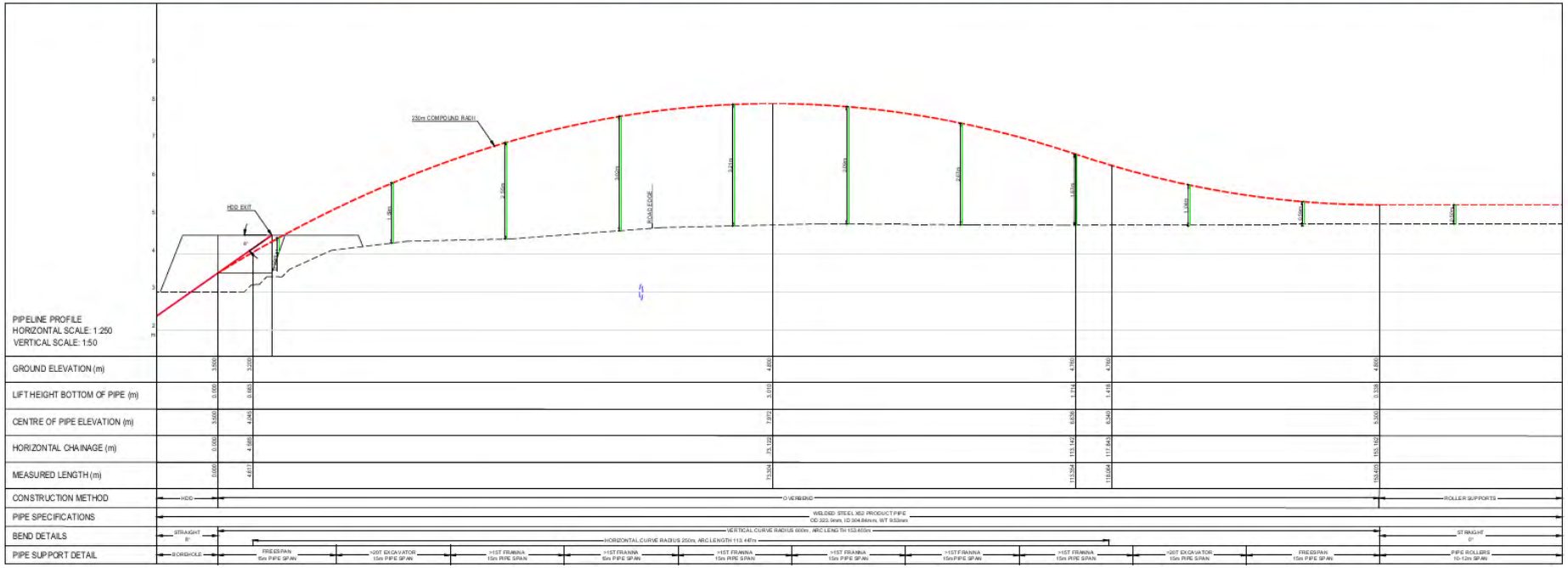

BATTERY HARDSTAND 2670m2
PEDESTRIAN GATES
WALK WAY
NO GO ZONE
24/7 SECURITY GATE ACESS
WATER TANKER
GATE ACCESS
132 KVL LINE
GATE ACCESS
TEMPORARY FENCE
GATE ACCESS
PWC YARD ACCESS
PIPE TRAILER
PIPE TRAILER W/ RACK
EXCLUSION ZONE
TOOL CONTAINER WORKSHOP
GATE ACCESS
ENTRY POINT
EXISTING FENCE
LAYOUT PLAN
SCALE 1:150

