Document Title:

SCOPE OF WORK

Project Title:

GEOTECHNICAL INVESTIGATION TO ASSESS THE FEASIBILITY OF HORIZONTAL DIRECTIONAL DRILLING FOR EXPOSED GAS PIPELINE CROSSINGS OVER RIVERS IN CARRINGTON AND UMHLALI

REVISION: 02

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ABBREVIATIONS

TPL	Transnet Pipelines
HDD	Horizontal Directional Drilling
KZN	KwaZulu-Natal
DSW	Durban Solid Waste
SPT	Standard Penetrometer Test
DPL	Dynamic Cone Penetrometer Light (DPL) Test
ASTM	American Society for Testing and Materials
RQD	Rock Quality Designation
PPE	Personal Protective Equipment

1. INTRODUCTION

Transnet Pipelines (TPL), the largest multi-Product pipeline operator in Southern Africa, maintains and operates a network of 3114 km of pipeline infrastructure. TPL plays a key role in the country's economy, with the core strategic objective of ensuring petroleum product security of supply for the inland market and gas security of supply for the KwaZulu-Natal market. Along the pipeline network are pump stations and depots which are spread across five provinces- KwaZulu Natal, Free State, Gauteng, North-west, and Mpumalanga.

The pipeline is laid within a servitude of 6m width which traverses through many properties (private, state-owned, and local authorities). Transnet Pipelines have Servitude rights to private property along all the pipeline routes. These rights refer to legal agreements that grant Transnet Pipelines certain rights to access and use private property for the construction, operation, and maintenance of its pipelines. Thus, it is TPL's responsibility to ensure the safety and protection of the pipeline, surrounding communities and the environment.

2. BACKGROUND

Transnet Pipelines manages and maintains an 18" steel methane-rich gas pipeline (Lily line) which runs from Secunda to Durban. In April of 2022, KwaZulu Natal (KZN) experienced long periods of heavy rainfall which caused flooding and mudslides in Durban and surrounding areas. These extreme weather conditions led to the widening of a river located in Carrington (Cato Manor) near the gas pipeline. This resulted in approximately 20 meters of the pipeline being exposed and suspended across the stream because of the riverbed erosion. Floods within previous years have also led to the exposure of the gas pipeline in Shakaskraal, which is situated 50 kilometres north of the city of Durban. The pipeline spans across the Mhlali river, with a portion of the pipeline being exposed occasionally on either side of the river. These pipeline exposure events have resulted in the need for pipe protection works for both the Carrington site and the Shakaskraal site.

An exposed pipeline poses several risks such as,

- Risk of damage: The pipeline is vulnerable to external factors such as debris carried by the stream, especially because illegal dumping is taking place alongside the stream and mechanical damage on the pipe by intruders.

- Environmental and public health impact: Any rupture or leakage from the gas pipeline could negatively affect the environment as methane is a potent greenhouse gas. Furthermore, exposure to the combustion products of methane can lead to respiratory problems.
- Regulatory compliance: Regulatory bodies often impose strict guidelines for pipelines crossing water bodies due to the potential environmental impact and safety concerns.

3. PROBLEM STATEMENT

Transnet Pipelines is exploring long-term solutions to mitigate the hazards associated with the exposed pipeline to ensure pipeline protection and compliance with regulatory requirements. The proposed solution under consideration is the use of horizontal directional drilling (HDD) to lower the +/- 200m and the +/- 270m length pipeline below the riverbeds in Carrington (Cato Manor) and Umhlali (Shakaskraal) respectively. HDD is a specialised trenchless operation used to install underground pipelines across obstacles such as rivers and fixed structures. Due to its trenchless nature, the geotechnical conditions of the surrounding area need to be assessed to determine the feasibility of this solution. The factors that need to be considered include, but are not restricted to, the following:

- Subsoil and groundwater conditions: Understanding the subsurface geology, soil types and groundwater conditions.
- Obstacles and utilities: Identification and accurate mapping of existing underground utilities (such as water pipes, gas lines, electrical cables) and other obstacles (like large rocks, boulders, or old foundations).
- Route length and alignment: The length and alignment of the desired bore path need to be assessed.
- Environmental considerations: Environmentally sensitive areas require additional HDD guidelines which should be established.
- Access and workspace: Access to both the entry (where drilling begins) and exit points (where drilling ends) must be feasible for equipment and personnel. Sufficient workspace for setup and operation of drilling equipment is also required.

