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REC SERVICES
ENVIRONMENTAL CONSULTANTS

SERVICE STATION LOCATED ON PORTION 112 OF THE FARM BUFFELSFONEIN 204/7 AS PART OF THE FUTURE HEROLDS BAY COUNTRY ESTATE, GARDEN ROUTE MUNICIPALITY, WESTERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PLAN

IN TERMS OF THE PETROLEUM PRODUCT SITE LICENSE ACT NO 120 OF 1977 UNDER THE REGULATIONS REGARDING PETROLEUM RETAIL & SITE LICENCES

(NO. R. 287 OF 27 MARCH 2006)

Prepared for: Mr. JACQUES CRONJE
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1. GENERAL

1.1 Environmental Management Plan (EMP) requirements

Definition of an "Environmental Management Plan": A plan or programme that seeks to achieve a required final state and describes how activities that have or could have an adverse impact on the environment, will be mitigated, controlled, and monitored. No standard format exists for compiling an Environmental Management Plan (EMP). It is therefore easy to adopt the EMP to fit its proposed circumstances and to meet its requirements. Additionally, the level of detail in an EMP varies depending on the size of the project as well as the magnitude of environmental impacts. An EMP is a very important tool in the sound environmental management of projects, provided that the specifications are implemented, and the user understands the contents of the report, and the reasons for the implementation of certain specifications.

It should be noted that this EMP is a document under the Petroleum Product Site License Act and does not form part of any EIA process. No Environmental Impact Assessment (EIA) process is needed for the installation of the tanks as the combined capacity will not exceed 80 000 litres, which would be a listed activity and require environmental authorization.

Secondly, the project does trigger the following listed activities as stipulated under listing notice 3 of the EIA regulations:
Environmental impact Assessment Regulations Listing Notice 3, Government Notice No. 324 of 7 April 2017:
Activity Number: 10
Activity Description: The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.

i. Western Cape

i. Areas zoned for use as public open space or equivalent zoning;
ii. All areas outside urban areas; or
iii. inside urban areas:
(aa) Areas seawards of the development setback line or within 200 metres from the high-water mark of the sea if no such development setback line is determined;
(bb) Areas on the watercourse side of the development setback
(cc) Areas on the estuary side of the development setback line or line or within 100 metres from the edge of a watercourse where no such setback line has been determined; or in an estuarine functional zone where no such setback line has been determined.

This listing therefore does apply. In this scenario, the combined capacity of the tanks will not require authorisation, but other EIA activities will be triggered.

1.2 The EMP has the following goals:

- Specifications for the installation of fuel tanks
- Identifying those construction and operational activities that may have a detrimental impact on the environment;
- Detailing the mitigation measures that will need to be taken, and the procedures for their implementation;
- Establishing the reporting system to be undertaken during the construction and operating phases.

The EMP also serves to highlight specific requirements that will be monitored during the development and should the environmental impacts not have been satisfactory prevented or mitigated; corrective action will have to be taken. The document should, therefore, be seen as a guideline that will assist in minimising the potential environmental impact of activities.

The EMP also defines the arrangements that will be put in place to ensure that mitigation measures are implemented. This is achieved by including recommendations towards the roles and responsibilities of the project proponent, environmental management team and contractors.

1.3 EMP in Context

This EMP will form part of the project implementation. The EMP is associated with a formal environmental application as it falls within the implementation thresholds of the EIA regulations of 2014 as amended.

It is with certainty that we assume that they will also require authorization (which was the case) in terms of the National Environmental Management Act 107 of 1998 (NEMA), listing activities. Section 28 of NEMA do require Duty of Care and reads as follows:

> *"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."*

This EMP in context will aim at adhering to the principle of Section 28 and will ensure that Duty of Care is taken.

1.4 Flexibility

The EMP is a flexible document subject to review and updating. During the implementation of a project there is always the possibility that unforeseen issues could arise, this EMP should therefore be revised where necessary to mitigate and include measures for unanticipated impacts.

1.5 Time frame of the EMP

The EMP will focus on the construction and operational phases of the underground storage tanks. The timing of these activities will correspond with the completion of final plans and approvals. It is noted that this country estate is in need of this filling station to help supplement the lack of nearby fuel filling station options.

1.6 Monitoring

All the issues described and discussed in this document will require monitoring, and it will be the responsibility of the owner and or associated appointed parties to implement monitoring.

2. DETAILS OF THE (EAP)

REC Services (Pty) Ltd was commissioned by the applicant to prepare an environmental management plan that seeks to comply with environmental legislation.

In fulfilment of this requirement, provided below are the details of REC and specifically the EAP:

REC SERVICES (PTY) LTD	ENVIRONMENTAL ASSESSMENT PRACTITIONER
Rubenstein office Park 566 Rubenstein Drive, 2nd Floor Moreleta Park 0044 P. O. Box 40541, Moreleta Park, 0044 Telephone: 012 997 4742 Email: info@recservices.co.za / rowan@recservices.co.za	**Rowan van Tonder** Rowan is the principal author of this report and works under the supervision of Mr. Pieter van der Merwe. Rowan undertook his studies at the University of Limpopo and obtained a M.Sc. degree in Botany (focus on Conservation Management) in 2007. Before this, he obtained his B. Hons degree in Physical Geography (focus on Environmental Management) at the University of Pretoria and B.Sc. in Environmental Science at the University of Pretoria. He has been part of Rock Environmental Consulting (Pty) Ltd. for 15 years (for extended details, See Appendix 6 – EAP CV). SACNASP (Pri.Sci.Nat) Reg. No.: 119204. EAPASA reg.: Submitted (Pending)

2.1 Expertise of REC services (Pty) Ltd

REC Services specializes in Environmental Impact Assessments and Management during the planning and development stages of a range of development projects. REC Services (Pty) Ltd, is a streamlined firm with an integrated approach to environmental impact assessments, networking with expertise where necessary, while always keeping a holistic view on assignments.

Our almost 30-year experience is across a broad range of development projects and clients involved in assignments in the urban and rural environments. Our main client base includes private land developers, local authorities, farmers, industrial developers, and mining enterprises where we form part of the project team which usually consist of Civil Engineers, land surveyors, Town and Regional Planners, Property Developers, and Architects etc.

Our services include processes in terms of various environmental acts and include: Basic Environmental Assessments, Environmental Scoping Reports, Environmental Impact Assessment Reports, Environmental management Plans, and Environmental Monitoring Reports and Water use licensing. REC has also undertaken various mining right and mining permit applications.

3. ENVIRONMENTAL MANAGEMENT PLAN IN CONTEXT

3.1 Purpose of the EMP and the EMP in Practice

The purpose of the EMP finds its origin from the Constitution (1996), National Environmental Management Act (1998), sectoral environmental legislation and the intergovernmental Relation Framework Act (2005) through providing a platform for Co-operative environmental governance. To achieve such co-operative environmental governance mechanisms such as EMPs and EIP (environmental implementation plans).

3.2 In Practice

The careful implementation and management of activities on site, during the entire process of project construction and operation, is vitally important. Focus should be placed on the activities to occur on the site; however, consideration of the adjacent environment (socially and ecologically) is equally important. The mitigation measures represented in this EMP should not be seen as static measures, but rather as methodologies that can be updated and improved during implementation, as and when site conditions become clearer. However, this EMP sufficiently serves to provide the most practicable methods to promote sound environmental management during the operational phases of the development.

This section of the report provides recommendations on matters relating to the impact of the development on the physical environment, the biological environment and the social environment of the site and study area by describing mitigation measures that are to be implemented.

3.3 Failure to comply with the EMP

Outlined below are a number of steps, relating to increasing severity of environmental problems, which will be implemented. The principle is to keep as many issues within the first few steps as possible.

Step 1: The Environmental Control Officer (ECO) discusses the problem with the applicant and the contractor or guilty party, and they work out a solution together. The ECO records the discussion and the solution implemented. This detection together with the solution will be included in the monthly monitoring report.

Step 2: The ECO observes a more serious infringement, and notifies the guilty party in writing, with a deadline by which the problem must be rectified. All costs will be borne by the contractor. This incident will be included in the monthly monitoring report

Step 3: The ECO may after discussions with the applicant, order the contractor to suspend part, or all, the works. The suspension will be enforced until such time as the offending party(ies), procedure or equipment is corrected, and/or remedial measures put in place if required. No extension of time will be granted for such delays and all cost will be borne by the contractor. The applicant shall be involved, and penalties will be allocated. In this time the department can decide to submit a pre-compliance notice and has authority to stop activities.

3.4 Significance assessment summary of potential impacts

3.4.1 Impact Significance Methodology

The following significance impact rating was used to evaluate the impacts of this project:

The **Significance** of Environmental Impacts is to be assessed by means of the following method: **Significance is the product of probability** and **severity. Probability** describes the likelihood of the impact occurring, and is rated as follows:			
•	Improbable	-	**Low possibility of impact to occur either because of design or historic experience.** **Rating = 2**
•	Probable	-	**Prominent possibility that impact will occur.** **Rating = 3**
•	Highly probable	-	**Most likely that impact will occur.** **Rating = 4**
•	Definite	-	**Impact will occur regardless of any prevention measures** **Rating = 5**
The **severity rating** is calculated from the *factors* given to intensity and duration. Intensity and duration factors are awarded to each impact, as described below. **The Intensity factor is awarded to each impact according to the following method:**			
•	Low intensity	-	Nature and/or man-made functions not affected, and a minor impact may occur. **Factor 1**
•	Moderate intensity	-	Environment affected but natural functions and processes can continue though often in a slightly altered manner. **Factor 2**
•	High intensity	-	Environment affected to the extent that natural functions are altered to the extent that it will temporarily or permanently cease. **Factor 3**

Duration is assessed, and a *factor* awarded in accordance with the following:			
•	Short term	-	≤ 1 to 5 years- **Factor 1**
•	Moderate term	-	5 – 15 years- **Factor 2**
•	Long term	-	Impact will only cease after the operational life of the activity, either because of natural process or by human intervention. **Factor 3**
•	Permanent	-	Mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient. **Factor 4**
The **severity rating** is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below, for example:			
The Severity factor e.g.: Intensity factor X Duration factor: 2 X 3 = 6			

A Severity factor of 6 (six) equals a Severity Rating of Moderate severity (Rating 3) as per table below:

Severity Ratings:	Factors
Low Severity (Rating 2)	Calculated values 2 to 4
Moderate Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High Severity (Rating 5)	Calculated values 13 to 16 and more
Severity factors below 3 indicate no impact	

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating:

The significance rating should influence the development project as described below:

Low significance (calculated Significance Rating 2 to 4)

- Positive impact and negative impacts of low significance should have no influence on the proposed development project

Moderate significance (calculated Significance Rating 5 to 8)

- Positive impact: Should indicate that the proposed project should be approved
- Negative impact: Should be mitigated or mitigation measures should be formulated before the proposed project can be approved

High significance (calculated Significance Rating 9 to 12)

- Positive impact: Should points towards a decision for the project to be approved and should be enhanced in final design
- Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be formulated and performed to reduce significance to at least low significance rating.

Very High Severity Rating (calculated Significance Rating of 13 and more)

- Positive Impact: Mo Positive Impacts are foreseen in the event of the proposed project having a severity rating of 13 or more.
- Negative impact: Before a decision can be made on the progress or proceeding of the project, all mitigation measures should be implemented, thereafter a decision can be made based on the significance rating of the findings.

The evaluation of the severity (or significance) of the identified impacts is done according to a set and objective Significance Rating Methodology, which uses both quantitative and subjective measures as set out above.

3.4.2 Evaluation of impacts in terms of significance Rating

The identified impacts are rated in terms of their significance during the constructional and operational phase of the proposed tanks. The identified impacts on the physical, ecological and social components of the site are discussed in terms of:

- Subsurface soil quality;
- Surface water run-off (quality);
- Air quality (due to dust generation);
- Ambient noise levels;
- Social environment (of adjacent community);
- Traffic safety aspects (safety of the community);
- Visual and aesthetic quality; and

It should be noted that the impact significance rating is given presuming that **no mitigation measures** are to be implemented **during the operational phase** of the project (this would imply a worst-case scenario). There after the significance rating is given when mitigation measures are implemented during the operational phase.

4. ENVIRONMENTAL DESCRIPTION

4.1 Site location

The site is located on a portion of Portion 7 of the Farm Buffelsfontein 204, Herold's Bay, George. The site is located directly north-east of the existing Herold's Bay township and directly west of the existing Oubaai Golf Estate. The site is situated on the southern portion of the Farm Buffelsfontein No. 204 and is bounded to the north and west by farmland.

The coordinates of the centre of the proposed development footprint site:

Latitude (S): 34° 02' 42.66"; Longitude (E): 22° 24' 19.94"

The project scope will include the following:

The proposal entails the development of a residential estate and business zone on a portion of Portion 7 of the Farm Buffelsfontein 204, Herold's Boy, George. The area where the development will take place is approximately 19 370 square metres in extent and the development will comprise of the following:

- A residential area consisting of 102 single residential erven (Single Residential Zone I) and 68 general residential erven (General Residential Zone II);
- A commercial area comprising of two erven for:
    - a filling station for the storage and handling of a dangerous good (Business Zone II);
    - a convenience centre (Business Zone II):
    - a restaurant (Business Zone II); and
    - office block (Business Zone IV).
- One open space area (Open Space Zone II) which includes the aquatic buffer;
- An erf for private road(s) (Transport Zone III);
- An erf for public streets (Transport Zone ll);
- Servitudes registered for the sewerage package plants.

This will require the clearance of more than l-hectare (but less than 20-hectares) of indigenous vegetation. Also, more than 300 square meters of an area mapped as Endangered Garden Route Granite Fynbos will be cleared of indigenous vegetation for this purpose but approximately 18.04 ha.

In addition, hereto the following associated infrastructure will be constructed:

- An internal road network with roads of 10 to 26 meters wide.
- Installation of 3 gravity fed package plants for the treatment of sewage and will be situated in three (3) drainage zones.

- The internal sewer network will consist of 160mm pipes with a 110mm connection to each erf.
- The internal water reticulation system will consist of pipes varying in size between 63 mm and 90 mm diameter with the necessary provision made for isolating valves, pressure reducing valves, fire hydrants, as required and erf connections;
- Electricity reticulation, substations and street lighting, and
- Stormwater drainage structures and stormwater pipelines.

The proposed filling station is envisioned to be positioned in the southwestern corner of the development footprint area, adjacent to the Oubaai Main Road. A total of 69m^3 storage capacity of fuel can be installed into 3 tanks, i.e., this will be split into 2 x 23 000l tanks for Diesel and 1 x 23 000l tank for Petrol.

The filling station area (footprint), in total, is approximately 1.5Ha.

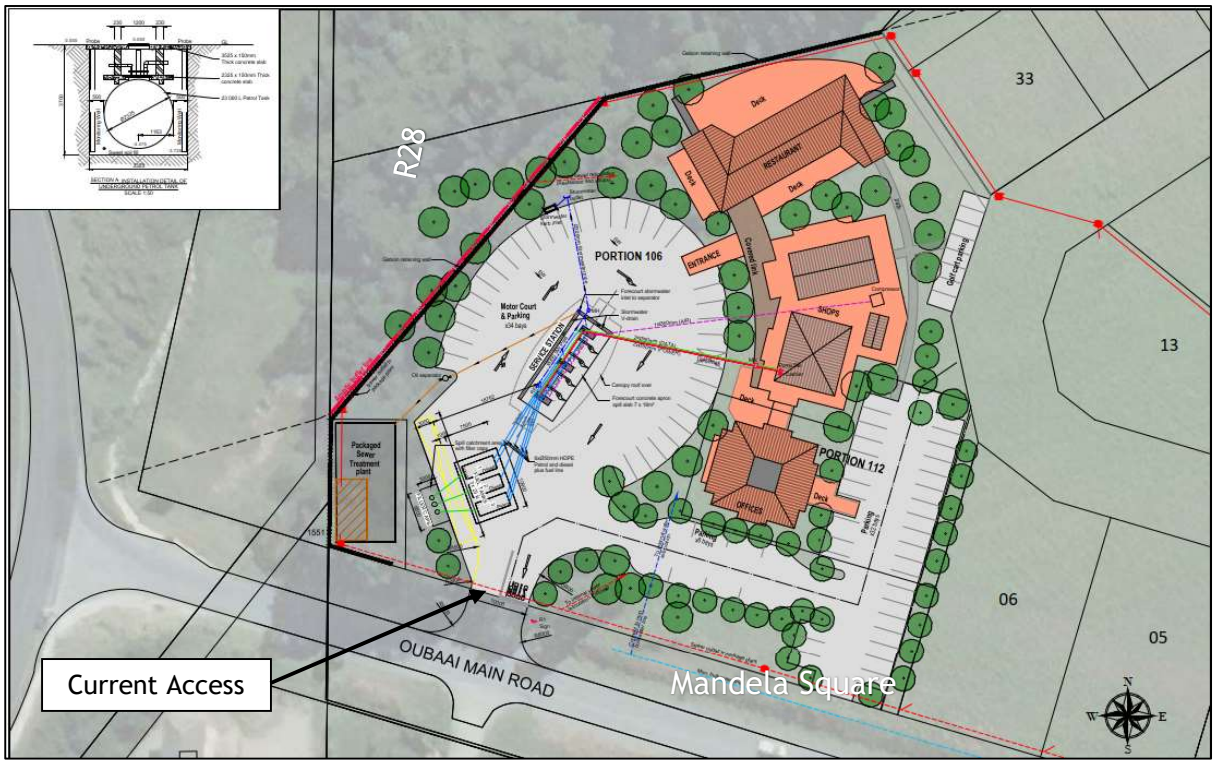


Figure 1: Site position in Herold's Bay Country Estate.

4.1.1 Site Layout

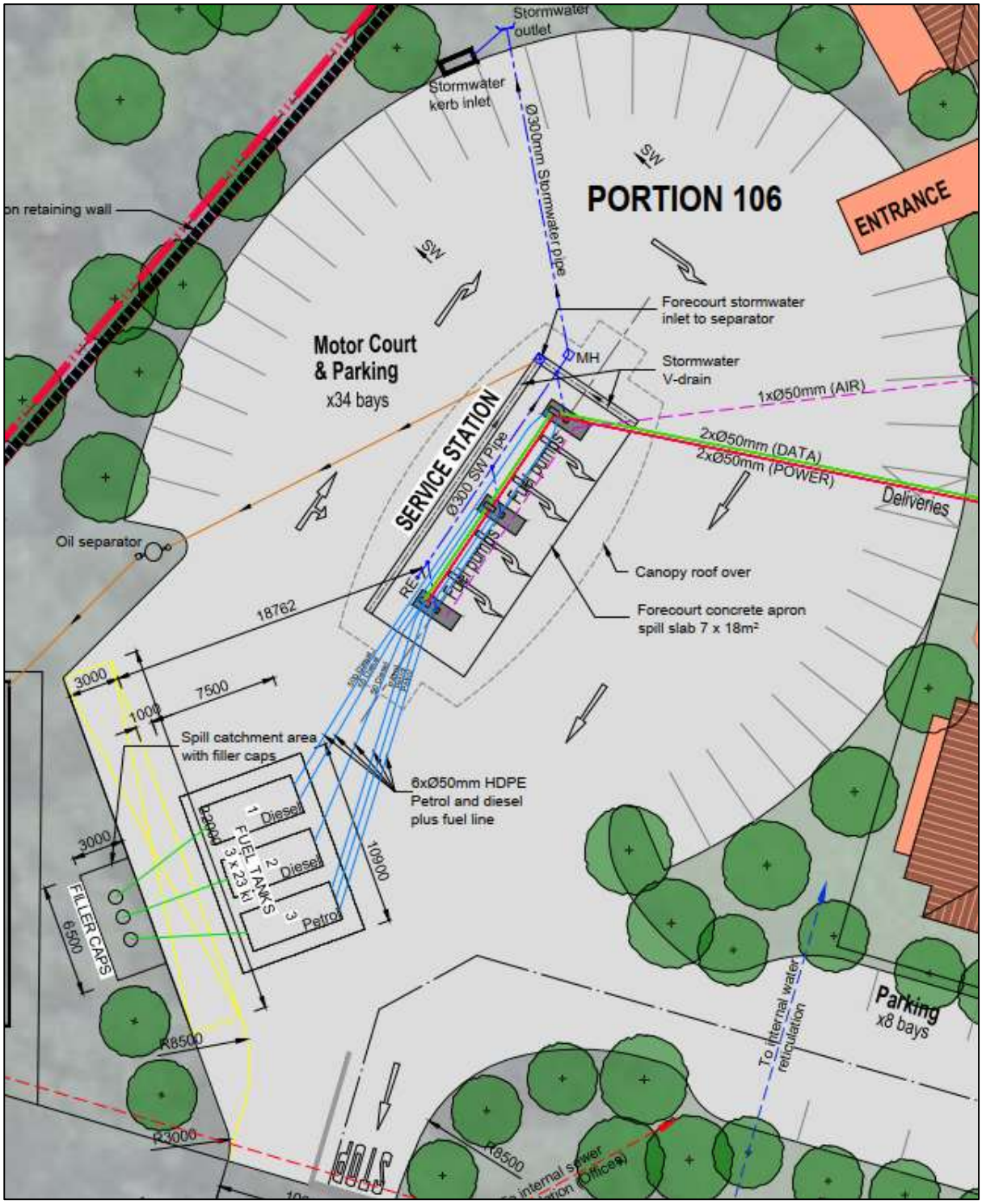


Figure 2: Site layout.

The coordinates of the site are as follow: -34.045954° (Latitude) 22.402361° (Longitude)

This filling station position did necessitate for a Geotechnical input, as well as a Traffic impact assessment.

The following photos illustrate the site and its surrounding area in.

4.2 Bio-Physical characters of the regional area

The following section describes the general biophysical and social environmental components of the study area. This description serves as background environmental information. Information was adopted from Munica & Rutherford, 2010 (CD set).

4.2.1 Vegetation

The site is located within the Garden Route Granite Fynbos vegetation type. Distribution: Western Cape Province: Garden Route—three main blocks south of the Outeniqua Mountains on the coastal

plain from Botterberg west of Brandwaghoogte (south of Robinson Pass) to Groot Brak River; the largest block from Groot Brak River to Woodfield near the Wilderness (with a few strips along the coast from Bothastrand to the Wilderness); lastly, north of the lakes from Woodville to Hoogekraal Pass, west of Karatara. Altitude 0–300 m.

4.2.2 Climate

Winter-rainfall region (MAP 350–880 mm (mean: 600 mm)). Mean daily maximum and minimum temperatures 27.8°C and 6.8°C for January–February and July, respectively. Frost incidence 2 or 3 days per year.

4.2.3 Landscape

Moderately undulating plains and undulating hills on the coastal forelands. Dense proteoid and ericoid shrubby grassland. Proteoid and graminoid fynbos are dominant with ericaceous fynbos in seeps. In the west, most remnants of this type are dominated by proteas. Eastwards graminoid and ericaceous fynbos are dominant on the flat plateaus, with proteas confined to the steep slopes.

4.2.4 Geology, land types and soil conditions

George Batholith of the Cape Granite Suite. Deep, prismacutanic- and pedocutanic-dominated soils typical of Db land types (mainly).

4.2.5 Conservation

Endangered. Target 23%. Only about 1% conserved in the proposed Garden Route National Park. About 70% has been transformed for cultivation (56%), pine plantations (7%) and by urban development (6%). Remnants are largely confined to isolated pockets on steeper slopes. Erosion moderate and high. Very few patches of this type remain in a pristine condition as most of it has been converted to pasture by liming, bush-cutting and frequent burning, and augmented with pasture grasses. Western remnants suggest that proteoid fynbos might have been dominant historically. It is easily converted to graminoid fynbos by regular fires and augmentation with pasture grasses.

5 ASSESSMENTS OF THE POTENTIAL IMPACTS

5.1 Assessment on the Environment as a whole

The environmental legislation and processes have provided for a more streamlined approached to assist in the decision-making process. The EMP honed-in on specific environmental issues that has been investigated in more detail. This approached ensures that the EMP focuses on the core issues (positive & negative).

This section provides a description and evaluation of the anticipated issues and impacts associated with the construction and operation of the underground tanks. Some of the issues/impacts are localised in their effects, whilst others are more generally applicable. The identification and brief description of the relevant physical and biological issues was conducted under:

- Environmental aspects: defined as those actions on site that may potentially cause an environmental impact;
- Environmental component to be impacted upon;
- Nature and description of the impact (including the relevant stage: construction or operation).

An impact significance rating for the listed aspects was given in table 2 below. The identified and anticipated impacts listed below will take effect into the operational stage.

5.1.1 Impacts and Issues Identified

The description and identification of anticipated impacts is based on the listing of so-called environmental aspects, which is the term used to describe the actions during the construction and operational stages of the project that may have a degree of impact on one or several of the environmental components listed.

The environmental aspects listed can be effective during the constructional and operational phase. Operational stage is considered as when the fuel retailer and its additional structures like pumps are fully operational. The following table provides a list of activities (environmental aspects) that will occur on site, and it provides an outline of the potential impacts that these actions will have on the environment (especially on the soil surfaces of the site). As well as the anticipated effects on the visual character being, biophysical and also social aspects.

Table 1: List of activities (environmental aspects) that will occur on site, the potential impacts that these activities may have on the environment and a description of the nature of the impact.

ENVIRONMENTAL ASPECT AND PROJECT STAGE	ENVIRONMENTAL COMPONENT	NATURE AND DESCRIPTION OF THE IMPACT
FILLING STATION SITE		
NEW FILLING STATION AND TANK INSTALLATION- CONSTRUCTION PHASE		
Preparation of the site, including the clearance of vegetation	Vegetation, soil, groundwater	The clearing of the site for the filling station, as well as the excavation for the placement of the tanks can lead to loss of potential important vegetation. The removal of vegetation cover, such that the soil surface is exposed, may lead to increased soil erosion in certain areas. Where the removal of surface vegetation is of a temporary nature only, the establishment of weed species is a threat. The topsoil layer is required to rehabilitate the vegetation in these areas.
Excavations for the establishment of foundations	Vegetation, soil, groundwater	The excavation of soil can lead to erosion and higher possibility of soil contamination. The existing vegetation will be permanently removed to accommodate the filling station foundations, which will be approximately the size of the built footprint.
Pit preparation	Soil, groundwater	Preparing the pits for the tanks will include construction of a concrete slab. Concrete will need to be mixed. River sand will need to be transported and dumped close to the installation area.
Installation of the tanks	Soil, groundwater, traffic	A truck will be needed to lift the tank into place. The tank will be mounted to the correct position. Composite bonded tanks to be installed. If not correctly installed there is the potential, though limited, to contaminate the soil and groundwater resources.
Fuel storage tanks on site	Soil, water	Faulty/leaky fuel storage tanks will contaminate the soil and groundwater resources of the study area. **Precautionary measures to be implemented.**
Generation of construction waste	Soil, vegetation, aesthetic quality of the site and surface water run-off.	Polluted surface water run-off may pollute the water resources (both the underground resources and dam areas in the vicinity). Construction waste that is not removed from site will also be an eye sore in the area and will promote the growth of unwanted weed species.
Movement of construction vehicles on the main road and/or other adjacent and local road networks.	Air quality due to dust generation and traffic safety aspects.	The movement of heavy vehicles (transporting building material) on tar roads and especially busy main roads adjacent to the site, can impact on traffic safety, due to accidental soiling of the road surface and/or speeds driven by construction vehicles.
Maintenance of construction vehicles	Possible soil contamination, which	Soil contamination during construction vehicle maintenance is easily prevented. But in the event of such an occurrence, the impact will be of a temporary nature only, as spills can and should immediately be cleaned up.

ENVIRONMENTAL ASPECT AND PROJECT STAGE	ENVIRONMENTAL COMPONENT	NATURE AND DESCRIPTION OF THE IMPACT
	in turn will affect surface water run-off.	The quality of surface water may temporarily be negatively affected.
Noise generation by operating air compressors, excavators, and other heavy machinery	Adjacent residential areas due to ambient noise levels.	As construction will occur within close proximity to residential areas, it is possible that the noise generated by the proposed development will cause discomfort to those around the development. Due to the size of the site and the type of development it is probable that this Environmental Management Plan would be sufficient in ensuring that noise does not inconvenience the local populous.
Sanitation provision to workers during the working day.	Possible contamination of subsurface soil and surface water quality.	Possible contamination as a result of this activity will be of a localised, temporary nature.
NEW FILLING STATION AND TANK INSTALLATION-OPERATIONAL PHASE		
Operation of the filling station and its additional components i.e. daily delivering and transfer of commodities (food, fuel, and other goods)	Traffic, noise, nuisance, soil, social environment and local economy.	The delivery of fuel can disrupt the flow of traffic within the area. The physical offloading of fuel can potentially cause spills into the soils. Leaks in the tanks can lead to soil erosion and potential groundwater pollution. The provision of fuel and other goods and services is beneficial to road user, mainly from the surrounding and local residential areas. Therefore, the convenience provided by the filling station has a positive impact on the users of the filling station. Furthermore, the opening and running of a filling station will result in job creation, thereby supporting the local economy.
Impact on prevailing ambient noise levels	Adjacent areas	Noise will be generated by the movement of vehicles utilising the filling station and its associated components.
Impact on storm water quality during the operation of the tank and in the event of accidental spillage	Storm water run-off, natural drainage courses and areas in the vicinity of the study area.	This is a common risk associated with hydrocarbon tanks. The highest risk is obviously during the transfer of fuel from the mobile fuel tanker to the underground fuel storage facilities. Should surface water run-off be contaminated it may run through the storm water systems into the natural drainage course. **This will occur under circumstances where no anti-pollution measures are designed and installed**. The design of the storm water system, to drain the premises, must be such that it prevents the risk of storm water pollution or abnormal soil erosion at its outlets.
Impact on soil in terms of leaking suction line-generator feeder pipe	Soil	The generator feeder pipe will be installed 500m below the surface and connect the fuel tank with the generator. This feeder pipe can potentially leak and impact soil quality.
Waste disposal and handling of solid waste and sewage associated with general	The aesthetic quality of the site, social impacts (health of	The proposed development is likely to generate waste (gaseous, liquid, and solid) during the construction and operational phases of the proposed development. Impacts associated with waste management have been included in this EMP.

ENVIRONMENTAL ASPECT AND PROJECT STAGE	ENVIRONMENTAL COMPONENT	NATURE AND DESCRIPTION OF THE IMPACT
trading and waste disposal by consumers	consumers and adjacent communities within the study area), possible surface water run-off and groundwater resource contamination, as well as air pollution.	
Cleaning and maintenance of surfaces	Surface water run-off (into the storm-water system) and water quality within the study area.	Chemicals used in the routine cleaning of surfaces (and possible oil and fuel spill clean-ups) can result in polluted surface water run-off, which enters the storm-water systems, thereby affecting the quality of the stormwater that may eventually end up contaminating the natural drainage system (dams in the area).
Production of possible take-away fast foods	Social environment and local economy.	Positive impacts are anticipated as a result of fast-food production at the filling station, in the form of job creation and convenience to road users and adjacent landowners utilising this aspect of the filling station.
Impact of illumination produced at night by the forecourt and parking area of the filling station	Visual and aesthetic quality, social environment of adjacent community.	Visibility is an important requirement of filling stations; therefore, night illumination will be required. The light produced could cause a disturbance to adjacent residential areas. However, light illumination is usually not a problem associated with filling stations. Light orientation will be important in this regard.
Impact of the proposed filling station on existing filling stations within the study area.	Commercial impacts on existing filing stations.	A new filling station within the study area is not anticipated to detract business from other filling stations within a 6 km radius of the proposed filling station. However, this is a commercial issue which cannot be resolved in environmental terms.
Biodiversity Impact	Vegetation / habitat	The proposed site can be considered a natural area and currently does positively contribute to the biodiversity of the area. The site therefore has moderate biodiversity value. It is necessary to request any biodiversity assessments for the site due to its natural/indigenous nature and its proximity to built-up areas.
Vapor Recovery	The site	The materials to be handled on site can be considered volatile which results in the presence of toxic vapour when the substance is transferred from vessel to vessel. This vapour can be considered a loss of hydrocarbons as well as a potential threat to the environment. In order to ensure that this filling station does not harm the health of patrons or the environment and minimises the loss of hydrocarbons, a vapour recovery plan/system must be put in place.

ENVIRONMENTAL ASPECT AND PROJECT STAGE	ENVIRONMENTAL COMPONENT	NATURE AND DESCRIPTION OF THE IMPACT
Health and safety issues	Surrounding environment	The proposed construction of a filling station could potentially pose a health and safety risk to surrounding inhabitants and patrons of the proposed structure. Fires, spills and other mishaps could cause significant injury to people on or near the proposed site as well as result in significant environmental degradation.

