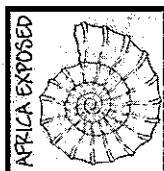
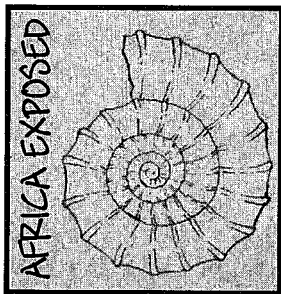




**PHASE I GEOTECHNICAL INVESTIGATION  
REPORT FOR  
PLATINUM PARK INDUSTRIAL PARK,  
KLERKSOORD, AKASIA.**



**AFRICA EXPOSED**  
CONSULTING ENGINEERING GEOLGISTS



# AFRICA EXPOSED

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### **PHASE I GEOTECHNICAL INVESTIGATION REPORT FOR PLATINUM PARK INDUSTRIAL PARK, KLERKSOORD, AKASIA.**

**Prepared for:**

**BCHOD CONSULTING ENGINEERS  
on behalf of  
SAFDEV HOLDINGS (PTY) LTD.**

**Report No.: 2503  
Date: July 2003**

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**PLATINUM PARK INDUSTRIAL PARK  
KLERKSOORD AKASIA,  
TSHWANE METROPOLITAN AUTHORITY**

**PHASE I GEOTECHNICAL INVESTIGATION REPORT**

**1. INTRODUCTION**

**1.1 Preamble**

On 19<sup>th</sup> May 2003, Mr. W. Barrett, of B.C.H.O.D Consulting Engineers invited Africa Exposed Consulting Engineering Geologists to submit a proposal for the phase I geotechnical investigation for the proposed development of the Platinum Park Industrial Park east of Klerksoord, Akasia.

A proposal, detailing the scope of work, investigation methodology and associated costs was submitted on 20<sup>th</sup> May 2003. The proposal was accepted by BCHOD, and a letter (Ref. 0137.WCB.LDG) confirming the appointment was received by Africa Exposed on 28<sup>th</sup> May 2003.

**1.2 Objectives**

The objectives of the investigation were:

- To complete a desk study of the site, utilising aerial photography, published literature, past reports and mapping of the area.
- To carry out a walk over inspection of the site.
- To identify the soil and rock conditions below the site to a depth of 3.5 m or refusal, by means of test pits excavated by means of a TLB excavator
- To recommend the most suitable foundation system, and founding depth for the proposed structure.
- To comment on the availability of suitable construction materials for the proposed project.
- To comment on any perceived geotechnical problems which may affect either the design or construction of the project.
- To determine the groundwater conditions and to advise on appropriate precautionary measures.
- To comment on any other factors that may influence the proposed development of the site.



## 2. FACTUAL REPORT

### 2.1 Programme of Work

#### 2.1.1 *Literary Review*

A literary review was conducted in order to obtain data from previous investigations and published data relevant to the area.

Appropriate information was obtained from the following sources:-

- i. The 1: 250 000 geological map, No 2528 Pretoria, published by The Government Printers, Pretoria 1986.
- ii. The 1 : 50 000 Topo-cadastral map 2528 CA and 2528 CB, published by The Department of Survey and Mapping, Mowbray 1979.
- iii. "Engineering Geology of Southern Africa" volume 1, by A.B.A. Brink (1979), published by Building Publications.
- iv. "The Natural Road Construction Materials of Southern Africa" by H.H. Weinert (1980) published by Council for Scientific and Industrial Research, Pretoria.
- v. Aerial photographs at a scale of 1:30 000 were obtained from Department of Surveys and Land, Job No. 603/1968.
- vi. Further photography was also obtained from International Aviation Services, which covered the north western portions of Pretoria and was flown at a scale of 1:20 000 in 2001.
- vii. A copy of the topo-cadastral drawing of the site, entitled "Proposed Platinum Park Township" prepared by Plan Africa Town and Regional Planners.

From the aerial photographs obtained, stereographic aerial photo interpretation (API) was undertaken by means of a Wild Stereoscopic API unit. Geological boundaries, soil facet boundaries, as well as drainage lines and cultural features were identified within the areas to be investigated. This information, together with all data obtained during the literature survey was collated onto an appropriate map at a scale of 1:5000.

#### 2.1.2 *Field Work*

Following numerous delays beyond the control of Africa Exposed, permission was obtained to proceed with the field work on 20<sup>th</sup> June 2003, and on 25<sup>th</sup> June a walk over site visit was conducted. The purpose was to become familiarised with the boundaries of the site, and also to collate and complete field proofing of data obtained from the aerial photographs.

On 27<sup>th</sup> June 2003, sixteen test pits were excavated by means of a CAT 428 TLB, provided by T.J. Potgieter Plant Hire. The holes were excavated to the limit of reach of the machine, or to refusal, at positions previously determined from the API. The layout of the test pits are shown on the Geotechnical Site Plan in Appendix 5. Each hole was profiled by an engineering geologist according to the Jennings, Brink and Williams<sup>2</sup> system and sampled as necessary. The detailed profile logs are shown in Appendix 2.



### 2.1.3 Office and Laboratory Work

From the soil samples recovered, fifteen disturbed samples were selected for Foundation and Road Indicator Tests, and three undisturbed samples were recovered to determine the collapse potential and consolidation characteristics of the soils.

All the individual test results are included in Appendix 3 of this report.

## 2.2 Site Description

The site, extending approximately 2000m along its north south axis and approximately 500m wide covers a surface area of some 80.4ha. The site is located in Klerksoord, Akasia within the Tshwane Metropolitan Council (see figure 1).

The area investigated is bound by the new Platinum Freeway and the main Pretoria to Soshanguve railway line in the south and is divided into two almost equal portions by the R 566 provincial road from Pretoria to Brits, which divide the site into a northern and southern half. The light industrial area of Klerksoord forms the western boundary, while the eastern boundary on the southern side is approximately defined by an unused and unnamed gravel road that is partially overgrown. The northern portion of the site is bound to the east by a surfaced road that provides access to the Akasia Municipal offices and stores. The northern boundary is clearly defined by the boundary fence to the Onderstepoort Nature Reserve.

The entire site is currently undeveloped and is covered by natural grasslands and small shrubs and trees, the more common species consisting of *Acacia karroo*, *A caffra* as well as species of the *Rhus* family.

Although undeveloped, services do traverse the site, with overhead 1kVa powerlines located along the northern boundary. The R 566 traverses the central portion, and a local stream that has been canalised crosses the southern third of the site from west to east. At the time of the site visit it was noted that a sewage servitude is located immediately north of the canal, and appears to run parallel to it.