Site Layout

Hydro fracture Considerations



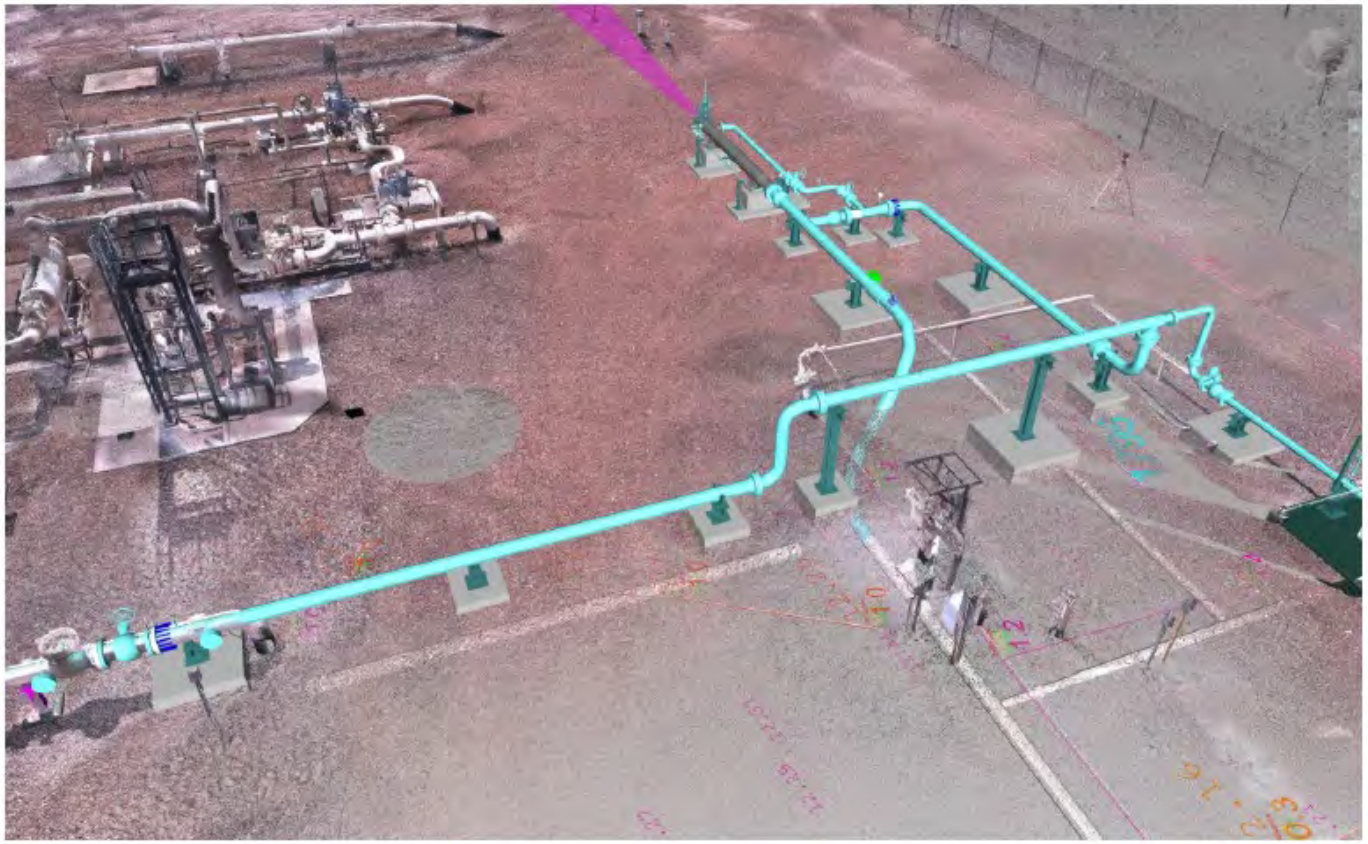
Pipe Breakover



Channel Island - Pipe Breakover