Significance rating of the anticipated impacts

ENVIRONMENTAL AND OTHER COMPONENTS TO BE AFFECTED C = relevant to construction stage O = relevant to operational phase	Probability value	Intensity value	Duration value	Severity value	Significance rating
Impact on the vegetation component of the site	C: 3 O: 2	2 1	2 3	2 2	6: Moderate (negative) 4: Low (negative)
Impact on soil (surface stability)	C: 3 O: 2	2 1	2 3	2 2	6: Low (negative) 4: Low (negative)
Impact on soil (topsoil layer - disturbance and compaction)	C: 3 O: 2	2 1	2 4	2 2	6: Low (negative) 4: Low (negative)
Impact on subsurface soil quality	C: 2 O: 2	2 2	2 4	2 3	4: Low (negative) 6: Low (negative)
Impact on topography	C: 2 O: 2	2 2	2 4	2 3	4: Low (negative) 6: Low (negative)
Impact on surface drainage and existing water bodies	C: 3 O: 2	2 2	2 4	2 3	6: Low (negative) 6: Low (negative)
Impact on surface water run-off quality	C: 3 O: 4	2 2	2 4	2 3	6: Low (negative) 12: Moderate (negative)
Impact on groundwater resources	C: 3 O: 4	2 2	2 4	2 3	6: Low (negative) 12: Moderate (negative)
Impact on air quality	C: 4 O: 2	2 2	2 4	2 3	8: Moderate (negative) 6: Low (negative)
Impact on ambient noise levels	C: 4 O: 4	2 2	2 4	2 3	8: Moderate (negative) 12: Moderate (negative)
Impact on the social environment of the adjacent community	C: 4 O: 4	2 2	2 4	2 3	8: Moderate (negative) 12: Moderate (negative)

Impact on the social environment of the filling station users	C: 4 O: 4	2 2	2 4	2 3	8: Moderate (positive) 12: Moderate (positive)
Impact on traffic safety aspects	C: 4 O: 4	2 2	2 4	2 3	8: Moderate (negative) 12: Moderate (negative)
Impact on land use & agricultural potential	C: 3 O: 3	2 2	1 4	2 3	6: Low (negative) 9: Moderate (negative)
Impact on visual and aesthetic quality	C: 3 O: 4	2 2	2 4	2 3	6: Low (negative) 12: Moderate (negative)
Impact on local economy (due to job creation)	C: 4 O: 4	2 2	2 4	2 3	8: Moderate (positive) 12: Moderate (positive)
Impact on health and safety	C: 3 O: 4	2 2	2 4	2 3	6: Low (negative) 12: Moderate (negative)
Impact on heritage resources	None	None	None	None	None

5.2 Impact mitigation during the construction phase- Installation of new tanks

The construction stage of the proposed activity will cause minor impacts on the biophysical and social environment. The site area was already impacted by historical activity of the area.

Although these impacts are short-term and low significance in nature, it still is essential to address them as sufficiently as possible. The following recommendations are proposed to assist as basic environmental management steps and to be implemented during the construction phase of the project:

- The locality of stockpile areas must be confirmed and discussed with the appointed contractor/Resident Engineer before construction activities commences.

- Specified areas of access and movement by construction vehicles during the construction period are essential. No additional or random routes should be developed in the vicinity of the construction area. It is imperative that limited disturbances to the surrounding area takes place.

5.2.1 Management of impacts on vegetation cover and faunal habitats

- Clearing/removal of the existing vegetation for the proposed work will be necessary; however, due to the size of the site, the significance of this impact is rated as moderate. The visible vegetation on site is of an indigenous nature.

- The propagation of exotic species and weeds will need to be controlled during the construction phase, as there are many activities on site that could lead to the establishment of weeds - including compaction of the soil by heavy machinery, construction waste, stockpile areas etc.

- Weed species should be removed on a four-week basis. Much of the site will be paved. It is recommended that only indigenous species be used in the landscaping process.

- Innovative landscaping of the site towards the end of the construction stage will contribute significantly to the visual and aesthetic attractiveness of the site and will also solve the problems associated with the removal of vegetation cover, including soil erosion, dust generation and the flourishing of weeds and/or other unwanted exotic species in the long term.

Implementation responsibility: The main contractor/municipality will be responsible for the implementation of the above measures as an on-going process during construction phase.

5.2.2 Soil stability

If construction is to take place during the summer months, the terrain could be susceptible to sheet and gully erosion as a result of the often-sandy texture of the bare topsoil layer. Aspects that typically impact on soil conditions are excavations, establishment of stockpile areas, removal and/or clearance of vegetation, movement of construction vehicles, and maintenance of construction vehicles and sanitation provision to workers during the construction period. Therefore, the following recommendations pertaining to soil conservation practices are made:

- Topsoil must be stripped from all areas, where construction activities are going to take place, to be re-used in landscaping the site.
- Any excess overburden material that is generated may not be dumped in a random manner. Dumping sites should be predefined, agreed upon and adhered to.
- All erosion channels developing during the construction period or during the operational and maintenance period should be backfilled and consolidated immediately.
- Soil contamination during construction vehicle maintenance or as a result of fuel storage on site is easily prevented, but in the event of such an accident, the spill should immediately be cleaned up by absorbing the worst of the fluid with saw dust and then disposing of the saw dust and the first bit of the soil layer at a hazardous waste disposal site. The other option is to have spill kits available on site.
- Seepage may result in the destabilizing of the soils above the seepage and special precautions may be required. The contractor is responsible for the implementation of suitably designed support systems. Embankments should be adequately compacted and protected from erosion.
- In addition to the above, the following restrictions will be enforced:
    - No borrow pit or quarry will be opened on site. All imported material will be obtained from commercial borrow pits or quarries.
    - The footprint of the various structures will be staked out prior to commencement of construction activities.
    - No moving or removal of stones, plants or any other natural specimens will be allowed outside the staked construction area.
- Trenches will only be as deep as required and be backfilled as soon as possible.
- All open trenches will be demarcated clearly with danger tape, or as otherwise instructed by the Engineer.

Implementation responsibility: The main contractor and project engineer will be responsible for the implementation of the above measures as an on-going process during construction phase.

5.2.3 Stockpiles and general storage of building material and equipment

Special care must be exercised when selecting the location of temporary material storage areas.

- Any excess soil or overburden material must be stockpiled to reduce visibility.
- Excess material that is not used during construction activities should be removed from the site to be used by other users in the construction industry.
- It is essential to place enough sandbags along the toe line of any loose material stockpiled and for the storage of building material.
- In the event of soil and overburden being removed from its locality, it must be suitably stockpiled away from any drainage ways.
- Overburden soil can alternatively be re-used in landscaping depending on the need.
- No material must in any event be dumped in any place in the surrounding region. Written proof of disposal at a waste disposal site must be given to the applicant and site manager on every load of construction waste removed from the site.

Implementation responsibility: The main contractor/Resident Engineer/ Project Manager will be responsible for the implementation of the above measures as an on-going process during construction phase.

5.2.4 Community or public safety

Large construction vehicles, including trucks and other heavy machinery, will impact on road safety circumstances on the roads they use, and it is the duty of the contractor to ensure that safety measures are implemented and adhered to.

The safety of the community throughout the construction period is of utmost importance. As road safety awareness is imperative, the following important actions must be noted that will assist in the management of safety during the construction phase where necessary:

- Adequate and correct caution signage and road marking during construction in accordance with the requirements of the South African Road Traffic Signs Manual and the CSRA / CUTA Road Signs Note 13. (Workers with red flags, visible workers and vehicles etc.)
- Names and identification numbers of each worker housed on-site must be provided by the contractor.

Implementation responsibility: The main contractor/resident engineer/ project manager will be responsible for the implementation of the above measures as an on-going process during construction phase

5.2.5 Waste disposal and management

It is crucial to implement strict and effective waste control and waste management procedures during the construction phase.

- No littering by any personnel is permissible.
- The site manager/contractor should conduct regular site clean-ups to keep the site litter free – as litter is not only aesthetically displeasing, but it is also harmful to the environment.
- All domestic solid waste produced must be disposed of in waste bins situated on site. The bins should be emptied into a covered skip (for storage) on a regular basis, until its collection and removal to a municipal waste disposal site (preferably on a weekly or bi-weekly basis).
- No liquid waste material should be disposed of on or near the site during construction, or in any non-designated areas.
- In the event of accidental spillage of liquid substances, like paints and resins, it is important to implement the correct emergency procedures and cleaning-up operations. Pollution of surfaces should be limited at all costs.
- The generation of construction waste occurs at every site under development and construction. Due to the costs involved in the disposal of this material at municipal or other licensed waste sites, the contractor or sub-contractor may be tempted to illegally dump waste at concealed locations to save on costs. Therefore, strict control is required from the project manager or landowner, to control this issue.
- Proof of disposal of waste material at a registered waste disposal site must be shown after off-loading of each waste load, which should then be logged or registered for control purposes.
- Control measures in terms of the National Building Regulations and standard requirements laid down by the local authority, with regards to spillage and waste disposal, must strictly be adhered to.
- General waste disposal management involves the collection of construction waste at a central collection facility, which should be pre-arranged and implemented. This should include making points available for solid as well as liquid waste – including mechanical fluids disposed of during vehicle maintenance.

Implementation responsibility: The resident engineer and contractor will be responsible for the implementation of the above measures as an on-going process during construction phase. Removal of waste from the terrain will be the responsibility of a certified waste contractor.

5.2.6 Noise

Another important aspect is the control of noise pollution. This is achieved by implementing the following measures:

- Ensuring that machinery and trucks are well-oiled and maintained; this will make less noise than poorly serviced construction equipment.
- Lastly, construction hours should be confined to daylight hours of a normal working day, specifically from 7 am to 5 pm in the summer and 7.30 am to 5 pm in the winter.
- No construction activities should take place on Saturdays after 14:00 and no actions must take place on Sundays.

Implementation responsibility: The main contractor/ project manager will be responsible for the implementation of the above measures as an on-going process during construction phase.

5.2.7 General rehabilitation

It is important that rehabilitation will commence as soon as feasible on each of the construction areas to run concurrently with the construction phase and not to be left until completion of the works. This will increase the chances of successful rehabilitation.

All areas disturbed by development activities will be rehabilitated on completion of the construction phase. The following general procedure will be followed:

- Removal of all remaining construction materials and equipment from the site, cleaning up of any remaining oil or other spills and removal of all construction waste from site;
- Shaping of the disturbed areas to blend with the surrounding landscape;
- Placing of topsoil on all disturbed areas (minimum depth 150 mm);

Implementation responsibility: The main contractor / project manager will be responsible for the implementation of the above measures as an on-going process during construction phase.

Final recommendations applicable to the construction stage.

This stage represents the period immediately after site hand over. The contractor must be made aware of the contents of the EMP, even if there are sections in the tender documentation which referred to environmental impact management measures to be budged for and implemented.

The following "rules" must be implemented to make the document relevant and handy on site:

- The EMP shall not be removed from the site office
- The EMP shall be updated when necessary
- The EMP shall be readily available to the Resident Engineer/Project Manager, and the site manager
- The EMP shall be available on site to any Interested and affected party but shall not be removed or copied to such a party or person.

5.3 General mitigation measures in the operational phase – Filling station and its tank installation

5.3.1 Contamination of surface water/soil through storm water run-off from hard surfaces.

- Other precautions to be implemented in order to prevent storm water pollution are:
  - Cover any waste that are likely to wash away with rain;
  - Build a bund around waste storage area to stop overflow into storm water channels;
  - Storm water outflows will not be allowed into a drainage line;
  - Natural storm water must not be piped other than in areas where it runs perpendicularly cross a roadway.

Implementation responsibility: The operational manager will be responsible for the implementation of the above measures as an on-going process during operational phase.

5.3.2 Contamination of soil and groundwater due to leaking fuel tanks

The risk of soil and groundwater contamination, as a result of faulty/leaky underground fuel storage tanks, can be limited through precautionary measures.

- It is recommended that the tanks should be placed on a solid concrete base or foundation as part of the concrete containment.
- The storage tanks must conform to SABS 1535 standards and must be manufactured by approved manufacturers (for example by approved suppliers to SANS 15).
- All the requirements pertaining to tanks design specifications and installation are set out in SABS codes of practice reports, which have to be adhered to by the petroleum company.

- The tanks must be manufactured according to composite bonded specifications (to prevent rusting and possible leaks).

Implementation responsibility: The operational manager will be responsible for the implementation of the above measures as an on-going process during operational phase.

5.3.3 Waste management

All hazardous waste must be stored in sealed and suitably marked containers for removal to a hazardous waste landfill site by the contractor on a bi-weekly basis. Hazardous waste could include used oils and contaminated gravel.

5.3.3.1 Liquid effluent

Liquid effluent will potentially be generated by the washing and cleaning of all paved surfaces. Waste management in this regard is important and includes the management of all cleaning operations:

- It should be a firm rule that no outdoor paved surfaces be cleaned with non-biodegradable detergents, so as to reduce the risk of contamination of natural drainage through the storm water management system.
- Alternatives regarding the manner in which the contaminated water can be handled should be considered. For example, water can be intercepted in a concrete lined evaporation pond. The site engineer can determine the placing, design and extent of the pond required.
- The management of other liquid effluent, like sewage produced during the operation of the filling station's bathroom facilities, will be handled through municipal sewage system.

5.3.3.2 Solid waste

Waste generated during the operation of the filing station must be collected in waste bins that are emptied on a regular basis into a central waste collection facility, which in turn is to be collected on a regular basis to be emptied at the nearest municipal solid waste disposal site. The products that will typically be generated by filling stations include empty oil cans, paper rolls (wastepaper from window cleaning and the wiping of dipsticks), empty bottles and cans, paper and cardboard boxes, cool drink tins, food wrappers and plastic.

5.4 Emergency events

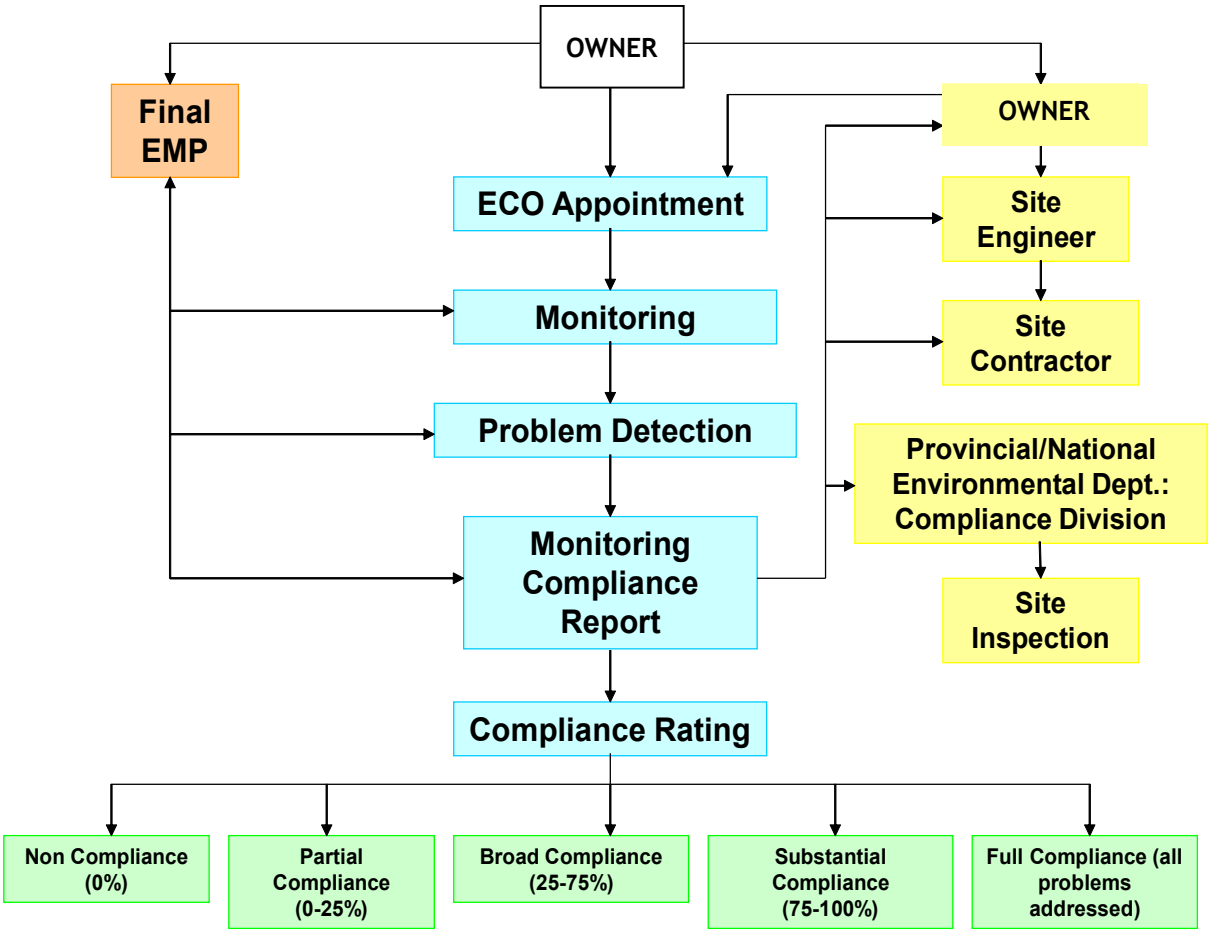
Emergency event	Mitigation	Responsible parties
1. Spillage of oil, fuel or solvents on pavement or on soil surfaces.	Prompt placement of suitable absorbent material e.g. wood shavings or fine sand. Mopping up of the surface. In case of significant spillage on open soil surface of grassy areas, the contaminated soil cover must be removed to a depth of 20cm and disposed of at the nearest hazardous waste disposal site. Paving should be cleaned with biodegradable substances. In the unlikely event of any type of spillage or soil contamination within 20m from a drainage line, sandbags must be placed between the stream course and the area of spill while cleaning up is taking place. If spill events occur, polluting surface drainage, such contaminated surface water will be pumped into containers and removed from the site to be disposed of at the nearest hazardous waste disposal site. The name and contact details of such a contractor must be kept in the site office at all times.	The project manager and the contractor responsible of that particular part of the site actions.
2.Fire occurrences	• Shut of the main shut off valve • Implement the fire safety measures as determined by internal health and safety procedures	Operational manager
	In the event of fire on the terrain, the Fire Department must be called in. It is also important that local firefighting equipment be ready and available at the site office. Such equipment includes a water cart and booster pipe and hose to fight minor veldt fires of fires at equipment or buildings. The contact details of the local fire brigade and emergency services will be kept available at the site office at all times.	Operational manager

5.5 Financial Provision/Quantum Calculation

See Annexure C

5.6 Planned monitoring and performance assessment of the EMP

Environmental monitoring will take place in accordance with the illustration below:



5.7 Closure of the site

Closure of the site will include the following:

- removal of fuel tanks
- removal of infrastructure
- removal of pump
- Ripping or ploughing of all compacted surfaced. Demolition of building structures, removal of all building rubble from the site
- Covering the site with 150mm layer of topsoil

5.8 Environmental objectives

- To operate the study site with limited environmental impacts.
- Address all fuel spillage incidents with sufficiency in time and effectiveness.
- Handle all waste activities in such a manner that environmental impact will be minimized to as low as possible.
- Strive for full out environmental due diligence and responsibility.
- Show environmental responsibility throughout the operation all phases of the project.

6. COMMENTS, RECOMMENDATIONS AND MITIGATION MEASURES FROM SPECIALISTS

6.1 The conditions and monitoring aspects associated with the groundwater monitoring activities

Prior to the construction phase the applicant will have a discussion with the Fuel Retailers Association to get and include their conditions and monitoring aspects associated with the groundwater monitoring activities and requirements.

6.2 Geotechnical Impact Assessment mitigation measures

Foundation Recommendations and Solutions

Below are typical recommendations for structures of this nature, taking into account the geotechnical characteristics of the investigated site:

Reinforced strip and/or pad foundation systems should be utilized. Foundations should be placed below the organic alluvium (transported horizon).

To reduce the risk of collapsibility potential, hydro compaction could be performed. This is the process where the collapsible horizon is saturated and then compacted to artificially break the collapsible grain structure.

It is recommended that EITHER of the following foundation designs be used in the development (According to the NHBRC guidelines):

Site Class C1/S:

1. Deep Strip Foundations:

▫ Reinforced strip footings placed at a depth of 0.8 m.

▫ Articulated joints at some internal and all external doors.

▫ Light reinforcement in masonry.

▫ Site drainage and plumbing/service precautions.

2. Limited Soil Raft:

▫ Remove in situ material to 0.8 m depth and 1.0 m beyond the perimeter of the structure and replace with competent material, compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.

▫ Construct a 500 mm soil raft.

▫ Reinforce the foundations and stiffen foundation brickwork

▫ Articulation of superstructure

▫ Moisture barriers around the perimeter of the structure

▫ Site drainage and plumbing/service precautions

It must be noted that differential settlement is assumed to equal 75 % of the total settlement. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.

Good Construction Practices

An important factor in the promotion of a stable site is the control and removal of both surface and ground water from the site. It is important that the design of the storm water management system allow for the drainage of accumulated surface water.

Surface Drainage

It is recommended that an efficient surface drainage system be installed around all structures and along all roads throughout the study area in order to:

▫ prevent the ponding of water next to structures directly after heavy precipitation events, this may lead to differential settlement as the saturated material undergoes densification.

▫ prevent large-scale changes in soil moisture beneath the structures on a seasonal basis.

▫ prevent the possible lateral movement of liquids within the upper soil horizons.

The precautionary measures should ideally include:

▫ the sealing of open ground surfaces by means of either of the following:

▫ the cultivation of a natural soil cover (e.g.: grass)

▫ compaction of the soil surface

▫ bitumen or concrete paving

▫ the removal of surface water to a distance of at least 1 m beyond structures by means of watertight paving.

▫ the removal of surface run-off by means of an efficient surface drainage system.

▫ roads should preferably be constructed parallel to the natural surface elevation contours rather than perpendicular to it, in order to reduce run-off velocities

Sub Surface Drainage

Adequate drainage should be implemented to avoid large scale moisture changes in the loadbearing strata.

Earthworks

It is recommended that all earthworks be carried out in accordance with SABS 1200 (current version). The fill should be placed in layers not exceeding 200 mm loose thickness and compacted to a minimum of 95% Modified AASHTO maximum dry density.

All fill operations should be observed by a competent professional and tested periodically to confirm compaction is achieved.

6.3 The requirements by WCG: Department of Environmental Affairs and Development Planning — Pollution and Chemicals Management

The D: PCM notes that effective management, protection and monitoring are required on site in order to avoid and mitigate contamination risk and any potential water, soil and groundwater impacts. The following mitigation measures are recommended with respect to the installation of the proposed underground storage tanks (USTs) and construction of the filling station, including, inter alia:

1. All liquid chemicals and fuel must be stored in a bunded area with a capacity of at least 110% of the maximum allowable volume. The storage area should be fenced, and all access controlled.

2. Corrosion resistant tanks, -pipes and -detectors must be used and must conform to the relevant SANS codes.

3. The tanks must be fitted with an overfill protection device.

4. Shear-off valves must be anchored below fuel dispensers so that no spillage occurs if the dispenser is accidently knocked over. There must also be breakaway couplings on the hoses in case a vehicle pulls away from pump dispenser while the nozzle is still in the filler.

5. During fuel tank delivery, the tanker driver must be present at all times during product offloading. An emergency cut-off switch must be installed to immediately stop fuel delivery should an accident occur.

6. The surfaces of all refuelling areas must be constructed from concrete to form an impervious layer, which must be sloped towards the spillage containment areas.

7. Stock reconciliation must be undertaken regularly to ensure effective stock monitoring, recording and regular auditing for early identification of possible leaks and such leakage records must be produced on demand.

8. Fire-fighting equipment, regularly serviced, must be present on site and staff training in emergency firefighting must have been completed.

9. Training of all staff must be given to prevent the risk of environmental pollution.

10. Appropriate management (handling, storage, transportation and disposal) of waste and chemicals must be implemented. All hazardous wastes must be stored in an enclosed and surfaced area prior to disposal at a registered waste management facility.

APPENDIX A: UNDERTAKING BY THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

I, **Mr Rowan van Tonder** from REC Services (Pty) Ltd. hereby confirm that I'm the EAP that has overseen the compilation of the Environmental Management Plan and that the information I have provided is accurate to my knowledge.

Rowan van Tonder

23 June 2022

APPENDIX B: UNDERTAKING BY THE APPLICANT TO EXECUTE THE EMP.

Undertaking by the Applicant to execute the EMP.

I, AJ Cronje from Long Island Trading (company) hereby undertake to execute the Environmental Management Plan as it is set out in the documentation of which this section forms part.

AJ Cronje (Name)


(signature)

23 June 2022 (Date)

ANNEXURE C: QUANTUM CALCULATION & REHABILITATION COSTS FOR FINANCIAL PROVISION BY TANK CONTRACTORS

The Financial Provision for the rehabilitation of the tanks after closure of the filling station facility will be based on the quantum calculation. It is currently in progress and will be provided as soon as available. Applicant will make provision for the rehabilitation.

PC PUMP & TANK (PTY)LTD

"A Partnership that Works"

Quotation

Address: 22 Van Riebeeck Ave

Alberton North

Alberton , 1449

011 869 7859

072 185 1492

086 660 5154

Reg No: 2012/165386/07

Vat No: 4890261557

pcpump.tank@telkomsa.net

Quotation No: QUO008619

Date: 23/06/2022

Attn: Rowan

Email: rowan@recservices.co.za

Herolds Bay Country Estate

SCOPE OF WORK:

Site Decommission

Description	Unit	QTY	Amount	Total
1) Degas tanks (U/G tanks) & pump last 150L fuel out	No	3	R 9 500.00	R 28 500.00
2) Remove of pumps (estemed)	No	3	R 3 000.00	R 9 000.00
3) Make safe electrical	All	1	R 25 000.00	R 25 000.00
4) Remove tar - paving or concrete over tanks & cart away	m2	1200	R 250.00	R 300 000.00
6) Excavate & remove back bund wall	m3	550	R 2 350.00	R 1 292 500.00
7) Clean site	m3	100	R 955.00	R 95 500.00
8) P's & G's	Sum	1	R 125 000.00	R 125 000.00
Total excl Vat				**R 1 895 500.00**
Vat 15%				**R 284 325.00**
Total incl Vat				**R 2 179 825.00**

Please note this quotation is valid for 30 days.

Reminder: Please include Quotation number as reference.

Payment Terms:

70% Deposit - 30% On Completion

Sign: _____

BANKING DETAILS

NAME: PC Pump and Tank Pty Ltd

BANK: Standard Bank

BRANCH: Alberton 012342

ACCOUNT: 300734247

ANNEXURE D: LOCALITY MAP AND TECNICAL LAYOUT / SDP

Locality Map

SERVICE STATION LOCATED ON PORTION 112 OF THE FARM BUFFELSFONEIN 204/7 AS PART OF THE FUTURE HEROLDS BAY COUNTRY ESTATE, GARDEN ROUTE MUNICIPALITY, WESTERN CAPE PROVINCE

Legend

Fill St Site

GEORGE CENTRAL

GEORGE SOUTH

George

R102

R102

R404

2

2

2

THEMBALETHU

PACALTSDORP

R404

Filling station Site

Oubaai Golf Estate

Herolds Bay

Google Earth

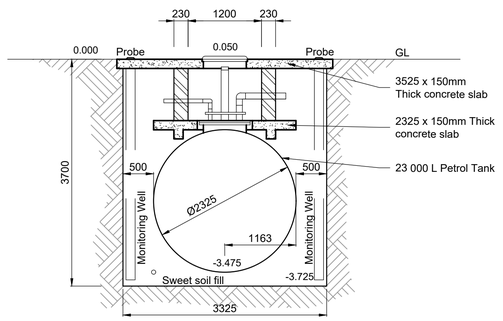
Image © 2022 CNES / Airbus

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image © 2022 Maxar Technologies

N

4 km



SECTION A: INSTALLATION DETAIL OF
UNDERGROUND PETROL TANK
SCALE 1:50

Gabion retaining wall
Deck
RESTAURANT
Deck
Deck
Internal sewer reticulation (Restaurant and shops)
Stormwater outlet
Stormwater kerb inlet
Ø300mm Stormwater pipe
SW
MH
PORTION 106
ENTRANCE
Covered link
path
Golf cart parking
Gabion retaining wall
Motor Court
& Parking
x34 bays
Forecourt stormwater inlet to separator
Stormwater V-drain
MH
1xØ50mm (AIR)
2xØ50mm (DATA)
2xØ50mm (POWER)
SHOPS
Compressor
Deliveries
MH
Pump DB
Cashier
SERVICE STATION
Ø300 SW Pipe
Fuel pumps
Fuel pumps
Canopy roof over
Forecourt concrete apron
spill slab 7 x 18m²
Oil separator
Aquatic buffer line
Sewer outfall to package plant
18762
3000
1000
7500
Spill catchment area
with filler caps
6xØ50mm HDPE
Petrol and diesel
plus fuel line
Packaged
Sewer
Treatment
plant
1 Diesel
2 Diesel
3 Petrol
FUEL TANKS
22600 x 2.5 W
10900
3000
FILLER CAPS
6500
1551
R8500
R3000
R6000
10000
R1
Sign
R6000
OUBAAI MAIN ROAD
Deck
OFFICES
PORTION 112
Deck
Parking
x8 bays
Parking
x32 bays
To internal water reticulation
R8500
To internal sewer reticulation (Offices)
Connect to mun bulk water line
Sewer outfall to package plant
Mun. bulk water line
33
13
06
05
N
W
E
S

Rev.	Date	Description	Rev. by
A	05/05/2022	PRELIMINARY DESIGN	MP

ELEMENT Consulting Engineers
A FIFTH DIMENSION TO ENGINEERING

82 Victoria Street,
George, 6530

P O Box 9962,
George, 6529

Tel: +27 44 884 1138
Fax: +27 44 884 1185
E-Mail: info@eceng.co.za

Client/Employer

HEROLDS BAY
COUNTRY ESTATE

Project

HEROLDS BAY ESTATE

Plan Description

FILL STATION
SITE DEVELOPMENT PLAN

	Name	Signature
Designed	MP	
Drawn	MP	
Checked	HL	
Approved	HL	
Pr. No.		

Scale 1:250

0 5 10 15 20 30 50mm

ORIGINAL SIZE A1

Contract No. 1701561

Drawing No. 1701561/C/G100

Revision A

P:\2021\1701561 - Herolds Bay Estate\D - Drawings\06 - Working Drawings\2022\1701561-C-A-Filling Station_Site Development Plan - 06May2022.dwg

ANNEXURE E: SPILL/EMERGENCY RESPONSE PLAN

INCIDENT MANAGEMENT PLAN:

VAPOUR RECOVERY, EMERGENCY/FIRE AND SPILL RESPONSE PLAN FOR FILLING STATIONS.

CONTENTS

1. BACKGROUND

1.1. PROJECT AIM/OBJECTIVE

To compile an Incident Management Plan for the establishment of a filling station on a portion of Portion 7 of the Farm Buffelsfontein 204, Herold's Bay, George. The information is sought to fulfill the requirements of the Basic Assessment Report (BAR) in reporting on Vapour Recovery Plan, Emergency/Fire and Spill Response Plan for integration into a Basic Assessment Report (BAR) as well as for an Environmental Management Plan for DME, to be compiled by REC Services Pty (Ltd).

Petrol and diesel are complex mixtures of hydrocarbons that release organic vapour into the environment if not adequately controlled. The individual chemicals in the mixture release vapours at different rates, attributed to the vapour pressures. The hydrocarbons emitted during petrol storage and distributions are broadly classified as Volatile Organic Compounds (VOCs) and are among the most common air pollutants. VOCs adversely affect air quality and can also have a negative impact on human health due to its toxicity. It is therefore essential to capture the petrol vapour that would normally escape into the atmosphere, and recover into the liquid state through the concept of Vapour Recovery to prevent detrimental health effects, and creation of an explosive atmosphere on the forecourt area.

The storage of hazardous substances on premises is controlled by the Regulations of Hazardous Chemical Substances. South Africa does not have air quality standards for most types of air pollutants. Those assessed have no standards and the Department of Environmental Affairs and Tourism utilizes a fraction of the Occupational Exposure Limit 1/100, if pollutant is carcinogenic (cancer producing substance) or 1/50, if pollutant is not carcinogenic. Therefore control measures are implemented for the filling station site in order to prevent catastrophic and fatal occurrences.

1.2. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are identified for the study:

- The Environmental Assessment Practitioner's (EAP) experience in similar projects is relevant and appropriate for reaching logical and scientifically based conclusions in the study;
- The Incident Management Plan has not been drawn up by a qualified risk consultant;
- The study does not account for future construction of another filling station in close proximity (within 20m) to the proposed site;
- The health of the petrol attendants has not been verified on site due to the site not being operational, and the state of health of the workers is also unknown; and
- The impact of the surrounding traffic on the air quality is beyond the scope of the investigation, therefore will not be investigated into detail, rather on a generic level.

2. VAPOUR RECOVERY PHENOMENON

2.1 EVAPORATIVE EMISSIONS

According to a study compiled by Cornelia Venter in Recovery of Petrol Vapour at a bulk storage facility (2003), maintains that evaporative emissions fall into four (4) types, viz:

1. Displacement emissions
   - These emissions occur from fixed storage facilities (bulk storage tanks) and underground storage tanks, and are due to vapour displacement by incoming petrol; and
   - It accounts for 0.16% of the total emissions losses from petrol storage and distribution systems.

2. Breathing and withdrawal emissions
   - These are caused by variations in tank contents, temperature change in barometric pressure that causes expansion and contraction of the liquid and vapour in the tank;
   - Withdrawal emissions occur when the petrol is pumped out of a storage tank resulting in the intake of air through pressure/vacuum relief valves or vents; and
   - Breathing and withdrawal emissions from service station storage tanks accounts for 0,01% of total emission losses.

3. Filling emissions
   - Petrol transfer from storage tanks to road tankers.

4. Emissions from vehicle refueling
   - During vehicle refueling at service station, the incoming petrol displaces the petrol vapour in the fuel tank, causing it to escape into the atmosphere.

2.2 SITE ENVIRONS

The following site environs were identified which could exacerbate or reduce the impact of petrol vapours when combined with the impact of the proposed filling station.

- The absence of confining structures or high rise buildings that could prevent the free flow and/or circulation of air on- and off-site;
- Tree buffers to aid as wind breakers and absorb air contaminants;
- The absence of similar filling stations and other total petroleum products (e.g. paraffin, benzene, oil etc) within 500m of the site to reduce the cumulative effect;
- The site's location relative to passer-by vehicular traffic associated with the emission of carbon monoxide; and
- The predominant northeasterly wind which blows away from the nearest sensitive receptors (about 400m to the northeast).

When taking the above factors into account coupled with site sampling the level of air contaminants present on site as a result of the storage of petroleum products and the filling thereof would be determined, and corrective measures would be implemented to remain within acceptable exposure limits.

3. PROPOSED FILLING STATION AND VAPOUR RECOVERY PLAN

Vapour recovery is a process where petrol vapour, which would normally escape into the atmosphere, is recaptured and recovered into the liquid state.