## 2.3 Site Geology

From the available literature as well as the observations during the site investigation, it is evident that the site is underlain by norite and gabbro of the Main Zone of the Rustenburg Layered Suite, Bushveld Igneous Complex. Typically these rocks decompose in-situ forming a surface horizon of black, highly expansive clay known colloquially as "black turf", while this residual material may often be covered in a horizon of transported fine colluvial sand. The regional geology is shown in figure 2.

The investigation has revealed that the entire site is underlain uniformly by gabbro, and no structural feature were identified that will affect the geology.

As a result of deep and extensive chemical weathering, the rockmass has been reduced to residual silty sand and gravels at depth and active clayey soils close to the surface. By experience it is known that the depth of this material varies considerably and is usually underlain by residual gabbro, at depths that vary from approximately 1.0m to greater than 5m.



## 2.4 Hydrology

The average annual rainfall in this area is approximately 750 mm, most of which occurs as heavy, isolated thunder showers between October and March. Due to the extensive occurrence of relatively impermeable clay over large portions of the site, stormwater runoff will be primarily in the form of sheetwash.

The general slope of the site is at a gentle gradient of approximately 1% down towards the south east, and minor concentrations of runoff in shallow localised gullies will occur on the site. The flow of surface water will be towards the canalised gully, that traverses the southern portion of the site and forms the primary drainage feature. With the exception of the R566 road which has obviously affected stormwater drainage from the site, no other significant drainage features were identified.

At the time of the investigation it was noticed that a significant volume of water could be seen flowing across the site on the south eastern side. This water discharged into the canal, and was traced back to its source, which appears to be a major leak in a water pipe. Clearly the pipe has leaked for a significant period of time as well established reed beds have formed on the "stream" banks.

No ground water seepage was recorded in any of the test pits, however it must be borne in mind that the investigation was completed following a period of below average rainfall and it must be anticipated that seasonal fluctuations of the level of the perched water table may occur.

## 2.5 Observations

The test pits were excavated to an average depth of 2.7 m and refusal was encountered in nine test pits at an average depth of 2.5m.

The detailed description of the soils which blanket the site are summarised below.

### 2.5.1 *Transported Soils*

The entire site is blanketed by a layer of variable thickness of transported hillwash. The material was described as being reddish brown, medium dense, silty sand, that was up to 2.3m deep in the extreme southern and northern portions of the site. With increasing depth it was noted that the soil becomes ferruginised with many ferricrete nodules present within the soil structure.

The remainder of the site is characterised by a thin layer of hillwash that is on average some 0.3m thick. This material was described as was described as being dark grey to black, firm sandy clay which is rich in organic matter.

### 2.5.2 *Reworked Residual Gabbro*

With the exception of the extreme southern and north eastern portions of the site, the entire area is underlain by an extremely weathered and reworked residual gabbro. The soil is described as being dark grey to black, firm to stiff, shattered and slickensided sandy clay. Typically these soils are derived from the in-situ decomposition of the underlying basic igneous rock formations and are composed of between 30% and 60% clay, in which montmorillonite is the predominant and often only clay mineral. The high proportion of active clay present in the soil profile gives rise to a highly active material in which



significant heave and shrinkage movements are possible. This is borne out by the shattered and slickensided structure described as well as the deep desiccation cracks recorded in the upper portions of the soil profile .

**2.5.3 Residual Gabbro**

The residual gabbro soil which originates from the in-situ weathering of the parent rock underlies the entire site at an average depth of 2.0m. This material was generally described as a light yellowish brown, speckled silty and clayey sand that is of dense consistency. This material is generally inert, and the contact between this horizon and the overlying active clay is usually well defined and easily identified in the field.

**2.5.4 Gabbro Bedrock**

Completely to highly weathered gabbro bedrock was encountered in nine of the test pits excavated on the central portions of the site. The rock varies in hardness in relation to the degree of weathering and may vary from very soft rock to medium hard rock. The excavator used to dig the test pits was a CAT 428 TLB, and the machine refused at an average depth of 2.5m below current ground level.

A summary of the depth of refusal and soil conditions experienced in each test pit are presented in Table 1 below.

<b>TABLE 1. Summary of Test Pits</b>			
<b>Test Pit No.</b>	<b>Comments</b>	<b>Test Pit No.</b>	<b>Comments</b>
1	Easy dig at 2.4m in ferruginised sand. Hillwash	9	Refusal at 2.4m on medium hard rock Gabbro
2	Easy dig at 2.6m in firm sandy silt. Residual gabbro	10	Refusal at 2.3m on medium hard rock Gabbro
3	Limit of reach at 3.2m in firm clay. Reworked residual gabbro	11	Refusal at 2.9m on medium hard rock Gabbro
4	Limit of reach at 3.2m in dense silty sand. Residual gabbro	12	Refusal at 2.1m on medium hard rock Gabbro
5	Limit of reach at 3.1m in dense silty sand. Residual gabbro	13	Limit of reach at 3.0m in stiff sandy silt. Residual gabbro
6	Refusal at 2.9m on medium hard rock Gabbro	14	Refusal at 2.9m on soft rock Gabbro
7	Refusal at 2.3m on medium hard rock Gabbro	15	Refusal at 2.5m on very soft rock Gabbro
8	Refusal at 2.4m on soft rock Gabbro	16	Limit of reach at 3.4m in stiff sandy silt. Residual gabbro

**2.6 Laboratory and Field Test Results**

**2.6.1 Indicator testing**





For more accurate identification and classification purposes, Particle Size Distribution and Atterberg Limits Tests were carried out on representative samples of the various soil horizons present within the area. The results are shown in Appendix 3 of this report and are summarised in Table 2 below.