4. SITE DESCRIPTION

1. Carrington

The Carrington site is in Durban, Cato Manor and the pipeline is exposed and suspended across the Mkhumbane River. The exposed portion of pipeline is surrounded by the Bellair Substation and DSW Bellair Garden Drop-off Site.

The site is depicted in figure 1.

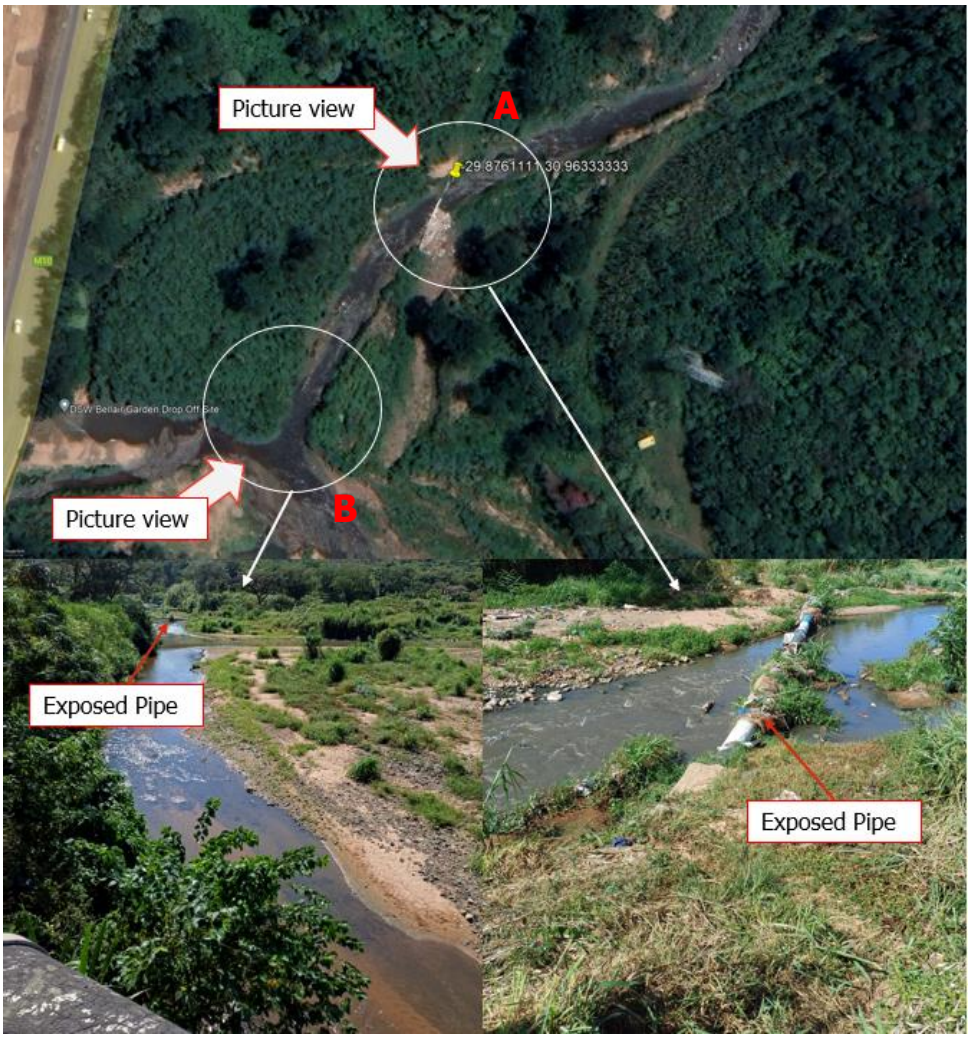

Figure 1: Carrington Site

- **Site Access**

Access to the exposed pipeline segment labelled A on figure 1 is gained through the Cato Manor Sports Field. Whereas access to the pipeline segment labelled B on figure 1 is gained through DSW. The Sports field access point is +/- 125m away from the exposed pipeline and has a narrow maintenance pathway as shown in segment A of figure 2. Whereas the DSW access point has

restricted access and is situated between the DSW boundary wall, and the eThekwini Municipality power station as shown in segment B figure 2.