3.1 Vapour collection methods:

3.1.1 During road tanker unloading at service station

- Modifications involve closing vents on a road tanker and underground storage tank (UST);
- Use rubber seals on the road tanker's dispensing pipe to the underground storage tanks; and
- Addition of piping and equipment to allow for vapour collection/re-routing.

3.1.2 During vehicle refueling

- Return of vapour to the filling station UST when refueling by using specially modified petrol filling nozzle or must be rubber sealed (**see figure 1: modified petrol nozzle**);
- On-board refueling Vapour Recovery units; and
- Use dispensing pipes with a rubber seal and automatic switch-valve to cut supply when tank is full to reduce the dispersal of VOC's.

Figure 1: Petrol nozzle adapted for vapour collection

3.2 Vapour recovery plan, installation and reporting

The following plan is recommended for the proposed filling station site:

- Emissions are estimated at about 0,16% of the volume throughput of the site, therefore this concentration will not expose sensitive receptors to substantial pollutant concentrations;
- The vapours dissipate from site within 5m of the forecourt and exposure by petrol attendants is below the national occupational limit;
- Limit the electrical energy in circuits and equipment to levels that are too low to ignite the most easily ignitable mixture of gas or vapour;
- All electrical equipments must be installed in accordance with the SABS Code 0142 - Code of Practices for the wiring of premises, and SABS 0108 as well as Occupational Health and Safety Act, 85 of 1993;
- Provide for leak detection on the tank gauge system together with stock reconciliation;

- Clean spillages of petrol, diesel and/or oil immediately;
- Implement good housekeeping measures in the presence vehicular traffic along R55;
- Air contaminants from spillages and bulk tank vents and other sources, are continuously being released into the environment. If a spillage occurs, these levels increase until the spillage is cleaned or the petrol evaporates. Therefore reduce or control the amount of air contaminants generated into the air from the garage activities, through the following means –
    - All open containers or open surfaces containing petrol and/or diesel, should be kept closed; and
    - All spillage should be removed or neutralized immediately.

- The bulk storage tank vents must be located above the apex roof of the building to improve dispersal;
- Site the filling station such that there is very minimal confining structures to improve air dispersal from the site's forecourt;
- Implement SABS standards that advocate breather pipes on the storage tanks; and
- Implement the following minimum design standards for a filling station:

Table 1: Minimum standards for filling station installations

Area of concern	Minimum standard (Technical level)
Underground tanks monitoring	▪ Composite steel/glass fibre tanks with a documented and auditable continual leak monitoring system; ▪ Single wall tanks.
Tank overfill protection	Install overfill protection device to all storage tanks.
Tank fill points	Provision of leak containment and collection features.
Off-set fill/remove pipe work	Single wall pipe work (self draining to tanks).
Suction pipe work (underground)	▪ Single wall pipe work; ▪ Check valve must be installed at the pump end of the line (self draining to tanks).
Pressure pipe work (underground)	▪ Double wall pipe work with interstitial monitoring alarm system; ▪ Fit under dispenser shear valves.
Fuel system monitoring	▪ Subject all tanks and pipes to testing every 5 to 10 years.

Source: Sasol Oil manual

4. INCIDENT MANAGEMENT PLAN

An incident management plan entails the assessment of potential incidents likely to occur in the operation of a filling station site and measures to be implemented in mitigating the potential detrimental impacts thereof.

The following incident management plan is provided:

4.1 Fire hazard on the filling station site
When a fire is noticed, the following **procedure** must be **followed**:

- Activate the emergency fire alarm of the filling station. The supervisor in charge has to ensure that he or she is familiar with the position of the fire alarm. If you don't know where the alarm is situated, get the attention of any worker of the filling station and instruct him to activate the alarm;
- Guide people away from the danger area;
- Determine the following:
    - The exact location of the fire?
    - What is burning?
    - Is there a possibility of a spill/pollution?
    - Are there any injuries?

IF YES:
- How many?
- How serious?

- Try to move injured people outside the danger area without endangering your own life
- ▫ Instruct and assist customers to remove their vehicles from danger area, if possible, without endangering your own life
- Evacuate to a safe distance (follow the example of fellow employees who know the site evacuation areas, close doors and windows where possible)
- Establish who the Emergency Controller is and inform him or her of:
    - The exact location of the fire
    - What is burning
    - Any injuries and seriousness thereof
    - Any spillage/pollution
    - Inform the Petroleum Company depot of the incident
    - Await further instructions from the Emergency Controller.

The Emergency Controller is responsible for reporting the incident to authorities, e.g.
DWA (spill/pollution) CAPCO Air pollution and within 24 hours to the SABS Manager:

- Biological Environmental and Timber.

If spillage/pollution exist/is possible, the Emergency Team for handling of spillage must be contacted, and they will either use the Drizit trailer or if needed help contact the Department of Water and Sanitation and Environmental Consultants/Contractors.

Hand fire fighting over to Fire Department on arrival and assist if necessary.

Contain product as far as possible by using soil, sandbags etc. Action plans must be in conjunction with Fire Department and Emergency Controller.

Can you get the situation under control; follow procedures for **"YES"** answer

- If trained, try to extinguish the fire without endangering your own life
- If trained, apply first aid to the injured

- Try to help customers remove their vehicles from the danger, if possible, without endangering your own life.

If you cannot get the situation under control, follow procedures for **"NO"** answer.

- Inform the Emergency Controller of:
    - exact location of fire
    - what is burning
    - any injuries and seriousness thereof
    - is there a spill/pollution or possibility thereof
    - action taken

- Inform the Petroleum Company depot of the incident.
- Await further instruction from the Emergency Controller.

4.2 Procedure for general fire fighting

4.2.1 Size up the fire

When first noting the existence of a fire ,whether it be by seeing smoke or being alerted to it by a co-worker, try to establish the size by judging the amount of smoke etc. If you will not be able to extinguish the fire yourself by means of handheld extinguishers or the emergency equipment available on the forecourt, the local Fire Department must be informed and the fire alarm must be sounded. If the size is within limits proceed to stage 2.

4.2.2 Evaluate the situation

Determine possible threats and dangers. Establish the safety/stability of the situation before commencing with fire-fighting. If the situation seems unstable or unsafe (e.g. Containers present that may explode or not enough fresh air present to guarantee a safe operation) do not attempt to extinguish it yourself. Rather sound the alarm and assist the appointed fire-fighting squad by giving background info (type of fuel, size of fire etc.) and directions. If the fire does seem out of control or the situation too hazardous then proceed to stage 3.

4.2.3 Remove the source of fire

Where a fire is situated in a dangerous environment (e.g. in the tank farm where ignition of tanks will probably result in fatal injury and enormous damages) there might not be sufficient time to remove the fuel first. In such cases, provided that the right type of extinguisher is at hand it is advisable to extinguish the fire without delay.

4.3 Evacuation procedure in the event of an emergency

4.3.1 Evacuation communication

In the event of an evacuation the Emergency Controller will give instructions to evacuate.
The instructions will be given via the internal communication system in language predominantly used at the filling station site.

Security must in all instances be notified of the evacuation so that necessary actions can be taken.

The following must be kept in mind should the premises have to be evacuated:
a) The protection of human life receives priority

b) Equipment (e.g. vehicles, computers, etc.) may only be removed should circumstances allow it, always keeping personal safety in mind.

The evacuation instructions must be kept clear and to the point with relevant information: "ATTENTION, PERSONNEL ARE REQUESTED TO EVACUATE THE PREMISES IMMEDIATELY. AN EMERGENCY SITUATION EMERGED BECAUSE OF ....." then the emergency procedure must be explained.

4.3.2 Vehicles
a) Wait for instructions from Emergency Controller.
b) Adhere to directions given by emergency controller.
c) Remove vehicles (if accessible without endangering own life)
d) With arrival at assemble point remain there, with vehicle, until further notice.

4.3.3 Supervisor on forecourt
a) Immediately switch off the emergency shut off valve
b) Control traffic in and out of the forecourt
c) Adhere to directions given by emergency controller
d) Provide the necessary firefighting equipment to extinguish the fire.

4.4 Implement an Emergency Plan
As discussed in the following section.

5. ON SITE EMERGENCY PLAN

5.1 FUEL SPILL – NO FIRE:
▫ Stop Pumps – Hit Site Emergency Button
This action should stop all pumps on site and switch off the electrics of dispensers. Not all sites have an emergency button, and the electrical distribution board must be readily accessible. Where emergency buttons do exist, ensure that this button does not also switch off the forecourt lights that might plunge the place into darkness and increase any panic. The lights are well above the hazardous zone created by the fuel vapours. The button/distribution board's location should be known to all personnel and should be regularly tested, with a vehicle being filled and using different dispensers.

▫ Shut off fuel from Tanker
This may need to be done by service stations personnel, as the tanker driver may be absent from his post (hence the spill) or incapacitated. The staff must therefore be shown how to do this on a delivery truck. There is an emergency button on most of these vehicles, which, when hit will shut all of the bottom valves of the individual compartments. The individual compartments' valves can also be shut using the buttons in the Alfons Haar box. Arrange with the delivery company that your staff be shown and can practice this.

▫ Evacuate all people on site (On foot)
Your staff will have to come charging out onto the forecourt shouting something like this.
"Massive petrol spill; might catch alight; run for your life!" They must stop people running towards their cars to evacuate. Ensure that staff in other sections of the service station are evacuating as well. If at all possible, get people to move upwind and to get as far away as practicable. It should be noted that should the vapour cloud of a large spill be ignited, there would unlikely be a massive explosion, as most sites are uncluttered.

▫ Prevent starting or entry of vehicles
Prevent people from starting their cars on the forecourt by shouting at them. “That might set it alight” Post people at entrances or mount barricades to stop them from entering the site, being unaware of the incident. You may need to give a stern warning to people who want to disobey such instructions, that they can be charged with culpable homicide and/or arson if their action starts a fire.

▫ Summon Emergency Services – Phone 112 (cell 0 or …….*)
This is an area where it is known to be a problem at certain sites where there is no phone accessible to the service station staff after hours, due to misuse/abuse of the phones at some time. It is essential that it will be possible to contact the emergency response services speedily, and you should not rely on the fact that a member of the public may be at hand with a cell phone. Provide a telephone but control its use. There are several ways of doing this now. *Ensure that the number of the local services is displayed and has not faded or changed. Phone it occasionally to check if it is still the right one. Ensure that they receive a clear description of the location of your site.

▫ Warn Vulnerable Neighbours
Send someone running to all of your neighbours who may become involved, being downwind or downhill, to warn them of the potential for disaster and to take steps to mitigate against it (close windows; douse and braai; etc). They might also be able to help with the problem, especially if they have been included in the practice, (which is advised).

▫ Prevent spread of Fuel (Use sand buckets)
Use the sand in the buckets to dam up or soak up the spilt fuel and prevent its outward spread to areas not under your control. A spill should always be kept as localized as possible.

▫ Take Fire Extinguishers & Dry Powder Units to a Safe Place
Remove the extinguishers from their mounting points on the forecourt, and wheel the large DP units to an unwind location. You may need them later.

▫ Do not flush fuel into drains
This is an admonition aimed at persons whose first action on encountering a spill is to try to spread it as far away as possible by flushing it down the drain. Persons 3 kilometers from a spill have been seriously burnt by such action.

▫ Contact Petroleum Company Emergency – Toll-Free
Every Petroleum Company has emergency teams on standby, who will be mobilised on receipt of a message that there is a serious problem somewhere. They may also give advice over the phone. It is therefore important to give details of the site to the 24 hour emergency controller.

▫ Further action dictated by circumstances.
The above actions are the immediate and high priority actions needed to render the situation as safe as can be under the circumstances. There will always be other things needed to control a given situation but these are not generic in nature and will be dictated by the situation. They cannot be forecast and planned for. Hopefully the person in charge will be able to cope with the situation and act according to the circumstances.

5.2 FUEL SPILL – WITH FIRE:
▫ Stop Pumps – Hit Emergency Button
See above

▫ Evacuate People & Vehicles – Allow to drive off
Because the spill has already caught alight there is no need to take ignition precautions.
You would want to clear the site of as many vehicles as possible as they will add to the amount of fuel present on the site and vulnerable to the fire. Fuel tanks of vehicles could also rupture/explode spreading the fire and creating extra for fire fighters.

▫ Shut off fuel supply
If you can. See above.

▫ Summon Emergency Services – Phone 112 (cell or……..*)
See above.

▫ Tackle the Fire Extinguishers & Dry Powder Units
If a fire is attacked early on, before steel has had a chance to heat up, etc. there is a good chance of extinguishing it. Dry powder (if the right material) has very good extinguishing potential and large fires can be knocked down with it. The use of extinguishers takes some practice, though, and, needs confidence. Both are enhanced by giving staff a chance to use them at (say) your local fire brigade's training ground.

▫ Warn Neighbours
Ensure that ALL of your neighbours are warned about this fire. It may spread before the fire brigade arrives. Rather have them aware of the fire than find out too late.

▫ Contact Petroleum Company Emergency – Toll-Free
See above.

6. CONCLUSION AND RECOMMENDATIONS
From the discussions contained in the report, the emissions as a result of evaporation are likely to create a hazardous environment if not controlled. Therefore, the layout of the forecourt and the filling station itself, provision of vent stacks above the forecourt and outside of confined space will prevent the creation of an explosive atmosphere on the forecourt. The vapour on the forecourt will disperse within 5 to 20m of the property. The absence of confining structures in the immediate boundary of the property, the impact of fuel vapours will disperse with ease into the atmosphere. However, the presence of traversing roads will contribute significantly to the elevated levels of vapours on site and on the adjoining properties. The significance of the impact is considered low in the absence of sensitive receptors in close proximity.

Cumulative impacts associated with the presence of similar land uses, could contribute towards elevated levels of vapour, which will dissipate in the atmosphere in the absence of confining structures/buildings, the effect of northeasterly winds predominant in the project area as well as spatial separateness or geographical location.

Once the filling station operator implements an incidence management plan, potential impact on the general environment will be within acceptable limits and/or mitigated to levels that comply with the EIA legislation and other applicable health and safety legislations. The existing

road infrastructure shall ensure that Emergency vehicles can easily access the property and any potential fire hazard can be extinguished with ease before it becomes fatal.

7. REFERENCES

GDACE – Gauteng Department of Agriculture, Conservation and Environment (2002): EIA administrative guideline for the construction and upgrade of filling stations and associated tank installations, 2002.

Occutech. Occupational Hygiene Assessment – Evaluation of air contaminants around petrol garages, 2003.

S.J. Van Der Westhuizen. Standard specification – Underground tank, pump and pipework specification, Sasol Oil, 2001.

Venter, Cornelia. Recovery of petrol vapour at a bulk storage facility. Master of Engineering in the Faculty of Engineering, Built Environment and Information Technology, University of Pretoria; 2003.

FIGURE 1: BOREHOLE PLACEMENT FOR THE FILLING STATION, HEROLDS BAY COUNTRY ESTATE ON PORTION 7 OF THE FARM. BUFFELSFONTEIN 204, WESTERN CAPE

Prevailing wind:
Summer: Southeast
Winter: Northwest

GPS Coordinates:
Latitude: 34° 2'44.39"S
Longitude: 22°24'15.31"E

Prepared for:
Herolds Bay Country Estate

Date:
June 2022

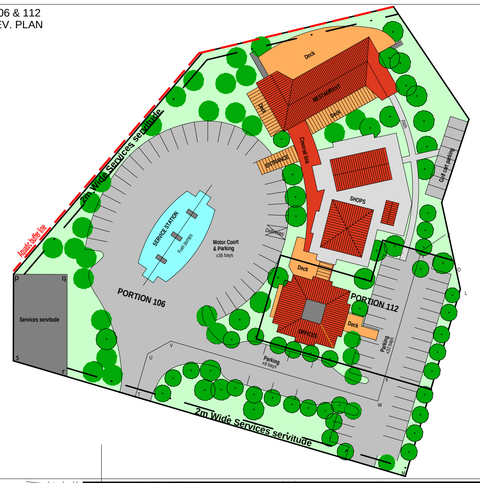
FIGURE 2: BOREHOLE PLACEMENT FOR THE FILLING STATION, HEROLDS BAY COUNTRY ESTATE ON PORTION 7 OF THE FARM. BUFFELSFONTEIN 204, WESTERN CAPE

FIGURE 3: BOREHOLE PLACEMENT FOR THE FILLING STATION, HEROLDS BAY COUNTRY ESTATE ON PORTION 7 OF THE FARM. BUFFELSFONTEIN 204, WESTERN CAPE

FIGURE 4: CLOSE-UP BOREHOLE PLACEMENT FOR THE FILLING STATION, HEROLDS BAY COUNTRY ESTATE ON PORTION 7 OF THE FARM. BUFFELSFONTEIN 204, WESTERN CAPE

INSERT 1

PTNS 106 & 112
SITE DEV. PLAN



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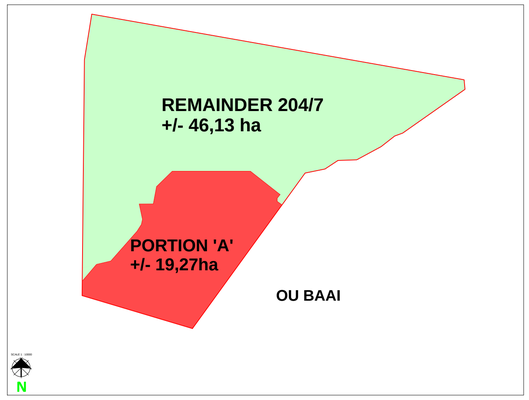
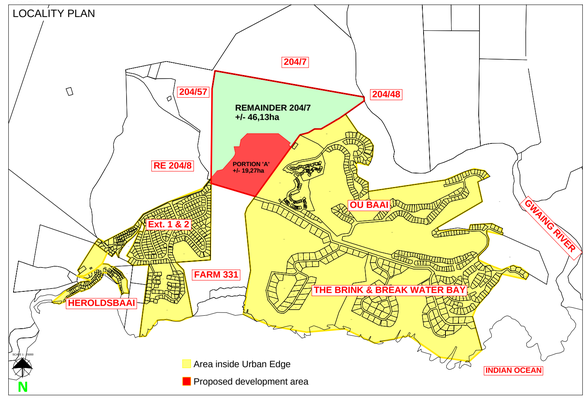
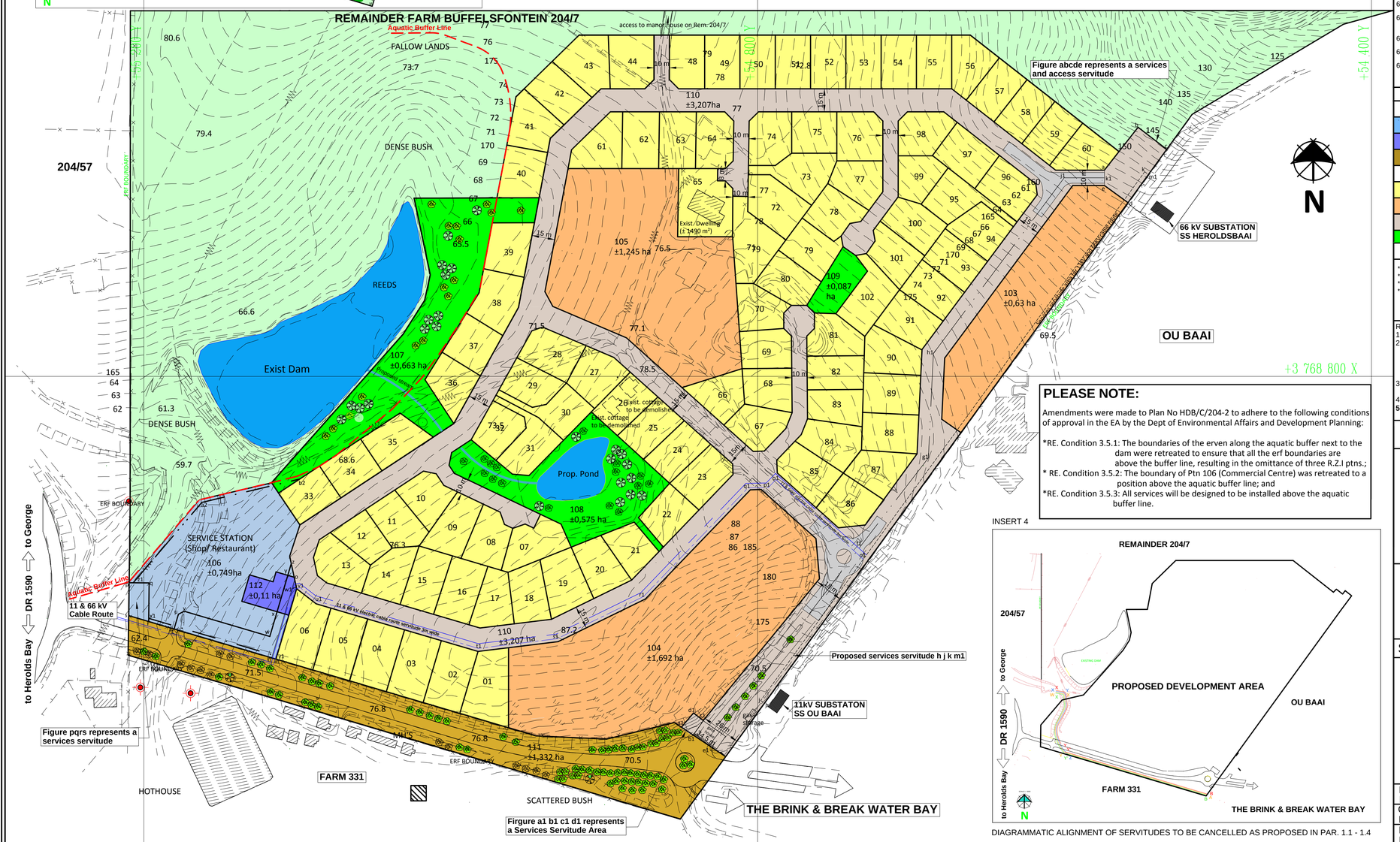


INSERT 3

LOCALITY PLAN



SUBDIVISION



PLEASE NOTE:

Amendments were made to Plan No HDB/C/204-2 to adhere to the following conditions of approval in the EA by the Dept of Environmental Affairs and Development Planning:

*RE. Condition 3.5.1: The boundaries of the erven along the aquatic buffer next to the dam were retreated to ensure that all the erf boundaries are above the buffer line, resulting in the omittance of three R.Z.I ptns.;
* RE. Condition 3.5.2: The boundary of Ptn 106 (Commercial Centre) was retreated to a position above the aquatic buffer line; and
*RE. Condition 3.5.3: All services will be designed to be installed above the aquatic buffer line.

INSERT 4

DIAGRAMMATIC ALIGNMENT OF SERVITUDES TO BE CANCELLED AS PROPOSED IN PAR. 1.1 - 1.4

APPLICATION FOR THE CANCELLATION AND REGISTRATATION OF SERVITUDES, SUBDIVISIONS, REZONING, AND CONSENT USES IN TERMS OF THE RELEVANT SECTIONS OF THE BY-LAWS ON LAND USE PLANNING FOR THE MUNICIPALITY OF GEORGE, 2015.

APPLICATION IS BEING MADE FOR :

1. Cancellation in terms of Section 15.2 (f) of the following title conditions applicable to servitudes as per Deed of Transfer T038436/2017 (as shown on Insert 4):

1.1 Par. B: A servitude right of way, 5.87 wide, marked XYZ, on SG Diagram 2223/45;

1.2 Par. C: Right-of-way, 5.67m wide, marked WXYA on SG Diagram 1827/52;

1.3 Par. D: Servitude, 9.45m wide, marked XY & Y'B on SG Diagram 916/65; and

1.4 Par. E: Right-of-way, 9.45m wide, marked XY and line Y'B on SG Diagram 5727/58.

2. Subdivision in terms of Section 15.2 (d) of Portion 7 of Farm Buffelsfontein No 204 as follows: (INSERT 2):

2.1 Portion A =±19.27 ha; and

2.2 Remainder Buffelsfontein 204/7 = ±46.13 ha.

3. Rezoning in terms of Section 15.2 (a) of the above mentioned PTN. A from Agriculture Zone 1 to Subdivisional Area;

4. Subdivision of the above mentioned Subdivisional Area in terms of Section 15.2 (d) as shown on plan and Table A.

5. Consent use in terms of Section 15.2 (o) for Restaurant/Shop on Portion 106.

6. Registration of the following servitudes in terms of Section 15.2 (d)

6.1 Services and access servitude area, marked figures a b c d e and a1 b1 c1 d1 on Ptn. 110;

6.2 Services servitude area 3m wide marked Figure h j k m1 on Ptn. 103 and Ptn. 110;

6.3 Services servitude area 3m wide marked Figure l m n o on Ptn. 112 and 106;

6.4 Figure marked p q r s represents a services servitude area on Ptn. 106;

6.5 Line t u v w x represents the centre line of a servitude right of way, 6m wide, on Ptn. 106 in favour of Ptn. 112, Portion 110 and Rem. Farm Buffelsfontein 204/7;

6.6 Line x y represents the centre line of a 6m wide servitude right of way on Ptn. 112 in favour of Ptn. 106, Ptn. 110 and Rem. Buffelsfontein Farm 204/7;

6.7 Line y z represents the centre line of a 6m wide servitude right of way on Ptn.106 in favour of Ptn.110 and Rem. Farm Buffelsfontein 204/7;

6.8 Access to the treatment plant on Figure pqrs will be registered in general terms on Ptn. 106 in favour of the H.O.A.;

6.9 A servitude for pipeline from treatment works on Fig. a b c d e to retention pond on Ptn. 108 via Ptn. 110 (Private Road) and Ptn. 109 (Private Open Space) will be registered when route is finalised;

6.10 Notarial Deed to be registered on Ptn. 107 in favour of Rem. Farm Buffelsfontein 204/7 for grazing purposes;

6.11 Servitude right of way in general terms on Ptn A (Insert 2) in favour of Rem. Farm Buffelsfontein 204/7;

6.12 Servitude right of way on Ptn 110 in favour of George Municipality: centre line e1 f1 (18m wide), centre line f1 g1 h1 j1 (15m wide) and centre line j1 k1 (10m wide);

6.13 Line n1 o1 p1 q1 r1 s1 t1 u1 v1 w1 represents 3m wide services servitude on Ptn. 110 for 11 & 66 kV cable route;

6.14 Line x1 y1 represents centre line of services servitude 2m wide on Ptn. 106; and

6.15 Line z1 a2 b2 represents centre line of services servitude 2m wide on Ptns. 106 and 107.

Table A

	Zoning	Ptn No's	Land Use	Number	Area (ha)	%
	Business Zone VI	106	Service Station*	1	± 0,749	3,9
	Business Zone IV	112	Office (300 m² floor space)	1	± 0,11	0,6
	Transport Zone II	111	Public Street	1	± 1,332	6,9
	Single Residential Zone II (Estate Housing):					
		1 - 44, 48 - 102 **	Dwelling House ***	99	± 8,847 ***	45,9
		103, 104 & 105	Group Housing ****	3	± 3,567	18,5
		110	Private Road	1	± 3,207	16,6
		107, 108 & 109	Private Open Space	3	± 1,456	7,6
	Total			109	± 19,267	100

* Service Station (Restaurant / Shop - Consent Use)
** Due to amendments along the aquatic buffer line the numbering of the three portions which were left out, viz. 45-47, are omitted
*** Average erf size = ±894 m² (min. +/- 733 m² and max. = ±1020 m² - excl. Ptn. 65 with exist. dwelling)
**** Detail planning of Group Housing Sites to be dealt with as a separate application with the following average densities:
Ptn 103 = ±16 units @ 26 / ha.
Ptn 104 = ±32 units @ 19 / ha.
Ptn 105 = ±20 units @ 16,5 / ha.

REMARKS:
1. Land concerned situated outside 'Urban Edge' in terms of 2015 L.S.D.P.
2. The emergency 11kV powerline connecting the 66kV and 11kV Sub-station on the abutting Oubaai will be accommodated within a 3m wide servitude to be registered along the south-eastern boundary of Portion 103. The 66kV and 11kV Municipal connecting powerlines from the 66kV Sub-station to Herolds Bay and the rural area will be accommodated in the proposed 15m wide road reserves as well as a 3m wide service servitude on Ptns. 106 & 112..
3. The Oubaai/The Brink/Breakwater Bay access road was surveyed, but diagram was not registered and therefore still forms part of Rem. 204/7.
4. Development will be implemented in phases as shown on Phasing Plan (Annexure 21).
5. **PLEASE NOTE: THIS IS A REVISED PLAN TO COMPLY WITH MUNICIPAL REQUIREMENTS AS SET OUT IN AN EMAIL dd. 9 NOVEMBER 2021.**

NOTES:
1. Contour and Cadastral information by Azur Aerial Services.
2. Contour intervals: 1.0m

HERALDS BAY COUNTRY ESTATE ™

PTN. 7 (A PORTION OF PORTION 6)
FARM BUFFELSFONTEIN No. 204
SITUATED IN MUNICIPALITY AND
ADMIN. DIST. OF GEORGE

SKAAL 1 : 1500 (A1) 1 : 2000 (A2) 1 : 3000 (A3) SCALE

del & dek
Town and Regional Planners
Stads -en Streekbeplanners
Yorkstraat 56 York Street
Posbus 1186 / P.O. Box 1186
George 6530
Tel: (044) 874 5207
Fax: (044) 873 6354
E-pos / E-mail: neldek@mweb.co.za

Beplan Planned	D.N.	Plan No	HDB/C/204-4
Geteken Drawn	A.H.		
Datum Date	10 NOVEMBER 2021		

PHYSIOGRAPHY
- The site slope from south-east to north-west.
- Average slope 1 in 6:7.
- Site slopes to be followed but filled.

ORIENTATION
- Solar orientation is positive due to north and west orientation.
- The retail facilities have views towards the Outeniqua mountains and ocean.
- Retail facilities are favorably orientated in relation to prevailing winds.

DEVELOPMENT COVENANTS

The property comprises portions 106 and 112.

- ZONING:
  Portion 106: Business Zone II: Shop = Restaurant, service station, supermarket.
  Portion 112: Business Zone IV: Office (2 floors) 300m²
- SITE AREA:
  Portion 106: 7490m² - Building area: 1303.8m²
  Portion 112: 1100m² - Building area: 246.6m²
- COVERAGE:
  Portion 106: (Actual = 17.4%)
  Portion 112: 60% (Actual = 22.6%)
- FLOOR FACTOR:
  Portion 106: 3 (Actual = 0.17)
  Portion 112: <1 (Actual = 0.44)
- GROSS FLOOR AREA:
  Portion 106:
  Portion 112
- PARKING:
  Portion 106 Shop/Supermarket: 4 bays/100m² GLA in normal areas.
  - Service station - 8 bays plus 4 bays/100m² GLA in normal areas:
    Provided - 32 (required 12)
    - 2 for disabled

  Portion 112 Office: 4 bays/100m² GLA in normal areas.
  - Service station - 8 bays plus 4 bays/100m² GLA in normal areas:
    Provided - 32 (required 12)
    - 2 for disabled
- ACCESS:
  - Access to portion 106 is from portion 111 (public street – public street i.e. the existing road connecting DR1590 and Oubaai, the Brink and Breakwater Bay.
  - Access to portion 112 is via a servitude over portion 106.
- HEIGHT:
  Portion 106: allowable 15m. Actual = 12m
  Portion 112: allowable 11m. Actual = 8.5m
- BUILDING LINES:
  Portion 106:
  - side and rear = 0m
  - street = 0m
  - parking not closer than 10m from street boundary.

  Portion 112:
  - side and rear = 3m
  - street = 6.5m
  - side and
- UTILITY AREAS:
  Portion 106:
  - Delivery area
  - Refuse area to facility at main entrance.

  Portion 112:
  - Loading bay
  - Refuse area to facility and main entrance.
- CIRCULATION:
  - The surface of the commercial site will be asphalt for all circulation and parking areas. The service station forecourt apron will be concrete.
- DEVELOPMENT PLANNING:
  Portion 106 to be developed before portion 112.

SERVICES

WATER SUPPLY:
Bulk water for the commercial development is obtained from the municipal 200mm uPVC bulk water line along Oubaai Main road along the southern boundary of the site where the connection point will also be.
The Average Annual Daily Demand (AADD) for the commercial development will be 7kl/d.
A suitable internal water reticulation network will be provided in accordance with all legislative and municipal requirements.

ELECTRICITY:
Power to be supplied from a municipal mini-sub (first phase 100kVA) via an underground cable to a kiosk with service connections.
The Developer plans a future solar farm for the whole development to supply renewable energy.

SEWAGE:
A package plant is planned for the site.

STORMWATER:
The commercial development (drainage zone A3) drains towards a general west-north-western direction towards Herolds Bay and will discharge into the unnamed drainage line to the west of the development crossing underneath the DR1590 in an existing culvert.
Energy dissipation will be performed at this outlet with a gabion mattress design.
A suitable internal stormwater drainage network will be provided in accordance with all legislative and municipal requirements.

FIRE HYDRANTS:
Fire hydrants will be provided on the internal water network in accordance with all relevant legislative and municipal requirements.

SOLID WASTE:
A formal solid waste collection area will be provided.
Refuse will be collected on a weekly basis and a formal arrangement for the removal of solid waste will be entered into with the George Municipality.

FUEL STORAGE:
A petrochemical plan has been compiled.
There are 3x double-walled petrochemical underground tanks with pipework in compliance with standards and legislation.
All required safety and fire equipment to be provided.
Space for maneuverability of a 22m fuel delivery vehicle is planned.
3 fuel pump islands provided.

ENVIRONMENT:
The environmental authorization has been obtained and requirements are addressed in the EMP. In particular stormwater and sewage.

GEOTECHNICAL:
The in-situ materials found on site are adequate for the construction of engineering services and foundations for low-level commercial development.
No natural slope instability is present.
No ground water and/or perched water are evident. A low to moderate water retention rate is expected.
Lateral movement of stormwater will be moderate due to the flat to undulating gradient.
Reinforced strip footings will be adequate for the development.