TP No.	Depth (m)	Material	PI (%)	PI (ws)	LS	Clay (%)	Activity
1	0.9-1.1	Silty fine sand. Hillwash	13	10	5.5	17	low
1	1.4-1.5	Silty fine sand. Hillwash	13	11	6	15	low
2	1.2-1.4	Silty and sandy clay. Colluvium	20	18	8.5	24	med
3	1.3-1.5	Shattered clay. Rew. Res. Gabbro	22	17	9	36	low/med
3	2.4-2.6	Shattered clay. Rew. Res. Gabbro	51	48	20	58	very high
4	3.0-3.2	Silty and clayey sand. Res. Gabbro	27	25	11.5	20	high
5	2.6-2.8	Silty and clayey sand. Res. Gabbro	28	26	11.5	15	med
7	2.0-2.2	Medium weathered soft rock. Gabbro	19	8	8.5	9	low
8	1.4-1.5	Silty and clayey sand. Res. Gabbro	38	37	15.5	59	high
8	2.2-2.3	Medium weathered soft rock. Gabbro	25	11	10.5	13	low
10	1.3-1.4	Shattered clay. Rew. Res. Gabbro	34	33	15.5	54	high
11	1.3-1.5	Shattered clay. Rew. Res. Gabbro	39	38	16	59	high
12	1.5-1.7	Silty and clayey sand. Res. Gabbro	44	7	19.5	8	low
13	1.8-2.0	Silty and. Hillwash	24	23	10.5	40	med/high
13	2.5-2.6	Sandy silt. Res. Gabbro	22	19	9.5	20	med

## 2.6.2

*Collapse Potential Testing*

In order to establish the consolidation characteristics of the transported hillwash and the reworked residual gabbro, undisturbed samples were retrieved from TP 1, 5 and 10 and were subjected to Single Oedometer tests. The results are summarised in table 3 below.

TP No	Depth	Material	Dry Density (kg/m <sup>3</sup> )	Moisture Content %	Co-efficient of Consolidation (Cc)
1	1.4-1.5	Silty sand. Hillwash	1381	15.9	0.235
5	2.6-2.8	Silty clayey sand. Residual Gabbro	1167	40.1	0.393
10	1.3-1.4	Shattered clay. Reworked Residual Gabbro	1644	19.1	0.241



### 3. INTERPRETIVE REPORT

#### 3.1 Geotechnical Mapping of Site.

In order to map the geotechnical characteristics of the underlying soils, the geotechnical classification method proposed by Partridge et.al (1993)<sup>3</sup> has been applied to this site. Table 4 shown below indicates the various geotechnical characteristics and the criteria used to evaluated the soils.

Based on the field appraisal the likely geotechnical properties of the soils which occur on the site have been mapped, and are shown below. These mapping zones are subject to confirmation on receipt of and complete analysis of the laboratory test results. The geotechnical zones which have been identified are shown on the Geotechnical Site Plan in Appendix 5.

**2A** Collapsible horizon greater that 750mm thick.

**3C** Greater than 15mm differential heave movement anticipated.

**2CF** 10 to 50% rock within 1.5m of the surface and 5 to 15mm differential heave movement anticipated.

**TABLE 4. Geotechnical Classification for Township Developments**  
(after Partridge et.al. 1993)

	PARAMETER	CLASS 1 (Most favourable)	CLASS 2 (Intermediate)	CLASS 3 (Least favourable)
A	Collapsible soil	Collapsible horizon <750mm thick	Collapsible horizon >750mm thick	
B	Seepage	Water table permanently deeper than 1.5m below surface	Permanent or seasonal water table within 1.5m of surface	Swamp and marshes
C	Active Soil	<2.5mm differential movement expected	2.5-15mm differential movement	>15mm differential movement expected
D	Highly Compressible Soil	<2.5mm differential movement expected	2.5 - 15 mm differential movement	>15mm differential movement expected
E	Erodible soil	Low	Moderately dispersive soils, fissured clay, thick colluvium.	Highly dispersive soil, fissured clay, thick colluvium
F	Difficulty of excavation to 1.5m depth	<10% rock or hardpan pedocretes	10-50% rock or hardpan pedocretes	>50% rock or hardpan pedocretes
G	Undermined ground	where depth of undermining is >100m in reasonably competent rock	Old undermined areas where slope closure has ceased	Where the depth of undermining is <100m
H	Instability in areas of soluble rock		Possibly unstable	Probably unstable
I	Steep slopes	Slope <6%	Slope 6-15%	Slope >15%
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk
K	Areas subject to seismic activity	100 year max probability of <5 Mod Mercalli intensity	100 year max probability of 5-8 Mod Mercalli intensity	100 year maximum probability of >8 Mod Mercalli intensity
L	Areas subject to flooding		Areas above 1:50 year flood line but with slope <1%	Areas below 1:50 year flood line



### 3.2 Design Solutions

For indicative purposes settlement calculations have been completed using the oedometer test results obtained from the site. These have been included in this report merely as an indicator of the magnitude of settlement that could be experienced by typical structures that may be constructed. For the purposes of determining the magnitude of the consolidation settlement that may be expected, it has been assumed that pad footings 1m x 1m in plan area and applying a maximum bearing pressure of 150kPa will be founded on the horizon tested. The results determined are presented in table 5 below:

Position	Material	Total Settlement (mm)
TP 1	Silty sand. Hillwash	120 to 130
TP 5	Silty clayey sand. Residual Gabbro	10 to 20
TP 10	Shattered clay. Reworked Residual Gabbro	40 to 50

#### 3.2.1 *Structures*

##### 3.2.1.1 **Geotechnical Zone 2A** (Collapsible and compressible horizon >750mm thick)

Potential founding solutions to the structures placed within geotechnical zone 2A are presented below.

- i. *Deep strip foundations.* In areas where inert residual gabbro or bedrock occurs within 1.5m of the surface, foundation trenches can be excavated through upper horizons to more competent material below. The soils within the upper 450mm below the surface bed must be removed and replaced in layers of 150mm, compacted to 93% Mod AASHTO density at -1% to +2% OMC. Foundation pressures are not to exceed 100kPa. Normal construction with sound site drainage may then be adopted.
- ii. *Soil raft.* Remove in situ materials to 1.0m beyond perimeter of building (ie. the foot print of the structure) to a depth of 1.5 times the widest foundation or to a competent horizon and replace with imported G 7 or better quality material, compacted to 93% Mod AASHTO density at -1% to +2% of OMC. Bearing capacity of the soil raft will depend on the quality of the soils used for raft construction. Normal construction may then be placed on the soil raft, with lightly reinforced strip footings.
- iii. *Concrete raft.* A concrete raft designed by a competent structural engineer to tolerate the anticipated settlement.
- iv. *Shallow piles.* Reinforced concrete ground beams or solid slabs on piled or pier foundations. Piles may be placed on the bedrock at an



average depth of 2.5m. The maximum allowable bearing capacity of the bedrock will be in the order of 500 kPa.

3.2.1.3

**Geotechnical Zones, 3C.**

*(Greater than 15mm differential heave movement anticipated.)*

Approximately 90% of the area investigated is underlain by reworked residual gabbro which have weathered to form active clay. The results of the indicator tests have shown that these soils are active, varying from medium to very high potential activity. Assuming an average thickness of 1.8m of highly active clay beneath the founding level of a structure, heave and shrinkage movements in the order of 50mm of total movement may be experienced. Development falling within geotechnical **Zone 3C** will therefore require special foundation design and typical foundation solutions are shown in Table 6 below.

