Beachlands South Wastewater Ocean Outfall

HDD Methodology

Beachlands South Limited Partnership

Revision History

Revision	Revision Date	Details/Status	Authorised	
			Name/Position	Signature
B	25/06/26	ISSUE	Sam Rowdon	

Contents

Beachlands South WW Ocean Outfall

1. Purpose

This methodology has been prepared in support of the substantive application submitted by Beachlands South Limited Partnership (BSLP) under the Fast-track Approvals Act for the Beachlands South development. The purpose of this report is to demonstrate the technical feasibility of installing the proposed wastewater ocean outfall using Horizontal Directional Drilling (HDD), describe the anticipated construction methodology, and outline the engineering considerations that have informed the proposed installation approach.

The methodology has been developed from preliminary design information, available geotechnical investigations and the preliminary geotechnical desktop assessment prepared by Tonkin & Taylor. It demonstrates that the proposed HDD installation methodology represents a practical and constructable solution while minimising disturbance to the coastal environment and maintaining appropriate environmental controls throughout construction.

2. Project Overview

The Beachlands South development includes the construction of a new wastewater treatment plant and associated marine outfall to convey treated wastewater from the proposed treatment facility to the offshore discharge location. The proposed outfall comprises an onshore pipeline extending from the wastewater treatment plant to the coast and an offshore pipeline extending beneath the foreshore and seabed to the marine diffuser.

The proposed development includes approximately 2,000 residential dwellings together with commercial, community and education facilities supported by new transport, water, wastewater and stormwater infrastructure. The wastewater ocean outfall forms a key component of this infrastructure and has been developed to provide a long-term treated wastewater discharge solution consistent with the overall servicing strategy for the development.

3. Existing Information and Ground Conditions

The proposed Beachlands South wastewater ocean outfall has been developed with consideration of the available topographical, geological and geotechnical information compiled during the preliminary design phase. A desktop geotechnical assessment undertaken by Tonkin & Taylor, together with published geological mapping and previous site investigations within the Beachlands area, has been used to establish the preliminary geological model for the proposed HDD alignment.

The preferred outfall alignment (Option 5) was selected following consideration of constructability, environmental constraints and anticipated subsurface conditions. The alignment has been developed to maximise the length of bore within competent East

Coast Bays Formation (ECBF) while maintaining adequate cover beneath the coastal cliff and seabed. Although the available geotechnical information provides confidence in the overall geological model, the offshore geology remains partially inferred due to the limited extent of marine ground investigations undertaken to date. It is anticipated that additional marine geotechnical investigations will be completed during subsequent design phases to confirm the depth to competent rock, the weathering profile and any geological features that may influence HDD construction.

The geological model indicates that residual soils and highly to completely weathered ECBF overlie moderately to slightly weathered ECBF bedrock. At the proposed landside HDD entry location, competent rock is interpreted to occur at approximately RL +10 m, with ECBF exposed within the coastal cliff and extending seaward as a wave-cut platform before becoming overlain by marine sediments. The proposed HDD profile has been developed to transition beneath the weathered near-surface materials and remain within competent bedrock for the majority of the installation, thereby reducing drilling risk, improving bore stability and minimising the potential for inadvertent drilling fluid returns.

The preferred outfall route is understood to be Option 5. The landside HDD rig pad is approximately RL +27 m, with the cliff line approximately 350 m seaward of the rig location. The offshore outfall location is approximately 1,650 m from the cliff line.

The ground model indicates residual soils and highly to completely weathered East Coast Bays Formation overlying moderately to slightly weathered ECBF rock. At the proposed landside drilling location, the top of moderately to slightly weathered rock is inferred at approximately 15 m to 20 m below ground level, or about RL +10 m. The ECBF is exposed in the coastal cliffs and across the wave-cut platform, which extends offshore from the beach. Offshore, the majority of the HDD alignment is inferred to pass through moderately to slightly weathered ECBF; however, the depth to rock near the offshore outlet remains uncertain and should be confirmed by marine geotechnical investigation.

The design shall account for the risk of variable ECBF weathering, open joints, faults, drilling fluid loss, and possible drilling fluid migration to the surface or marine environment.

4. Coastal Outfall Alignment and Feasibility

The preferred coastal outfall alignment has been developed to provide a technically feasible and environmentally responsible solution for the installation of the Beachlands South wastewater ocean outfall. The alignment has been selected to minimise disturbance to the coastal environment while providing a constructable trenchless installation beneath the coastal cliffs, intertidal zone and seabed.

The proposed HDD alignment extends from the landside HDD rig located approximately 350 m inland of the coastal cliff at an elevation of approximately RL +27 m to the offshore outfall location approximately 1,650 m beyond the cliff line. The preliminary drill profile has been developed to transition from the landside entry into

competent East Coast Bays Formation (ECBF) bedrock beneath the coastal cliff before continuing along a near-horizontal alignment beneath the seabed. The profile then transitions through a vertical curve to an inclined exit at the offshore jack-up barge.

Development of the preferred alignment has been informed by the available topographical, geological and geotechnical information together with the operational requirements of the proposed wastewater outfall. The profile has been designed to maximise installation within competent bedrock while maintaining appropriate separation beneath the coastal environment and reducing the potential for inadvertent drilling fluid returns within the weathered near-surface materials.

The proposed dual-ended intersect HDD methodology has been adopted to improve constructability for the overall drill length. By advancing pilot holes from both the landside and offshore work fronts, the steering distance for each HDD rig is significantly reduced, improving positional accuracy and reducing cumulative deviation over the full alignment. The methodology also enables drilling fluid management to be undertaken from both ends of the installation and provides greater operational flexibility during pilot drilling, reaming and pullback operations.

The preferred alignment and construction methodology have been developed on the basis of the preliminary geological interpretation and are considered technically feasible for the anticipated ground conditions. The alignment will be refined during subsequent design stages following completion of additional marine geotechnical investigations and detailed HDD design.

5. Relevant New Zealand Precedent

Trenchless construction techniques have become an established method for the installation of marine pipelines throughout New Zealand, particularly where projects seek to minimise disturbance to environmentally sensitive coastal environments and avoid the need for extensive marine excavation. Horizontal Directional Drilling (HDD) and other trenchless installation methods have been successfully applied on numerous wastewater, water supply and utility crossing projects where conventional open-cut construction would present significant environmental, technical or operational challenges.

A notable example is the Army Bay Ocean Outfall project in Auckland, which involved the trenchless installation of a large-diameter marine outfall beneath the coastal environment. While the construction methodology adopted for that project differs from the methodology proposed for the Beachlands South Wastewater Ocean Outfall, it demonstrates that long offshore trenchless pipeline installations are achievable within New Zealand and that appropriately selected trenchless technologies can successfully overcome the geological, environmental and logistical constraints associated with coastal infrastructure projects.

The proposed Beachlands South Wastewater Ocean Outfall has been developed using a construction methodology specifically selected to suit the project alignment,

anticipated East Coast Bays Formation geology and overall installation requirements. The methodology presented in this report incorporates established HDD construction practices and has been adapted to address the particular site constraints associated with the Beachlands South development. The proposed dual-ended intersect HDD methodology is considered to provide a practical and technically robust solution that minimises disturbance to the coastal environment while maintaining constructability over the full length of the proposed outfall.

The successful delivery of previous trenchless marine outfall projects in New Zealand provides confidence that the proposed Beachlands South Wastewater Ocean Outfall can be constructed using proven trenchless construction techniques, supported by appropriate geotechnical investigation, detailed design, construction planning and environmental management.

6. Site Establishment

The landside HDD compound shall be established at the approved HDD rig pad. The compound shall include the HDD rig, mud mixing and recycling plant, mud pumps, drill pipe storage, tooling area, generator sets, fluid storage, cuttings handling area, welfare facilities, access roads, exclusion zones, and environmental controls.

The offshore HDD spread shall be established on a jack-up barge positioned at the offshore exit location in approximately 4.5 m water depth. The barge shall support an HDD rig, casing hammering equipment, mud recycling plant, tanks, pumps, drill pipe storage, tooling area, lifting equipment, spill response equipment, and marine safety systems.

The barge shall be positioned and jacked up in accordance with the marine temporary works design, marine operations plan, weather limits, seabed bearing assessment, and navigation requirements.

7. Survey and Set-Out

The HDD alignment, landside entry point, offshore exit point, casing positions, rig positions, barge position, and pipe pullback alignment shall be set out by survey. Survey control shall be established on land and, where required, transferred to the offshore barge.

Prior to drilling, the design profile, steering tolerances, intersection location, casing line and level, and ParaTrack 2 or equivalent guidance requirements shall be confirmed.

Existing services, utilities, drainage features, access constraints, ecological exclusion areas, and marine work zones shall be confirmed before works commence.

8. Temporary Isolation Casing Installation

Temporary steel isolation casing shall be installed at both the landside entry and offshore exit.