LIGHTING
- The visual impact of accent and functional lighting will be reduced by the use of reflective rather than direct lighting.
- Advertising signage and associated lighting will be in accordance with municipal requirements.

BUILDING STYLE AND DETAIL

Building forms are determined by the following variables:
- Form-following function
- Site slope
- Commercial requirements
- Local vernacular
- Compliance with height regulations

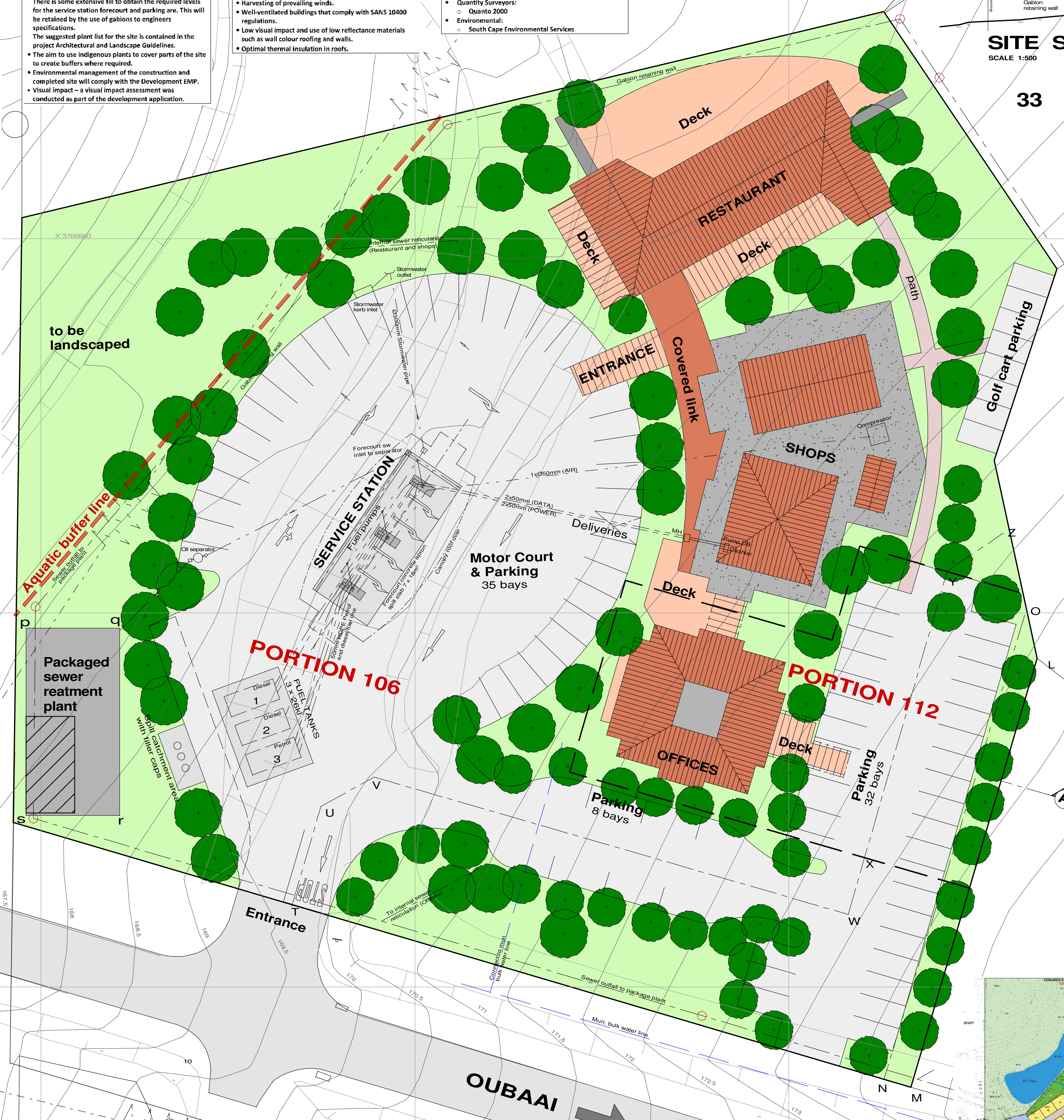
As the residential component of the development overlooks the commercial it is important that elements outlined in the Herolds Bay Country Estate Architectural and Landscape Guidelines be followed like matt-coloured Zinzalume roof sheeting, plastered walls and some use of natural stone as an accent.
Colours are muted.
The use of steel and hardwood pergolas and screens provide interesting functional detail.

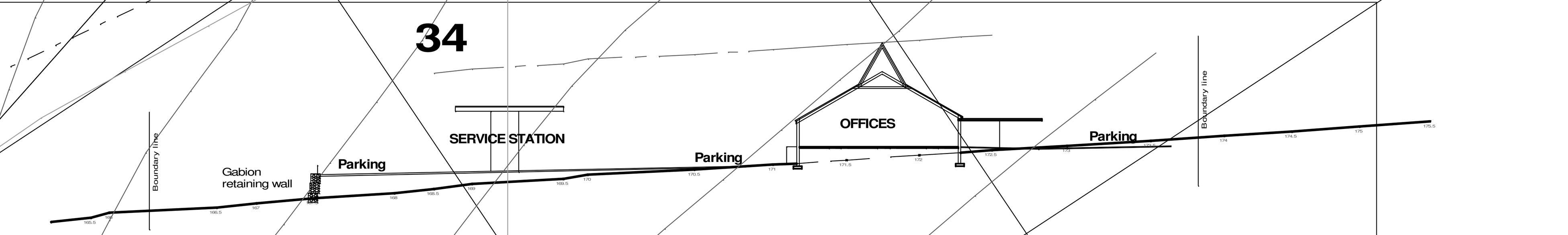
LANDSCAPE
- The existing landscape has been covered for many years in alien Black Wattle and used as agricultural land. These aliens are to be removed and indigenous species established.
- During construction a system of temporary haul roads will be used and all topsoil temporarily stored for re-use. There is some extensive fill to obtain the required levels for the service station forecourt and parking are. This will be retained by the use of gabions to engineers specifications. The suggested plant list for the site is contained in the project Architectural and Landscape Guidelines.
- The aim to use indigenous plants to cover parts of the site to create buffers where required.
- Environmental management of the construction and completed site will comply with the Development EMP.
- Visual impact – a visual impact assessment was conducted as part of the development application.

GREEN BUILDING CONSIDERATIONS

The development is planned to incorporate the following building technologies:
- Rainwater harvesting.
- Harvesting of roof stormwater to be used for irrigation and cleaning of paving.
- Provision of electricity from an estate photo-voltaic farm.
- Harvesting of prevailing winds.
- Well-ventilated buildings that comply with SANS 10400 regulations.
- Low visual impact and use of low reflectance materials such as wall colour roofing and walls.
- Optimal thermal insulation in roofs.

PROFESSIONAL TEAM
- Architects and Landscape Architects:
  - Brink Stokes Mkhize (Pty) Ltd
- Civil and Structural Engineers:
  - Element Consulting Engineers (Pty) Ltd
- Electrical Engineers:
  - BDE Consulting Engineers (Pty) Ltd
- Quantity Surveyors:
  - Quanto 2000
- Environmental:
  - South Cape Environmental Services

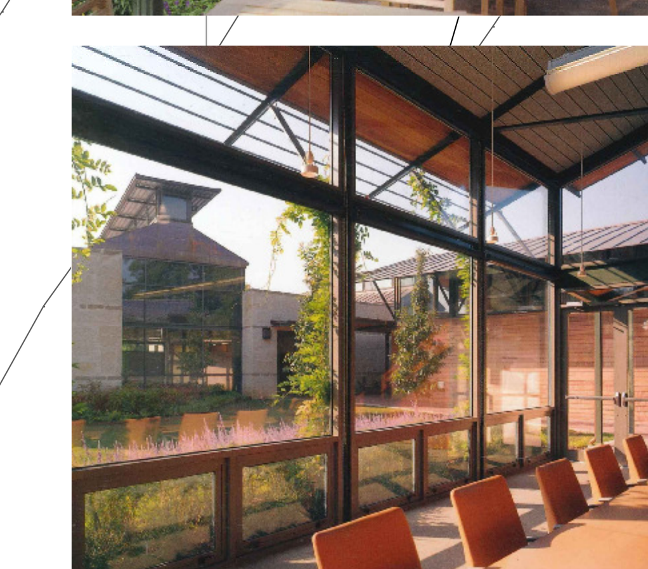


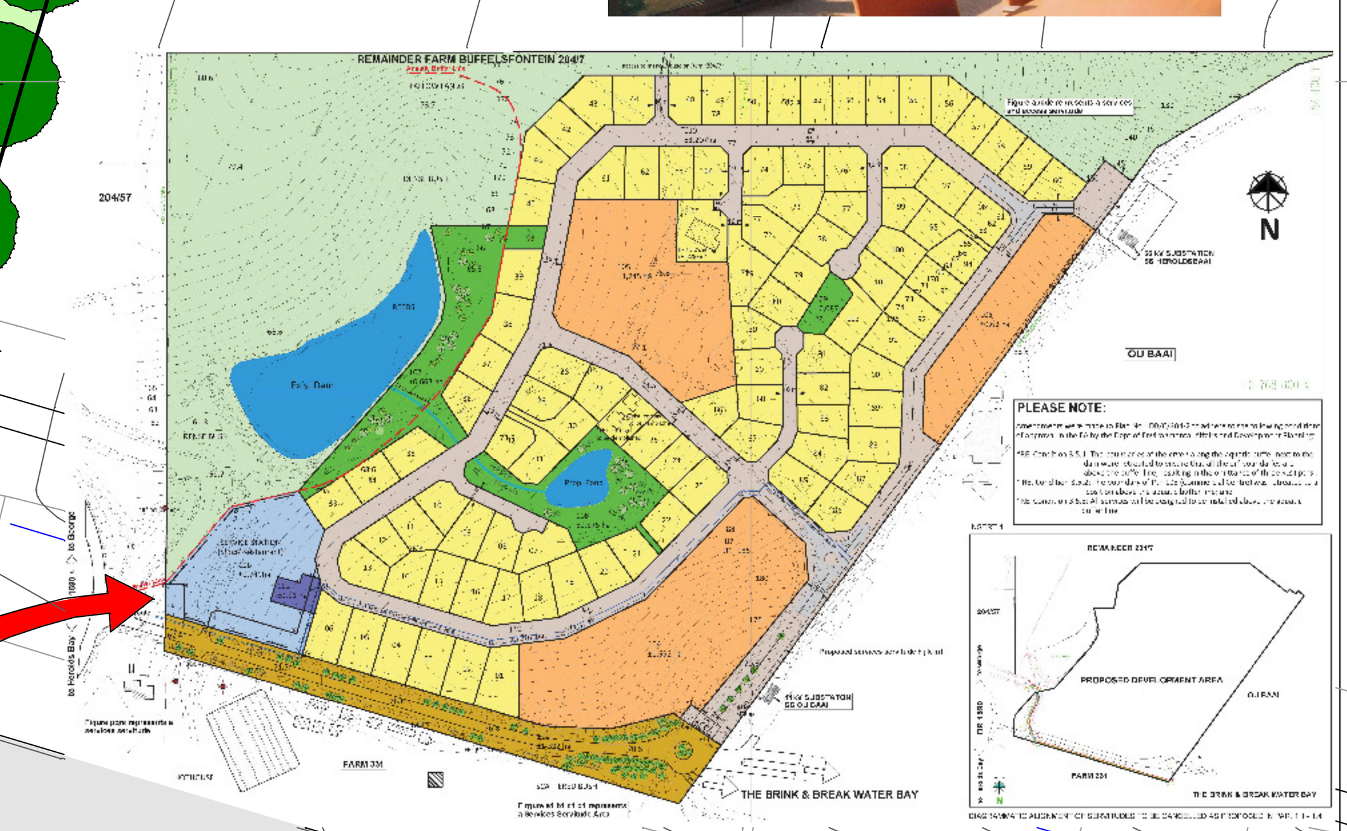


SITE SECTION A

SCALE 1:500

33





BRINK STOKES MKHIZE

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PROJECT

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HEROLDS BAY™
COUNTRY ESTATE

HEROLDS BAY COUNTRY ESTATE: COMMERCIAL DEVELOPMENT
for Long Island Trading 44 (pty) ltd.
Portion no.106 + no.112
A Portion of Portion 7 of the Farm Buffelsfontein no.204
GEORGE

SITE DEVELOPMENT PLAN

SCALE	PROJECT NUMBER	
1:250	G493	
DRAWING NUMBER	REVISION	
S03	.	
PRINT ISSUED	DRAWN	CHECKED
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	14 Jun 2022	

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Terra Geotechnical

Where Engineering Meets Earth

Engineering Geological Investigation in support of the township establishment at

Harolds Bay Country Estate

Harolds Bay

Western Cape

Document History and Distribution:

Title:	Harolds Bay Country Estate
Project No:	TG-22-022

Name	Organization	Date	Document no	Version
Jacques Cronje	Long Island Trading 44 (Pty) Ltd	June 2022	TG22/022/1	Draft Report

Conducted For:

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Terra Geotechnical

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The information presented in this document is based on the information supplied by the Client prior to the commencement of the investigation. All care and diligence have been taken in rendering services and preparing these documents.

Table of Contents

1. Introduction

This report describes the results of a geotechnical site investigation in support of the proposed township establishment known as Herolds Bay Country Estate, on Portion 7 of the Farm Buffelsfontein 204. The development entails the construction of various residential units and associated internal roads network.

1.1. Terms of Reference

Terra Geotechnical was appointed in April 2022 by Mr Hannes Lourens (representing Element Consulting Engineers), to conduct this geotechnical investigation. The area of the investigation was defined and approved before the commencement of the investigation. The distribution of testing locations and the associated sampling were done where physically possible and to best model the geotechnical character of the site for this specific development. Testing frequency was discussed and approved by the engineer during the quotation phase and were guided by the standards provided by the *SANS 634: "Geotechnical Investigations for Township Development"*.

The quantity and nature of samples were governed by the nature of the proposed development and the in-situ characteristics of the material excavated across the site.

1.2. Sources of Information

The following sources of information were utilized:

- Remote Sensing Information:
- Google Earth Pro TM
- Elevation Heat Map; Online Resource
- Planet GIS
- Previous Report by Mr N Paxton of GEOSS South Africa (Pty) Ltd
    - *Groundwater Impact Assessment for a proposed development near Herolds Bay, Western Cape*. GEOSS Report No.: 2020/07-14.

1.3. Objectives

The investigation had the following aims:

- identify potential hazards
- to determine and evaluate the mechanical properties of the soil material occurring within the boundaries of the study area regarding the construction of low load bearing buildings
- define the ground conditions and classify the conditions through detailed soil profile descriptions and groundwater occurrences within the zone of influence of foundations
- to determine the reusability of the natural soil materials during the construction phase
- to evaluate site excavatability
- to recommend measures to be implemented during design and development of the area

The development potential of the study area is assessed based on the following premises:

- Construction of low load bearing residential structures incorporating shallow foundations.

It must be noted that this investigation was conducted to assist with the design and construction phases.

2. General Location and Description of Site

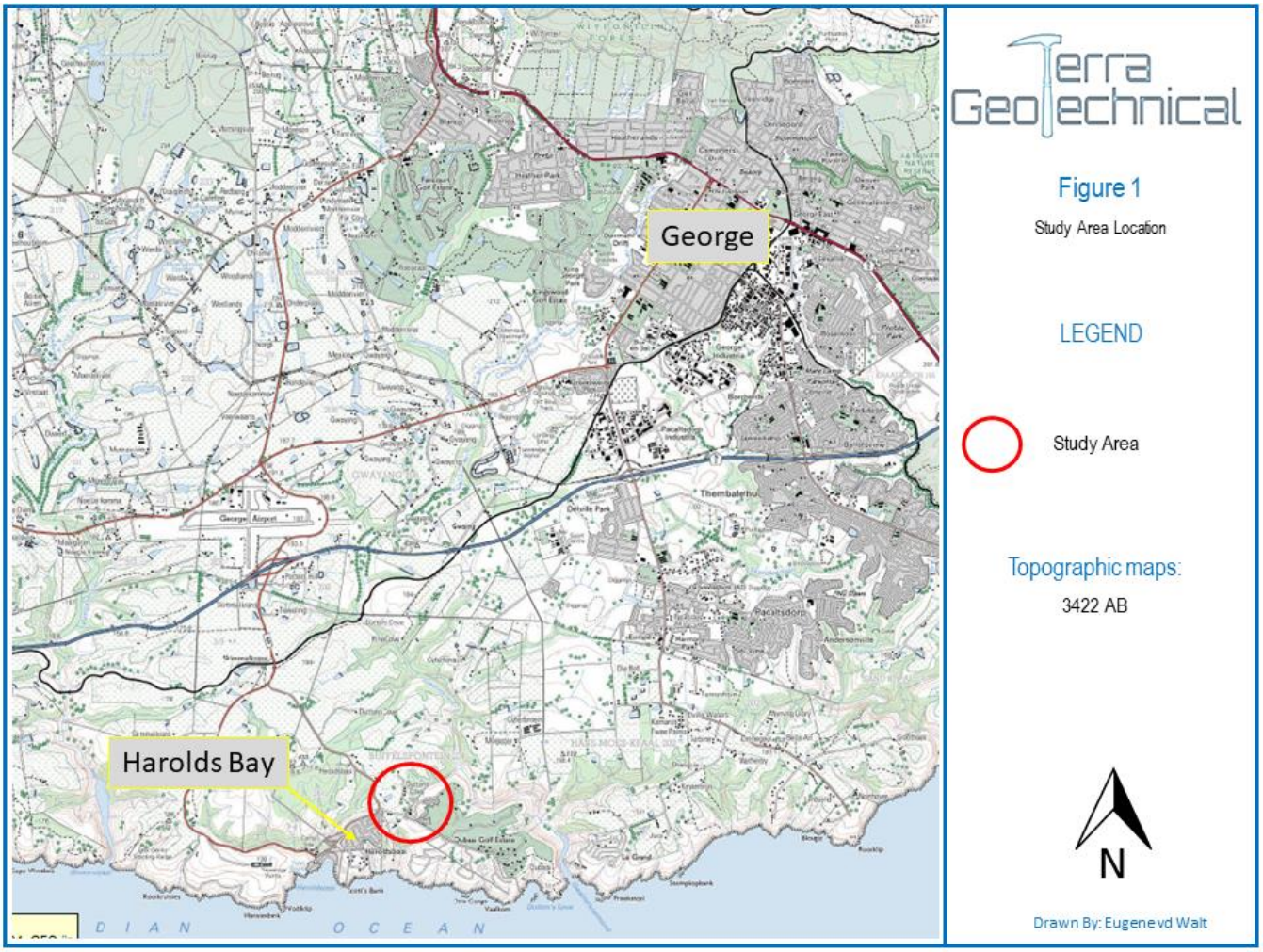
2.1. Location

The study area for this investigation is located approximately 10 km south west of the city of George and just north of Harolds Bay, forming part of the George Local Municipality within the south eastern portion of the Western Cape Province.

Figure 1 graphically depicts the location of the study area.

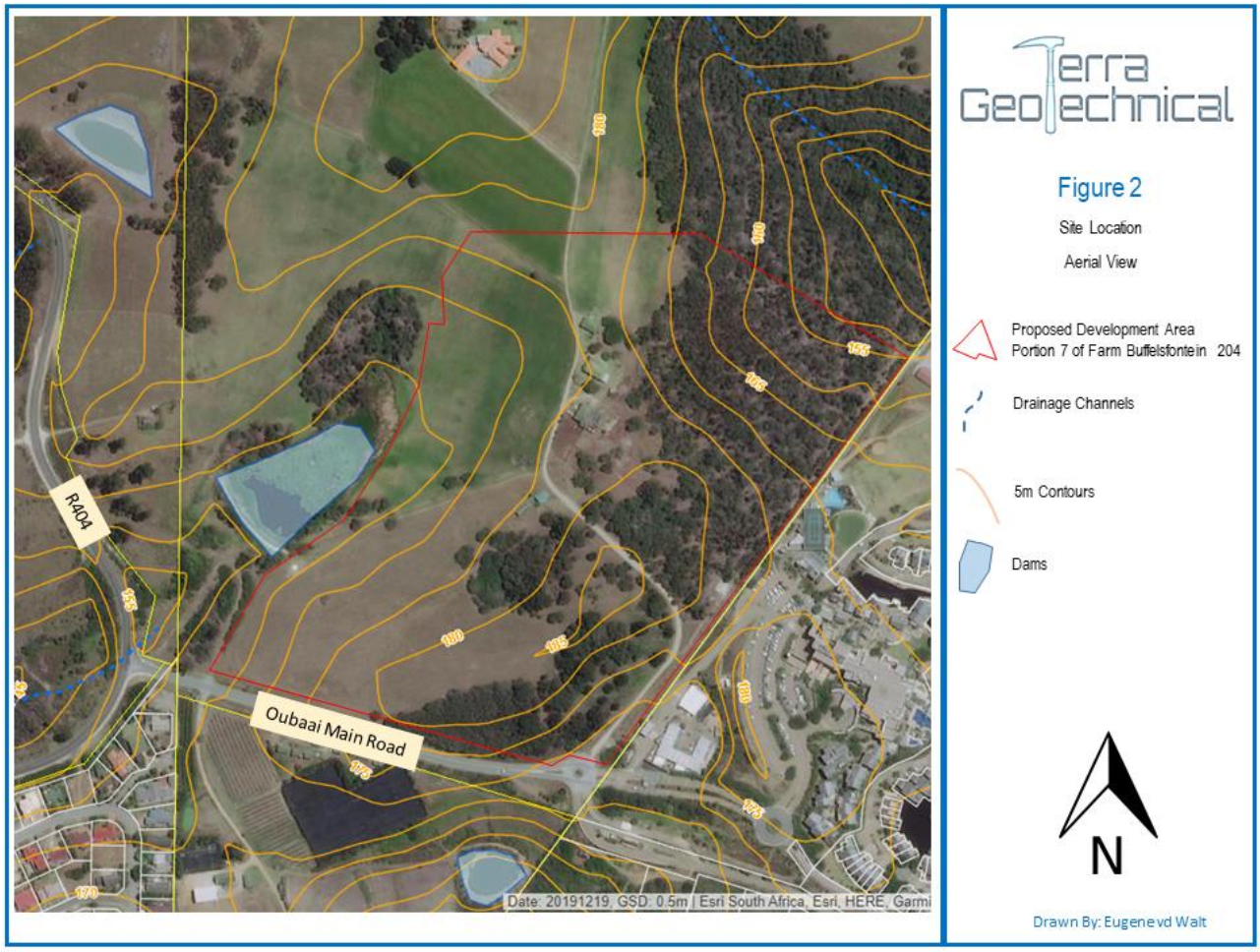
The site is located roughly at the following coordinates:

Latitude: 34.044043° S Longitude: 22.405375° E



The site is further located on Portion 7 of the Farm Buffelsfontein 204. The site is an irregularly shaped parcel of land and covers a total surface area of approximately 18 ha. The eastern boundary is defined by the Oubaai Golf Estate and the southern boundary by the Oubaai Main Road.

Figure 2 graphically depicts the location of the site

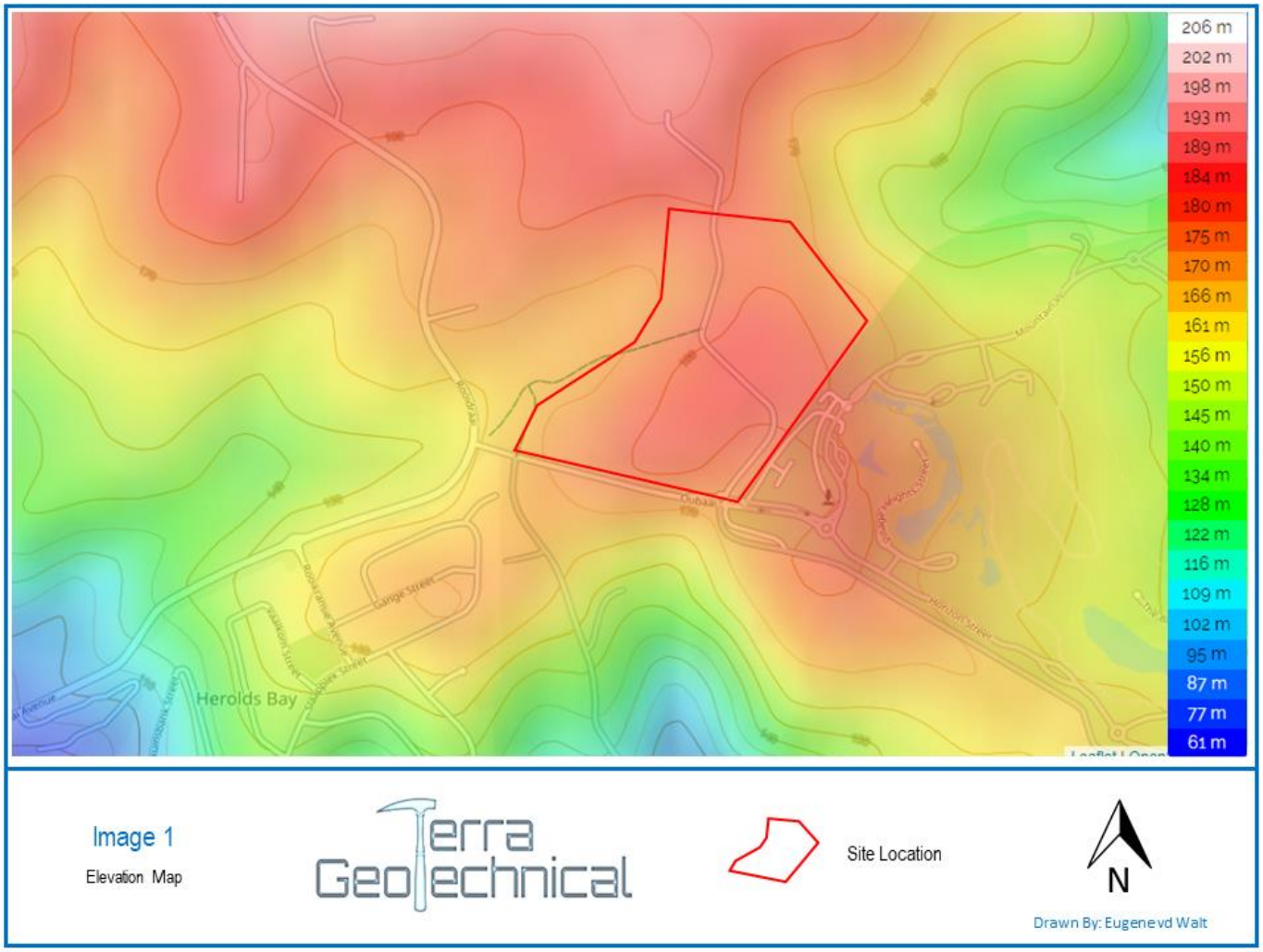


2.2. Topography

The site is defined by a ridge type structure located within the south eastern portion of the site. This ridge structure is approximately 180 m above mean sea level. The remainder of the site is then characterized by gentle to moderate sloping side slopes, decreasing in elevation radially from the ridge. The site slopes are generally gently sloping (between 2 and 8°) across most of the site with isolated moderate slopes (up to 12°) in the south eastern corner.

The colour coded image below depicts the topographic nature of the study area, with the higher lying ridge type structures depicted by the red/white and the lower lying side slopes and valley structures depicted by the yellow/green colours. The site is located at an elevation of approximately 185 m above mean sea level.

Image 1: Topography and elevation



2.3. Drainage

The study area is located in the Breede-Gouritz Water Management Area, with the area falling within Quaternary Catchment Area K30A.

The study area is drained mainly by means of surface run-off (i.e.: sheetwash), with storm water following the topography of the site. A dam is located immediately west of the site. The available data as well as the site investigation provide no evidence of any natural feeding system into the dam. This dam is deemed to be supplied with water by means of an artificial pumping system, bringing water from a nearby drainage to this dam. This dam water is then utilized for irrigation during day-to-day farming activities. It is also evident that shallow lateral groundwater flow drains towards the dam.

2.4. Climate

The climatic N-value (Weinert, 1980) of the area is deemed to be less than 5; therefore, chemical decomposition rather than mechanical disintegration, of the parent rocks is deemed the principal mode of weathering.

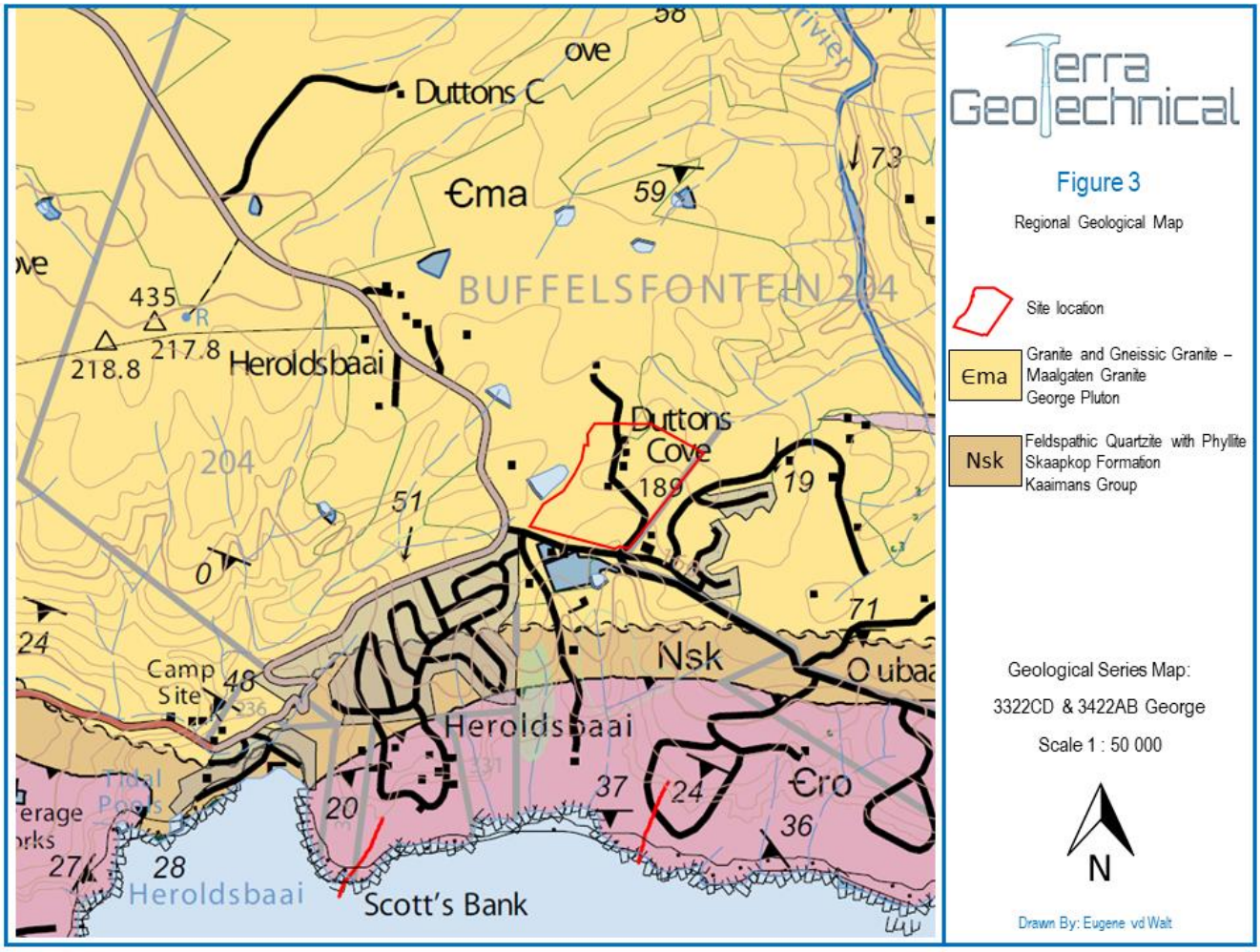
3. Geological Setting

3.1. Regional Geological Setting

The study area is located on bedrock deemed to form part of the George Pluton. The George Pluton is subdivided into the Maalgaten, Kleinfontein, Rooiklip and Modderkloof subunits (Gresse, 1976). According to Scheepers and Schoch (2006), the site is underlain by Granite and Gneissic Granite of the Maalgaten Granite.

The regional geological setting of the study area (minus the surficial soil cover) is illustrated by Figure 3.

The study area does not reflect any risk for the formation of sinkholes or subsidence caused by the presence of water-soluble rocks (dolomite or limestone), and as such is not deemed “dolomitic land



3.2. Prominent Geological Structures

The available geological information does not indicate the presence of any geological structures traversing the site.

4. Geotechnical Field Investigation and Laboratory Testing

4.1. Reconnaissance Study

The investigation commenced with the conducting of the following actions:

- The collation and evaluation of available geological, geo-hydrological and geotechnical information, with specific reference to previous geotechnical investigations undertaken within the vicinity.
- The compilation of a base map showing the regional geological setting

4.2. Site Investigation

The field work phase was conducted by Terra Geotechnical during April 2022. Test pits were placed throughout the study area in such a way as to accurately describe the general soil conditions occurring within the boundaries of the study area.

The placement of the test pits was conducted in unisons with the project engineer, in order to obtain the general subsoil conditions across the site. The investigation and associated sampling further followed the industry standard guidelines as set out by **SANS 634: Geotechnical Investigations for Township Development**.

The succession of soil and rock layers exposed within the test pits were logged according to the industry-standard method proposed by Jennings et al (1973), and a series of detailed photographs were taken of the different soil layers, and samples were taken of the soil- and rock material deemed to be important to the proposed development.