<b>TABLE 6. Foundation design in Geotechnical Zone 3C.</b>	
<b>Construction Type</b>	<b>Foundation Design and Building Procedures</b>
Soil raft	Remove all or part of the expansive horizon to 1.0 m beyond the perimeter of the structure and replace with inert backfill, compacted to 93% Mod AASHTO. Normal construction with lightly reinforced strip footings and light reinforcement in masonry. <b>Drainage from the base of the excavation</b> Good site drainage.
Stiffened or cellular raft	To comply with recommendations of structural engineer
Piled Construction	Piled foundations designed to resist up lift by heaving clay. Placed at an average depth of 2.5m on residual gabbro or bedrock. Floor slabs suspended or on ground beams

3.2.1.3

**Geotechnical Zone 2CF**

*(10 to 50% rock within 1.5m of the surface and 5 to 15mm differential heave movement anticipated)*

Buildings placed completely on bedrock require no special precautions and standard strip footings may be used, and the maximum allowable bearing capacities in the order of 350kPa may be applied.

Should the footings straddle rock and soil, it is strongly recommended that the entire structure is placed on soil mattress due to the high risk of differential movement occurring. The rock should be removed to a minimum depth of 1.5m below the proposed founding level. A suitable G7 to G8 quality fill material should be placed in layers of 150mm, compacted to 93% Mod AASHTO at -1% to +2% OMC. The final two layers below the foundations should be compacted to 95% Mod AASHTO.

Articulation joints must be included in the superstructure of the building that will enable the structure to move along predetermined joints.

Alternatively the structure should be placed on a cellular raft designed to tolerate the anticipated movement.



### 3.2.2 Generalised Foundation Recommendations

Without detailed knowledge of the structures to be erected on the site, comments regarding the most appropriate foundation solutions have been based on representative types of structures usually found in such developments. The following table sets out some suggested foundation systems for the various types of structures, in relation to the general soil conditions.

It must be emphasised however that these suggestions are not detailed and it is essential that site specific investigations are conducted for individual structures.

**Table 7. Foundation Design Solutions**

Structure	Soil Facet	Foundation System
Double storey, brick under tile and commercial, educational, single and double storey brick under tile.	2A, 3C, 2CF	Either remove all active/collapsible material and found on non active/collapsible horizon below, use a soil mattress, concrete raft, or shallow piles.
Commercial and residential structures above 2 storeys.	2A, 3C, 2CF	Remove all active/collapsible material and found on non active/collapsible horizon below, use a soil mattress, concrete raft, or shallow piles.
Light industrial steel framed IBR clad structures	2A, 3C, 2CF	Either remove all active/collapsible material and found on non active/collapsible horizon below, or use a soil mattress, or use compacted foundation trenches.
Heavy industrial structures	2A, 3C, 2CF	Remove all active/collapsible soils and found on underlying dense to very dense residual material, usually found at a depth of between 1m to 2.5m below NGL

### 3.2.3 Roads and Terraces

The results of the indicator tests have been used to classify the in-situ soils to determine the suitability of this material for the construction of terraces and pavement layers. The results of the test are summarised in Appendix 3, and are shown in table 8 below. All the samples are classified as G10 as a result of the low Grading Modulus and high PI values, which exceed the 3xGM +10 rule.

As a general recommendation it is preferable to construct the proposed roads above the clay horizon as opposed to removing a portion of the expansive clay in a box cut. Placing a compacted inert fill into the cut generally introduces a more permeable material above the clay, thereby creating a "French drain", from which drainage becomes difficult. The resulting seasonal moisture fluctuations can cause the rapid deterioration of the pavement layers.

**Table 8. Summary of Test Results for Road and Earthworks**

Test Pit No	Depth (m)	Material	PI	LS	GM	CBR at 95%*	TRH 14 <sup>8</sup> Class
4	3.0-3.2	Silty and clayey sand. Res. Gabbro	27	11.5	0.57	3	G 10
5	2.6-2.8	Silty and clayey sand. Res. Gabbro	28	11.5	0.56	3	G 10
7	2.0-2.2	Medium weathered soft rock. Gabbro	19	8.5	1.58	16	G 10
8	2.2-2.3	Medium weathered soft rock. Gabbro	25	10.5	1.69	13	G 10
13	2.5-2.6	Sandy silt. Res. Gabbro	22	9.5	0.56	5	G 10

\* Results are inferred from empirical test data, see Appendix 4

Indications are that the silty and clayey sand of residual gabbro origin is not suitable for engineering purposes. The possible exception is the highly weathered very soft to soft rock gabbro which occurs at an average depth of 2.5m below NGL. The variability of the quality of the material and the depth at which it occurs probably precludes the development of a borrow pit on this site.

Suitable materials for use in the selected, sub-base and base coarse layers must be imported from a commercial source. The nearest commercial quarry, namely Canyon Rock is located immediately north of Rosslyn, some 10km from the proposed Platinum Park development. The quarry mines gabbro and norite, and appropriate information obtained from the quarry is presented in table 9 below.

**Table 9. Canyon Rock Quarry**

Contact person	Tel No.	Indicative prices delivered within 10km radius	
		Material Type	R/ton*
Canyon Rock Quarry	(012) 541-2029	Overburden (G7 quality)	R41.00 to R47.00
Graham McKieth (Sales manager)	(083) 259-7882	Crusher run	R52.00 to R58.00

\* SG of norite and gabbro is approximately 2.9 and loose bulk density approximately 1430kg/m<sup>3</sup>

### 3.2.4 Excavation Classification

In the zones marked as **2A** and **3C**, it is expected that the excavation class will be "soft" according to SABS 1200 D: Earthworks, up to a depth of 2.5m. It is anticipated that the excavation will be "intermediate" with possible blasting required for service trenches and deep foundations in the zone shown as **2CF**. Boulders and remnant core stones may also be encountered throughout the site, but particularly in zone **2CF**.



### 3.2.5 *Drainage and Buried Services*

Although perched water was not noted during the field work it must be anticipated that localised ground water seepage could be encountered in **zone 3C and 2CF** after periods of sustained rainfall. It is therefore recommended that standard damp proofing of structures is required, and all down pipes and surface stormwater drainage measures should be carefully considered.