At the landside rig, casing shall be installed by pneumatic hammer along the HDD entry inclination through overburden and weathered materials into competent ECBF or other approved competent ground. The casing shall stabilise the entry section and reduce the risk of drilling fluid breakout near the rig pad.

At the offshore barge, casing shall be hammered from the jack-up barge along the offshore exit inclination into competent seabed material or rock. The offshore casing shall provide a controlled bore entry/exit, support pilot drilling from the barge, assist with pilot intersection, and provide containment for drilling fluid returns at the offshore work front.

Casing installation shall be monitored for line, grade, penetration, refusal behaviour, and alignment with the final HDD profile.

9. Drilling Fluid Management

Drilling fluid management is a critical component of the HDD operation and shall be implemented throughout pilot drilling, reaming and pullback activities. Drilling fluid shall be mixed, circulated, recovered and recycled using dedicated systems located at both the landside compound and offshore barge. Fluid properties shall be monitored and adjusted to suit the geological conditions encountered and to maintain bore stability, effective cuttings transport and drilling performance. Drilling fluid volumes, flow rates and returns shall be continuously tracked to identify potential losses or inadvertent returns. Spill response equipment shall be maintained at both work fronts, and all drilling fluid handling activities shall be undertaken within bunded containment systems. No uncontrolled discharge of drilling fluids or contaminated water to the marine environment shall be permitted. In the event of a suspected drilling fluid release, operations shall be modified or suspended and the project's environmental response procedures implemented.

10. Pilot Hole Drilling

Pilot drilling shall be undertaken from both ends of the alignment.

The landside HDD rig shall commence drilling from the landside entry through the landside casing and advance along the approved HDD profile. The offshore HDD rig shall simultaneously or sequentially commence drilling from the jack-up barge through the offshore casing and advance along the approved offshore profile.

The pilot holes shall be steered toward the planned intersection location. Steering shall be controlled using ParaTrack 2 or an equivalent magnetic guidance system, supported by survey control, inclination and azimuth monitoring, and continuous drilling parameter records.

The pilot holes shall always remain at a sufficient depth below ground and seabed level to prevent hydrofracture and shall follow the approved design profile. Steering corrections shall be gradual and shall remain within the minimum bend radius limits for the drill string and final product pipe.

11. Pilot Hole Intersection

As the two pilot holes approach the planned intersection zone, drilling shall proceed under controlled conditions. Survey and guidance readings shall be checked frequently to confirm relative position, separation, inclination, and azimuth.

The intersection shall be completed by advancing one pilot assembly into the opposing pilot bore or by another approved intersect method. Once intersected, the bore shall be confirmed as continuous from the landside rig to the offshore barge.

Following confirmation of the intersect, the landside drill string shall be advanced through the completed pilot bore to the offshore barge. At the barge, the pilot steering bottom hole assembly shall be broken out and recovered.

12. Reaming BHA Make-Up

A reaming bottom hole assembly shall be made up at the offshore barge. The assembly shall typically comprise drill pipe, crossover subs, a hole opener or suitable rock reamer, stabilising components as required, and a tail string connected back to the offshore HDD rig.

The tail string shall remain connected to the offshore HDD rig during back reaming. This arrangement maintains control from the barge side and allows drilling fluid to be pumped down the tail string and managed through the offshore recycling system where required.

The reamer selection, cutting structure, diameter, jetting arrangement, and staged reaming sequence shall be confirmed based on final pipe OD, required annular clearance, anticipated ECBF rock conditions, drilling fluid performance requirements and available rig capacities. Prior to commencing reaming operations, all tooling components shall be inspected and assembled in accordance with the manufacturer's recommendations and project quality requirements.

13. Back Reaming Operations

Following completion of the pilot-hole intersection and installation of the reaming bottom hole assembly, the bore shall be progressively enlarged to accommodate installation of the 450 mm OD PE100 outfall pipeline. Reaming shall be undertaken from the offshore jack-up barge toward the landside HDD rig. The reaming assembly shall be pulled through the pilot bore while drilling fluid is circulated through the drill string and discharged through the reamer to transport cuttings, stabilise the bore and maintain drilling performance.

The reaming programme may comprise multiple stages depending on the geological conditions encountered, tooling performance and final bore diameter requirements. The selected reaming sequence shall be designed to minimise installation loads and maintain bore stability throughout the operation. The offshore tail string shall remain connected to the reaming assembly throughout the enlargement process to provide

positive control of the tooling and facilitate drilling fluid circulation from the offshore work front.

During reaming operations, drilling parameters including pull force, rotational torque, drilling fluid pressure, drilling fluid returns and cuttings characteristics shall be continuously monitored. Any significant deviations from expected operating conditions shall be investigated and addressed before drilling proceeds. Additional reaming passes may be undertaken where required to achieve the final bore diameter and improve bore quality.

14. Bore Conditioning and Final Reaming

Upon completion of the final reaming pass, the bore shall be conditioned to confirm that it is suitable for installation of the product pipe. Bore conditioning may include additional circulation, cleaning passes, swabbing operations or supplementary reaming runs to remove residual cuttings and maintain bore stability. The bore shall remain filled with conditioned drilling fluid at all times to minimise the risk of collapse or instability.

The completed bore shall be assessed using drilling records, drilling fluid returns, reaming performance data and tooling observations. Prior to commencement of pipe installation, the Engineer shall be satisfied that the bore is suitably sized, stable and free from obstructions that may adversely affect the pullback operation.

15. Recovery of Reaming Assembly

Following acceptance of the completed bore, the reaming assembly shall be tripped back through the bore from the landside HDD rig to the offshore jack-up barge. The bore shall remain conditioned throughout this operation to maintain stability and minimise the risk of settlement or collapse.

Upon arrival at the offshore barge, the reaming assembly shall be recovered and inspected. Tooling components shall be assessed for wear, damage and suitability for subsequent pullback operations. Any components that do not meet project requirements shall be replaced prior to assembly of the pullback bottom hole assembly.

16. Pullback Assembly Installation

Following recovery of the reaming assembly, a dedicated pullback assembly shall be installed at the offshore barge. The pullback assembly shall typically comprise the drill string, swivel, pull head and associated connection hardware required to facilitate installation of the product pipe. The swivel shall isolate the product pipe from rotational forces generated by the HDD rig while the pull head shall provide a secure connection between the drill string and the product pipe.

All pullback components shall be inspected prior to installation and shall be rated for the anticipated installation loads. Connections shall be assembled in accordance with

the manufacturer's recommendations and project quality requirements. A final inspection shall be completed before pullback operations commence.

17. Product Pipe Preparation

The 450 mm OD PE100 outfall pipeline shall be assembled and prepared prior to commencement of pullback operations. Pipe welding shall be undertaken by qualified personnel using approved welding procedures and equipment. Weld records shall be maintained throughout fabrication and all completed welds shall be inspected and recorded.

Following fabrication, the completed pipe string shall be inspected to confirm dimensional compliance, weld quality and overall integrity. The pipe shall be supported to prevent damage and shall be positioned to provide a smooth and continuous alignment toward the offshore barge. Where required, buoyancy floats, rollers, skids or support vessels shall be utilised to protect the pipe during marine handling operations and maintain compliance with the minimum allowable bend radius.

Prior to pullback, the pull head shall be attached to the offshore end of the product pipe and all connections shall be inspected and approved.

18. Product Pipe Pullback

Following confirmation that the bore is ready and the product pipe has been accepted for installation, pullback operations shall commence. The pullback assembly shall be connected to the product pipe at the offshore barge and the product pipe shall be pulled from the offshore work front toward the landside HDD rig.

As pullback progresses, the product pipe shall enter the offshore casing before passing through the reamed HDD bore. The pipe shall remain fully supported throughout the operation and shall be protected from excessive bending, abrasion, torsional loading and impact damage. The pipe string shall be continuously monitored by marine and landside personnel to ensure that installation proceeds safely and efficiently.

Drilling fluid circulation shall be maintained throughout the pullback operation to reduce frictional forces and facilitate movement of the pipe through the bore. Pullback loads, drilling fluid pressures, return volumes and pipe movement shall be continuously monitored and recorded. Installation shall proceed as a controlled and continuous operation wherever practicable.

19. Completion of Pullback

Pullback shall be considered complete once the product pipe has been installed along the full HDD alignment and the pullback assembly has reached the landside HDD rig. Following completion of installation, the pullback assembly shall be disconnected and recovered.

The installed pipe shall be inspected and secured pending connection to downstream infrastructure and subsequent commissioning activities. Survey verification may be undertaken to confirm installation position and alignment. The final installed configuration shall comprise a continuous 450 mm PE100 outfall extending from the landside connection point to the offshore marine works interface.

20. Demobilisation and Reinstatement

Upon completion of the HDD installation and associated testing activities, all temporary works, plant, equipment and construction facilities shall be progressively removed from both the landside and offshore work fronts. The offshore jack-up barge shall be demobilised following removal of the offshore HDD rig, drilling fluid systems, pumps, tooling, tanks and ancillary equipment. The barge shall then be removed from site in accordance with the approved marine operations plan.