Figure 2: Site Access

4.2 Umhlali

The Umhlali site is in Shakaskraal which is situated 50 kilometers north of the city of Durban. The pipeline spans across the Mhlali River.

The site is depicted in figure 3.

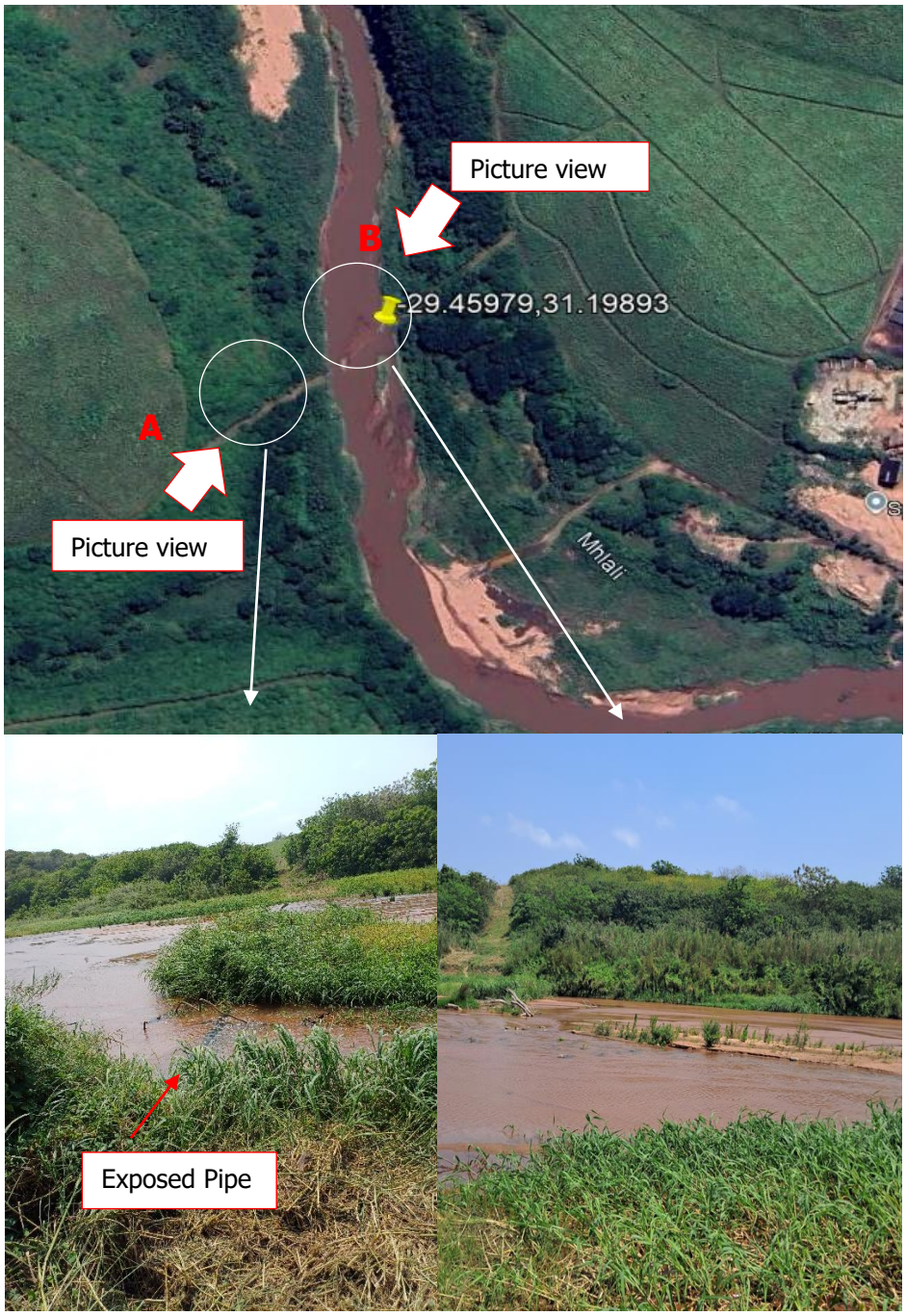

Figure 3: Umhlali Site

- **Site Access**

Access to the exposed pipeline is through a dirt road that is just off the R102. The terrain can be described as hilly-steep through the rural, sugar-cane valley. The flat section of the access road is situated +/- 110 meters from the river on both sides as shown in figure 4.