4.3. Laboratory Testing

The following tests were conducted on soil samples taken during the field work phase:

- Standard foundation indicator tests were conducted on disturbed soil samples in order to determine its composition (i.e.: the relative percentages of gravel, sand, silt and clay present within each sample). The following tests were conducted:
  - ❖ Atterberg Limits (Liquid Limit and Plasticity Index) and Linear Shrinkage
  - ❖ Particle-size distribution
- Standard road indicator tests were conducted on bulk soil samples in order to determine its composition, and to evaluate the suitability of the materials for use in the construction of access roads and parking areas. These tests were conducted:
  - ❖ Maximum Dry Density versus Optimum Moisture Content
  - ❖ Californian Bearing Ratio versus Compaction Effort (MOD AASHTO method)
- Specialised Geotechnical testing on undisturbed samples were conducted in order to determine the in-situ properties of the material present across the site. The following tests were conducted:
  - ❖ Consolidation test (Single Oedometer)
  - ❖ Swell Potential.

5. Geotechnical Setting

5.1. Trenching

5.1.1. Excavation of test pits

During the site investigation, a total of 13 test pits, numbered TP1 to TP13, were excavated across the site, by means of a TLB-type light mechanical excavator, at which time the exposed soil layers were profiled and samples extracted.

Figure 4 below depicts the test pit layout across the site. The red locations indicate the 13 test pits excavated during the investigation of Terra Geotechnical. Two additional test pits (in blue) are depicted. These are test pits performed during the prior investigation of GEOSS. These are purely utilized as additional data points.

5.1.2. DCP results

DCP tests were conducted adjacent to each of the excavated test pits to at locations across the site. These tests started at the surface and were advanced to maximum depths of 2.0 m below ground level. This was to determine the consistency of the material encountered within the subsoils.

The test results indicate the upper sandy alluvial material (upper 300 mm) generally displayed loose to moderately dense consistency with DCP results in excess of 25 mm per blow.

From below this upper alluvial horizon, an increase in material consistency is noted within the lower alluvium and residuum, with DCP results of less than 15 mm per blow, which correlate to the soil exhibiting a consistency ranging between stiff and very stiff. The DCP results. Generally, the material displayed a significant increase in consistency with depth due to the very stiff reworked residuum encountered at depth.

TP13 is the only exception, with a reduction in consistency from a depth of approximately 1800 mm, due to the occurrence of loose, wet, silty sand. This test pit is the only test pit where alluvial material was encountered for the entire depth of the profile.

DCP9, 10, 11 and 12 experienced refusal at shallow depth and as such the tests were not completed. The cause of the shallow refusal is deemed to be roots within the upper soil horizons.

Detailed DCP results are included as Appendix C.

5.1.3. Generalised engineering geological parameters

The following general engineering geological characteristics were noted:

- **Site Excavatability**

Across the site, the TLB-type light mechanical excavator experienced only localized difficulty to a depth of 2.5 m. This difficulty in excavation was encountered at a depth of 2.2 m due to the presence of a very dense/very stiff residual material at the base of test pit TP9.

No problems are foreseen during the excavation of **shallow foundations,** with **localized difficulty** expected during the excavation of **deep service trenches** to a depth of at least 2.5 m below the existing ground level, through the use of a TLB-type light mechanical excavator.

- **Rock- and/or pedocrete outcrops**

Bedrock or pedocrete outcrops were not encountered within the investigated area.

- **Sidewall stability**

With the exception of TP13, the sidewalls of all test pits generally remained stable for at least 1 hour. TP 13 had strong water seepage at the base of the test pit. This water seepage caused instability in the loose alluvial material at depth within this test pit. This instability caused collapse of the sidewalls of this test pit. **Image 2** on the following page depicts the conditions encountered at TP13.

- **Groundwater seepage**

Strong groundwater seepage was only encountered at depth in test pit TP13 (**Image 2** on the following page depicts the conditions encountered at TP13). However, pedogenic material (ferricrete nodules) was identified across the site, indicating the occurrence of a fluctuating water table or soil moisture evaporation. This pedogenic material was seen to occur from a shallow depth.

There is the possibility that localized saturation of the upper sandy soil material overlying less permeable reworked residual clayey material occurring throughout the site, during and directly after the rainfall season, especially after heavy precipitation events (i.e.: perched water tables).

Full Profile of TP13

Base of TP13 depicting water seepage and subsequent sidewall instability

Image 2

Test pit TP13

Terra Geotechnical

Drawn By: Eugene vd Walt

5.1.4. Generalised soil profile

Note: this description is based on field observations, and does not reflect the results of any laboratory tests

The results of the trenching phase indicate that the whole site is covered by a relatively homogeneous succession of soil layers. Typically, the site was covered by a silty sandy alluvium of which the upper parts hosting abundant root structures. Underlying this silty sandy alluvial horizon, the residuum was encountered.

Alluvium:

The Alluvium was found to cover the site and was generally present as a light brown, loose, intact silty sand. This layer was found to be between 400 and 1500 mm. The upper 300-500 mm of this horizon was found to host abundant root structures.

Residual Granite:

These are derived from the weathering of the underlying rock and have not moved from the place of origin as with the transported soils. The residual soil horizon can be divided into two sub-horizons.

1) A reworked residual horizon where macro structure (joints, bedding) and micro structure (mineral grain boundaries) have been destroyed by biotic action.

   These soils typically occur immediately below the alluvial horizon and consist predominantly of clayey silt. The reworked residual granite was profiled as having a stiff to very stiff consistency. The upper portion of this horizon is impregnated with abundant ferricrete nodules. This horizon is found to occur to depths of between 900 and 2000 mm.

2) A residual horizon where the macro and micro structure inherited from the parent rock remains intact and visible. The residual granite was profiled as clayey/silty sand with scattered gravels with a firm/dense consistency. The clayey portions of the horizons exhibit signs of slickensides, indicating the material being sensitive to moisture changes. This horizon is found to occur to final excavation depth of at least 2200 mm.

TP13 is the only test pit where alluvial material was encountered for the entire depth of the profile. Strong groundwater seepage was encountered at its base. The origin of this water is not known whether it is due to broken services in the area, or if this is a paleo drainage channel.

Detailed test pit profiles are included in Appendix A.

6. Geotechnical Evaluation

6.1. Engineering- and material characteristics

6.1.1. Sampling

The following samples were taken:

Disturbed samples	:	2 x Alluvium
	:	6 x Residuum
Bulk samples	:	1 x Alluvium
	:	1 x Residuum
Undisturbed Sample	:	1 x Residuum

Detailed soil test results are included as in Appendix B.

It should be noted that when saturated and loaded, the soils will undergo loss of strength with the soil grains being forced into a denser state of packing and a reduction in void ratio (decrease in volume). The result of which is varying degrees of consolidation and/collapse settlement. For this reason, the assessment and quantification of both the degree and nature of consolidation, under planned foundation loads, will form the basis of the mechanical assessment of the sites' subsoils to follow.

6.1.2. Soil Test Results: Alluvium

In the light of the soil test results and visual observations, the **Alluvium** sampled across the site can be summarised as follows:

- The material has a fines fraction (passing the 0.425m sieve) of between 88 and 98%, with the clay fraction constituting between 4 and 15% of the sample.
- This **plasticity** of the fines fraction of the material is tested to a maximum of **2**.
- According to the Unified Soil Classification System the material classifies as a silty sand **(SM)** with a **Grading Modulus** of between **0.76** and **0.93**
- According the to the ***van der Merwe*** method of determining **Potential expansiveness**, this material classifies as a **low risk** for potential expansiveness.
- This material is deemed to be **Potentially Compressible and/or Collapsible.**
- According to the USCS classification system, SM-type material exhibits an inferred cohesion and friction angle of 0 kPa and 34° respectively.

The results of road indicator tests conducted on the bulk samples of this material can be

summarized as follows:

- This material classifies as a **G8-type** material (COLTO classification system)**.**

6.1.3. Soil Test Results: Residuum (Reworked- and Residual Granite)

In the light of the soil test results and visual observations, the **Alluvium** sampled across the site can be summarised as follows:

- The material has a fines fraction (passing the 0.425m sieve) of between 90 and 99%, with the clay fraction constituting between 8.3 and 11.1% of the sample.
- This **plasticity** of the fines fraction of the material is tested to between **4** and **13**.
- According to the Unified Soil Classification System the material classifies as a silty sand **(SM)** and/or clayey sand **(SC)** with a **Grading Modulus** of between **0.58** and **0.85.**
- According the to the ***van der Merwe*** method of determining **Potential expansiveness**, this material classifies as a **low risk** for potential expansiveness.
- This material is deemed to be **Potentially Compressible and/or Collapsible.**
- According to the USCS classification system, SM/SC-type material exhibits an inferred cohesion and friction angle of 0 kPa and 32° respectively.

The results of road indicator tests conducted on the bulk samples of this material can be summarized as follows:

This material classifies as a **G9-type** material (COLTO classification system)**.**

Detailed soil test results are included as in Appendix B.

The table on the next page provides a summary of the lab results of the on-site material.

Soil Profile Make-up and Associated Sampling		Material Characteristics- Laboratory Assessment																	
Test Pit nr & Material Description	Sample Depth (mm below ground level)	Soil Composition						USCS Classification			Fines Analysis (measured from material passing the 0.425 mm sieve)			Activity		Material Compaction Characteristics			
		Sieve Analysis (cumulative percentage passing)					Grading Modulus (GM)	USCS Classification	Inferred Shear Strenght Properties		Plasticity Index (PI)	Linear Shrinkage (LS)	Weighted PI (PI of whole sample) (WPI)	Potential Expansiveness (according to van der Merwe)	Swell Percentage	COLTO Classification	Measured CBR Values (percentage compaction of MOD AASTHO; CBR of 13.344 kN)		
		5,0 mm	2,0 mm	0,425 mm	0,075 mm	0,002 mm			Cohesion (kPa)	Friction Angle (°)							90%	93%	95%
Portion 7 Farm Buffelsfontein 204																			
TP1 Residual Granite	1000-3200	100	100	98	26	9,6	0,76	SM & SC	0	32	4	1,6	4	Low	0,00%	>G9	2	2	3
TP2 Alluvium	400-900	93	92	88	27	15	0,93	SM	0	34	2	0,6	2	Low	0,00%	-			
TP3 Alluvium	400-1500	99	99	98	27	4,3	0,76	SM	0	34	NP	-	-	Low	0,00%	G8	10	13	16
TP5 Residual Granite	1400-2800	100	100	99	40	10,2	0,61	SM & SC	0	32	7	2,7	7	Low	0,00%	Inferred >G9, due to low GM			
TP6 Residual Granite	1600-2500	96	95	94	31	8,3	0,8	SM & SC	0	32	6	2,6	6	Low	0,00%	-			
TP11 Reworked Residual	900-1700	98	98	96	35	11,1	0,71	SC	0	32	10	3,6	10	Low	0,00%	Inferred >G9, due to low GM			
TP12 Residual Granite	1200-1600	99	99	97	45	9,3	0,58	SC	0	32	13	5,1	13	Low	0,00%	Inferred >G9, due to low GM			
TP13 Reworked Residual	1000-1500	97	94	90	32	8,7	0,85	SC	0	32	9	3,8	8	Low	0,00%	-			

6.1.4. Heave Characteristics of In-Situ Soils:

Soil heave is the process of the change in volume correlating to a change in moisture content. This phenomenon is prominent in soils containing a high content of active clays.

Swell Potential tests conducted on an undisturbed sample of the residuum proved this material is not potentially expansive.

The material encountered across the site displayed **low plastic** values and hosts a **low percentage of clay materials**. As such, this material is interpreted to undergo **negligible heave**.

According to van der Merwe, the material across the site also classifies as a **Low potential for heave.**

6.1.5. Standard Consolidation of In-Situ Soils:

There are three components to settlement namely immediate settlement (also referred to as elastic settlement), primary consolidation settlement and secondary consolidation (also referred to as creep).

Immediate settlement takes place as a load is exerted on the soil mainly due to distortion of the soil. As pore water begins to flow out of the soil a time dependant decrease in volume occurs which is termed consolidation settlement. This settlement will continue until a condition of constant effective stress is reached. This primary consolidation settlement takes place generally in fine grained materials (high percentage of clay or silt).

Secondary consolidation settlement is not considered a concern as this type of settlement usually occurs in soft organic clays where plastic flow within the soil mass results in displacement of the soil particles.

Based on the consolidation tests performed on samples extracted from the subsoils, it is noted that low amounts of settlement are expected when exposed to various different loads. The results assume a foundation with of 0.6 m and a factor of safety of 1.5.

Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,551		
	Loaded	0,550	0,540	0,524
a		0,0004	0,0004	0,0003
Mv		0,2705	0,2588	0,2247
Oedometer Settlement		3,35	6,41	11,12
*Settlement Range (mm)	Lower	3	5	8
	Upper	4	7	12

Preconsolidation State	
Pressure (kPa)	Void Ratio
133,3	0,520
Overconsolidated	

Factor of Safety	1,5
Foundation Width (m)	0,6

The residuum is classified as being overconsolidated with the soils being exposed to a past effective stress in excess of 100 kPa. At the anticipated foundation loads of between 50 and 100 kPa, settlements of between 5 and 12 mm can be expected.

Detailed results are included in Appendix B.

6.1.6. Collapse Settlement Characteristics of the In-Situ Soils

Collapse settlement is defined as the sudden loss of volume of a material once saturated, as compared to the more gradual settlement related to standard consolidation. As such, these soils typical undergo low settlement in the dry state (apparent strength), with a sharp increase in settlement upon saturation.

A marked characteristic of the collapsible grain structure of the residual granites is that it appears to be confined to slopes where the soils are well drained. The collapsible grain structure develops as a result of leaching out of soluble and colloidal matter from the residual soils, and conditions of advanced decomposition, relatively high annual rainfall and good internal drainage are therefore prerequisite conditions. There are indications that the potential collapse decreases with depth in the soil profile which leads to the conclusion that the foundation design could be based on permissible tolerable settlement rather than on permissible bearing capacity.

This horizon is considered to have a collapsible grain structure. Such a structure consists of sand grains bridged by clay particles. When dry the soil appears to have a fairly high strength. However, when subjected simultaneous loading and saturation the clay bridges often and abruptly lose strength resulting in sudden and often catastrophic settlement.

The material is **deemed to undergo a degree of collapse settlement.**

6.2. Material usage

The alluvial material encountered across the site displayed a non-cohesive nature and typically tests as a G8-type material. Due to the tested low GM values of the alluvium, it is recommended that the material be stockpiled and re-tested for use in layer works.

The residuum (reworked and residual granite) underlying the site reacted poorly to compaction and combined with low GM values yielded poor results under the COLTO-Classification System, with material testing as worse than G9.

It is not recommended that any of the material be utilized in any load bearing layer works during the construction phase.

6.3. Bearing Capacity

Observations during the field work phase indicates that the soils encountered across the site exhibits a consistency of at least stiff/dense consistency, typically increasing to very stiff/very dense with depth.

By using the equation of Terzaghi combined with general material characteristics as presented by the Unified Soil Classification System (USCS), the allowable bearing capacity of the soil on site can be calculated. The calculations are based on the following assumptions;

- USCS Soil classification – Material tested as SM/SC type material.
- SM/SC type material typically have soil friction angles of at least 32° (according to USCS)
- Soil density is tested to 19 kN/m^3
- It is assumed that foundations will be 0.8 m wide and placed at 0.6 m depth

Allowable bearing capacity (incorporating a factor of safety of 3) is calculated to 150 kPa.

Ultimate bearing capacity is not deemed the major problem on this site for the housing units. Differential settlement and/or collapse are the biggest conditions that have to be designed for.

The effect that an increase in moisture content has on the strength of the material can clearly be seen by comparing the laboratory tested CBR results. The reason for these poor CBR results are that the **lab specimen** is tested under **saturated** conditions. This proves that should the soil on site become saturated, it will undergo a reduction in strength.

6.4. Retaining Structures

Should any significant temporary cuts be made during the construction phase, the following should be adhered to. Where the batter within the residuum cannot be restricted to a maximum of 1:2 due to space restrictions, cut and fill slopes must be supported by a suitably designed retaining structures. The lateral support should incorporate adequate drainage behind, above and through the structure and be suitably damp proofed. The following conservative soil shear strength parameters are recommended for use in retaining wall design;

Angle of internal friction (ϕ) - 32°

Soil cohesion (c) - 0 kPa.

7. Geotechnical Site Classification

7.1. General

The results of this study reveal that the site exhibits geotechnical characteristics that may require the implementation of specific design and precautionary measures to reduce the risk of structural damage due to adverse geotechnical conditions.

The following constraints needs to be considered;

- The results of this investigation reveal that the soils covering the site may undergo a degree of **consolidation and/or collapse** (i.e. loss of volume) under loading or when saturated; requiring that structures be adequately strengthened to prevent structural damage due to **differential settlement** beneath foundations.
- Occurrence of potentially compressible material across the site, with an estimated **settlement** of less than **10 mm** assuming a foundation pressure of **50 kPa**.
- Occurrence of potentially collapsible material across the site, with an estimated **collapse settlement** of up to **10 mm**.
- Presence of ferruginized material indicating the presence of a seasonal **fluctuating groundwater table** or excessive soil moisture movement.
- **Isolated moderate slopes** in excess of 6 degrees across the south eastern portion of the site.
- Due to its variable and organic nature, it is recommended that the **topsoil** across the site be removed beyond the perimeter of the proposed developments.

However, these characteristics do not disqualify the site from being used for the proposed development, but rather require the implementation of site-specific precautionary measures.

7.2. Groundwater Occurrence

Strong groundwater seepage was only encountered at depth in test pit TP13. However, pedogenic material (ferricrete nodules) was identified across the site, indicating the occurrence of a fluctuating water table or soil moisture evaporation. This pedogenic material was seen to occur from a shallow depth.

There is the possibility that localized saturation of the upper sandy soil material overlying less permeable reworked residual clayey material occurring throughout the site, during and directly after the rainfall season, especially after heavy precipitation events (i.e.: perched water tables).

7.3. Soil Excavatability

Across the site, the TLB-type light mechanical excavator experienced only localized difficulty to a depth of 2.5 m. This difficulty in excavation was encountered at a depth of 2.2 m due to the presence of a very dense residual material at the base of test pit TP9.

No problems are foreseen during the excavation of **shallow foundations,** with **localized difficulty** expected during the excavation of **deep service trenches** to a depth of at least 2.5 m below the existing ground level, through the use of a TLB-type light mechanical excavator.

The following additional comments on excavation of service trenches apply:

- sidewalls of deep excavations should be shored to prevent injury or death due to side wall failure (according to standard construction practices)
- Trenches will have to be dewatered after heavy precipitation events

7.4. Slope Stability

Although the slopes composed of residual granites are generally stable when dry, these soils tend to pose stability problems when the materials become saturated, particularly if prevailing stress conditions are changed.

Should significant bulk earthworks be required to create a level platform due to the sloping terrain, temporary excavation in slopes less than 2m high will be generally stable at near-vertical angles for short periods of time, but the engineer should inspect deep excavations. The upper 0.5m of the profile which is potentially unstable should be trimmed back on temporary slopes. Permanent slopes should be cut back to less than 1:2, or retained using suitable retaining methods as per the engineer's design.

Care should be taken that excess surface water is removed from the opened excavations during construction, as to limit the infiltration of water into the exposed strata which could potentially weaken the strata.

Note that water present within the slope, along with destabilising pore pressures, are often the main cause of slope instability. Therefore, adequate drainage measures need to be implemented.

7.5. Site Classification

In the light of the results of this study, the site can be subdivided into a SINGLE geotechnical entity/development potential zone**.** This classification is based on placing foundations below the hillwash horizon. The site carries a dual class, due to both consolidation and collapse expected under loads.

Development Potential Zone	NHBRC Site Classification	Partridge, Wood and Brink (1993) Classification	Excavation Class	Slope Stability
Zone A	C1/S	2A- Collapse Horizon >750mm thick 2B- Fluctuating moisture conditions less than 1.5 m below ground 2D- Moderate soil Compressibility 2I- Localized Slopes of between 6 and 12°	No Problems with excavation to a depth of at least 2,5 m	Stable slopes as long as it is kept in a dry state

8. Foundation Recommendations and Solutions

Below are **typical recommendations** for structures of this nature, taking into account the geotechnical characteristics of the investigated site:

Reinforced strip and/or pad foundation systems should be utilized. Foundations should be placed below the organic alluvium (transported horizon).

To reduce the risk of collapsibility potential, hydro compaction could be performed. This is the process where the collapsible horizon is saturated and then compacted to artificially break the collapsible grain structure.

It is recommended that EITHER of the following foundation designs be used in the development (According to the NHBRC guidelines):

Site Class C1/S

1. **Deep Strip Foundations:**
    - Reinforced strip footings placed at a depth of 0.8 m.
    - Articulated joints at some internal and all external doors.
    - Light reinforcement in masonry.
    - Site drainage and plumbing/service precautions.
2. **Limited Soil Raft:**
    - Remove in situ material to 0.8 m depth and 1.0 m beyond the perimeter of the structure and replace with competent material, compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
    - Construct a 500 mm soil raft.
    - Reinforce the foundations and stiffen foundation brickwork
    - Articulation of superstructure
    - Moisture barriers around the perimeter of the structure
    - Site drainage and plumbing/service precautions

It must be noted that differential settlement is assumed to equal 75 % of the total settlement. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.

9. Good Construction Practices

An important factor in the promotion of a stable site is the control and removal of both surface and ground water from the site. It is important that the design of the storm water management system allow for the drainage of accumulated surface water.

9.1. Surface Drainage

It is recommended that an efficient surface drainage system be installed around all structures and along all roads throughout the study area in order to:

- prevent the ponding of water next to structures directly after heavy precipitation events, this may lead to differential settlement as the saturated material undergoes densification.
- prevent large-scale changes in soil moisture beneath the structures on a seasonal basis
- prevent the possible lateral movement of liquids within the upper soil horizons

The precautionary measures should ideally include:

- the sealing of open ground surfaces by means of either of the following:
- the cultivation of a natural soil cover (e.g.: grass)
- compaction of the soil surface
- bitumen or concrete paving
- the removal of surface water to a distance of at least 1 m beyond structures by means of watertight paving.
- the removal of surface run-off by means of an efficient surface drainage system.
- roads should preferably be constructed parallel to the natural surface elevation contours rather than perpendicular to it, in order to reduce run-off velocities

9.2. Sub Surface Drainage

Adequate drainage should be implemented to avoid large scale moisture changes in the loadbearing strata.

9.3. Earthworks

It is recommended that all earthworks be carried out in accordance with SABS 1200 (current version). The fill should be placed in layers not exceeding 200 mm loose thickness and compacted to a minimum of 95% Modified AASHTO maximum dry density.

All fill operations should be observed by a competent professional and tested periodically to confirm compaction is achieved

10. Limitations

The extent of the investigations undertaken is deemed adequate, within the time and budget constraints, to present an overview of the geotechnical conditions across the investigation site.

It must be borne in mind that the overall interpretation of geotechnical conditions is based upon point information derived from the respective test positions and that conditions intermediate to these have been inferred by interpolation, extrapolation and professional judgement.

It is recommended the author be appointed to inspect the earthworks and foundation excavations during the development of the site to confirm founding depths and validate the recommendations provided in this report.

11. Bibliography

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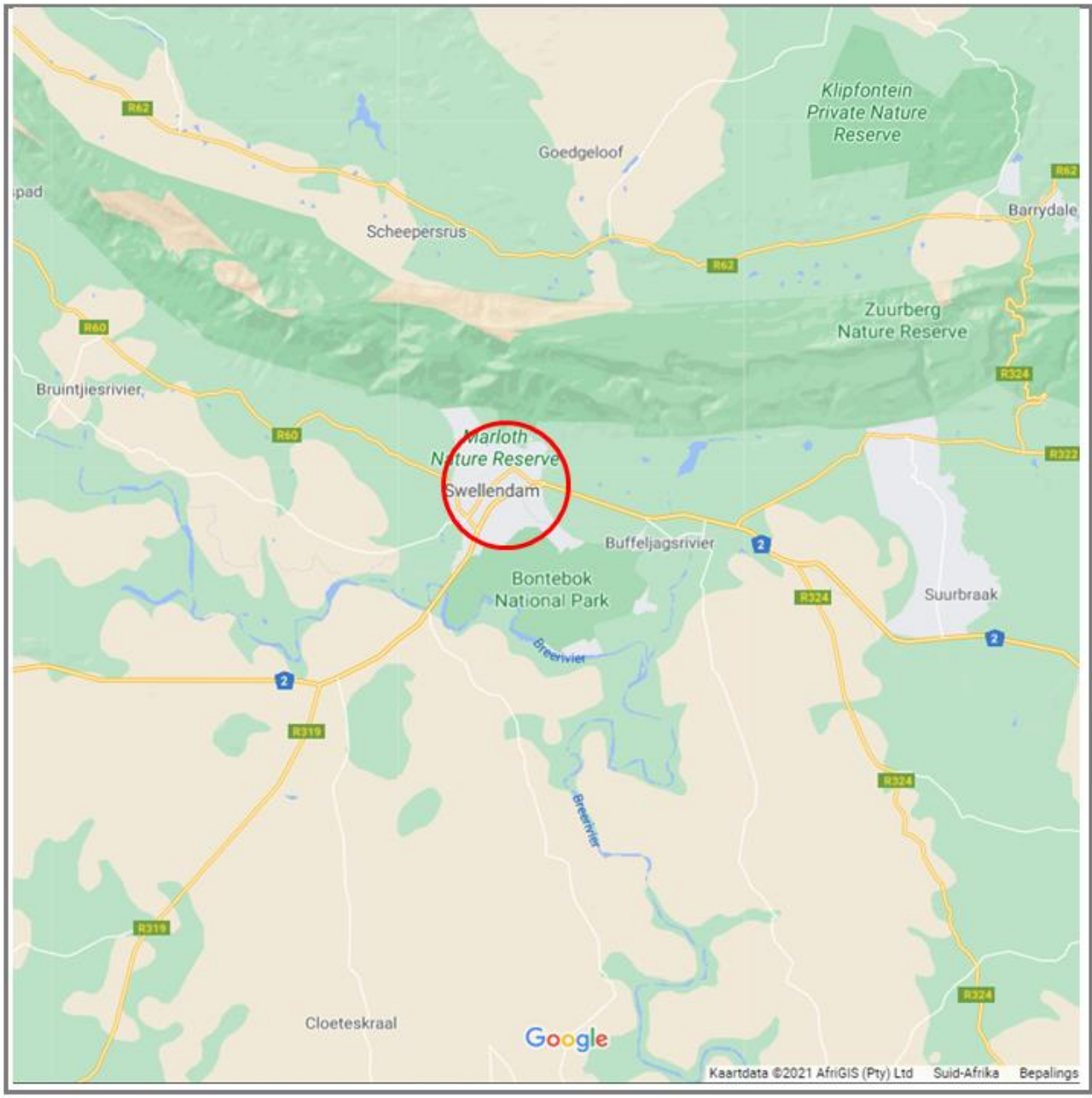
MAPS



Terra Geotechnical

Figure 1

Study Area Location

Legend

Study Area

N

Drawn By: Eugene vd Walt

Terra Geotechnical

Figure 2

Site Location

Erf 2780

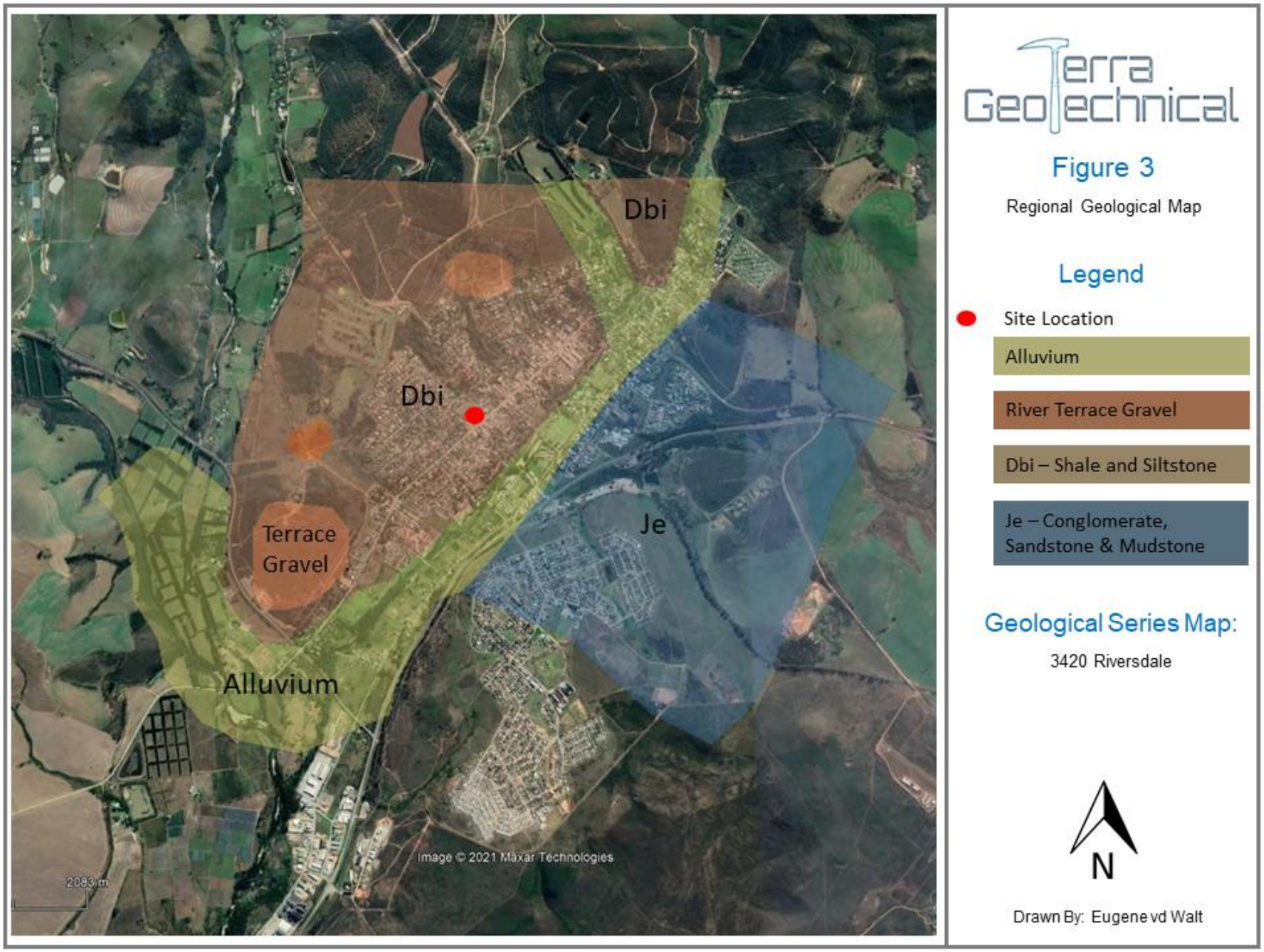
Erf 843

Erf 842

Drainage

N

Drawn By: Eugene vd Walt


Dbi
Dbi
Terrace
Gravel
Je
Alluvium
Image © 2021 Maxar Technologies
2083 m
Terra
GeoTechnical
Figure 3
Regional Geological Map
Legend
Site Location
Alluvium
River Terrace Gravel
Dbi – Shale and Siltstone
Je – Conglomerate,
Sandstone & Mudstone
Geological Series Map:
3420 Riversdale
N
Drawn By: Eugene vd Walt

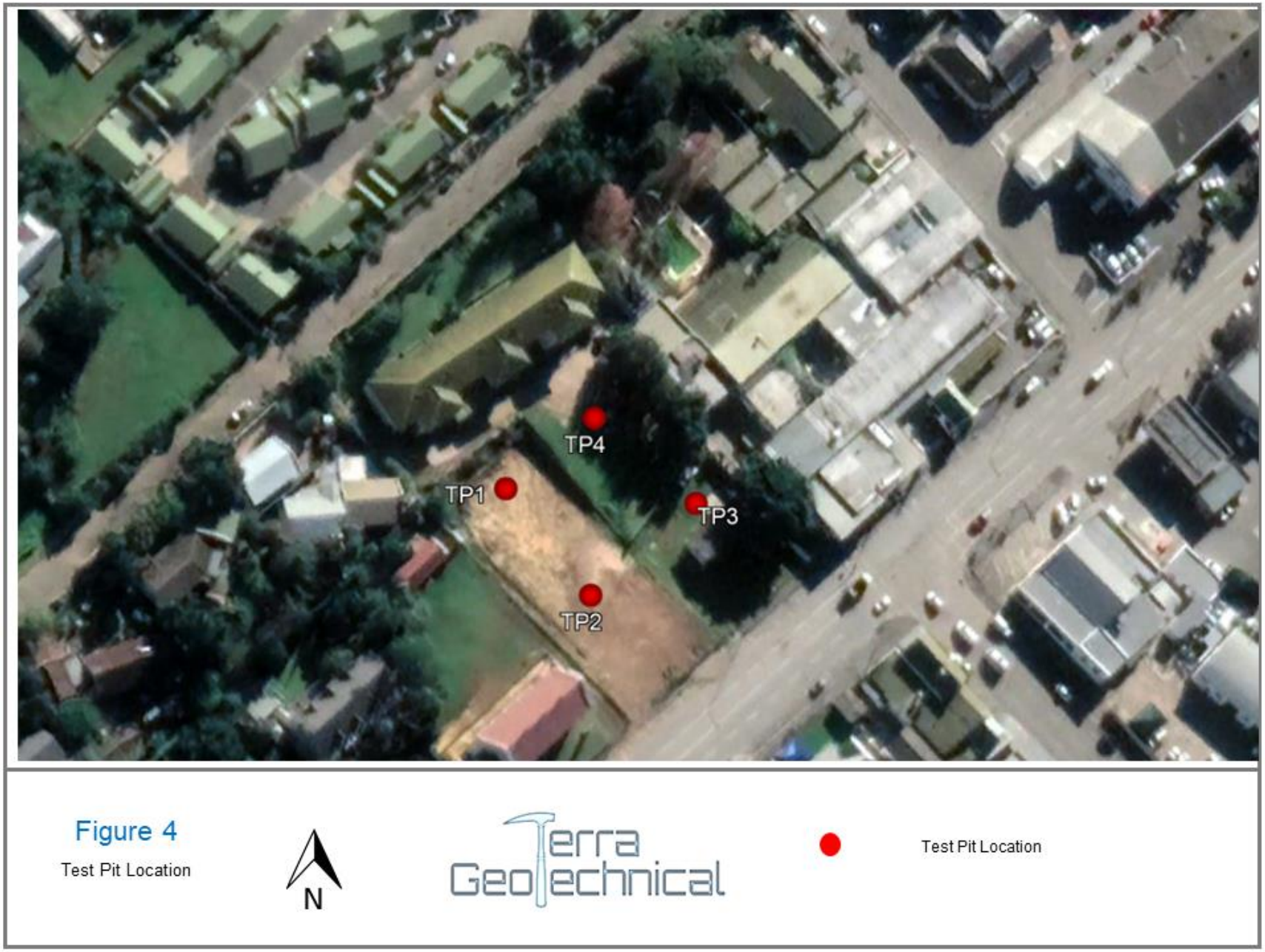


Figure 4

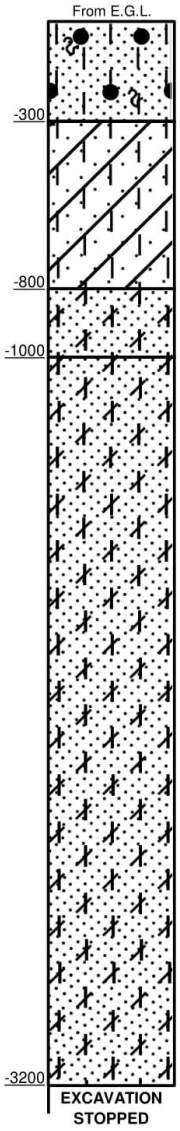
Test Pit Location

APPENDIX A

A.1
Test Pit Profiles

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP1



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

slightly moist; light brown; loose; intact; silty sand; alluvium; Not Sampled.

moist; dark brown speckled black red; very dense; intact; silty sand with frequent ferricrete nodules; nodular ferricrete; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Bulk Sample No. TP1.