At the landside HDD compound, drilling equipment, recycling systems, generators, storage facilities, temporary fencing, access controls and construction materials shall be removed. Temporary working platforms, laydown areas and access tracks shall be reinstated to a condition consistent with the project requirements and landowner agreements.

All disturbed areas shall be stabilised and reinstated as necessary. Final surveys, quality documentation, environmental records and completion reports shall be submitted to the Principal. Following acceptance of the completed works, the HDD installation phase shall be deemed complete, and the project shall proceed to subsequent commissioning and operational activities.

21. Testing, Survey and Quality Verification

Following completion of the HDD installation works, all required testing and quality assurance activities shall be undertaken. These activities may include pipeline integrity testing, pressure testing, weld record review, survey verification, inspection of installed infrastructure and preparation of as-built documentation.

Quality records shall be compiled throughout the works and shall include drilling records, steering logs, drilling fluid records, casing installation records, reaming records, pullback records, pipe fabrication records and inspection documentation. Any non-conformances identified during the works shall be addressed in accordance with the project quality management system.

Final as-built information shall be prepared and submitted to the Principal and Engineer for review and acceptance.

22. Offshore Diffuser

At the offshore exit point, the final outfall diffuser would be installed at or near seabed level.

The diffuser arrangement is intended to:

- Improve dilution and dispersion of treated wastewater;
- Promote mixing within the receiving environment; and
- Minimise potential seabed effects.

The preliminary diffuser concept currently comprises either:

- A bell-mouth outlet diffuser; or
- A multi-port diffuser system.

22.1 Bell-Mouth Diffuser Option

The bell-mouth arrangement would involve a gradual diameter expansion at the outlet, approximately 2–3 times the outfall pipe diameter.

This configuration is intended to:

- Reduce outlet velocity;
- Encourage radial dispersion of the discharge; and
- Minimise potential seabed scour effects.

22.2 Multi-Port Diffuser Option

The multi-port diffuser arrangement is also a diffuser option that has been considered for consenting and environmental performance purposes.

The multi-port system can:

- Maximise initial dilution;
- Enhance vertical mixing;
- Reduce localised environmental effects; and
- Improve overall discharge dispersion.

The final details on the diffuser type, location, arrangement, and size will be confirmed during detailed design.

22.3 Diffuser Installation Methodology

The installation methodology for the offshore diffuser will be confirmed during detailed design, informed by marine geotechnical investigations, seabed conditions, water depth, and environmental constraints. A range of installation techniques are considered feasible for the proposed works.

22.4 Cofferdam Installation

One potential installation method involves the construction of a temporary cofferdam at the diffuser location. Under this approach:

- A temporary enclosed structure is installed around the diffuser footprint;
- The enclosed area is dewatered to create a dry working environment;
- The diffuser structure is installed and secured within the prepared foundation;
- The cofferdam is removed following completion of works.

This approach allows:

- High-quality installation under dry conditions;
- Improved control over foundation preparation and structural placement; and
- Reduced turbidity and sediment disturbance during construction.

However, the suitability of a cofferdam will depend on water depth, wave conditions, and constructability constraints.

22.5 Marine Based Installation

In Marine based installation, the diffuser may be installed directly within the marine environment using barges and specialised marine equipment. Under this approach:

- The diffuser assembly is prefabricated onshore and transported to site;
- Marine cranes or lifting frames position the diffuser on the seabed;
- Divers or remotely operated equipment undertake positioning, connection, and tie-in works.

This approach:

- Avoids the need for temporary dewatering;
- Is well suited to deeper water environments; and
- Minimises temporary structures within the coastal zone.

22.6 Final Installation Methodology

The final installation methodology will be selected during detailed design based on:

- Confirmed seabed and geological conditions;
- Water depth and marine access constraints;
- Environmental considerations;
- Health and safety requirements; and
- Construction efficiency.

All methods described above are established marine construction techniques and are considered feasible for the proposed outfall works.

23. Environmental Management During Completion Works

The proposed dual-ended intersect HDD methodology has been developed to minimise environmental effects associated with construction of the Beachlands South Wastewater Ocean Outfall. By adopting a trenchless installation methodology, the majority of the pipeline is installed beneath the coastal cliff, intertidal zone and seabed without the need for extensive excavation or dredging. This significantly reduces disturbance to the coastal environment, minimises impacts on the intertidal and marine habitats, and avoids the widespread seabed disturbance typically associated with conventional marine pipeline installation methods.

The selected HDD methodology also substantially reduces the temporary construction footprint within the coastal environment. Construction activities are largely confined to the established landside HDD compound and the offshore jack-up barge, thereby limiting disturbance to the foreshore, coastal vegetation and surrounding marine environment. The use of temporary steel entry and exit casings provides controlled drilling conditions through the near-surface materials and assists in reducing the potential for inadvertent drilling fluid returns within environmentally sensitive areas.

Environmental management measures shall be implemented throughout all phases of the works in accordance with the Project Environmental Management Plan, consent conditions and relevant statutory requirements. Environmental controls shall be reviewed throughout construction and modified where necessary to respond to changing site conditions, weather events and construction activities.

Key environmental management measures shall include:

- implementation of erosion and sediment control measures at the landside HDD compound;
- containment, storage, recycling and disposal of drilling fluids and drill cuttings;
- continuous monitoring of drilling fluid returns to identify potential inadvertent returns (frac-outs);

- implementation of an Inadvertent Return Contingency Plan, including immediate cessation of drilling where required, notification procedures and remediation measures;
- spill prevention and response measures for fuels, oils and hazardous substances, including bunded storage areas and spill response equipment;
- management of construction noise, vibration and lighting in accordance with project consent conditions;
- marine environmental protection measures including management of vessel operations, refuelling procedures and waste disposal;
- implementation of biosecurity procedures for marine plant and equipment where required;
- monitoring of weather, tides and sea conditions to ensure marine works are undertaken within safe operating limits;
- management of construction waste and recycling of materials where practicable;
- protection of environmentally sensitive coastal and marine habitats throughout the construction period; and
- progressive reinstatement of temporary work areas following completion of construction activities.

Environmental controls shall remain in place until all HDD activities have been completed and all temporary works removed. Drilling fluid storage systems, containment measures and spill response equipment shall remain operational until the risk of release has been eliminated.

All drilling fluids, cuttings, waste materials, temporary containment systems and surplus materials shall be removed from the site and disposed of at approved facilities. Any inadvertent environmental impacts identified during the works shall be addressed in accordance with the project environmental management requirements.

A final environmental inspection shall be completed prior to demobilisation to confirm that all work areas have been left in a safe and environmentally acceptable condition.

24. Construction Risks and Mitigation

The proposed dual-ended intersect HDD methodology has been developed to reduce the principal construction risks associated with the installation of a long offshore wastewater outfall beneath the coastal environment. While HDD is a well-established trenchless construction technique, successful delivery of the proposed works is dependent upon appropriate planning, detailed design, geotechnical verification, experienced personnel and effective construction management.

The principal technical risk associated with the proposed works is uncertainty in the offshore geological conditions. Although the preliminary geotechnical assessment indicates that the majority of the HDD alignment is likely to be constructed within East Coast Bays Formation (ECBF), the geological profile beneath the offshore section remains partially inferred. This risk will be reduced through completion of additional marine geotechnical investigations during subsequent design phases to confirm the

depth to competent rock, weathering profile and any significant geological structures that may influence drilling operations.

Pilot-hole steering accuracy is a key consideration for long HDD installations. The proposed dual-ended intersect methodology significantly reduces the drilling distance from each HDD rig to the pilot-hole intersection point, thereby reducing cumulative steering deviation and improving positional accuracy. Continuous survey control, ParaTrack guidance and verification of steering data throughout drilling operations will further reduce this risk.

Bore stability and inadvertent drilling fluid returns represent recognised risks during HDD construction. The proposed drill profile has been developed to transition into competent ECBF beneath the weathered near-surface materials, while temporary steel entry and exit casings will provide stable drilling conditions through the overburden. Drilling fluid properties, circulation volumes and drilling parameters will be continuously monitored throughout pilot drilling, reaming and pullback operations to identify potential instability or drilling fluid losses. An Inadvertent Return Contingency Plan shall be implemented to provide a structured response should an unexpected drilling fluid release occur.

Marine construction activities introduce additional operational risks associated with weather conditions, sea state, vessel operations and offshore lifting activities. The offshore HDD spread will operate from a jack-up barge, providing a stable working platform independent of tidal fluctuations during drilling operations. Marine works will be undertaken in accordance with an approved Marine Operations Plan, with weather windows, communication protocols and emergency response procedures established prior to commencement of offshore activities.