Due to the active nature of the underlying soils it is recommended that the following precautions are implemented when designing the buried water bearing services:

- i. No plumbing and drainage should be placed under floor slabs as far as practicable.
- ii. The fall of all trenches should be directed away from buildings.
- iii. All service trenches should be located at least 1.5m away from buildings and should be backfilled with in situ materials to not less than 88% Mod AASHTO density.
- iv. Sewer and drain pipes and fittings should be provided with flexible joints.
- v. Water pipe entries into buildings should be provided with flexible piping to allow for movement.
- vi. Pipes through walls should be provided with sleeves to permit relative movement.

## 3.3 General

### 3.3.1 *Ground Water*

No ground water seepage was encountered on the site, however it must be anticipated that shallow ground water may occur in isolated areas throughout the site after periods of sustained rainfall. Appropriate precautions should therefore be implemented beneath all the structures and paved areas, as well as on any exposed excavated surfaces in the terraces.

### 3.3.2 *Stormwater Management*

It is strongly recommended that sound stormwater management is implemented around each building constructed on this site and it is suggested that the precautions presented below are considered to limit the amount of moisture reaching the foundation and thereby reducing the risk of settlement occurring.

- i. All water bearing services must be provided with flexible couplings where pipes enter the buildings.
- ii. A 1200mm wide apron paving must be provided around the perimeter of the structures. Joints between the paved areas and the walls of the buildings should be sealed with a flexible sealant to prevent moisture reaching the foundations.
- iii. Storm water management around the structures must facilitate the efficient disposal of excess water from the site.
- iv. No flower beds, garden taps, trees or down pipe discharge must be allowed adjacent to the structures, and must be placed as far away as possible.



### 3.4 Construction Problems

It must be anticipated that corestones and boulders may be encountered in the excavations, some "intermediate" class material may be encountered on the northern portions of the site.

Access and mobility on the site will be severely restricted after even limited periods of rainfall.

### 3.5 Additional Investigations

This investigation was completed for the purposes of phase I preliminary investigation, and whilst the site has been zoned and generalised foundation recommendations have been presented for typical structures that may be constructed on the site, the results contained in this report should not be used for site specific foundation design purposes. Additional detailed geotechnical investigations would be required for individual structures.

## 4. REFERENCES

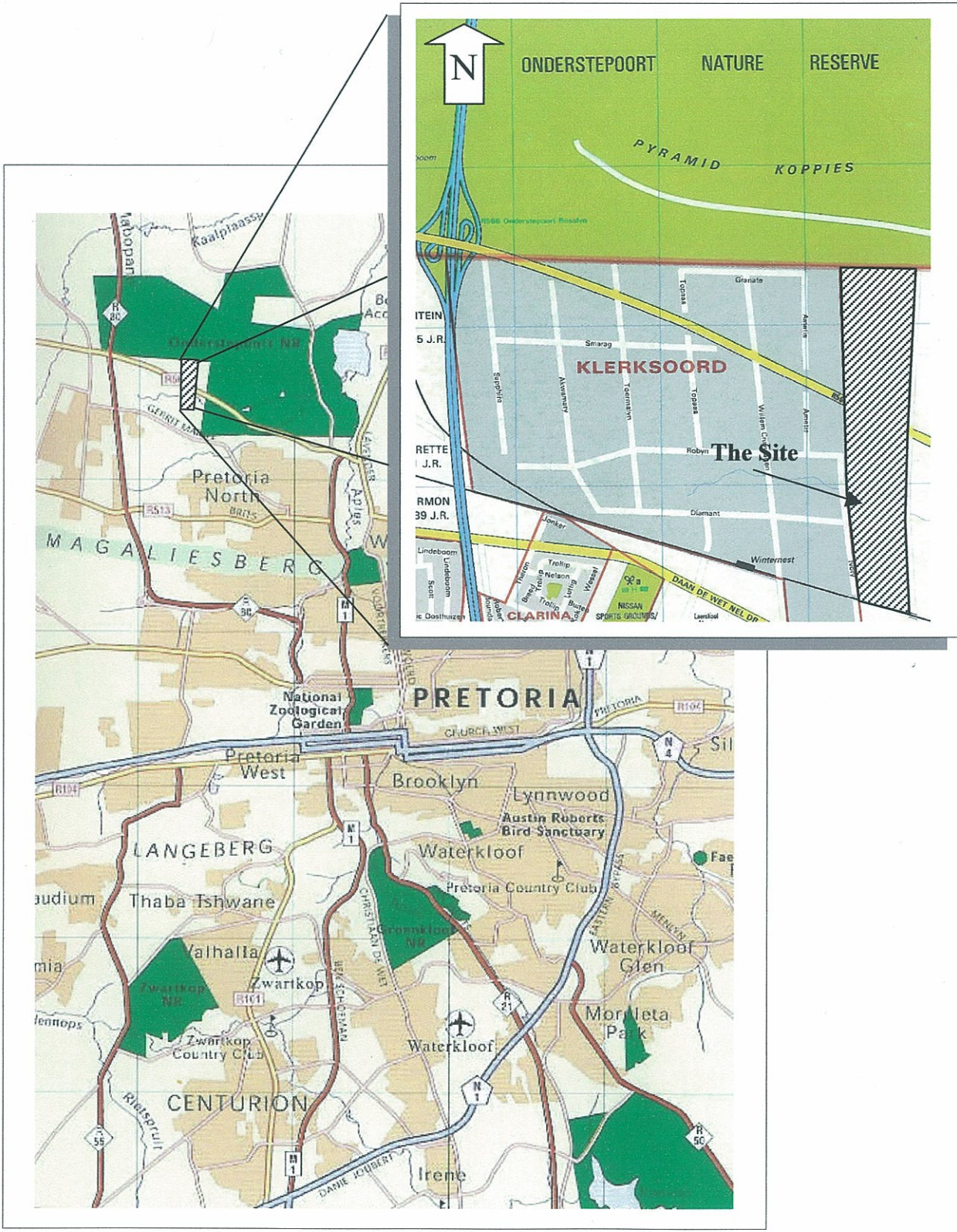
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**APPENDIX 1**