Test Pit Notes

Coordinates:	34,046086°S 22,402863°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Bulk Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP1

Terra Geotechnical Harolds Bay Country Estate

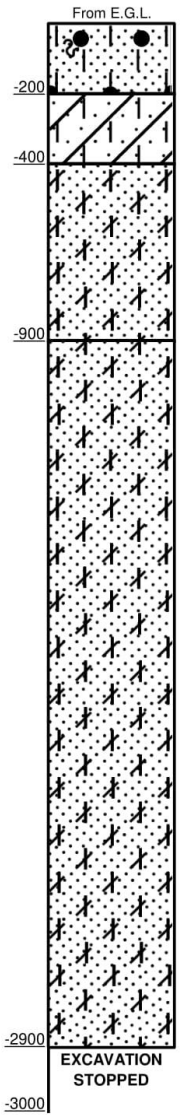
Material Present in Test Pit TP1

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP1

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP2



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

slightly moist; light brown; loose; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark brown mottled red orange; stiff; intact; clayey silt; reworked residual; fine rootlets; Disturbed Sample No. TP2.

slightly moist; orange brown patched red grey and white; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

Coordinates:	34,046477°S 22,403738°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP2

Terra Geotechnical Harolds Bay Country Estate

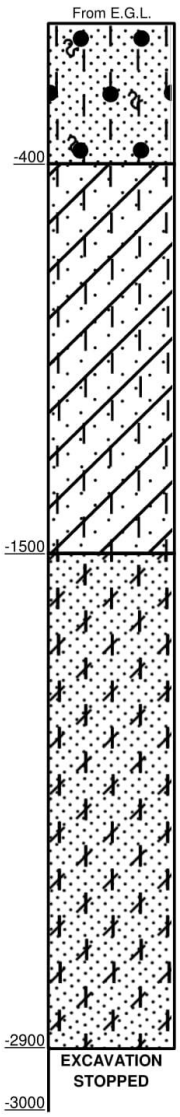
Material Present in Test Pit TP2

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP2

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP3



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; orange brown patched red; moderately dense; intact; clayey silty sand; residual; Disturbed Sample No. TP2.

Test Pit Notes

Coordinates:	34,046084°S 22,405169°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP3

Terra Geotechnical Harolds Bay Country Estate

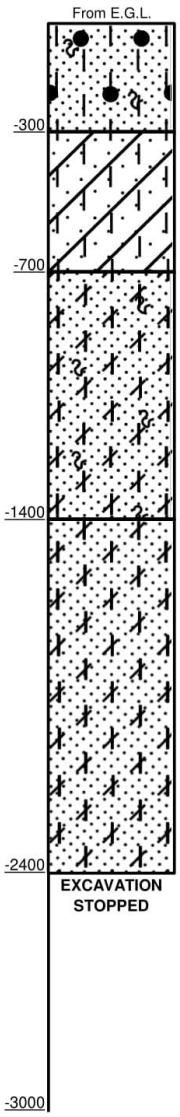
Material Present in Test Pit TP3

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP3

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP4



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

slightly moist; light brown; loose; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact slickensided and shattered; clayey silt; reworked residual; decomposed roots; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

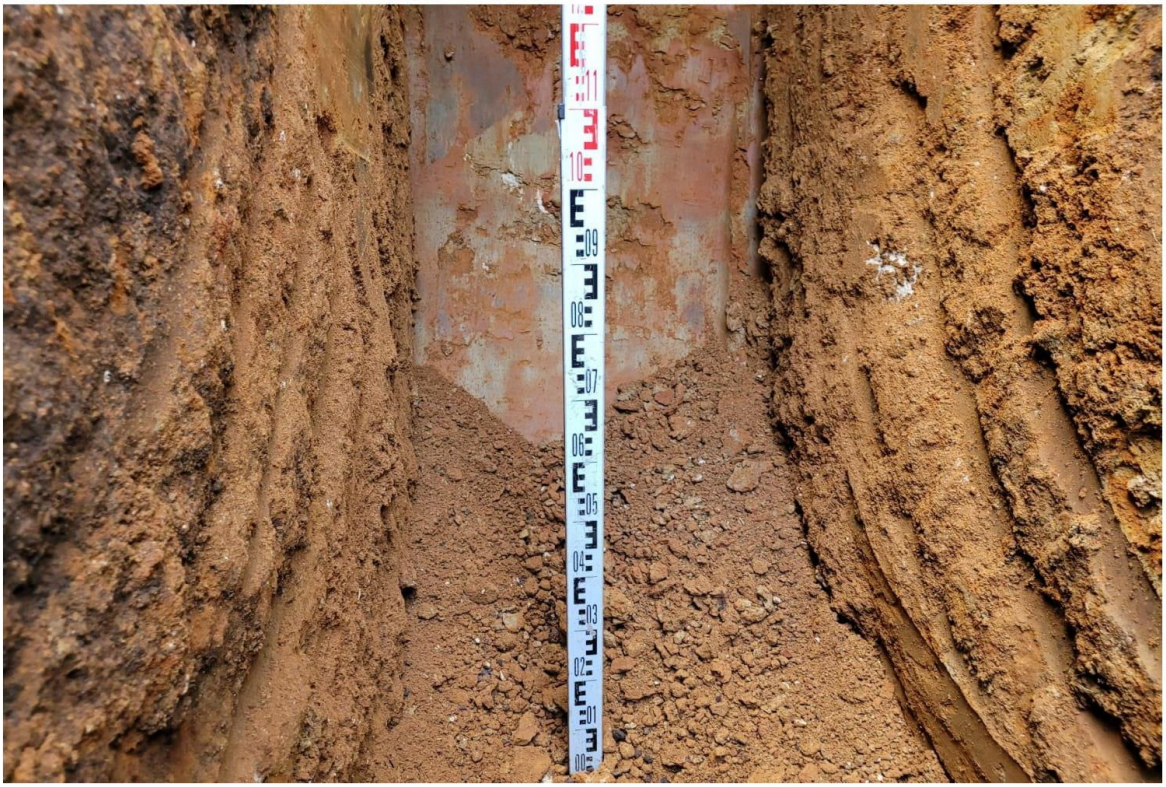
Coordinates:	34,046687°S 22,405485°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP4

Terra Geotechnical Harolds Bay Country Estate

Material Present in Test Pit TP4

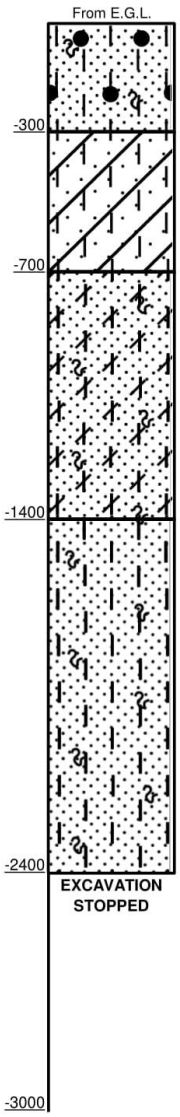


Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP4

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP5



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slightly moist; dark orange brown mottled red orange; stiff; intact with slickensided and shattered areas; clayey silt; reworked residual; decomposed roots; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Disturbed Sample No. TP5.

Test Pit Notes

Coordinates:	34,046072°S 22,406541°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP5

Terra Geotechnical Harolds Bay Country Estate

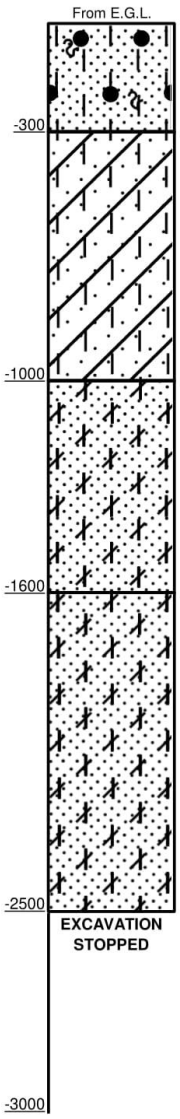
Material Present in Test Pit TP5

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP5

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP6



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dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt with ferricrete nodules; reworked ferrugenized residual; Not Sampled.

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Test Pit Notes

Coordinates:	34,044912°S 22,40529°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

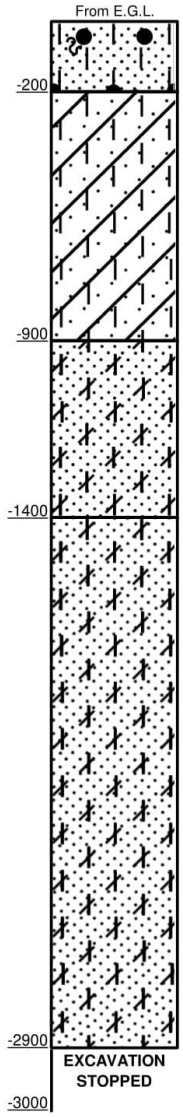
Soil Profile Photo of Test Pit TP6

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP6

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP7



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dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt with ferricrete nodules; reworked ferrugenized residual; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

Coordinates:	34,045766°S 22,404058°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

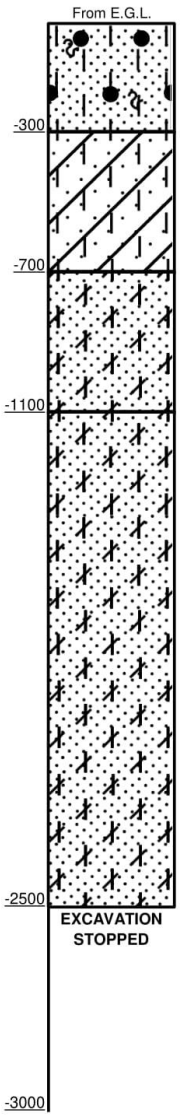
Material Present in Test Pit TP7

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP7

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP8



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt; reworked residual; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

Coordinates:	34,044043°S 22,405375°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP8

Terra Geotechnical Harolds Bay Country Estate

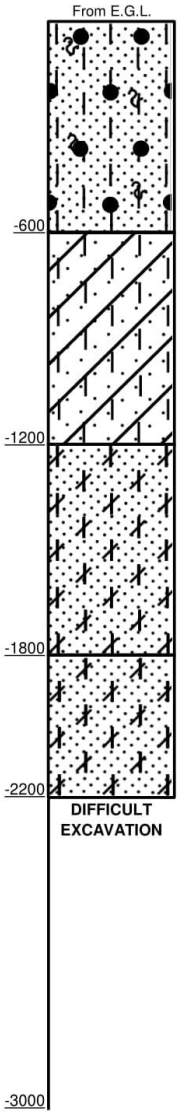
Material Present in Test Pit TP8

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP8

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP9



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand with ferricrete nodules at base; ferruginized alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt; reworked residual; Not Sampled.

slightly moist; orange brown patched red grey; very stiff; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

Coordinates:	34,045226°S 22,407423°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Difficult Excavation in Residual at 2,2 m below existing ground level
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP9

Terra Geotechnical Harolds Bay Country Estate

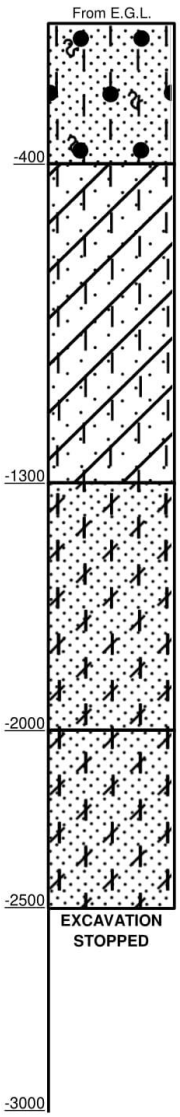
Material Present in Test Pit TP9

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP9

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP10



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clay with ferricrete nodules; reworked ferruginized residual; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

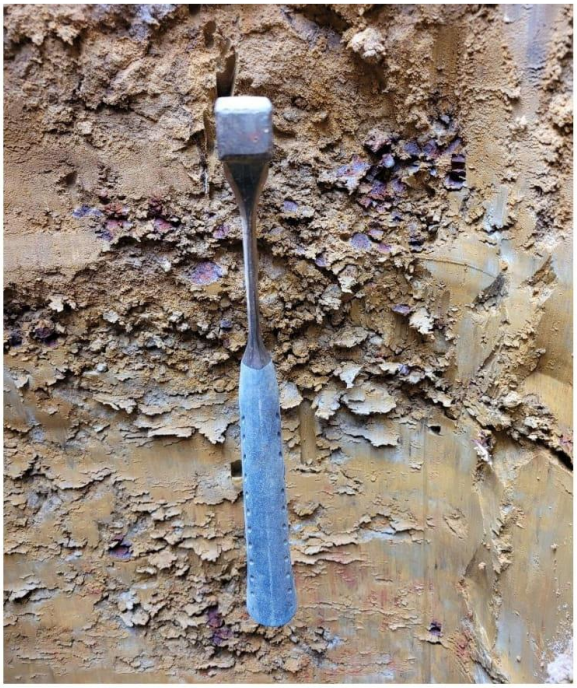
Coordinates:	34,044156°S 22,408167°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP10

Terra Geotechnical Harolds Bay Country Estate

Material Present in Test Pit TP10

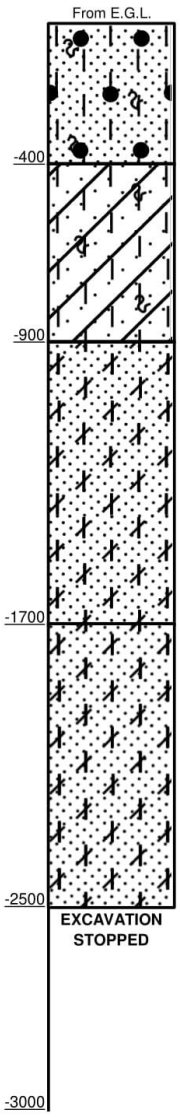


Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP10

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP11



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; frequent roots; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt; reworked residual; Disturbed Sample No. TP11.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Not Sampled.

Test Pit Notes

Coordinates:	34,044445°S 22,406775°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP11

Terra Geotechnical Harolds Bay Country Estate

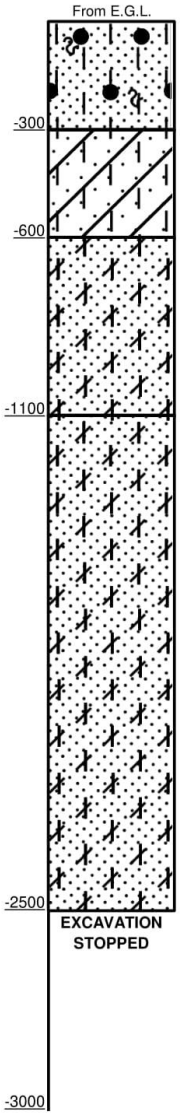
Material Present in Test Pit TP11

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP11

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP12



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clayey silt; reworked residual; Not Sampled.

slightly moist; orange brown patched red grey; firm; mostly intact with clay rich areas being slightly slickensided; clayey silty sand; residual; Undisturbed sample taken at 1200-1600mm; Undisturbed Sample No. TP12.

Test Pit Notes

Coordinates:	34,043127°S 22,406834°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Undisturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP12

Terra Geotechnical Harolds Bay Country Estate

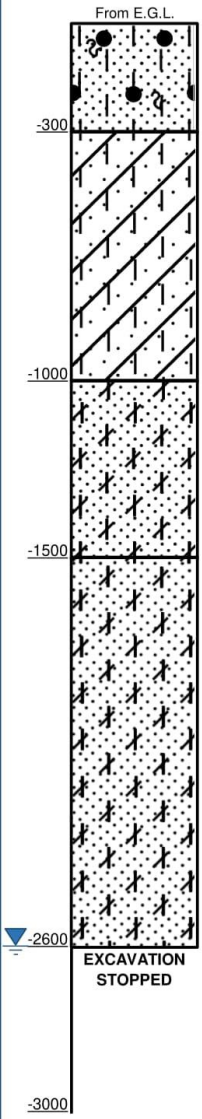
Material Present in Test Pit TP12

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP12

Terra Geotechnical	**Site:**	Harolds Bay Country Estate
	Location:	Harolds Bay
	Client:	Element Consulting Engineers (PTY) LTD

Soil Profile for Test Pit TP13



slightly moist; light brown; loose; intact; silty sand; alluvium; frequent roots; Not Sampled.

dry; light brown; moderately dense; intact; silty sand; alluvium; Not Sampled.

slightly moist; dark orange brown mottled red orange; stiff; intact; clay with ferricrete nodules; ferruginized alluvium; Disturbed Sample No. TP13.

wet; light yellow brown; loose; intact; silty sand; alluvium; side wall collapse due to strong water seepage; Not Sampled.

Test Pit Notes

Coordinates:	34,043265°S 22,405201°E
Method of Excavation:	TLB Type Light Mechanical Excavator- JCB 3CX
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	29/04/2022
Date Profiled:	29/04/2022
Groundwater Seepage:	Strong Water Seepage at base of test pit
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Harolds Bay Country Estate

Soil Profile Photo of Test Pit TP13

Terra Geotechnical Harolds Bay Country Estate

Material Present in Test Pit TP13

Terra Geotechnical Harolds Bay Country Estate

Surroundings of Test Pit TP13

APPENDIX B

B.1 Laboratory Test Results

ROADLAB

Roadlab laboratories (PTY) Ltd
7 Bally Crescent, Voorbaai
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Email: elizabeth@roadlab.co.za
Web:

Job Request No.: RM14879
Terra Geotechnical
Andre Nel Building
C/O Fynbos & Perdekuil Avenue, Stilbaai
6674
Attention : Eugene van der walt

Date Reported : 2022/05/17

Project : Herolds Bay Estate

Full Classification SANS 3001 - GR40/GR41

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.		8849	8851		
HOLE NO./ Km / CHAINAGE		TP1	TP3		
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2		N/S	N/S		
LAYER TESTED/SAMPLED		N/S	N/S		
SAMPLE DEPTH		1000-3200mm	400-1500mm		
DATE SAMPLED		2022/04/29	2022/04/29		
COLOUR OF SAMPLE		Dark Brown	Light Brown		
TYPE OF SAMPLE		Silty Clayey Gravel	Silty Sand		
SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)					
SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm				
	75.0 mm				
	63.0 mm				
	50.0 mm				
	37.5 mm				
	28.0 mm				
	20.0 mm				
	14.0 mm		100		
	5.0 mm		99		
	2.0 mm	100	99		
	0.425 mm	98	98		
	0.075 mm	26	27		
GM %		0.80	0.80		
SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)					
COARSE SAND	2.000 - 0.425	1	1		
COARSE FINE SAND	0.425 - 0.250	23	5		
MEDIUM FINE SAND	0.250 - 0.150	40	38		
FINE FINE SAND	0.150 - 0.075	10	28		
SILT CLAY	0.075	26	27		
ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)					
ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT				
	PLASTICITY INDEX	SP	NP		
	LINEAR SHRINKAGE	1.5	0.0		
CLASSIFICATION	H.R.B.	A-2-4(0)	A-2-4(0)		
	COLTO	-	G8		
	TRH 14	-	G8		
CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)					
SANS GR30	OMC %	13.6	8.6		
MAX. DRY DENSITY	MDD (kg/m³)	1926	1768		
	COMP MC %	13.4	8.7		
SWELL % @	MOD | NRB | PRO	1.51 | 1.34 | 0.87	0.00 | 0.00 | 0.00		
C.B.R. SANS GR40	100 %	5	24		
	98 %	4	20		
	97 %	4	19		
	95 %	3	16		
	93 %	2	13		
	90 %	2	10		
STABILISER IN LAB					
TEST TYPE		CBR	CBR		
SAMPLING METHOD		TMH5	TMH5		
WEATHER WHEN SAMPLED		Sunny	Sunny		

Deviation from Test Method : Samples & delivered by client.
Remarks and Notes : None.

Opinions and interpretations are not included in our schedule of accreditation. (T0947)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
Further use of the above information is not the responsibility or liability of Roadlab.
Document may only be reproduced of published in their full context.
Report compiled by : Jessica Myburgh

sanas Testing Laboratory
Accreditation No.
Prog.ver 10.7 (2019/11/07)

Elizabeth Roux
Technical Signatory

2

Terra Geotechnical

ROADLAB

Roadlab laboratories (PTY) Ltd
7 Bally Crescent, Voorbaai
P.O Box 35 Hartenbos
Tel: 067 418 4529 Fax:
Email: elizabeth@roadlab.co.za
Web:

Job Request No.: RM14879
Terra Geotechnical
Andre Nel Building
C/O Fynbos & Perdekuil Avenue, Stilbaai
6674
Attention : Eugene van der Walt

Date Reported : 2022/05/17

Project : Herolds Bay Estate

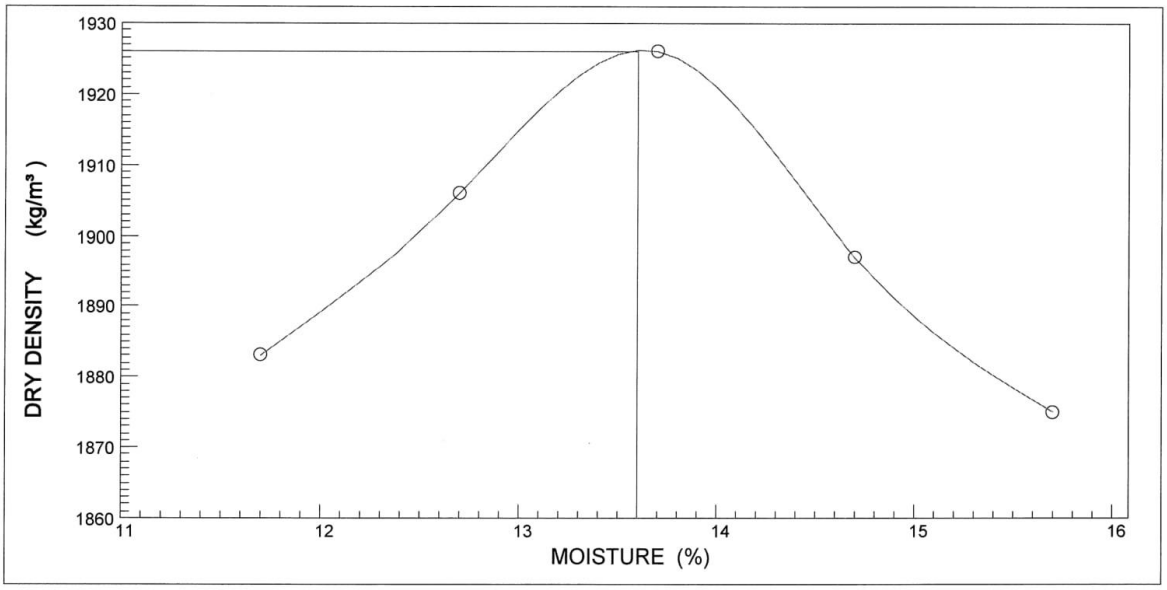
Test Report: MDD & OMC

SANS 3001 - GR30

SAMPLE NO.	8849
CONTAINER FOR SAMPLING	Sampling Bag
SIZE / APPROX. MASS OF SAMPLE	84400g
MOISTURE CONDITION OF SAMPLE	Slightly Moist
LAYER TESTED / SAMPLED FROM	1000-3200mm
MATERIAL DESCRIPTION	Clayey Silty Gravel
HOLE NO./ km / CHAINAGE	TP 1
ROAD NO.	N/S
DATE RECEIVED	2022/04/29
DATE SAMPLED	2022/04/29
CLIENT MARKING	None
COLOUR AND TYPE	Dark Brown

POINT NO.	1	2	3	4	5			
DRY DENSITY (kg/m³)	1883	1906	1926	1897	1875			
MOISTURE (%)	11.7	12.7	13.7	14.7	15.7			

MAXIMUM DRY DENSITY (kg/m³) : 1926	OPTIMUM MOISTURE CONTENT (%) : 13.6



Deviation from Test Method : Sampled & Delivered by client.
Remarks and Notes : None.

Opinions and interpretations are not included in our schedule of accreditation. (T0947)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
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Report compiled by : Jessica Myburgh

sanas Testing Laboratory
Accreditation No.
Prog.ver 10.7 (2019/11/07)

Elizabeth Roux
Technical Signatory

3

Terra Geotechnical

ROADLAB

Roadlab laboratories (PTY) Ltd
7 Bally Crescent, Voorbaai
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Tel: 067 418 4529 Fax:
Email: elizabeth@roadlab.co.za
Web:

Job Request No.: RM14879
Terra Geotechnical
Andre Nel Building
C/O Fynbos & Perdekuil Avenue, Stilbaai
6674
Attention : Eugene van der Walt

Date Reported : 2022/05/17

Project : Herolds Bay Estate

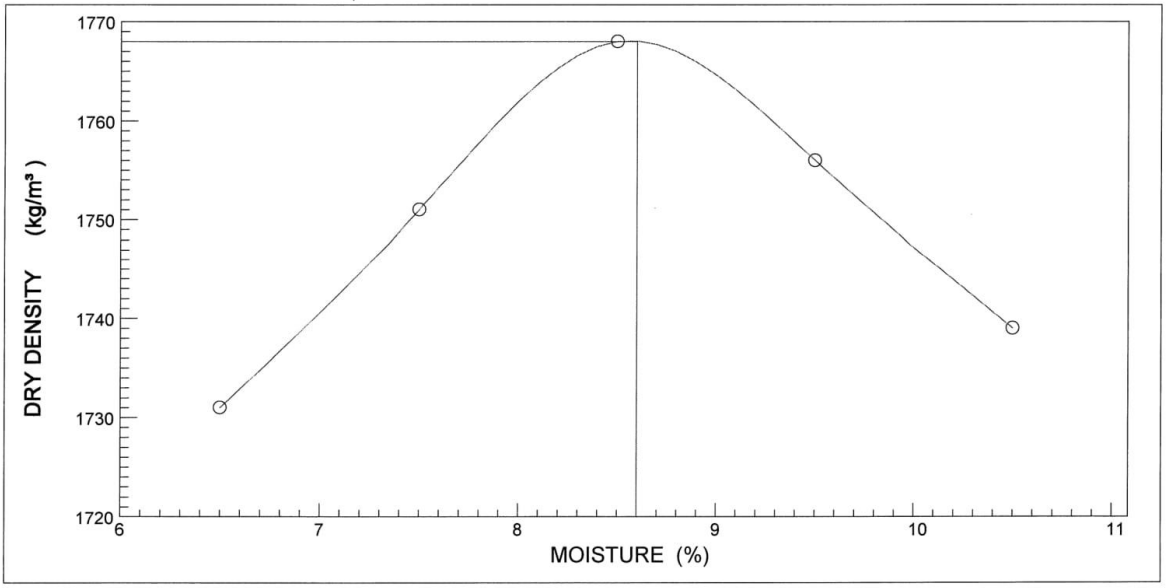
Test Report: MDD & OMC

SANS 3001 - GR30

SAMPLE NO.	8851
CONTAINER FOR SAMPLING	Sampling Bag
SIZE / APPROX. MASS OF SAMPLE	90900g
MOISTURE CONDITION OF SAMPLE	Slightly Moist
LAYER TESTED / SAMPLED FROM	400-1500mm
MATERIAL DESCRIPTION	Silty Sand
HOLE NO./ km / CHAINAGE	TP 3
ROAD NO.	N/S
DATE RECEIVED	2022/04/29
DATE SAMPLED	2022/04/29
CLIENT MARKING	None
COLOUR AND TYPE	Light Brown

POINT NO.	1	2	3	4	5			
DRY DENSITY (kg/m³)	1731	1751	1768	1756	1739			
MOISTURE (%)	6.5	7.5	8.5	9.5	10.5			

MAXIMUM DRY DENSITY (kg/m³) : 1768	OPTIMUM MOISTURE CONTENT (%) : 8.6



Deviation from Test Method : Sampled & Delivered by client.
Remarks and Notes : None.

Opinions and interpretations are not included in our schedule of accreditation. (T0947)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
Further use of the above information is not the responsibility or liability of Roadlab.
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Report compiled by : Jessica Myburgh

sanas Testing Laboratory
Accreditation No.
Prog.ver 10.7 (2019/11/07)

Elizabeth Roux
Technical Signatory

4

Terra Geotechnical

ROADLAB™

Roadlab Laboratories (Pty) Ltd

Civil Materials Testing
BBBEE Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4670261090

+27 67 418 4529
elizabeth@roadlab.co.za
7 Belly Crescent, Voorbaai, Mosselbay, Western Cape

› material Passion.
› trusted Accuracy.
› timeous Excellence.