The product pipe pullback represents one of the most critical phases of the HDD installation. Installation loads, drilling fluid circulation and pipe handling activities will be continuously monitored throughout the pullback operation to ensure that the allowable limits for the product pipe, pull head and swivel are not exceeded. Appropriate marine support equipment will be utilised to maintain the required pipe alignment and minimum bending radius during offshore pipe handling.

Collectively, these measures provide a robust framework for managing the principal construction risks associated with the proposed HDD installation and demonstrate that the Beachlands South Wastewater Ocean Outfall can be constructed using established trenchless construction practices and appropriate engineering controls.

26. Conclusion

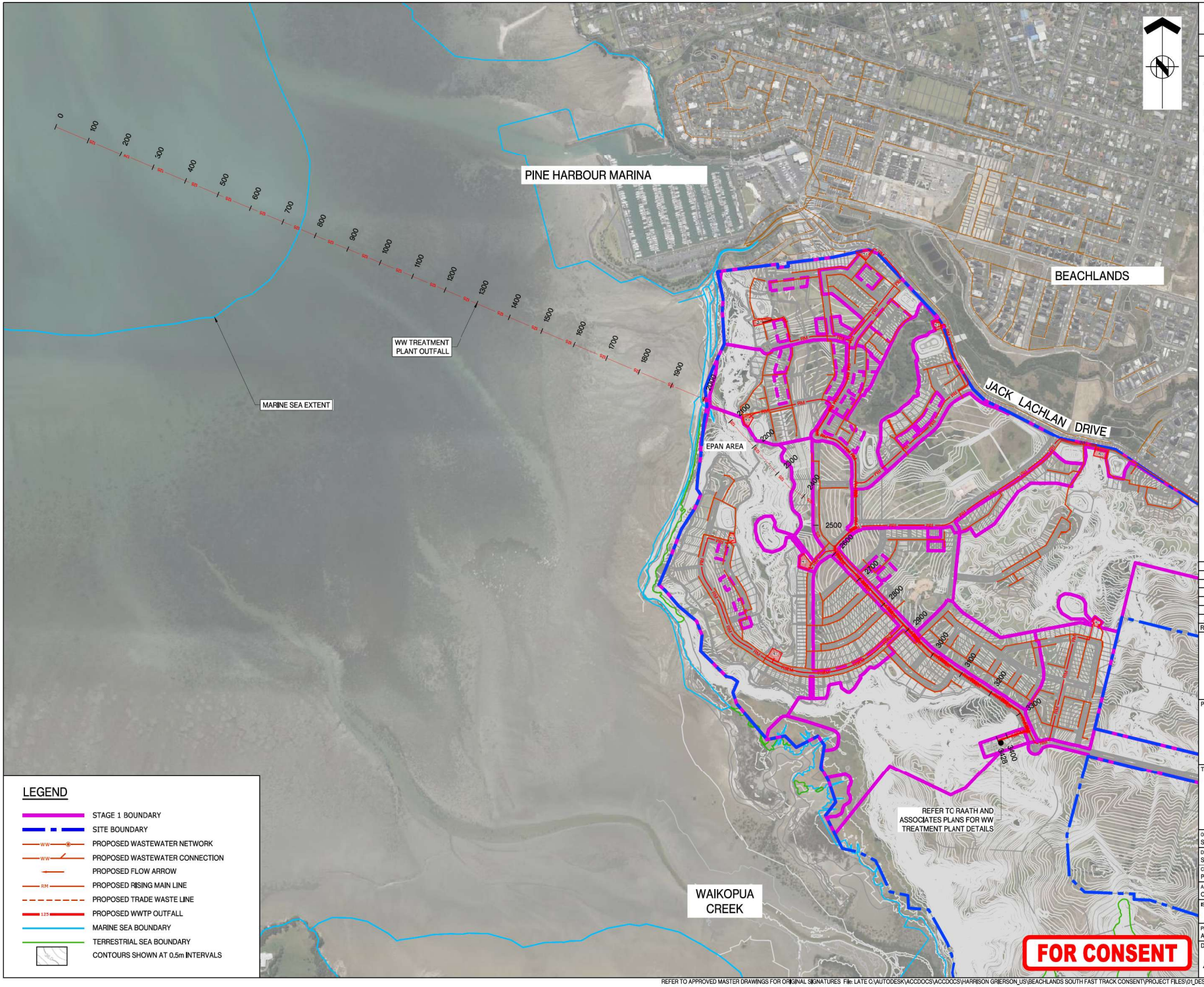
This report has presented the proposed construction methodology for installation of the Beachlands South Wastewater Ocean Outfall using a dual-ended intersect Horizontal Directional Drilling (HDD) methodology. The proposed approach has been developed having regard to the preliminary geological interpretation, anticipated East Coast Bays Formation (ECBF) ground conditions, the coastal environment and the operational requirements of the proposed wastewater outfall.

The proposed methodology incorporates established trenchless construction techniques, including dual-ended pilot-hole drilling, intersect drilling, staged reaming and installation of the 450 mm PE100 outfall pipeline through a fully reamed bore. The methodology has been specifically developed to address the overall installation length while improving steering accuracy, maintaining effective drilling fluid management and reducing construction risk when compared with a conventional single-ended HDD installation.

The use of trenchless offshore installation techniques provides significant environmental benefits by avoiding extensive excavation within the coastal cliff, intertidal zone and seabed, thereby minimising disturbance to environmentally sensitive coastal and marine environments. Construction activities are largely confined to the established landside HDD compound and offshore jack-up barge, resulting in a substantially reduced environmental footprint compared with conventional marine pipeline installation methods.

Based on the available preliminary geotechnical information and the proposed construction methodology, the Beachlands South Wastewater Ocean Outfall is considered technically feasible using the proposed dual-ended intersect HDD methodology. The methodology represents a practical and robust trenchless offshore installation solution that is capable of being refined during subsequent design phases following completion of additional geotechnical investigations and detailed engineering design.

Appendix A – WWTP OUTFALL LAYOUT PLAN



ACENZ ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

ISO 9001 QUALITY ASSURED

NOTES

1. ALL WASTEWATER WORK TO BE COMPLIANT WITH THE BUILDING CODE AND WATERCARE SERVICES LIMITED CODE OF PRACTICE.
2. ALL EXISTING SERVICES NEED TO BE LOCATED/MARKED AND CONFIRMED PRIOR TO WORK COMMENCING ON SITE.
3. REFER TO PARTICULAR SPECIFICATION WITHIN THE CONTRACT DOCUMENT FOR AS-BUILTING REQUIREMENTS AND CONSTRUCTION DETAILS.
4. HARDFILL BACKFILL ALL TRENCHES BELOW CARRIAGEWAY AND AS SHOWN WITH GAP 65.
5. ALL WORK DEEMED BY THE ENGINEER OR AUCKLAND COUNCIL OFFICERS AS BEING SUBSTANDARD WORK SHALL BE RECTIFIED AT THE CONTRACTORS EXPENSE.
6. ALL PIPES TO BE DN125 PE UNLESS OTHERWISE STATED.
7. REFER TO DRAWING A 2515591.00-0016 FOR STAGE DETAILS.
8. AERIAL PHOTO FROM GOOGLE EARTH FOR THE PURPOSES OF SHOWING THE LOCATION OF THE OUTLET STRUCTURE
9. FINAL DESIGN AND LOCATION OF OUTFALL WITHIN THE SEA SUBJECT TO CONSENT AND ENGINEERING APPROVAL

REF	REVISIONS	BY	DATE
B	FOR CONSENT	CJM	06.2026
A	FOR CONSENT	CJM	05.2026

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PROJECT:

BEACHLANDS
FAST TRACK CONSENT APPLICATION
BEACHLANDS SOUTH, AUCKLAND

TITLE:

WASTEWATER TREATMENT PLANT OUTFALL LAYOUT PLAN

ORIGINATOR: SCT	DATE: 05.2026	SIGNED:	PLOT BY: SCT
DRAWN: SCT	DATE: 05.2026	SIGNED:	PLOT DATE: 22.06.26
CHECKED: PZS	DATE: 05.2026	SIGNED:	SURVEY BY: SURVEYED BY
APPROVED: CJM	DATE: 05.2026	SIGNED:	SURVEY DATE: SURVEYED DATE