**LOCALITY AND REGIONAL GEOLOGY  
MAP**



Not Drawn To Scale



**AFRICA EXPOSED**  
Consulting Engineering Geologists

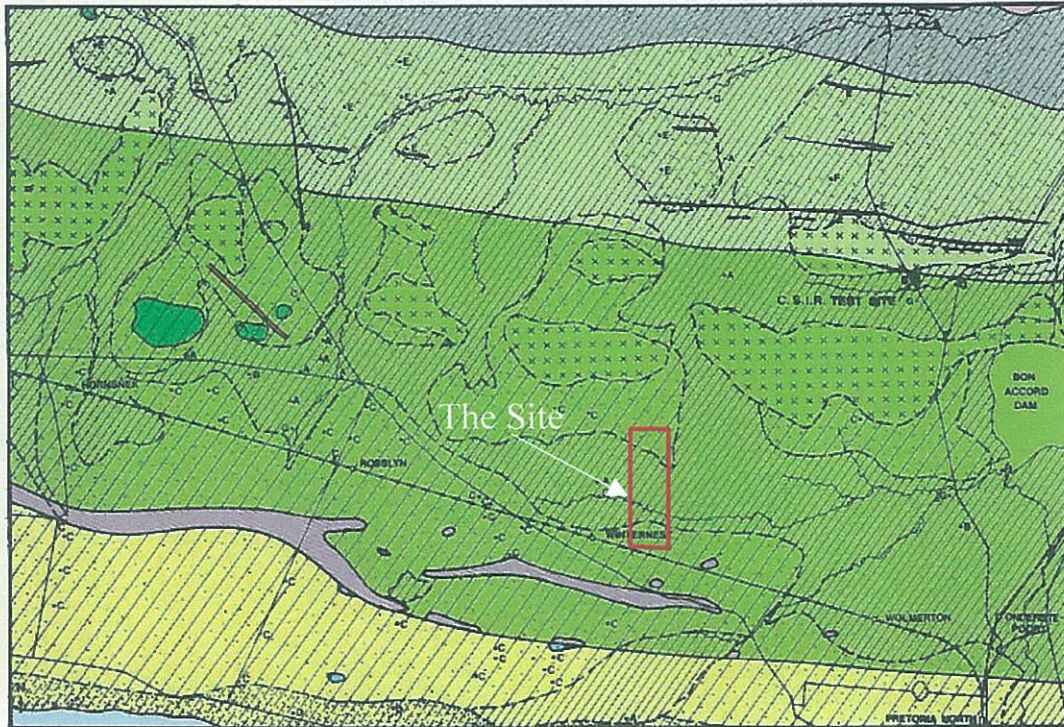
**BCHOD CONSULTING ENGINEERS**  
**PLATINUM PARK INDUSTRIAL PARK**  
**AKASIA.**

Job No: 2503

Date: July 2003

Locality Map

Figure: 1



**LEGEND OF SOIL PROFILES**

(Soil boundaries and most soil) Identifications of soil profile types taken from a map prepared by D.H. van der Merwe 1965)

- SOIL PROFILE TYPE A (black clay), WITH UNDIFFERENTIATED PATCHES OF TYPE B (black and grey clays in cloness) AND OF TYPE G (stevian)
- SOIL PROFILE TYPE C (reddish brown, sandy clay under thin hilwash cover)
- SOIL PROFILE TYPE D (reddish brown, clayey sand under thick hilwash cover) WITH UNDIFFERENTIATED PATCHES OF TYPE F (ferrocrite in gully-heads)
- SOIL PROFILE TYPE E (red sandy clay on ferrogabbro) WITH UNDIFFERENTIATED PATCHES OF TYPE F (ferrocrite in gully-heads)
- OUTCROP OF MAGIC ROCK WITH LITTLE OR NO SOIL COVER

**SEDIMENTARY ROCKS**

- Ecca Series sandstone and grit
- Swellierskop quartzite
- Mogaliesberg quartzite

**IGNEOUS ROCKS**

- Diabase
- Granophyre
- Hartzburgite, dunite and serpentine
- Ferrogabbro with magnetite bands
- Gabbro
- Norite
- Hybrid rocks

**Not Drawn To Scale**  
(from Brink 1979)



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**BCHOD CONSULTING ENGINEERS**  
**PLATINUM PARK INDUSTRIAL PARK**  
**AKASIA.**

Regional Geology Map

Job No: 2503

Date: July 2003

Figure: 2

**APPENDIX 2**

**TRIAL HOLE PROFILES**



# AFRICA EXPOSED

CONSULTING ENGINEERING GEOLOGISTS

P.O. Box 68 Honeydew, 2040

Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 1

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SILTY SAND: Dry, dark reddish brown, loose to medium dense, intact, silty fine sand with many roots. Hillwash
0.2			
0.4			SILTY SAND: Dry, reddish brown, medium dense, intact, silty fine sand with many roots. Hillwash
0.6			
0.8			
1.0	Disturbed sample at 0.9 - 1.1m		
1.2			
1.4	Undisturbed sample at 1.4 - 1.5m		
1.6			SILTY SAND WITH FERRICRETE: Dry, reddish brown, medium dense, intact, silty sand with many ferricrete nodules. Ferruginised Hillwash.
1.8			
2.0			
2.2			
2.4	EOH at 2.4m		

### NOTES

1. EOH easy dig of TLB at 2.4m.
2. No ground water seepage
3. Undisturbed sample taken at 1.4 to 1.5m
4. Disturbed sample taken at 0.9 to 1.1m