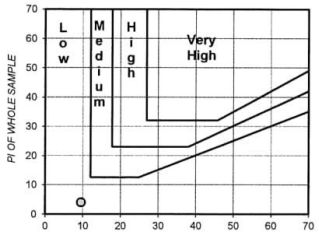
OUR REF : RM14879
CLIENT : Terra Geotechnical
PROJECT : Herolds Bay Estate

DATE RECEIVED : 2022.04.29
POSITION : TP1
LAYER : 1000-3200mm
SAMPLE No. : 8849
SAMPLE DESCRIPTION : Dark Brown Clayey Silty Gravel Sand

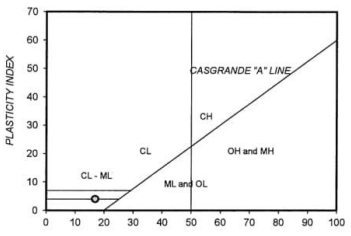
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**3.9**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	100
	2.000	100
	0.425	98
	0.250	76
	0.150	36
	0.075	26
	50 µm	16
	5 µm	12
	2 µm	9.6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1
	0.425 - 0.250	23
	0.250 - 0.150	40
	0.150 - 0.075	10
	< 0.075	26
Effective size		0.002
Uniformity Coefficient		84.7
Curvature Coefficient		20.2
Oversize Index		0.0
Shrinkage Product		161.4
Grading Coefficient		0.3
Grading modulus		0.76
Alter-berg Limits	Liquid Limit	17
	Plasticity Index	4
	Linear Shrinkage	1.6
	PI < 0.075	-
Unified Soil Classification		SM & SC
U.S. Highway Classification		A-2-4 (0)

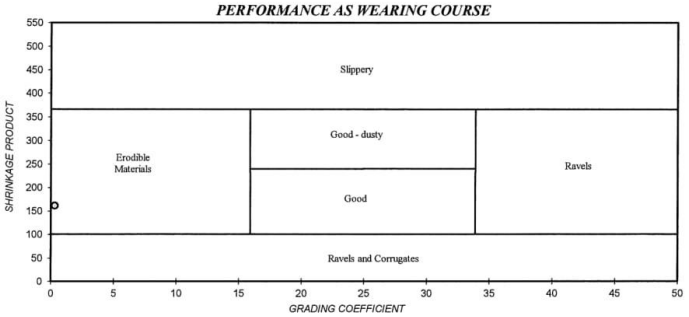
POTENTIAL EXPANSIVENES



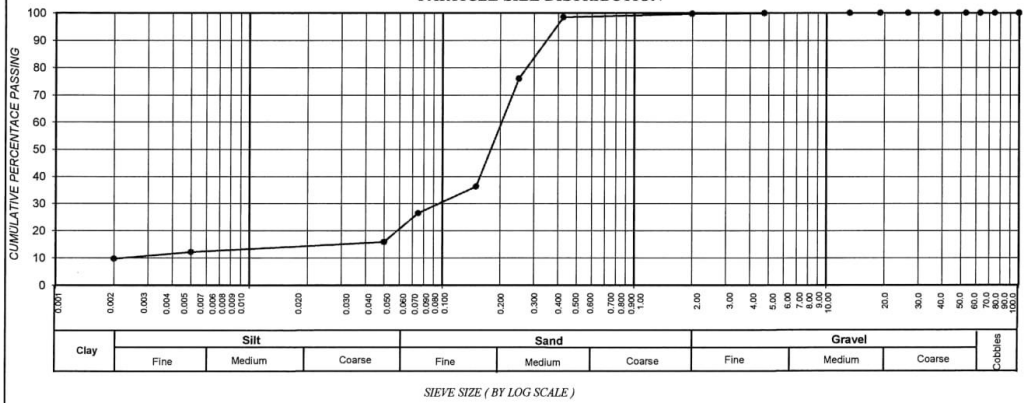
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
9.6	8.9	81.2	0.3

ROADLAB™

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Civil Materials Testing
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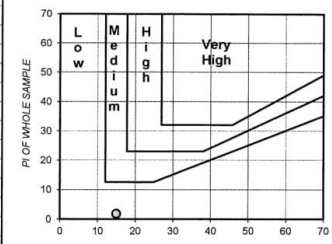
OUR REF : RM14879
CLIENT : Terra Geotechnical
PROJECT : Herolds Bay Estate

DATE RECEIVED : 2022.04.29
POSITION : TP2
LAYER : 400-900mm
SAMPLE No. : 8850
SAMPLE DESCRIPTION : Dark Brown Sandy Silty Gravel Clayey Sand

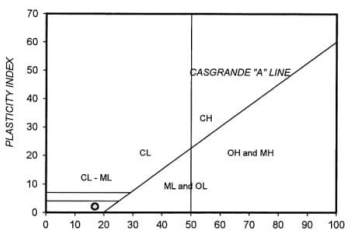
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**1.8**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	99
	5.00	93
	2.000	92
	0.425	88
	0.250	68
	0.150	38
	0.075	27
	50 µm	22
	5 µm	19
	2 µm	15.0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4
	0.425 - 0.250	21
	0.250 - 0.150	33
	0.150 - 0.075	12
	< 0.075	29
Effective size		0.002
Uniformity Coefficient		111.4
Curvature Coefficient		21.3
Oversize Index		0.0
Shrinkage Product		48.4
Grading Coefficient		7.4
Grading modulus		0.93
Atter-berg Limits	Liquid Limit	17
	Plasticity Index	2
	Linear Shrinkage	0.6
	PI < 0.075	-
Unified Soil Classification		SM
U.S. Highway Classification		A-2-4 (0)

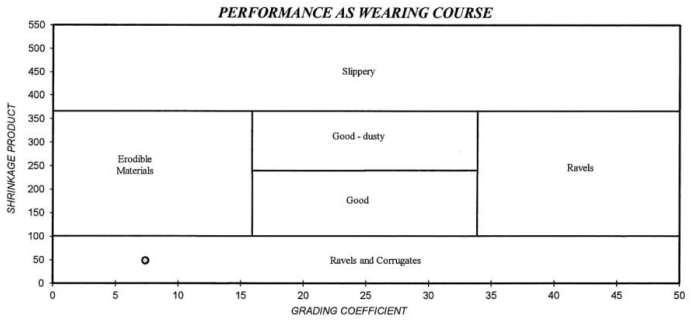
POTENTIAL EXPANSIVENES



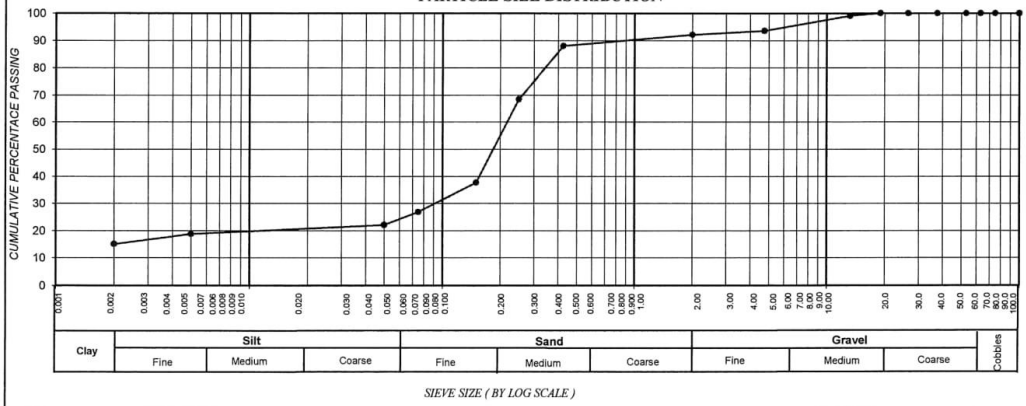
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
15.0	8.7	68.4	7.9

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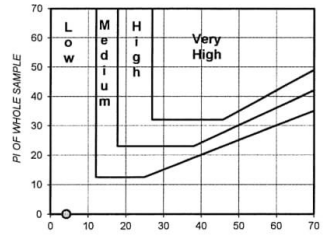
OUR REF : RM14879
CLIENT : Terra Geotechnical
PROJECT : Herolds Bay Estate

DATE RECEIVED : 2022.04.29
POSITION : TP3
LAYER : 400-1500mm
SAMPLE No. : 8851
SAMPLE DESCRIPTION : Light Brown Silty Sand
Sand

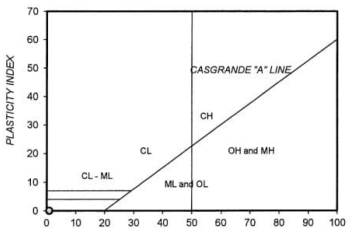
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		-
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	99
	2.000	99
	0.425	98
	0.250	93
	0.150	55
	0.075	27
	50 µm	10
	5 µm	9
	2 µm	4.3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1
	0.425 - 0.250	5
	0.250 - 0.150	38
	0.150 - 0.075	28
	< 0.075	28
Effective size		0.050
Uniformity Coefficient		3.3
Curvature Coefficient		0.8
Oversize Index		0.0
Shrinkage Product		0
Grading Coefficient		1.0
Grading modulus		0.76
Atter-berg Limits	Liquid Limit	-
	Plasticity Index	NP
	Linear Shrinkage	-
	PI < 0.075	-
Unified Soil Classification		SM
U.S. Highway Classification		A-2-4 (0)

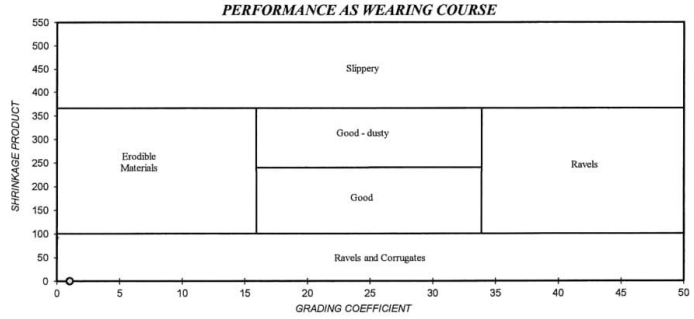
POTENTIAL EXPANSIVENES



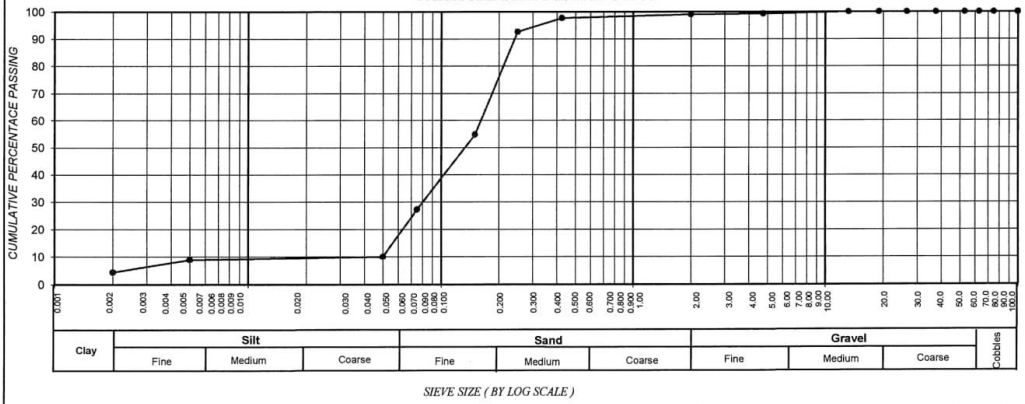
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.3	9.1	85.6	1.0

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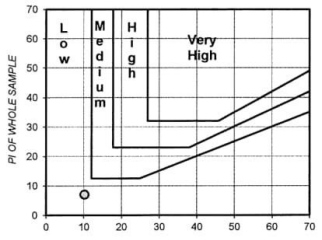
PROJECT : Herolds Bay Estate

DATE RECEIVED : 2022.04.29
POSITION : TP5
LAYER : 1400-2800mm
SAMPLE No. : 8852
SAMPLE DESCRIPTION : Reddish brown Clayey + Silty Gravel
Clayey Silty Sand

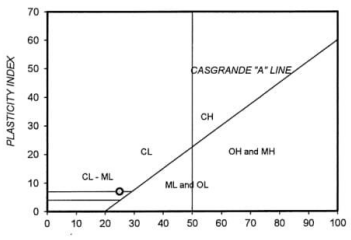
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**7.0**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	100
	2.000	100
	0.425	99
	0.250	98
	0.150	70
	0.075	40
	50 µm	19
	5 µm	15
	2 µm	10.2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	0
	0.425 - 0.250	1
	0.250 - 0.150	28
	0.150 - 0.075	31
	< 0.075	40
Effective size		0.002
Uniformity Coefficient		62.4
Curvature Coefficient		16.2
Oversize Index		0.0
Shrinkage Product		271.1
Grading Coefficient		0.4
Grading modulus		0.61
Atter-berg Limits	Liquid Limit	25
	Plasticity Index	7
	Linear Shrinkage	2.7
	PI < 0.075	-
Unified Soil Classification		SM & SC
U.S. Highway Classification		A-4 (0)

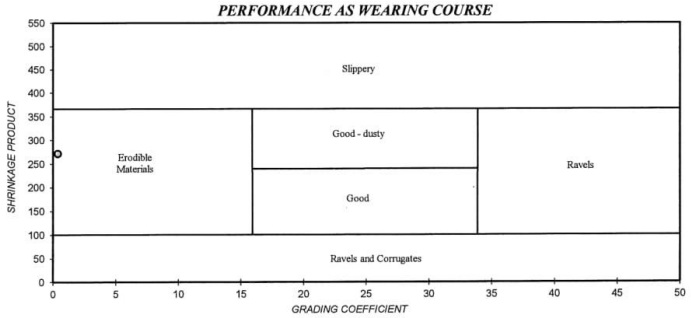
POTENTIAL EXPANSIVENES



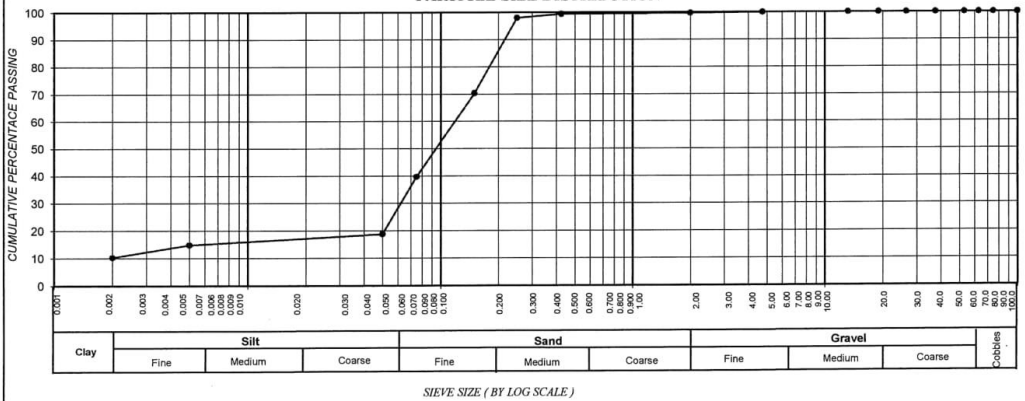
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
10.2	14.2	75.2	0.4

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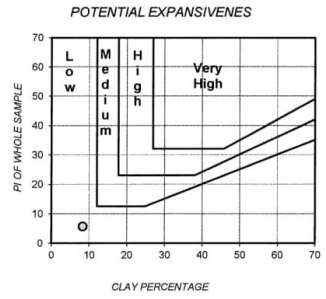
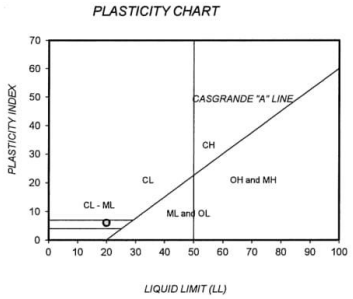
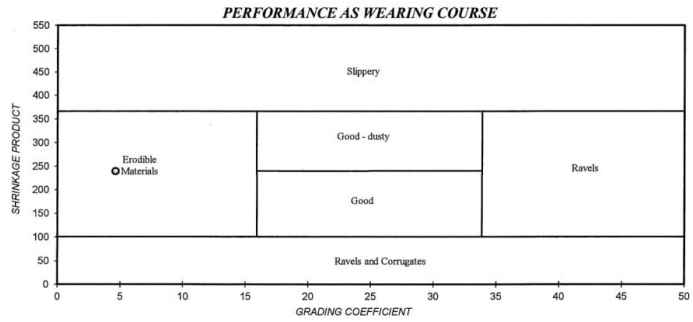
DATE RECEIVED : 2022.04.29
POSITION : TP6
LAYER : 1600-2500mm
SAMPLE No. : 8853
SAMPLE DESCRIPTION : Light Brown Reddish Silty Clayey Silty Sand

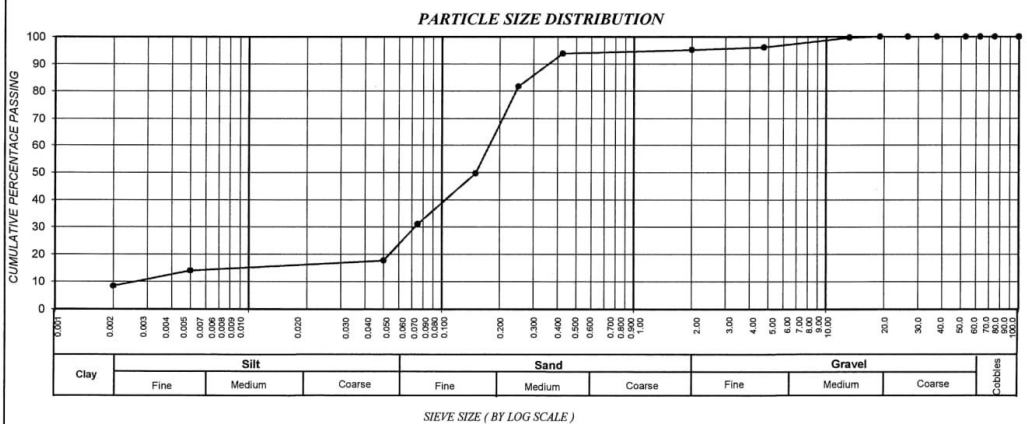
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		5.6
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	96
	2.000	95
	0.425	94
	0.250	82
	0.150	50
	0.075	31
	50 µm	18
	5 µm	14
	2 µm	8.3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1
	0.425 - 0.250	13
	0.250 - 0.150	34
	0.150 - 0.075	20
	< 0.075	33
Effective size		0.003
Uniformity Coefficient		62.7
Curvature Coefficient		10.0
Oversize Index		0.0
Shrinkage Product		239.1
Grading Coefficient		4.6
Grading modulus		0.80
Atter-berg Limits	Liquid Limit	20
	Plasticity Index	6
	Linear Shrinkage	2.6
	PI < 0.075	-
Unified Soil Classification		SM & SC
U.S. Highway Classification		A-2-4 (0)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
8.3	13.1	73.8	4.8

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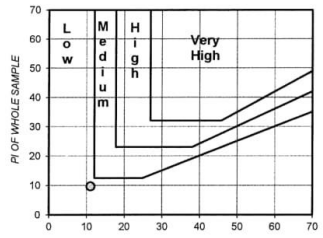
DATE RECEIVED : 2022.04.29
POSITION : TP11
LAYER : 900-1700mm
SAMPLE No. : 8854
SAMPLE DESCRIPTION : Dark Brown Reddish Clayey Silt
Clayey Silty Sand

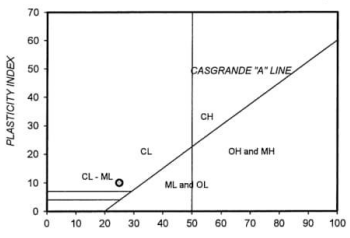
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**9.6**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	98
	2.000	98
	0.425	96
	0.250	87
	0.150	59
	0.075	35
	50 µm	18
	5 µm	15
	2 µm	11.1
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	10
	0.250 - 0.150	29
	0.150 - 0.075	24
	< 0.075	36
Effective size		0.002
Uniformity Coefficient		77.1
Curvature Coefficient		14.6
Oversize Index		0.0
Shrinkage Product		345.2
Grading Coefficient		2.2
Grading modulus		0.71
Atter-berg Limits	Liquid Limit	25
	Plasticity Index	10
	Linear Shrinkage	3.6
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-2-4 (0)

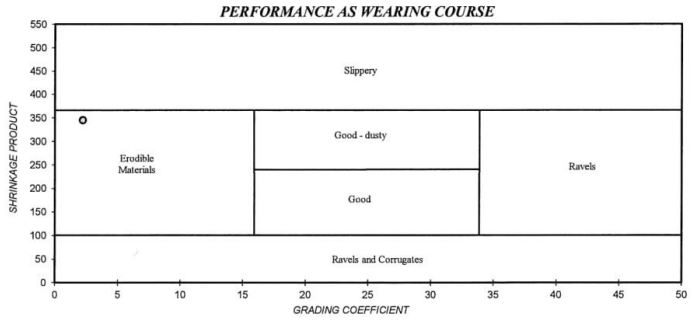
POTENTIAL EXPANSIVENES



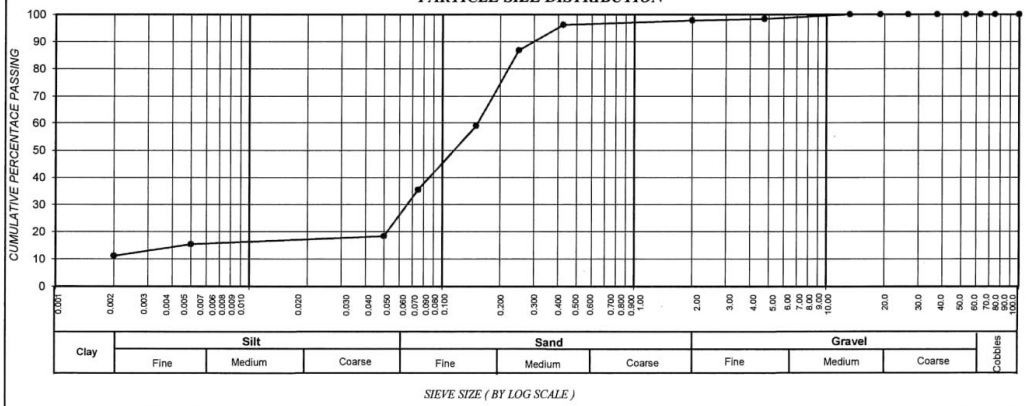
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
11.1	11.7	75.0	2.3

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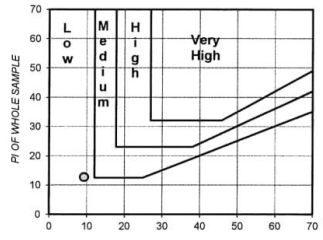
DATE RECEIVED : 2022.04.29
POSITION : TP12
LAYER : 1200-1600mm
SAMPLE No. : 8855
SAMPLE DESCRIPTION : Light Brown Olive Silty Clayey Silty Sand

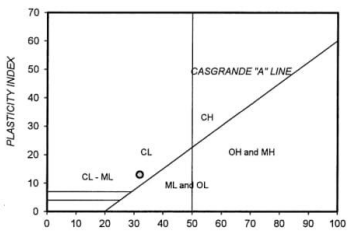
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**12.7**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	99
	2.000	99
	0.425	97
	0.250	87
	0.150	62
	0.075	45
	50 µm	19
	5 µm	15
	2 µm	9.3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	10
	0.250 - 0.150	26
	0.150 - 0.075	17
	< 0.075	45
Effective size		0.002
Uniformity Coefficient		59.3
Curvature Coefficient		10.7
Oversize Index		0.0
Shrinkage Product		496.4
Grading Coefficient		0.8
Grading modulus		0.58
After-berg Limits	Liquid Limit	32
	Plasticity Index	13
	Linear Shrinkage	5.1
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-6 (3)

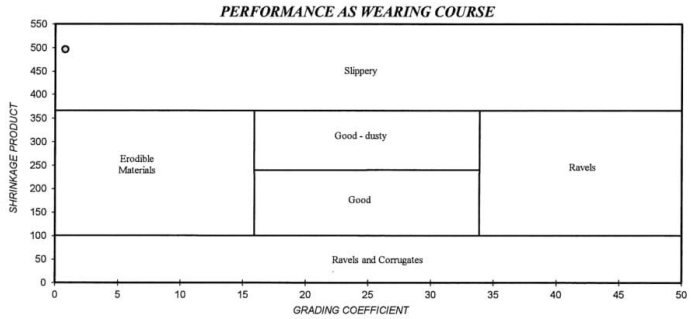
POTENTIAL EXPANSIVENES



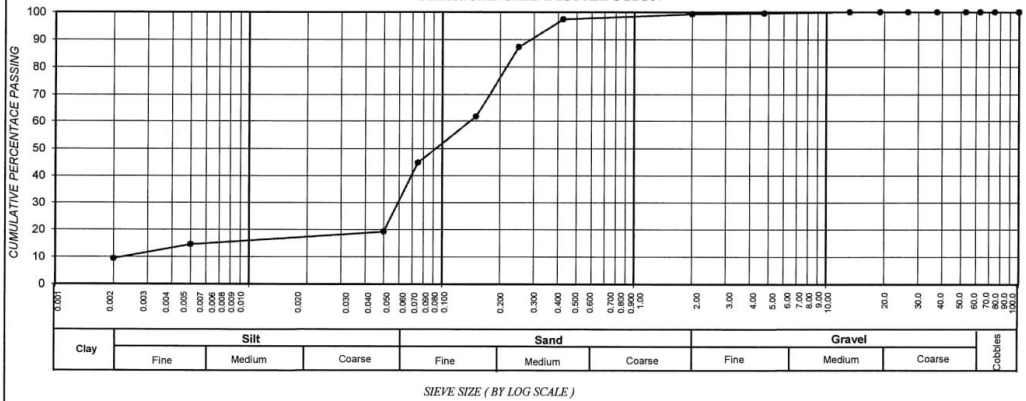
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
9.3	17.2	72.7	0.8

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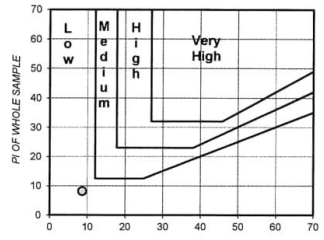
DATE RECEIVED : 2022.04.29
POSITION : TP13
LAYER : 1000-1500mm
SAMPLE No. : 8856
SAMPLE DESCRIPTION : Dark Brown Reddish Clayey + Silty Sand Silty Sand

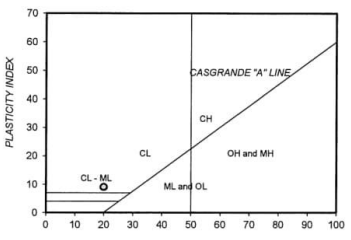
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**8.1**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	97
	2.000	94
	0.425	90
	0.250	69
	0.150	41
	0.075	32
	50 µm	20
	5 µm	15
	2 µm	8.7
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4
	0.425 - 0.250	22
	0.250 - 0.150	29
	0.150 - 0.075	10
	< 0.075	34
Effective size		0.003
Uniformity Coefficient		83.0
Curvature Coefficient		8.7
Oversize Index		0.0
Shrinkage Product		337.1
Grading Coefficient		6.2
Grading modulus		0.85
Alter-berg Limits	Liquid Limit	20
	Plasticity Index	9
	Linear Shrinkage	3.8
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-2-4 (0)

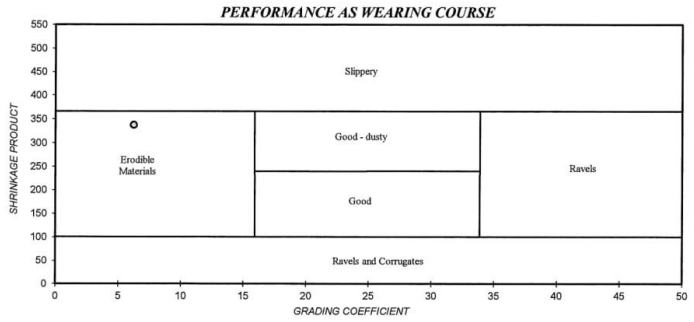
POTENTIAL EXPANSIVENES



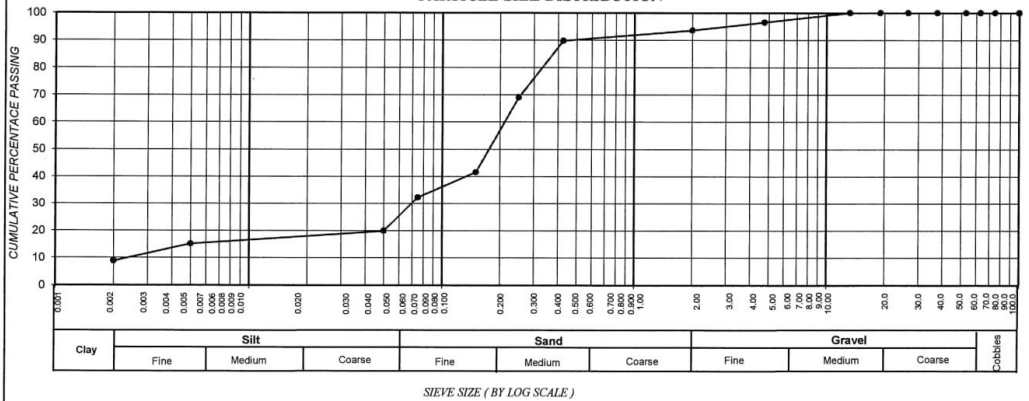
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

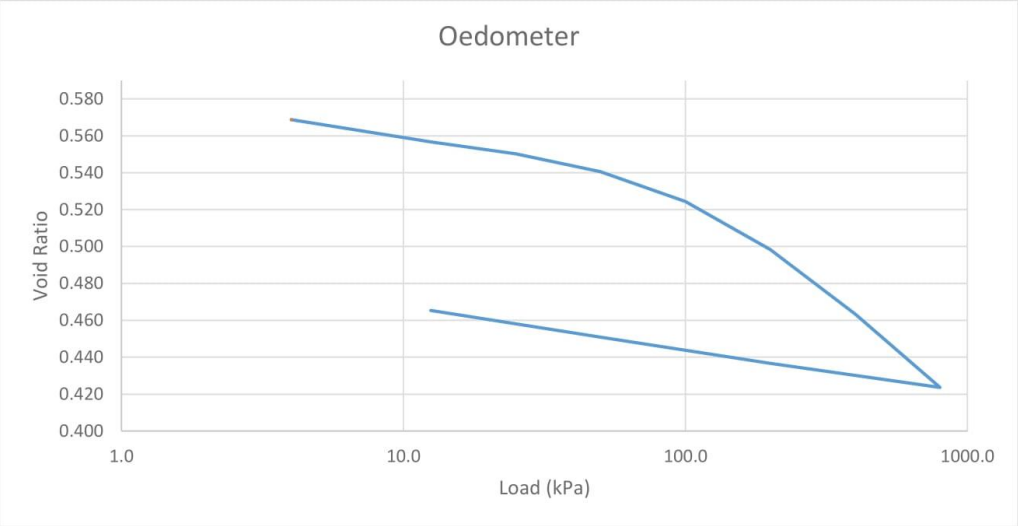
CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
8.7	14.6	70.2	6.5

Oedometer Swell Test

Sample Detail		Initial	Final
Height	(mm)	20.3	19.0
Diameter	(mm)	63.5	63.5
Weight	(g)	126.4	132.2
Moisture	(%)	15.5	22.0
Dry Density	(Mg/m^3)	1.70	1.81
Bulk Density	(Mg/m^3)	1.97	2.20
Void Ratio		0.569	0.465
Particle Density	(Mg/m^3)	2.67	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m^3)	-	

Load (kPa)	Height (mm)	Void Ratio
4.0	20.300	0.569
4.0	20.301	0.569
12.5	20.145	0.557
25	20.061	0.550
50	19.935	0.540
100	19.727	0.524
200	19.391	0.498
400	18.937	0.463
800	18.423	0.424
200	18.591	0.437
50	18.776	0.451
12.5	18.963	0.465

Swell Results		
Swell Percentage	0.0	%
Swell Pressure	0	kPa



STEYN-WILSON GEOTECHNICAL

sanas Testing Laboratory

Project	Harolds Baai		
Sample	TP12		
Client	Terra Geotechnical	Test Method	BS1377 - 5: 1990
Jobfile	SWG00342	Test Date	25/05/2022

01/02/2021 Rev2 TR/GEO-SW0009 Compiled: M. Steyn Approved: R. Wilson

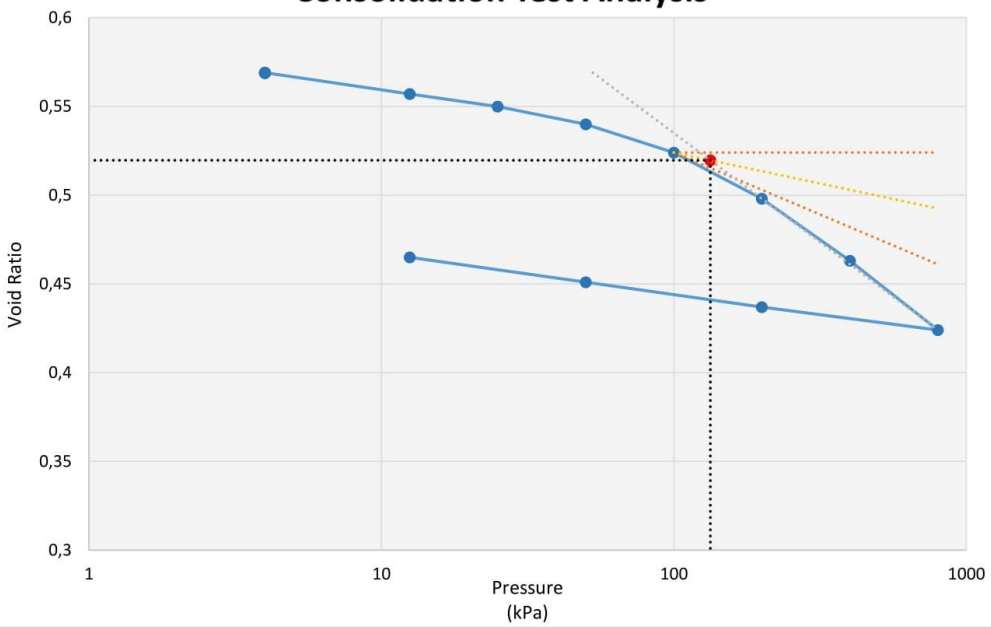
Terra Geotechnical

Single Oedometer "Consolidation" Test

Undisturbed Sample UNTP12

Load Increment (kPa)		4	12,5	25	50	100	200	400	800
Void Ratio	Loading	0,569	0,557	0,550	0,540	0,524	0,498	0,463	0,424
	Unloading	-	0,465	-	0,451	-	0,437	-	-

Horizons	H1	H2	H3	H4	H5	H6	Inferred In-situ Overburden (kPa)
Final Depth (m)	1,2						
Moisture Content (%)	15,5						
Dry Density (kg/m^3)	1700						
Bulk Density (kg/m^3)	1970						
Overburden (kPa)	23,167						**23,2**



Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,551		
	Loaded	0,550	0,540	0,524
a		0,0004	0,0004	0,0003
Mv		0,2705	0,2588	0,2247
Oedometer Settlement		3,35	6,41	11,12
*Settlement Range (mm)	Lower	3	5	8
	Upper	4	7	12