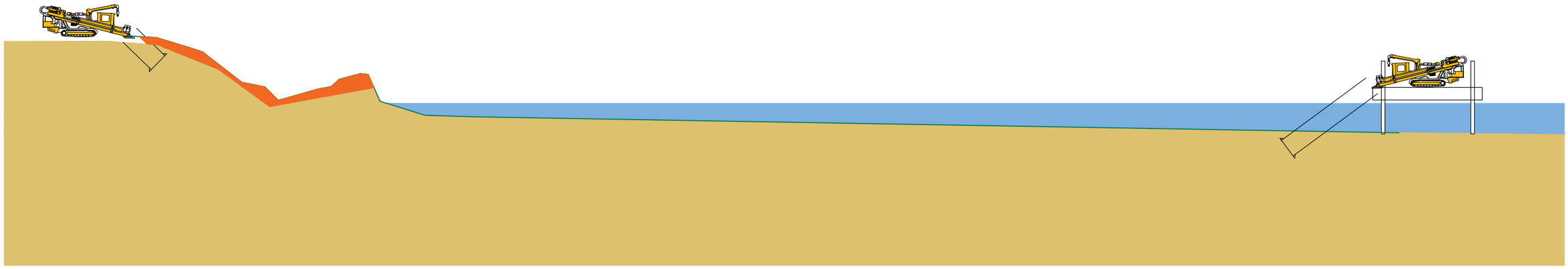
ISSUE STATUS: FAST TRACK CONSENT

PROJECT No: A2515591.00	SCALES: 1:5000 - A1 1:10000 - A3	A1
DRAWING No: A2515591.00-5036		REV B

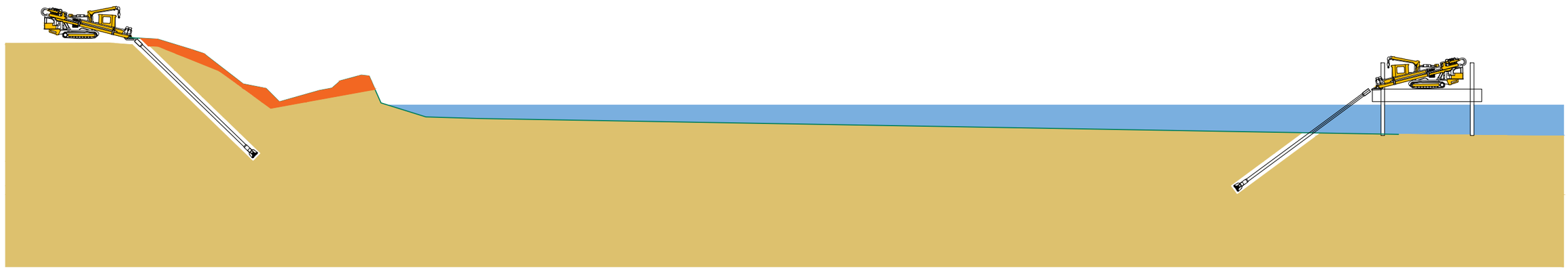
Appendix B – HDD METHOD SEQUENCE

1.0 ESTABLISH HDD LAND RIGSITE AND OFFSHORE HDD BARGE

1.1 HAMMER ISOLATION CASING TO COMPETENT ROCK AT ENTRY AND EXIT



2.1 COMMENCE DRILL OF PILOT HOLE FROM LAND AND OFFSHORE BARGE



ISSUE	DATE	AMENDMENT	BY	APPD.

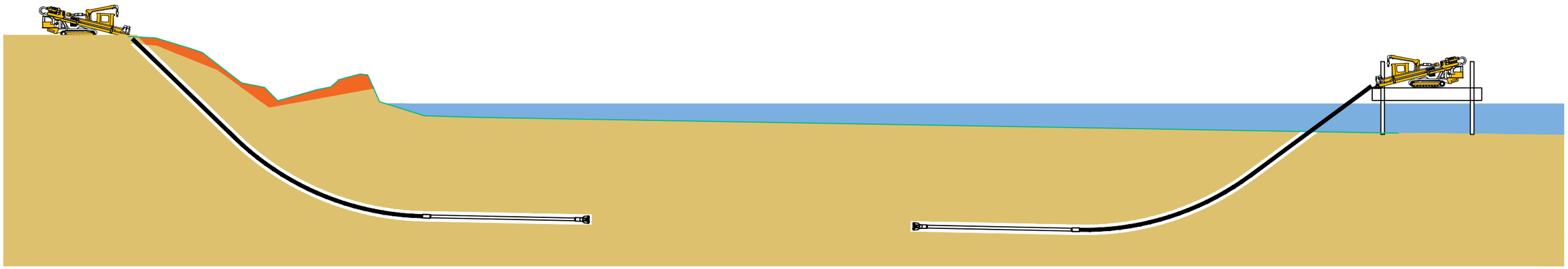
DESIGNED		
DES. APPROVED		
DRAWN		
DWG. APPROVED		
WSL DESIGN MGMT.		
WSL PROJ. LEAD		
BY	DATE	

CDS HDD DESIGN

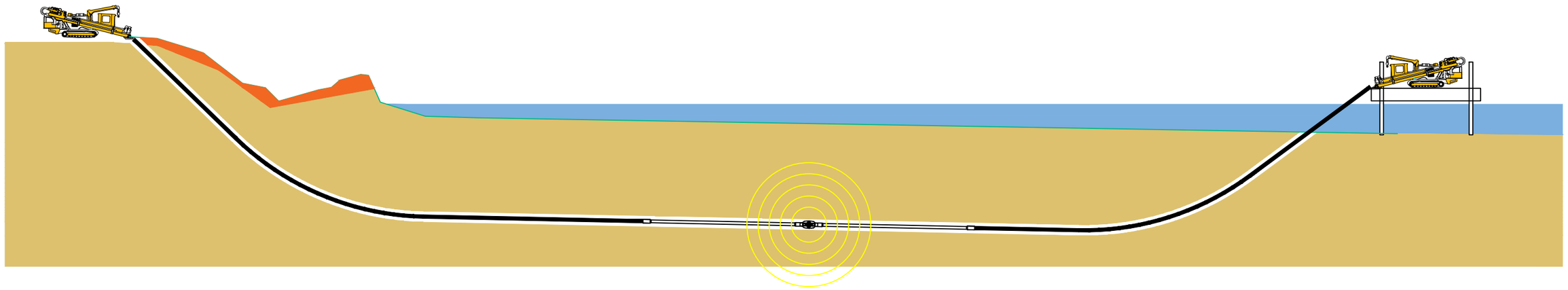
BEACHLANDS SOUTH LIMITED PARTNERSHIP
Bucklands South WW Ocean Outfall
HDD EXECUTION SEQUENCE - Stage 1.0 - 2.1

CAD FILE	DATE
ORIGINAL SCALE A3	CONTRACT No.
REF No.	
DWG No.	ISSUE

2.2 CONTINUE DRILLING PILOT HOLE FROM LAND AND OFFSHORE BARGE

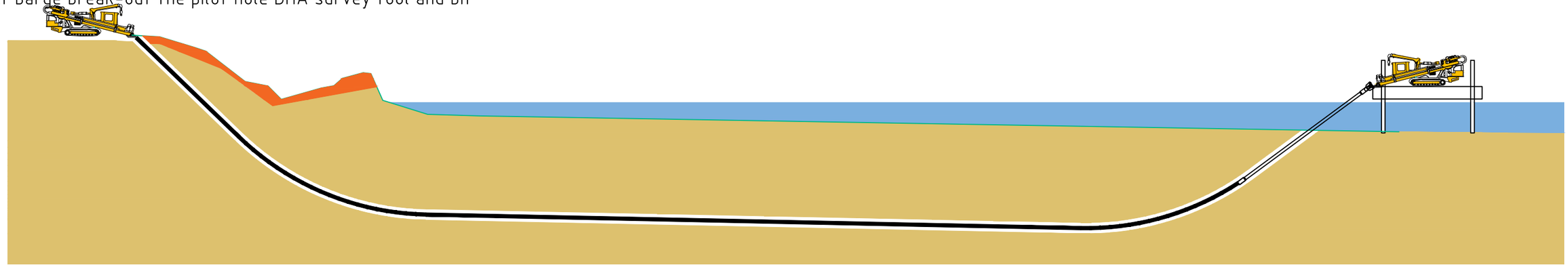


2.3 INTERSECT PILOT HOLES USING PARATRACK 2 MAGNETIC SURVEY



2.4 COMPLETE PILOT PHASE BY ADVANCING LAND RIG DRILL PIPE THROUGH BOREHOLE TO OFFSHORE BARGE

At barge break-out the pilot hole BHA survey tool and bit



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DWG. APPROVED		
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Bucklands South WW Ocean Outfall
HDD EXECUTION SEQUENCE - Stage 2.2 - 2.4