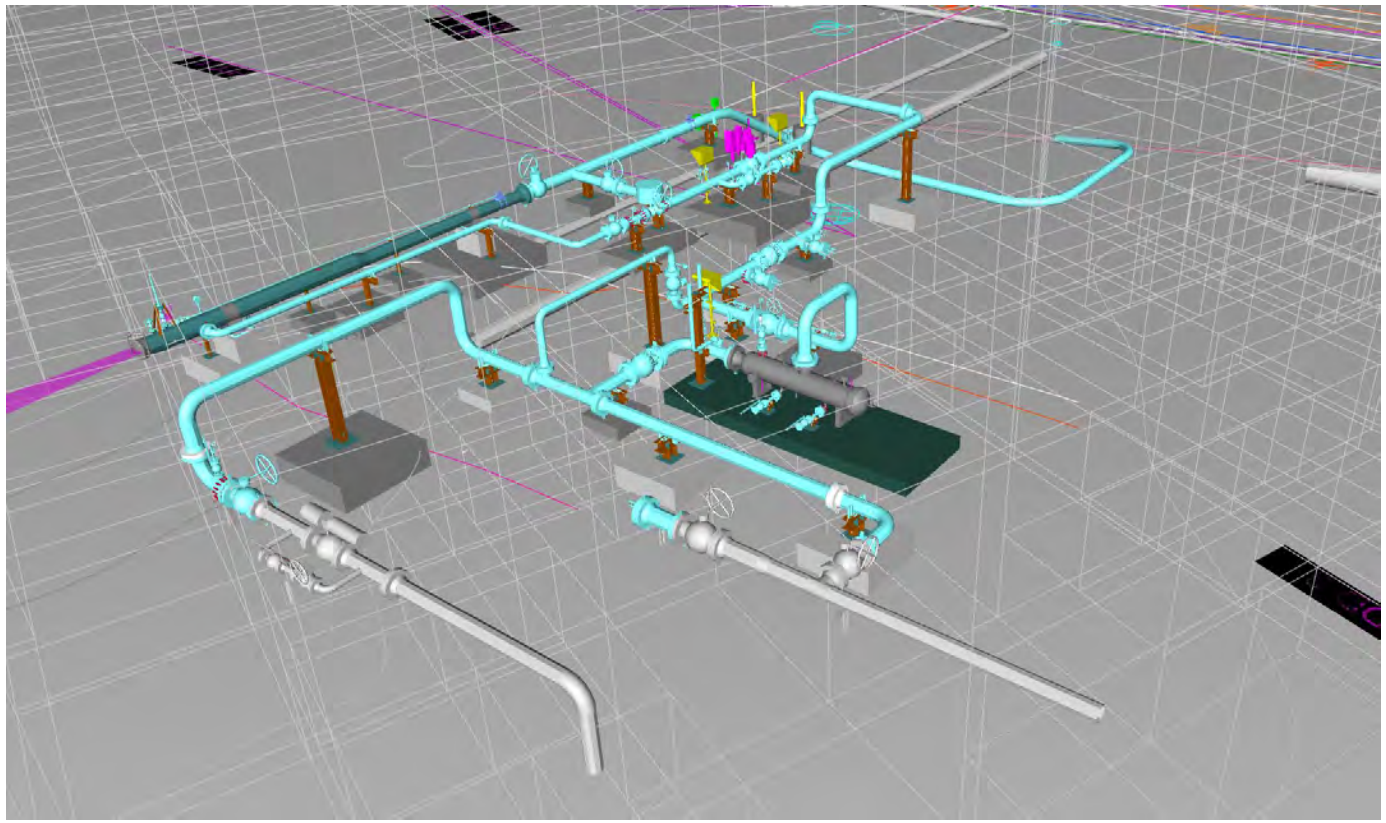
Channel Island - Facilities

- Installation and tie-in of pig launching facility (DCG)