**HOLE No.: TP 1**

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

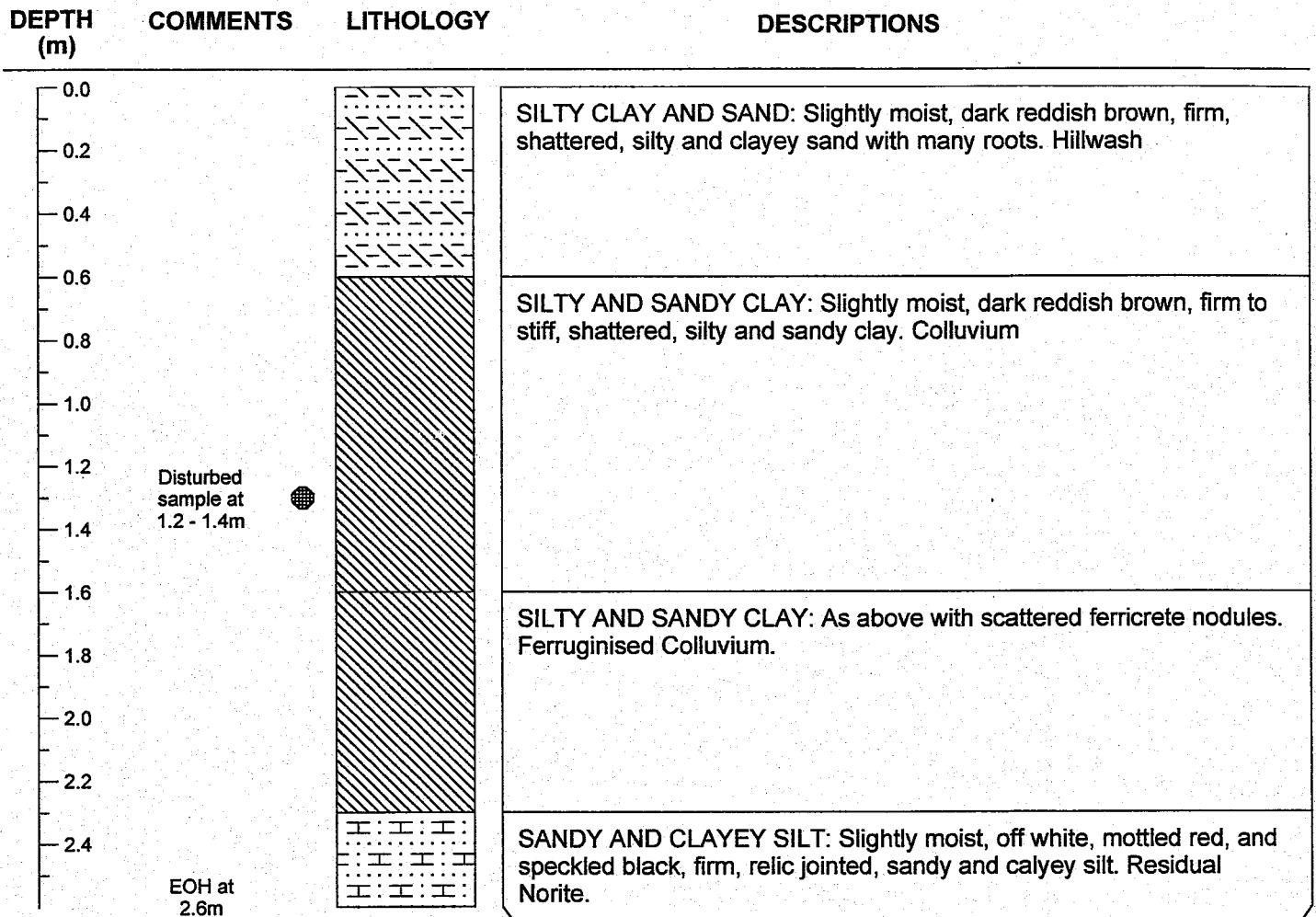
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 Tel: (011) 675-0292  
 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 2



**NOTES**

1. EOH easy dig of TLB at 2.6m.
2. No ground water seepage
3. Disturbed sample taken at 1.2 to 1.4m

**HOLE No.: TP 2**

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

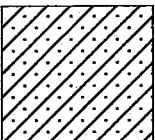
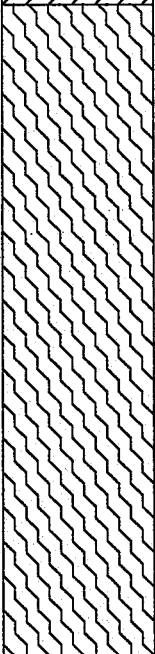


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 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 3

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4	Disturbed sample at 1.3 - 1.5m		
1.6			
1.8			
2.0			
2.2			
2.4	Disturbed sample at 2.4 - 2.6m		SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
2.6			
2.8			
3.0			
3.2	EOH at 3.2m		

**NOTES**

- EOH limit of reach of TLB at 3.2m.
- No ground water seepage
- Disturbed sample taken at 1.3 to 1.5m and at 2.4 to 2.6m

**HOLE No.: TP 3**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



# AFRICA EXPOSED

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 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 4

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.4			
0.6			
0.8			
1.0			SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
1.2			
1.4			
1.6			
1.8			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.0			
2.2			
2.4			
2.6			Disturbed sample at 3.0 - 3.2m
2.8			
3.0			
3.2			

**NOTES**

1. EOH limit of reach of TLB at 3.2m.
2. No ground water seepage
3. Disturbed sample taken at 3.0 to 3.2m
4. Numerous stone age and iron age atreifacts located in vicinity of TP

**HOLE No.: TP 4**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



**FBB Comments on Geotech Report as supplied by Messrs Africa Exposed**

- Soil generally poor quality for founding purposes
- The central-most portion of the site exhibits a thin layer of hillwash over reworked residual gabbro material to fairly large depths (>2.5m ave). This reworked residual gabbro material exhibits expansive to highly expansive characteristics with potential heave of >50mm being expected.
- The deep hillwash materials occurring near the Northern as well as on the Southern-most boundaries of the site exhibit large scale collapsible characteristics and as such must not, under any circumstances, be founded directly upon.

**Reworked Residual Gabbro – Expansive Clay Areas:**

- The topsoil/hillwash, whether with or without roots and no matter how thin a layer, must be removed beneath all proposed structures here.
- Bed rock depths vary considerably across the site, being situated deeper than 3m in the close proximity of the existing valley (near TH3 & TH4)
- Foundation types will vary according to usage, types of building and finishes envisaged as well as local bedrock depths, but would in all probability be of the following order:
  - **Single storey masonry buildings** – On reworked residual gabbro areas: RC raft foundations – if plan dimensions are excessive then will need to articulate buildings, but note must be taken of possible and probable differential movements between segments and the effects thereof- if this poses a problem then RC piles/piers with ground beams option req'd– deep strip footings could probably only be used in a small portion of the site where residual gabbro or the bedrock itself is encountered shallower than 1,5m from surface –Special note: May encounter problems with deep foundations half on rock and half on clay due to differential – see report.
  - **Double storey masonry structures** - On reworked residual gabbro: Will have to check feasibility of RC rafts vs suspended RC groundbeams and slabs on RC piles/piers on bedrock or other suitable profile. Note to be taken of differential movements between articulations if raft – deep strip footings could probably be used in only a small portion of the site where residual gabbro or the bedrock itself is found shallower than 1,5m from surface. Personally think RC Grnd beams/slabs on RC piles/piers/pods probably more suitable in this case.
  - **Light industrial with No brittle finishes or strict tolerance req'ments (ie IBR sheet covering)** – Found on residual gabbro material or rock with either RC Pad footings (if shallow ie say <2m) or RC piles/piers if deeper.
    - provide suspended ground floor slab with void beneath or maybe consider ground-bearing slab on thickened "biscuit", but must check with pavement guys and assess anticipated movements and confirm with client. Must allow adequate drainage if thickened "biscuit" option followed.
  - **Light industrial with brittle finishes or strict tolerance req'ments or heavy loadings** – Found on rock with either RC Pad footings (if shallow i.e. say <2m) or RC piles/piers if deeper.
    - Suspended RC groundbeams and ground floor slab
  - **Heavy industrial - All**– Found on rock with either RC Pad footings (if shallow i.e. say <2m) or RC piles/piers if deeper.
    - Suspended RC groundbeams and ground floor slab or soil replacement to suitable depth or soil stratum beneath surface beds

cont. next page.....