CAD FILE	DATE
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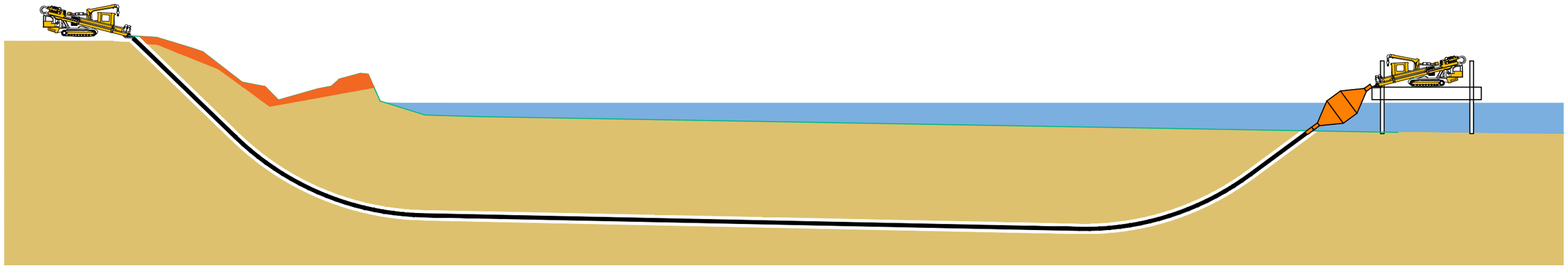
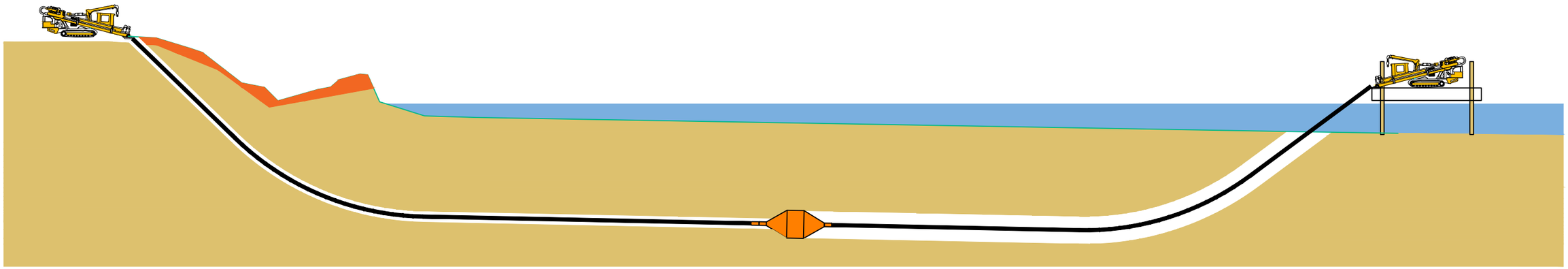
REF No.	
DWG No.	ISSUE

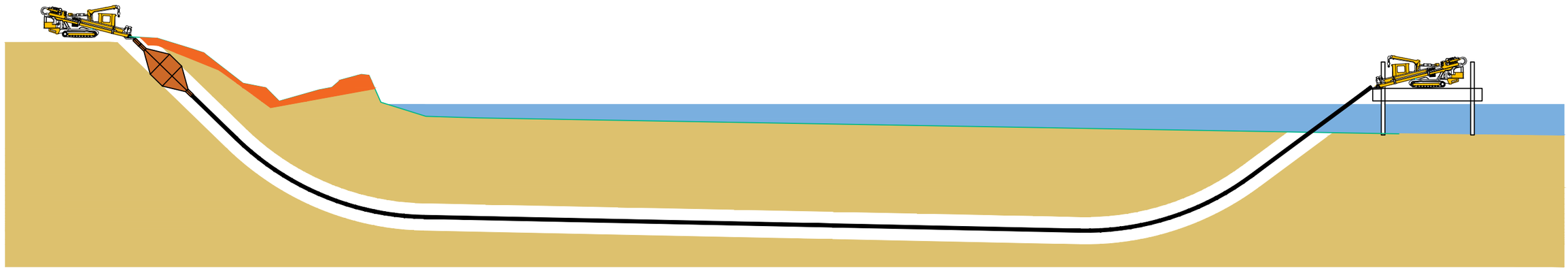
3.1 MAKE-UP REAMING BHA TO DRILL PIPE ON OFFSHORE BARGE AND COMMENCE BACK REAMING



3.2 CONTINUE BACK REAMING



3.2 COMPLETE BACK REAMING



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DWG. APPROVED		
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Bucklands South WW Ocean Outfall
HDD EXECUTION SEQUENCE - Stage 3.1 - 3.2

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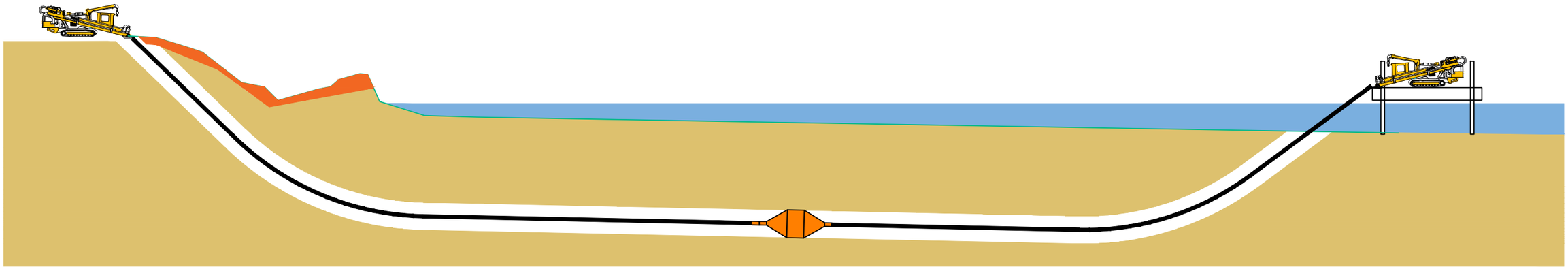
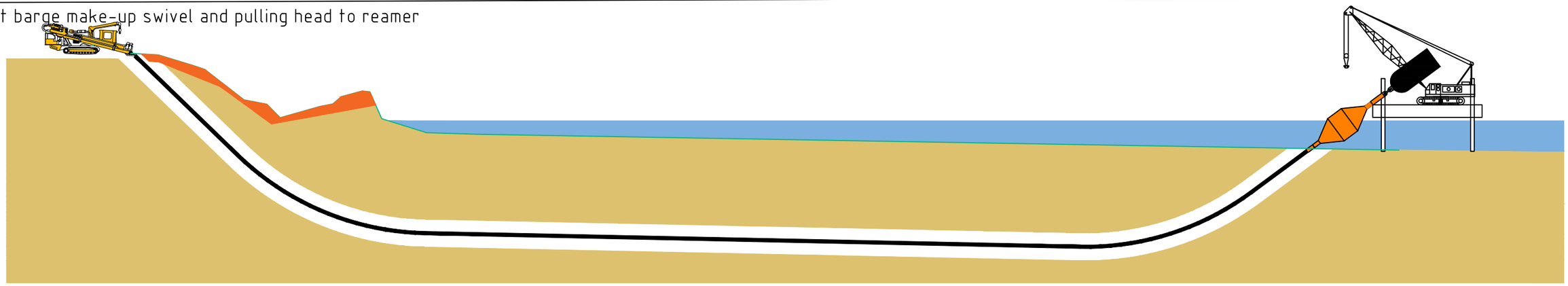
DWG No.	ISSUE

4.0 TRIP REAMING TOOL BACK IN HOLE

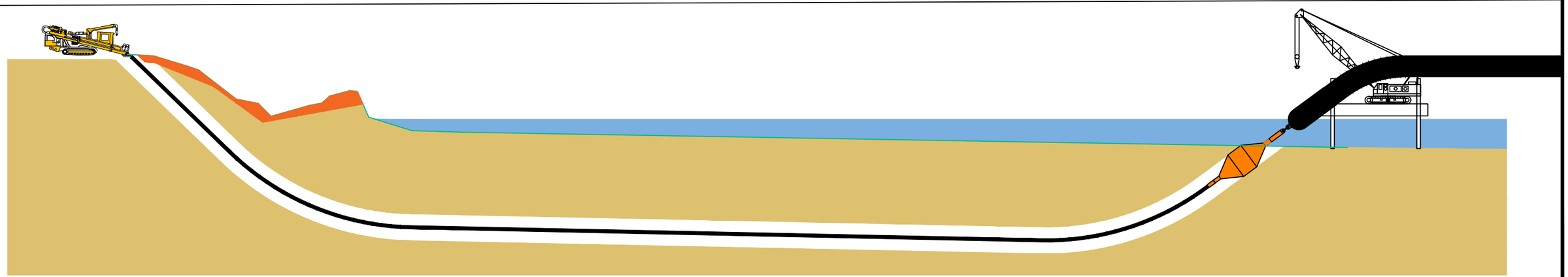


5.0 TRIP REAMING TOOL FROM LAND SIDE ENTRY POINT TO OFFSHORE BARGE

At barge make-up swivel and pulling head to reamer



6.1 COMMENCE PIPE STRING PULLBACK



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Bucklands South WW Ocean Outfall
HDD EXECUTION SEQUENCE - Stage 4.0 - 6.1