Preconsolidation State	
Pressure (kPa)	Void Ratio
133,3	0,520
Overconsolidated	

Factor of Safety	1,5

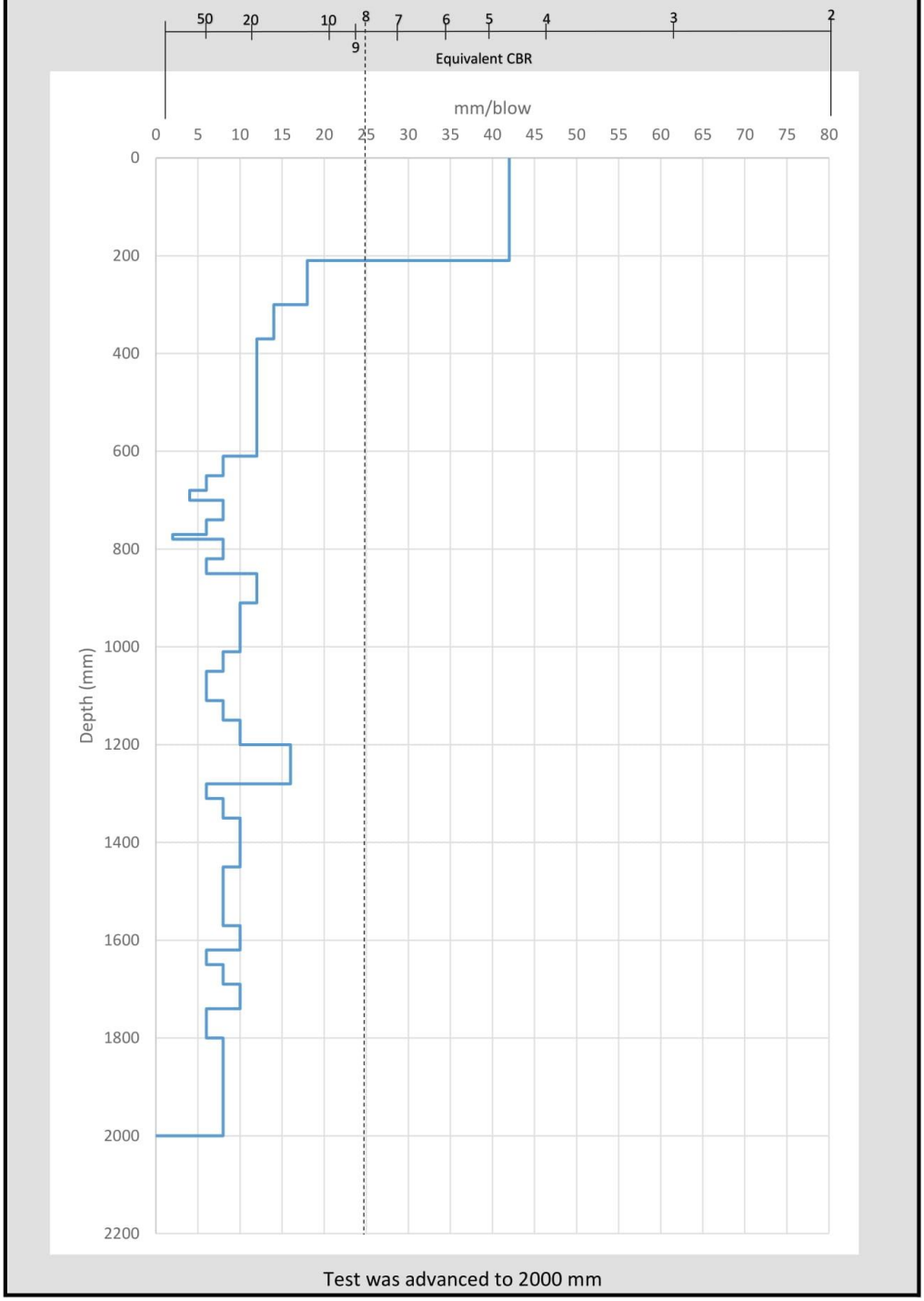
Foundation Width (m)	0,6

** the settlement range presented above assumes a **depth of influence** factor of 1.5 times the presented foundation width (below the foundation level)*

APPENDIX C

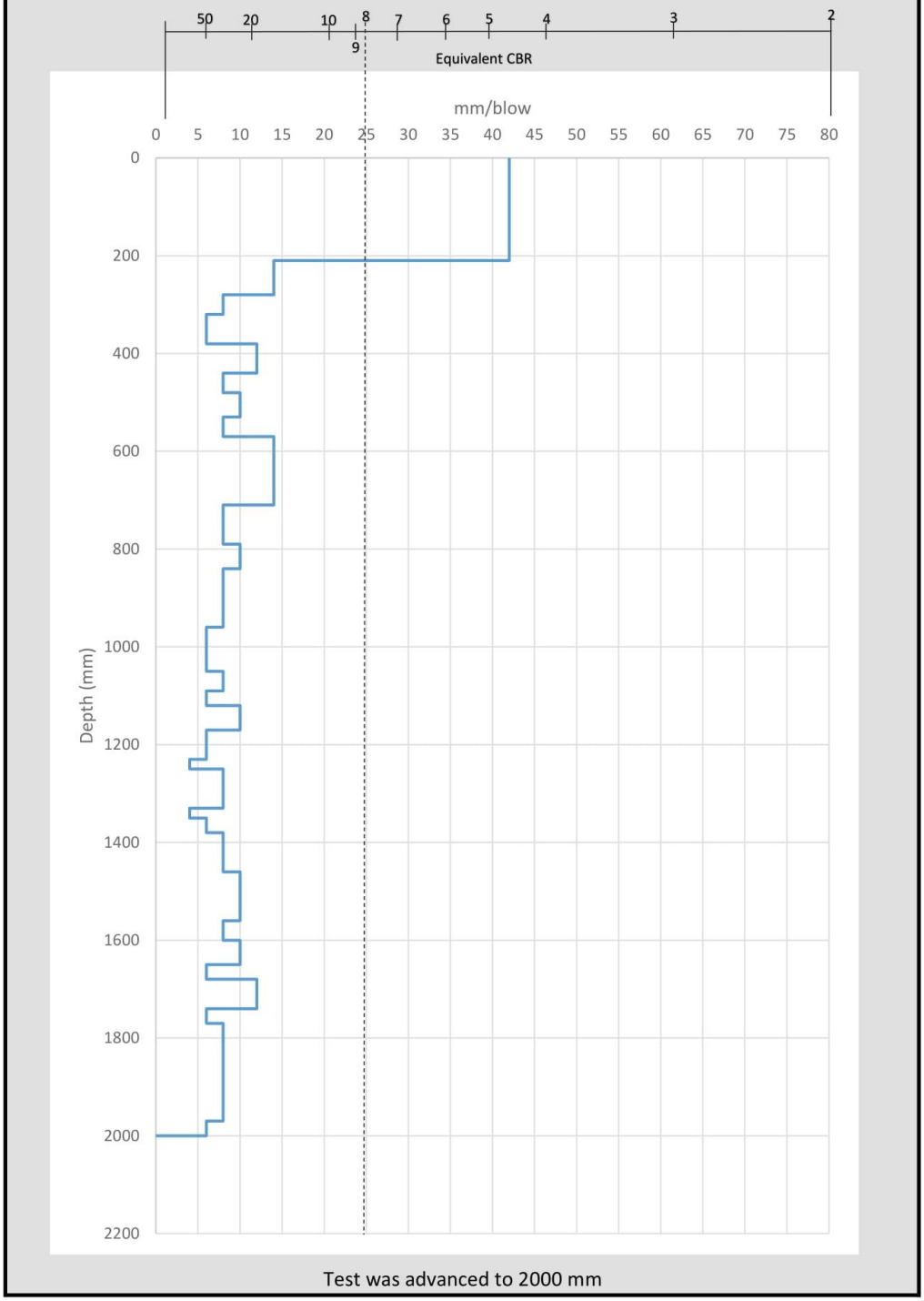
C.1
DCP Test Results

Site: Harolds Bay Country Estate
Test: DCP 1
Note: Test conducted from surface
Date: April 2022



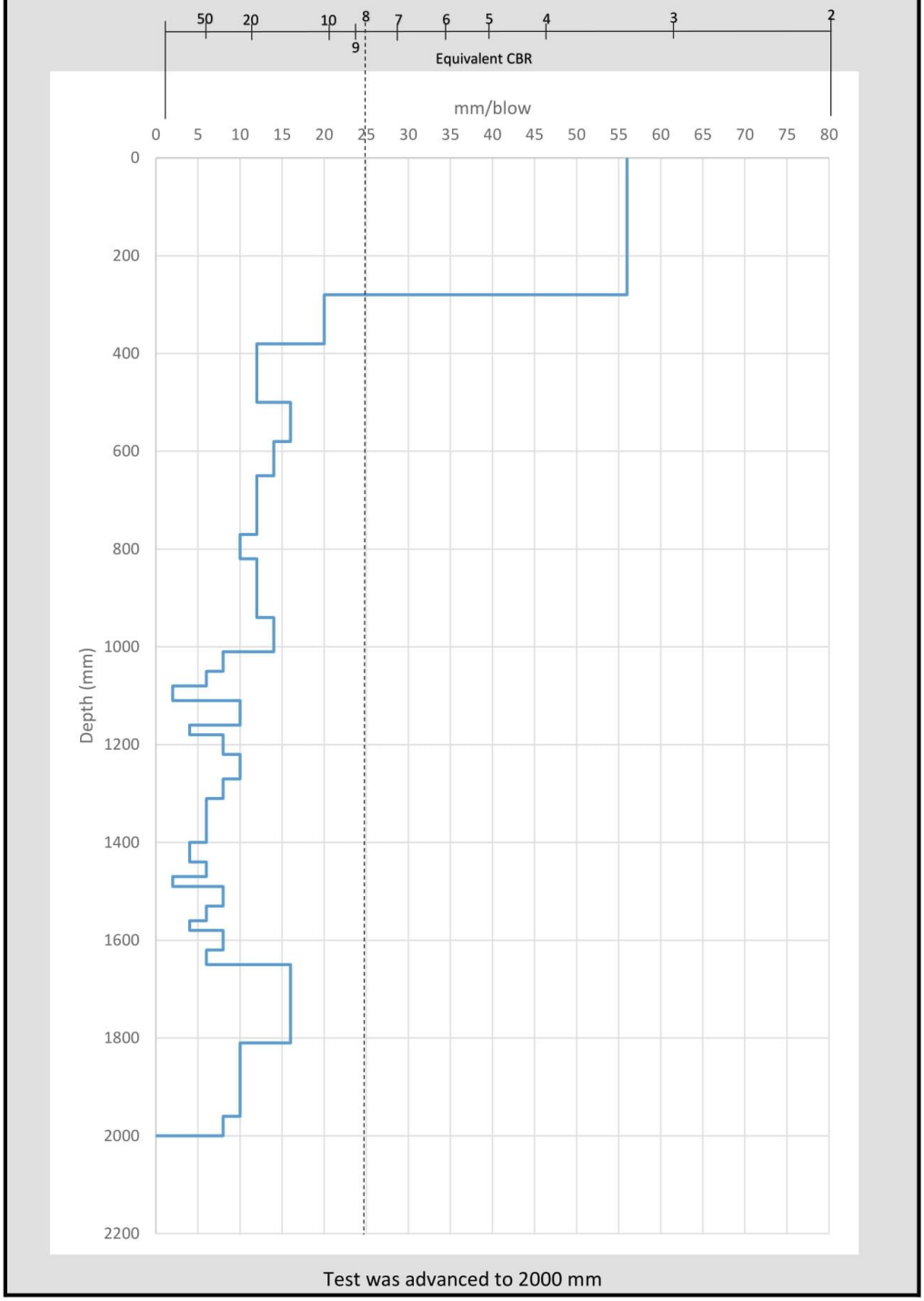
Test was advanced to 2000 mm

Site: Harolds Bay Country Estate
Test: DCP 2
Note: Test conducted from surface
Date: April 2022



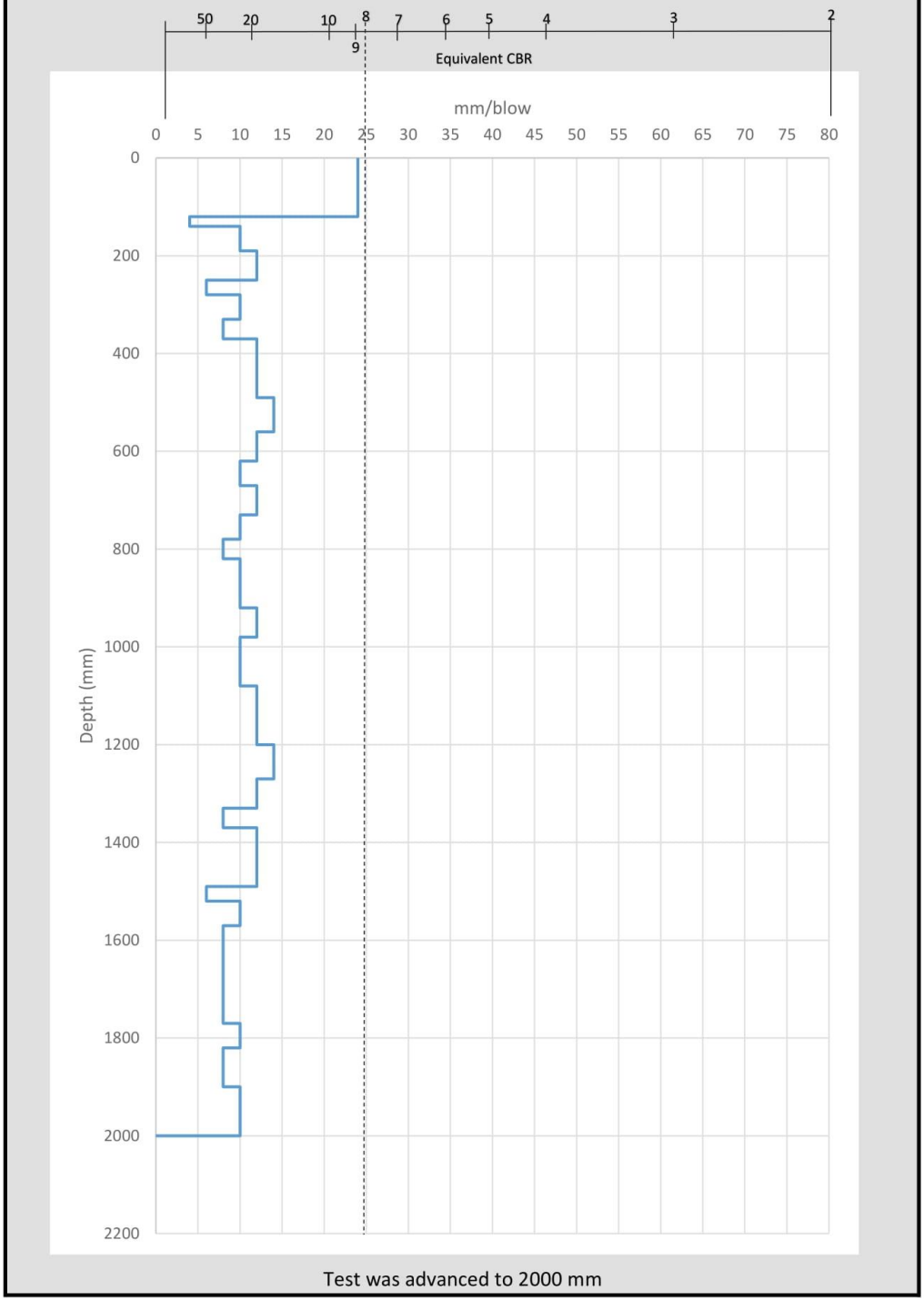
Test was advanced to 2000 mm

Site: Harolds Bay Country Estate
Test: DCP 3
Note: Test conducted from surface
Date: April 2022



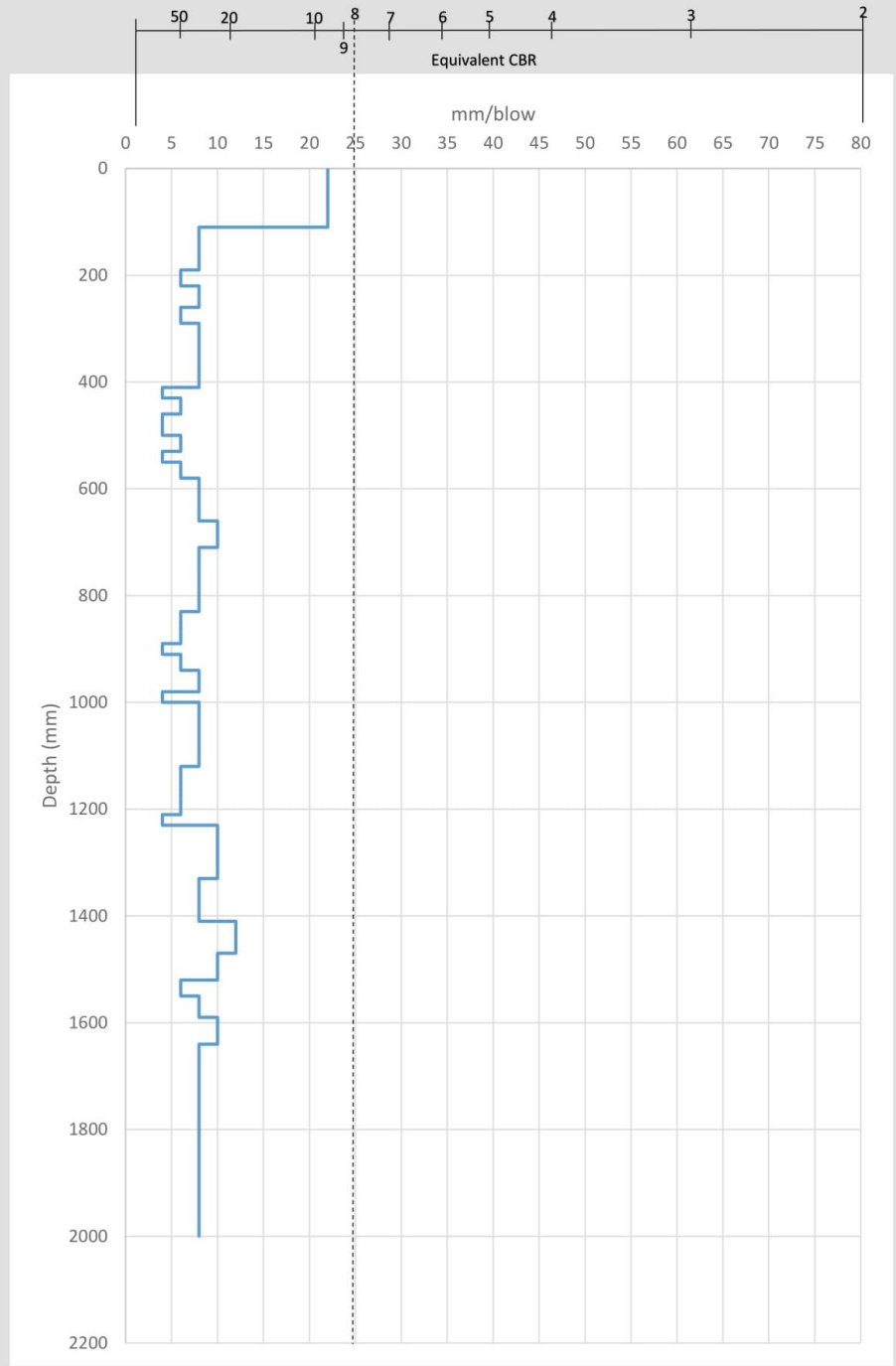
Test was advanced to 2000 mm

Site: Harolds Bay Country Estate
Test: DCP 4
Note: Test conducted from surface
Date: April 2022



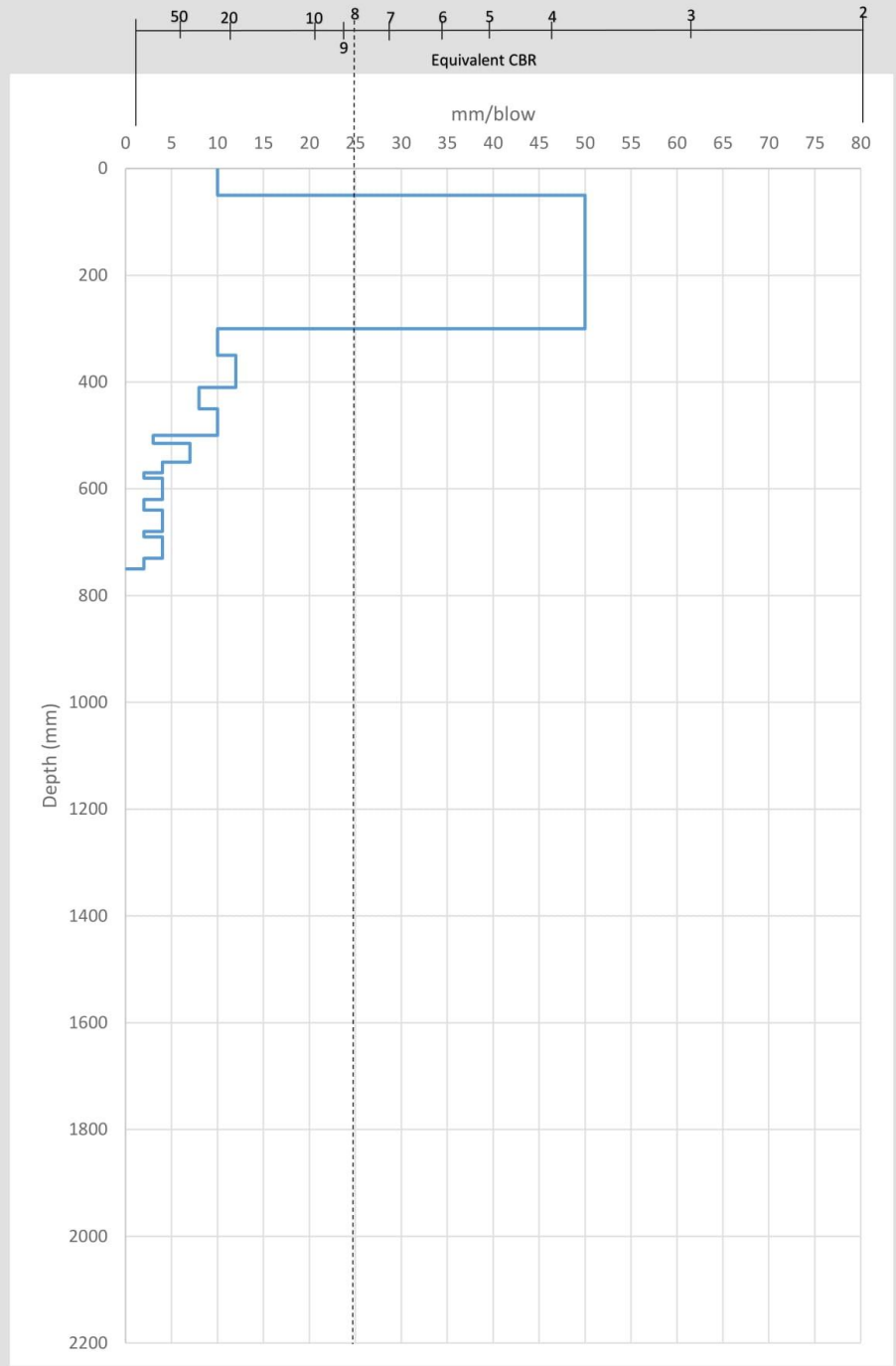
Test was advanced to 2000 mm

Site: Harolds Bay Country Estate
Test: DCP 5
Note: Test conducted from surface
Date: April 2022



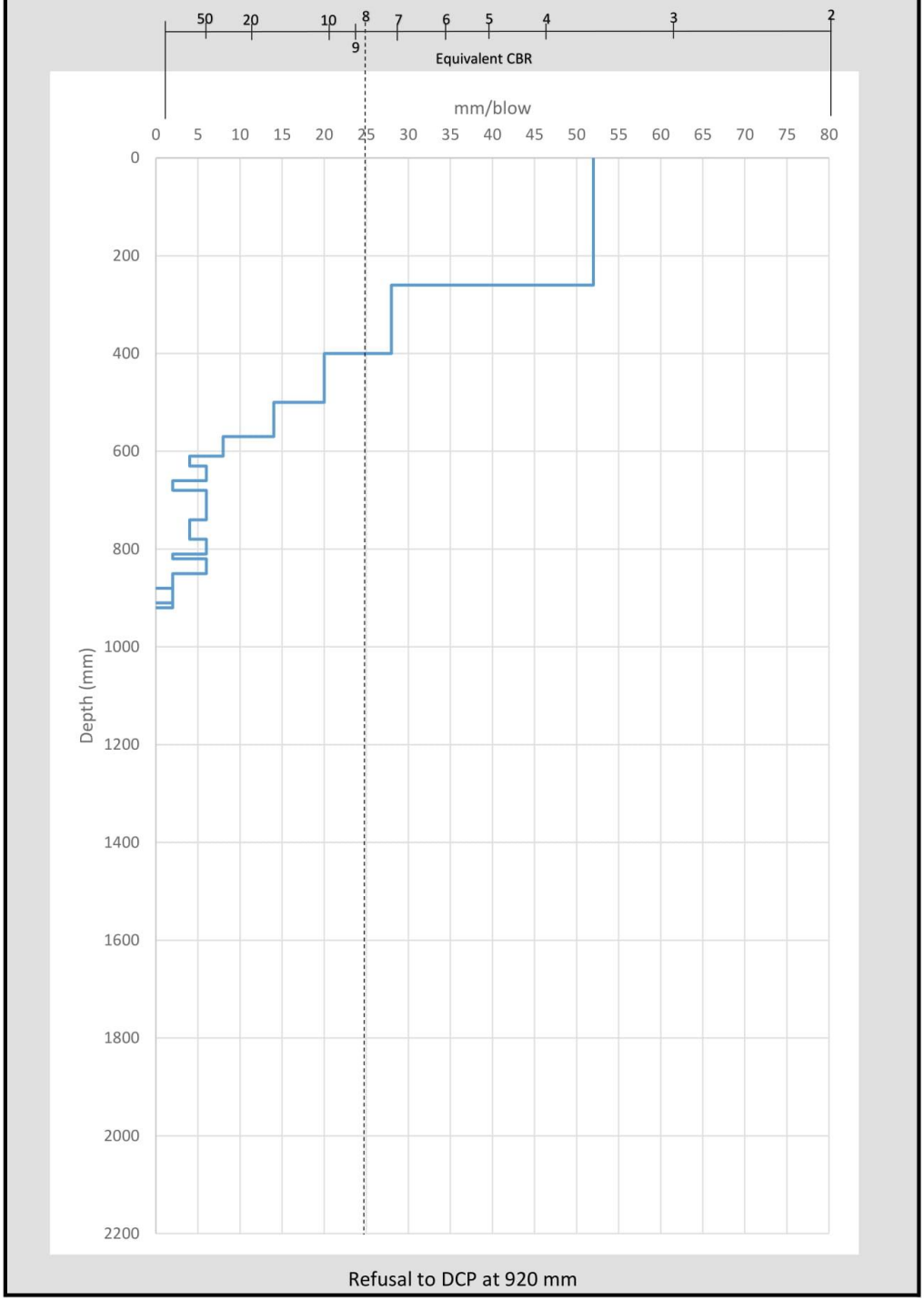
Test was advanced to 2000 mm

Site: Harolds Bay Country Estate
Test: DCP 6
Note: Test conducted from surface
Date: April 2022



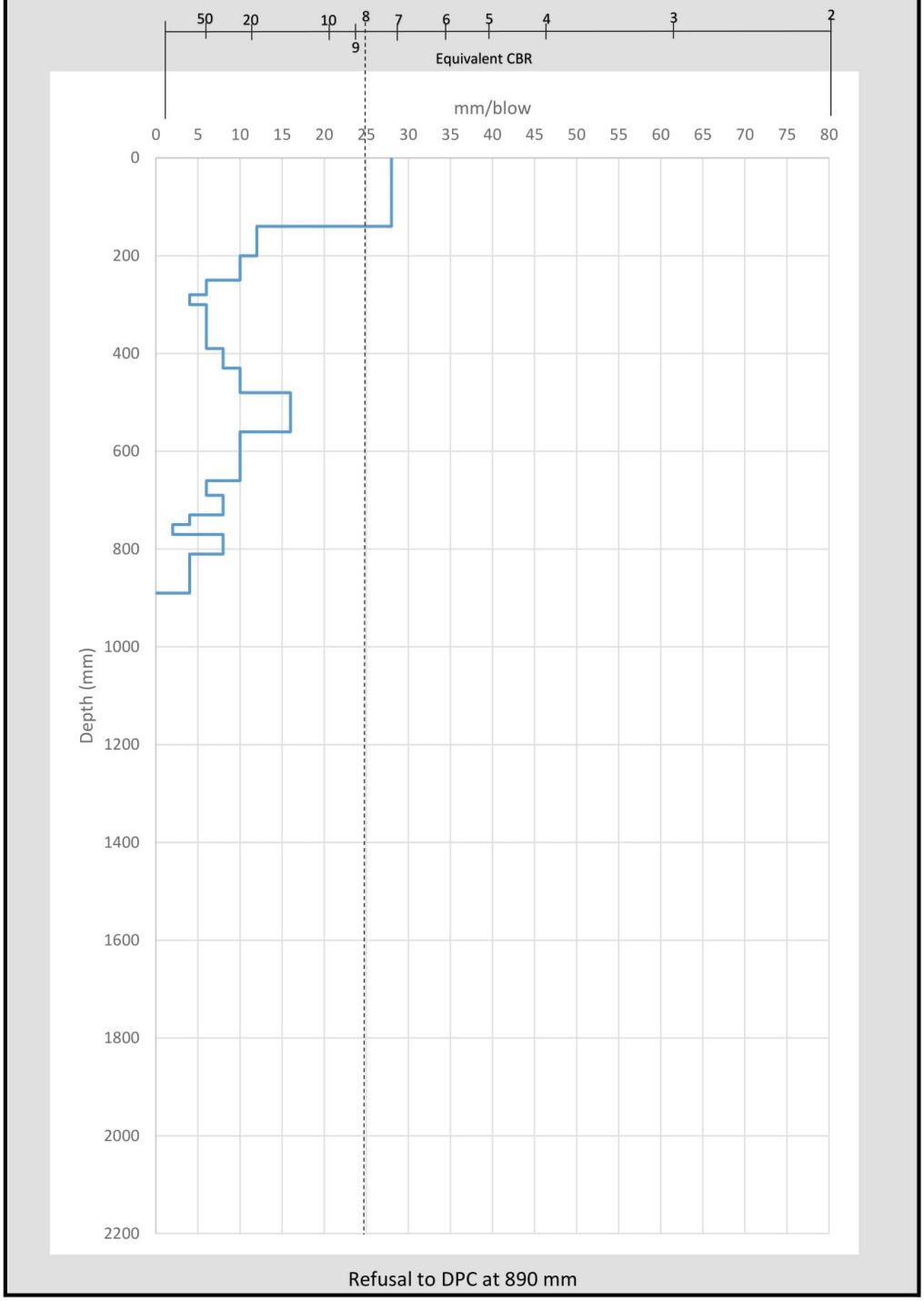
Refusal to DCP at 750 mm

Site: Harolds Bay Country Estate
Test: DCP 7
Note: Test conducted from surface
Date: April 2022



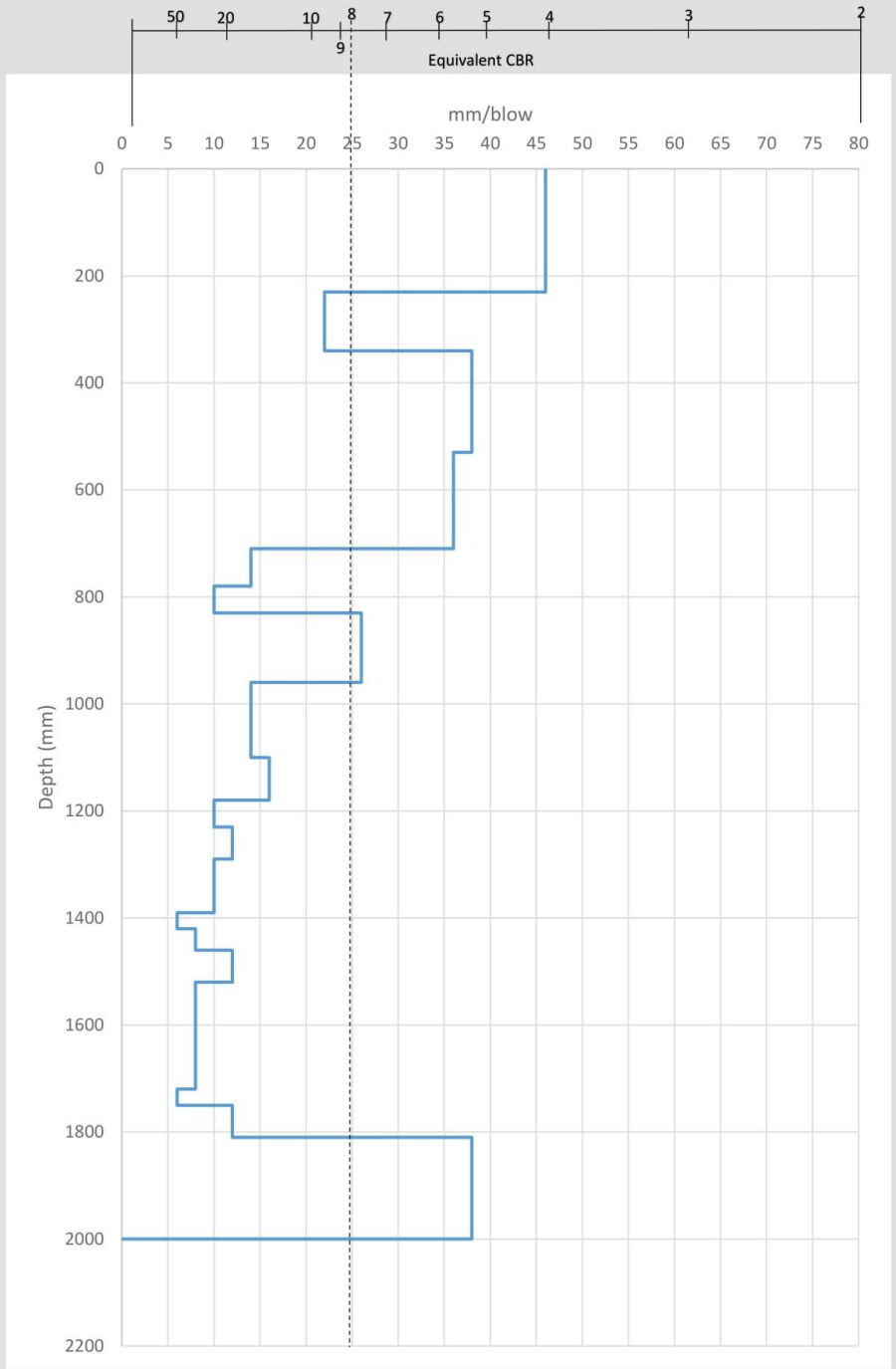
Refusal to DCP at 920 mm

Site: Harolds Bay Country Estate
Test: DCP 8
Note: Test conducted from surface
Date: April 2022



Refusal to DPC at 890 mm

Site:	Harolds Bay Country Estate
Test:	DCP 13
Note:	Tip of DCP wet upon extraction
Date:	April 2022



Test was advanced to 2000 mm