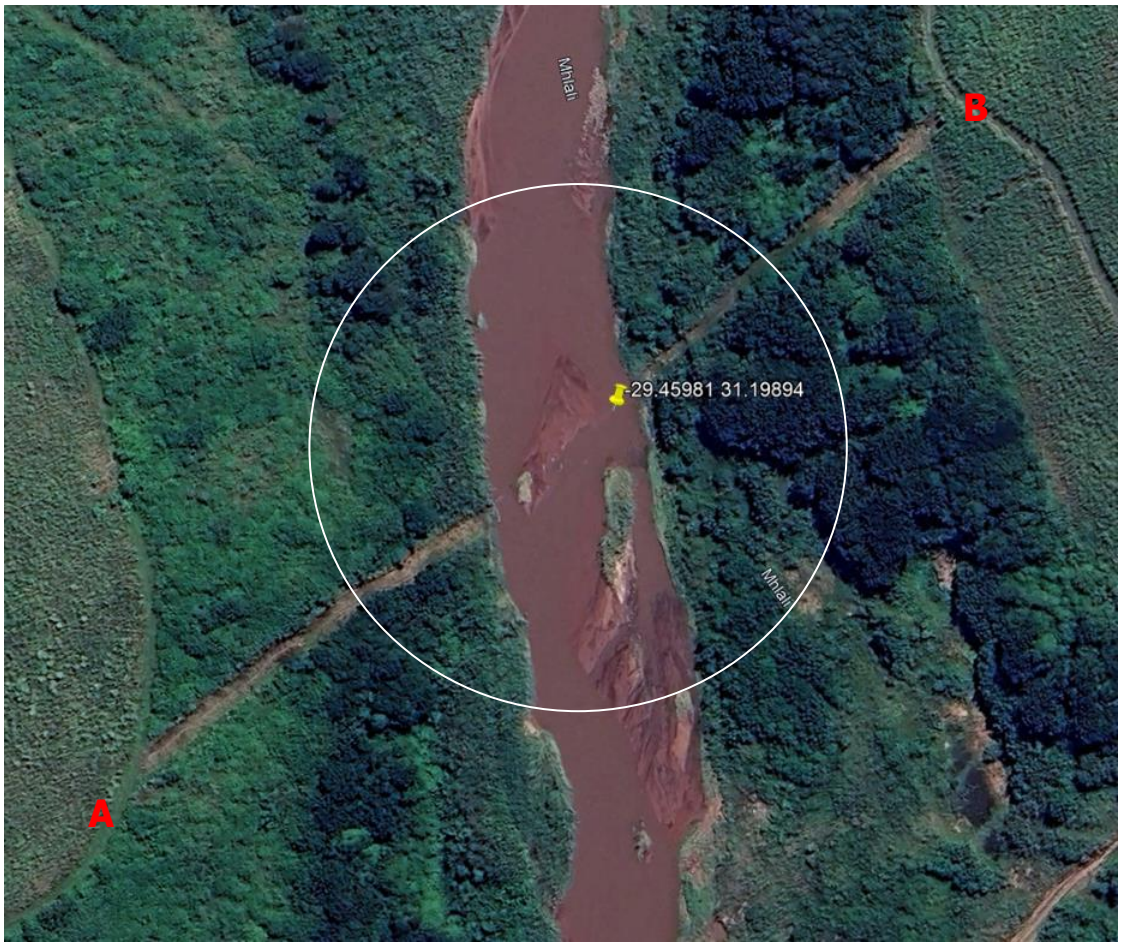

Figure 4: Site Access

5. PROJECT OBJECTIVES

The project objectives are to,

- Conduct a geotechnical investigation to assess the subsoil and groundwater conditions, as well as to determine the site conditions that may influence engineering decisions.
- Use geotechnical investigations to provide routing recommendations and assess the practicality of horizontal directional drilling on the proposed site.
- Produce a geotechnical report addressing the sampling program, laboratory analysis, interpretation of geotechnical engineering properties, bore logs and a profile of the subsurface conditions.

6. DESCRIPTION OF THE WORKS

6.1 Fieldwork

The proposed solution under consideration is the use of horizontal directional drilling (HDD) to lower the +/- 200m and the +/- 270m length pipeline below the riverbeds in Carrington and the Umhlali respectively. The fieldwork to be undertaken at the sites comprises of the following:

6.1.1 Boreholes

- An adequate number of boreholes should be drilled using biodegradable drilling fluid . If results indicate highly varying strata, then additional boreholes may be required.
- Boreholes should be located to track stratigraphy and detect geological sequence, structure, and areas of significant change.
- Standard penetrometer testing sampling should be undertaken at selected depth intervals within the borehole when soils are encountered.
- Borehole logs/profiles should be presented and must include data relating to the rock drilling core runs, percentage recovery, rock quality designation (RQD) and fracture frequency.
- Groundwater levels must be measured in the boreholes and documented.

6.1.2 Dynamic Cone Penetrometer Light (DPL) Tests

- Light dynamic penetrometer (DPL) tests should be performed to determine the thickness of the different soil layers as well as the strength and deformation parameters. The results of these tests should be presented in the geotechnical investigation report.

6.2 Laboratory Tests

Conduct particle size distribution analysis and determine the Atterberg limits to define the engineering properties of the in-situ soils. A minimum of the following tests is required to achieve this:

- Sieve Analysis (in accordance with ASTM D422)
- Hydrometer Analysis (in accordance with ASTM D422)
- Atterberg Limit Test (liquid limit test in accordance with ASTM D4318, Plastic limit test in accordance with ASTM D4318, Shrinkage limit test in accordance with ASTM D4943)

6.3 Geotechnical Investigation Report

The geotechnical investigation report produced should include but not be limited to the following:

- Site description and location: A detailed description of the site including coordinates and terrain characteristics.
- Geological and geotechnical conditions: An assessment of the soil and rock types present at the site. Including any geological structures that may affect the drilling operations.
- Subsoil conditions: Results from borehole tests.
- Soil properties: Results from laboratory test and detailed analysis of soil properties from these results.
- Groundwater conditions: Assessment of groundwater levels, flow direction and potential effects on drilling operations and stability.
- Risk assessment: Identification and evaluation of potential risks associated with HDD operations such as ground movement, inadvertent returns and environmental impacts.
- Construction specifications: Specific guidelines and specifications for construction such as excavation and grouting requirements.
- Environmental considerations: Evaluation of potential environmental impacts and recommended mitigation measures to protect sensitive areas.
- Conclusions and recommendations: Summary of findings, conclusions regarding feasibility and recommendations for HDD route, design and construction based on geotechnical considerations.

7 GENERAL REQUIREMENTS

7.1 Attending site briefing is compulsory.

7.2 The Contractor shall submit a method statement detailing the approach and methodology that will be used to address the project's scope and objectives. The method statement should cover but not be limited to:

- Detailed technical approach and management.
- Full details on how the works will be executed with reference to the scope of works.
- Determining potential risks and mitigations aligned to Scope of works.
- Techniques and tools to be used to achieve the scope objectives.