CAD FILE	DATE
ORIGINAL SCALE A3	CONTRACT No.
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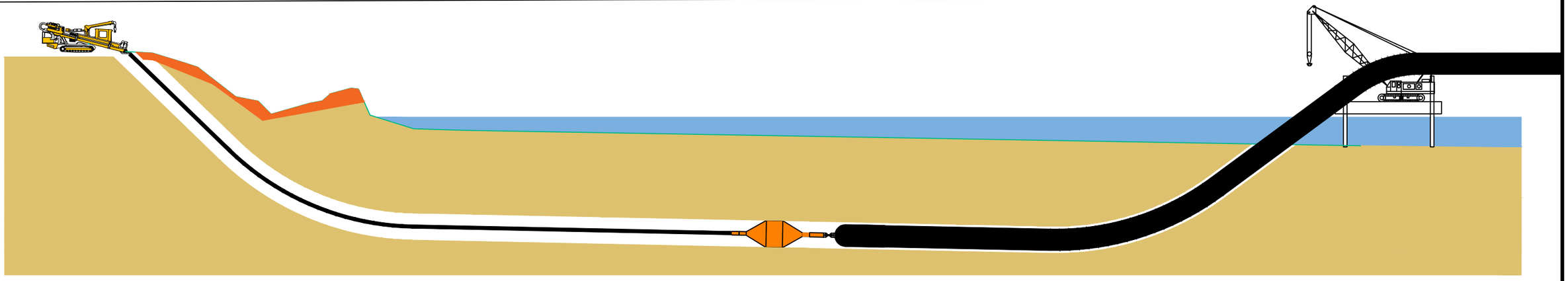
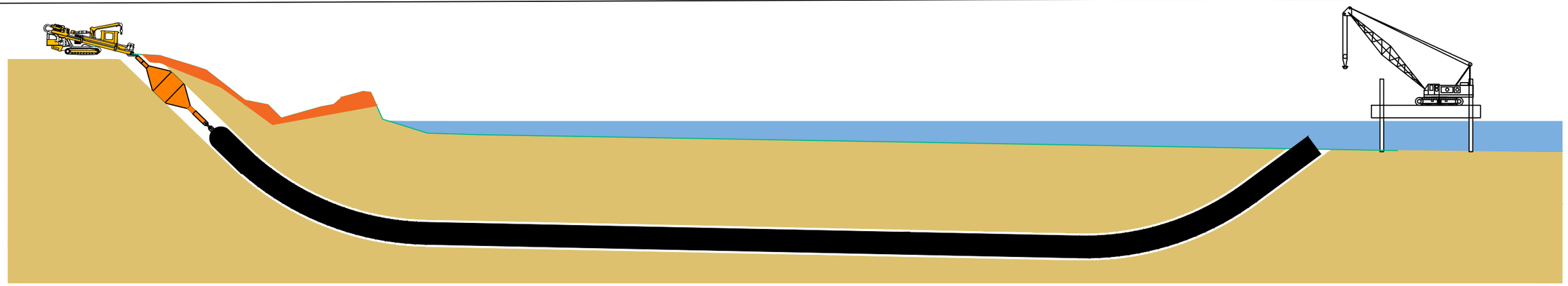
DWG No.	ISSUE

6.2 CONTINUE PIPE STRING PULLBACK

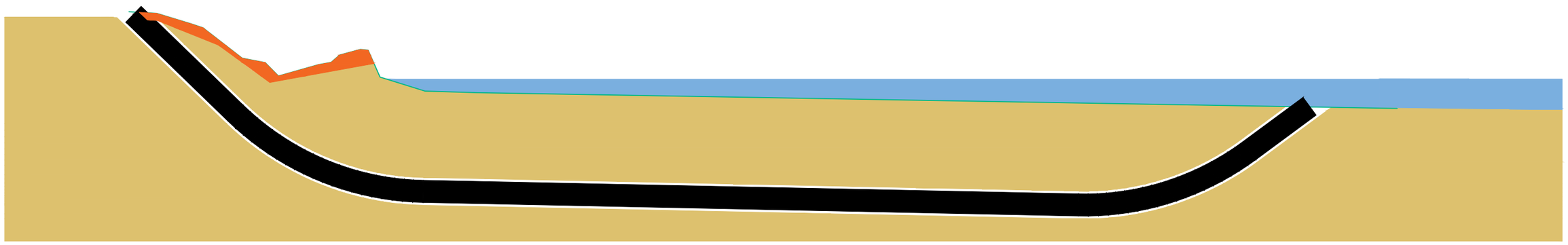


6.3 COMPLETE PIPE STRING PULLBACK



7.0 REMOVE ISOLATION CASING, DISESTABLISH OFFSHORE BARGE AND RESINSTATE LAND RIG COMPOUND

Complete testing and commissioning of waste water ocean outfall



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BEACHLANDS SOUTH LIMITED PARTNERSHIP
Bucklands South WW Ocean Outfall
HDD EXECUTION SEQUENCE - Stage 6.2 - 7.0

CAD FILE	DATE
ORIGINAL SCALE A3	CONTRACT No.
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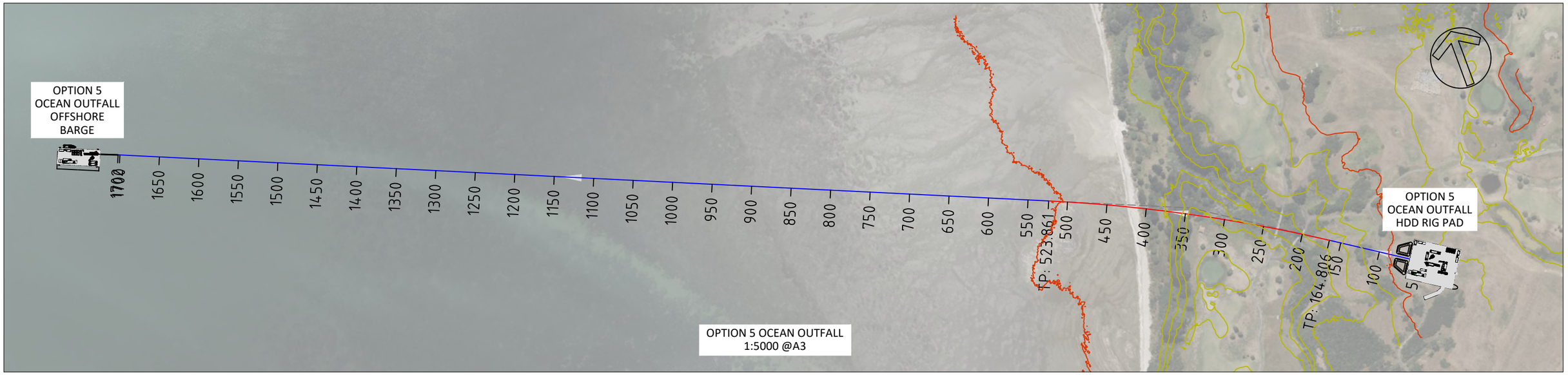
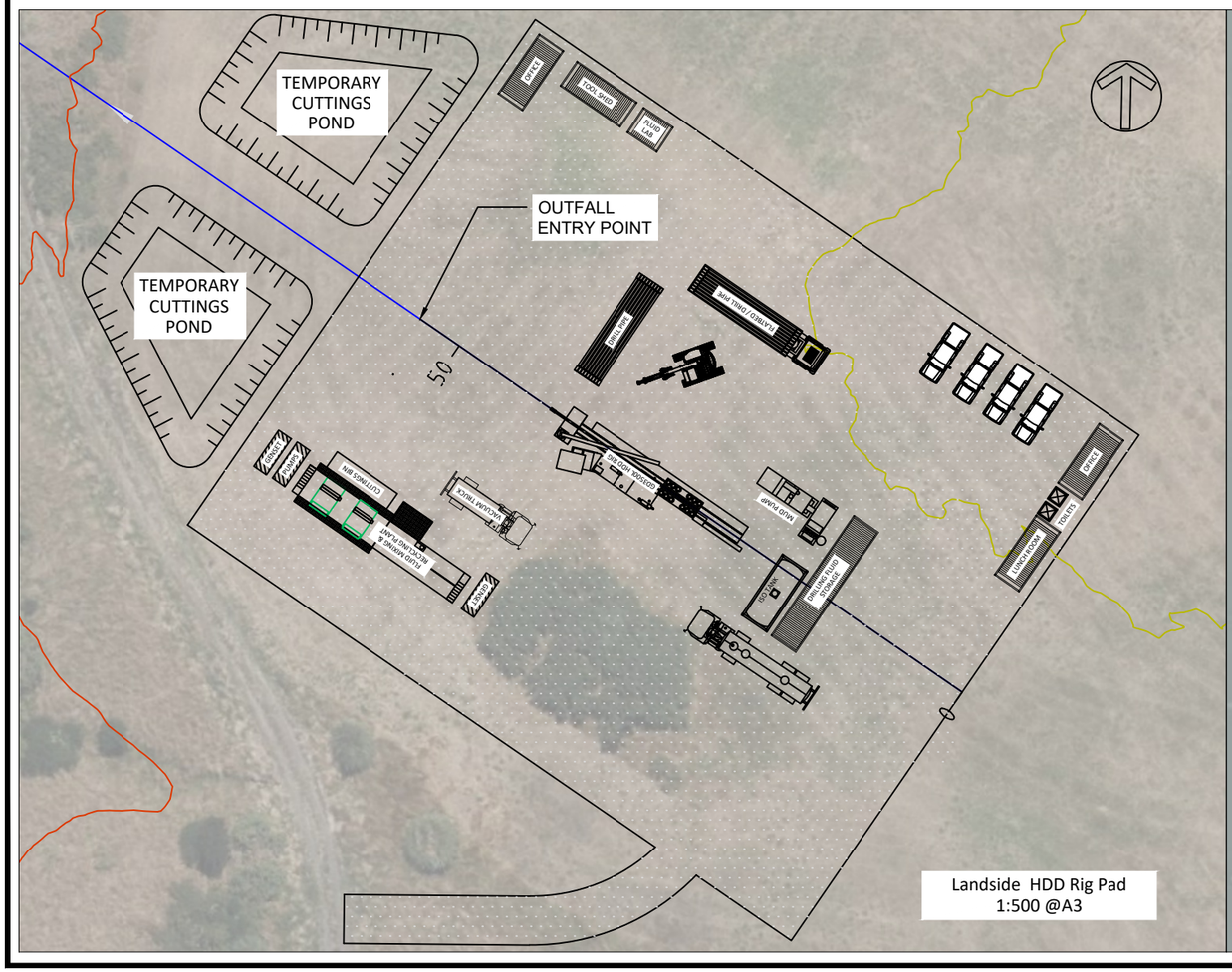
DWG No.	ISSUE