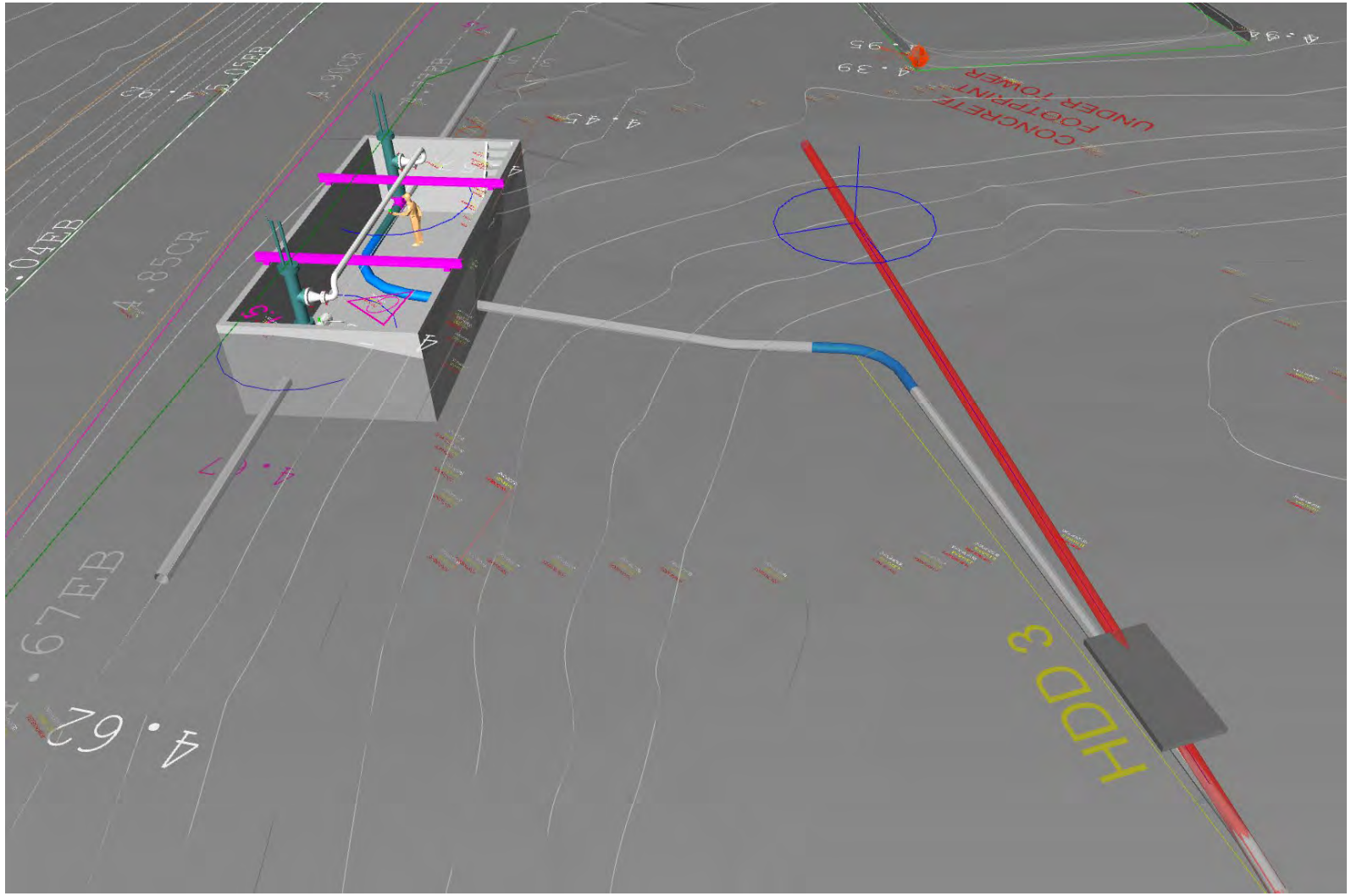


Channel Island - Facilities

- Installation of Pig Receiving facility (CIMS)



Channel Island – Hot Tap Tie-in



Channel Island – Hot Tap Tie-in

In Conclusion

- Technically difficult project made more challenging by COVID impacts
- Many challenges faced with highly experienced and competent personnel in the right positions allowed planning for these
  - UV lights for curing coating
  - Loss of containment area identified and planned for (drilling this area at low tide, cleanup crews on standby, using water for this section of drilling)
  - Difficult hot tap tie in using experienced crew and appropriate technology (STATS tecnoplug)
  - Large product pipe installation lift – appropriate communications in place on the project and for road closures
- Continued a strong relationship with APA throughout working off trust and transparency