7.3 The Contractor shall provide a programme that demonstrates their capability to deliver the services. The programme should cover but not be limited to:

- Ability to execute the work in terms of the Employer's requirements and within the required timeframe indicating, in a logical sequence, the order and timing of the works to achieve the deliverables as per the Scope of work, clearly indicating the capacity and capability to achieve the dates stated in the Contract Data.
- Dates when the Contractor will need access to any part of site, submission & approval process & timing for Health & Safety Files, Quality Files. Two (2) months allowance should be made for the safety file approval process.
- The *Consultant* indicates how he plans in achieving the following dates and clearly demonstrates them on the schedule - Start Date, Access Date, Planned Completion, Key Dates Completion Date. In addition, the Programme clearly demonstrates adequate provisions for Time Risk Allowance (TRA). Time Risk Allowances are not float, are owned by the Tenderer, can be included in the activity duration, and illustrated in the schedule in a code field or as an attachment.

7.4 Provision to work on weekends should be made for circumstances whereby access to certain equipment's could result to maximum disruptions.

7.5 The Contractor shall supply adequate and competent labour, supervision, tools, equipment, services, PPE, and testing devices for all items necessary to complete the work. Transnet Pipelines reserves the right to terminate the Contract at any point if it is found that the Contractors performance, supervision, tools, equipment, services, testing devices, and materials do not comply with specified requirements. The Contractors will only be allowed to claim for work completed to the specified acceptable standard.

7.6 All waste shall be disposed of in accordance with relevant local environmental regulations.

7.7 The Contractor is required to satisfy himself that all tools provided will comply with all specifications as included in the Tender Documents. Failure to meet specifications shall render the Contractor liable to rectify the problem at no cost to Transnet Pipelines.

7.8 The successful Contractor is to note with regards to works on site, that responsibility for the protection of all existing equipment and services related to the SOW shall rest solely with the Contractor. The Contractor shall be required to bear all costs that may arise because of damage that may have been caused to equipment or services or that may arise because of his operation on the respective site.

7.9 The Contractor shall only utilize testing devices and measuring equipment that are certified where applicable and carry a valid calibration certificate as issued by an approved calibration authority.

7.10 If additional scope is requested by the Project Manager or any other authorised representative, the Contractor shall provide a written estimate for carrying out the works, and there shall be no additional fee charged for providing such estimates.

8 HEALTH AND SAFETY REQUIREMENTS

8.1 As part of commitment to safety, the Contractor must comply with OHS Act 85 of 1993, the Construction Regulations and any other occupational health and safety regulations as amended. The Contractor will be required to submit a SHE Compliance File upon award.

8.2 Site access will only be granted once the SHE Compliance File has been reviewed and approved by Transnet Pipelines. All contractor personnel must undergo induction before conducting any work on site, wear the minimum required personal protective equipment within site, and adhere to all relevant signage within their working area as well as open a permit before conducting any work.

9 ENVIRONMENTAL MANAGEMENT

9.1 The appointed Contractor must comply with Transnet's Minimum Environmental Standards for Construction document (009-TCC-CLO-SUS-11385) as attached in Annexure B.

9.2 The Contractor shall comply with the statutes that prohibit pollution of any kind. These statutes are enacted in the following legislation:

- The National Environmental Management Act, 107/1998
- The Environmental Conservation Act, 73/1989; and
- The National Water Act, 36/1998

10 TECHNICAL STANDARDS & REGULATIONS

Geotechnical Engineering Standards

- ASTM D 422 Standard Test Method for Particle Size Analysis of Soils
- ASTM D 4318-17 Standard Test Methods for Liquid Limit, Plastic limit, and Plasticity Index of Soils
- SANS2001 – BS1 Site Clearance

- SANS2001- BE1 Earthworks (General)

All other applicable Standards and Specifications that is not mentioned above should be applied during execution of project scope.