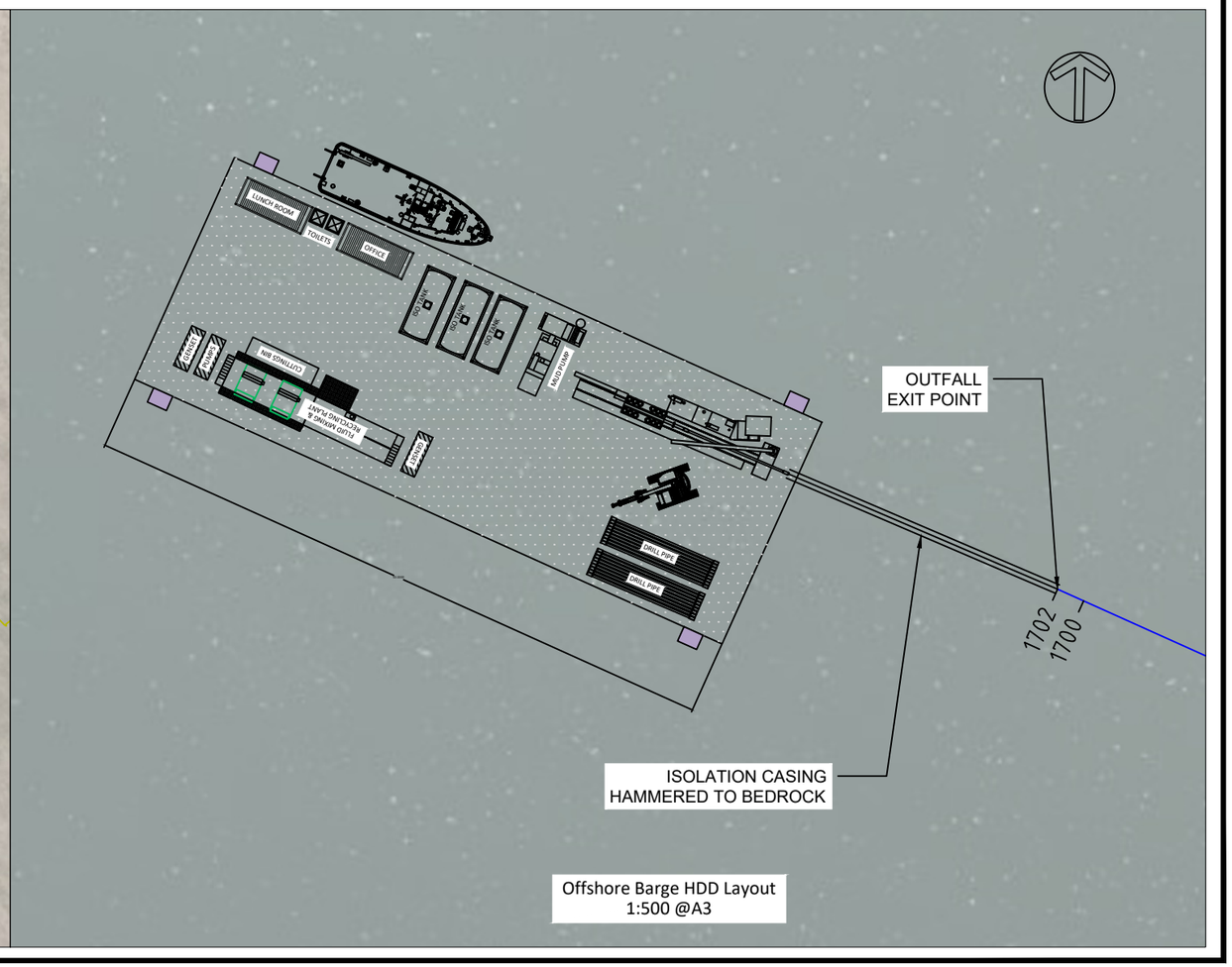
Appendix C – HDD TEMPORARY WORKS LAYOUT PLAN



OPTION 5 OCEAN OUTFALL
1:5000 @A3



Landside HDD Rig Pad
1:500 @A3



Offshore Barge HDD Layout
1:500 @A3

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Bucklands South WW Ocean Outfall
HDD Temporary Works

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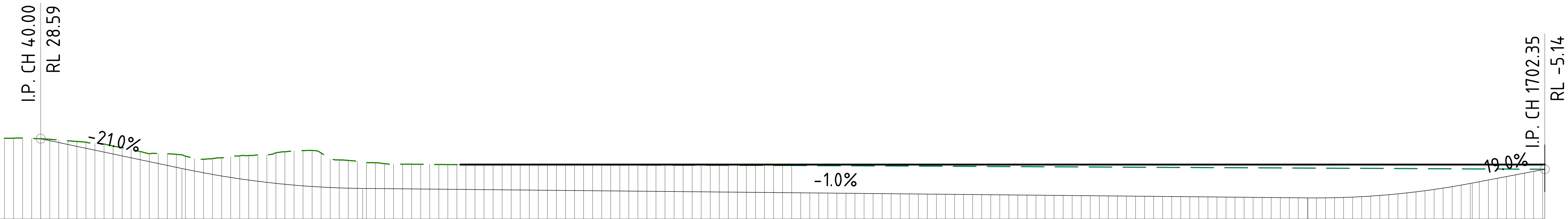
Appendix D – HDD DRILL PROFILE



VERT EXAG 1:1
Datum -60.000

Chainage	Existing Levels	Design Levels	Depth
		28.586	
50.000	28.036	26.481	1.555
100.000	23.732	15.958	7.774
150.000	14.417	5.434	8.983
164.806	12.495	2.318	10.177
		-4.271	
200.000	9.338	-5.082	14.420
250.000	8.753	-14.156	22.909
300.000	13.002	-20.722	33.724
350.000	12.863	-24.780	37.642
		-26.297	
400.000	2.418	-26.337	28.755
450.000	0.441	-26.837	27.278
500.000	0.026	-27.337	27.363
523.861	-0.044	-27.576	27.532
550.000	-0.097	-27.837	27.740
600.000	-0.174	-28.337	28.164
650.000	-0.317	-28.837	28.520
700.000	-0.409	-29.337	28.928
750.000	-0.561	-29.837	29.277
800.000	-0.706	-30.337	29.632
850.000	-0.867	-30.837	29.970
870.068	-0.924		30.114
900.000		-31.337	
950.000		-31.837	
1000.000		-32.337	
1050.000		-32.837	
1100.000		-33.337	
1150.000		-33.837	
1200.000		-34.337	
1250.000		-34.837	
1300.000		-35.337	
1350.000		-35.837	
1400.000		-36.337	
		-36.744	
1450.000		-36.789	
1500.000		-35.394	
1550.000		-31.243	
1600.000		-24.336	
		-20.377	
1650.000		-15.097	
1700.000		-5.586	
1702.347		-5.140	

VERTICAL

G: -21.0% L: 156.110	R: 996.7 K: 10.0 L: 199.803	G: -1.0% L: 1044.706	R: 907.1 K: 9.1 L: 181.627	G: 19.0% L: 80.101

HDD WW OCEAN OUTFALL LONG SECTION

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BEACHLANDS SOUTH LIMITED PARTNERSHIP
Bucklands South WW Ocean Outfall
HDD DRILL PROFILE

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DATE
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CONTRACT No.
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DWG No.
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This report may only be read or transmitted in its entirety, including the appendices.