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**Deep Hillwash – Collapsible Silts:**

- This material exhibits excessive collapsible and resultant settlement tendencies and is found near the northern- and southern-most boundaries of the site.
- Bed rock depths vary considerably, being situated from 2 to over 3m deep in the northern part of the site. The rock depth was not determined in the southern-most part.
- Foundation types will vary according to usage, types of building and finishes envisaged, but would in all probability be of the following order:

- **Single storey masonry buildings**

- If residual gabbro or bedrock <1,5m from surface then use deep strip foundations with surface bed on "biscuit" of imported material
- If residual gabbro>1,5m deep consider RC piles/pods/piers down to "good" layer with either suspended RC ground floor slab or surface bed on thick "biscuit" noting possible future movements.
- Soil raft may be considered, but probably more expensive and quite tricky.
- Personally don't like idea of RC raft on this material due to possibility of tilting due to differential settlement

- **Double storey masonry structures -**

- If residual gabbro or bedrock <1,5m from surface then use deep strip foundations with surface bed on "biscuit" of imported material and check anticipated settlements.
- If residual gabbro>1,5m deep consider RC pods/piers down to "good" layer with either suspended RC ground floor slab or surface bed on thick "biscuit" noting possible future movements.
- Soil raft may be considered, but probably more expensive and quite tricky.
- Personally don't like idea of RC raft on this material due to possibility of tilting due to differential settlement

- **Light industrial with NO brittle finishes or strict tolerance req'ments (ie IBR sheet covering)** – Found on residual gabbro material or rock with either RC Pad footings if shallow (i.e. say <2m) or RC piles/piers if deeper.

- provide suspended ground floor slab on in-situ material as permanent shutter on condition that hillwash not underlain by expansive materials. Maybe consider ground-bearing slab on thickened "biscuit", but must check with pavement guys and assess anticipated movements and confirm with client

- **Light industrial with brittle finishes or strict tolerance req'ments or heavy loadings** – Found on rock with either RC Pad footings if shallow (i.e. say <2m) or RC piles/piers/pods if deeper.

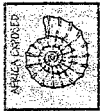
- Suspended RC groundbeams and ground floor slab

- **Heavy industrial - All**– Found on rock with either RC Pad footings if shallow (i.e. say <2m) or RC piles/piers/pods if deeper.

- Suspended RC groundbeams and ground floor slab or soil replacement to suitable depth or soil stratum beneath surface beds

*PS: 1 Note must be taken of fact that geotechnical report of general nature and more in-depth, localized investigation may be required for individual structures, especially if highly loaded or with high tolerances*

*2 Should, for the purposes of civil engineering roadworks (i.e. for heavy vehicular traffic), it be found necessary that any part of- or the whole area require soil replacement it may be more economical that structures be founded on the same.*



# AFRICA EXPOSED

CONSULTING ENGINEERING GEOLOGISTS

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 Tel: (011) 675-0292  
 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 5

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.4			
0.6			
0.8			
1.0			SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
1.2			
1.4			
1.6			
1.8			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.0			
2.2			
2.4			
2.6	Undisturbed sample at 2.6 - 2.8m		
2.8			
3.0	EOH at 3.1m		

**NOTES**

1. EOH limit of reach of TLB at 3.1m.
2. No ground water seepage
3. Undisturbed sample taken at 2.6 to 2.8m

**HOLE No.: TP 5**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



# AFRICA EXPOSED

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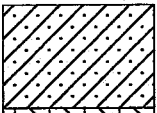
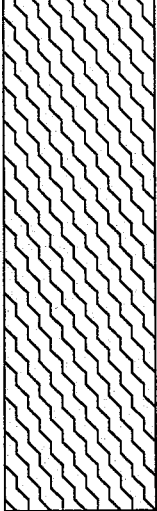
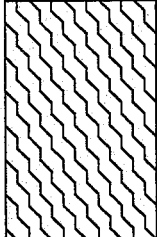
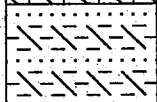
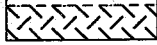
Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 6

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
2.2			
2.4			
2.6			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.8	EOH at 2.9m		GABBRO: Medium weathered, medium hard rock. Gabbro

### NOTES

1. EOH refusal of TLB at 2.9m.
2. No ground water seepage
3. No samples taken

**HOLE No.:** TP 6

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

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Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 7

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4			SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
1.6			
1.8			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.0	Disturbed sample at 2.0 - 2.2m EOH at 2.3m		GABBRO: Medium weathered, medium hard rock. Gabbro
2.2			

## NOTES

1. EOH refusal of TLB at 2.3m.
2. No ground water seepage
3. Disturbed sample taken at 2.0 to 2.2m

**HOLE No.:** TP 7

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

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Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 8

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			<b>SANDY CLAY:</b> Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			
0.6			<b>SHATTERED CLAY:</b> Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.8			
1.0			
1.2			
1.4	Disturbed sample at 1.4 - 1.5m		
1.6			<b>SHATTERED CLAY:</b> Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
1.8			
2.0			<b>SILTY CLAYEY SAND:</b> Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.2			
2.4	EOH at 2.4m		<b>GABBRO:</b> Medium weathered, medium hard rock. Gabbro

## NOTES

1. EOH refusal of TLB at 2.4m.
2. No ground water seepage
3. Disturbed sample taken at 1.4 to 1.5m

**HOLE No.: TP 8**

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

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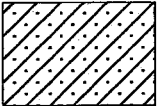
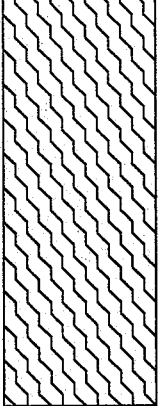
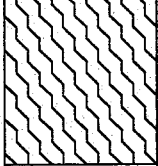
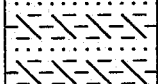

Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 9

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark grey to black, firm to stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			SHATTERED CLAY: Slightly moist, light grey, firm to stiff, shattered and slickensided, sandy clay, with occasional gravels. Reworked Residual Gabbro.
1.8			
2.0			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.2			
2.4	EOH at 2.4m		GABBRO: Medium weathered, medium hard rock. Gabbro

## NOTES

1. EOH refusal of TLB at 2.4m.
2. No ground water seepage
3. No samples taken
4. Deep dessication cracks extend to 1.0m depth

**HOLE No.: TP 9**

**JOB No.:** 2503

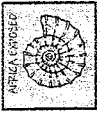
**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

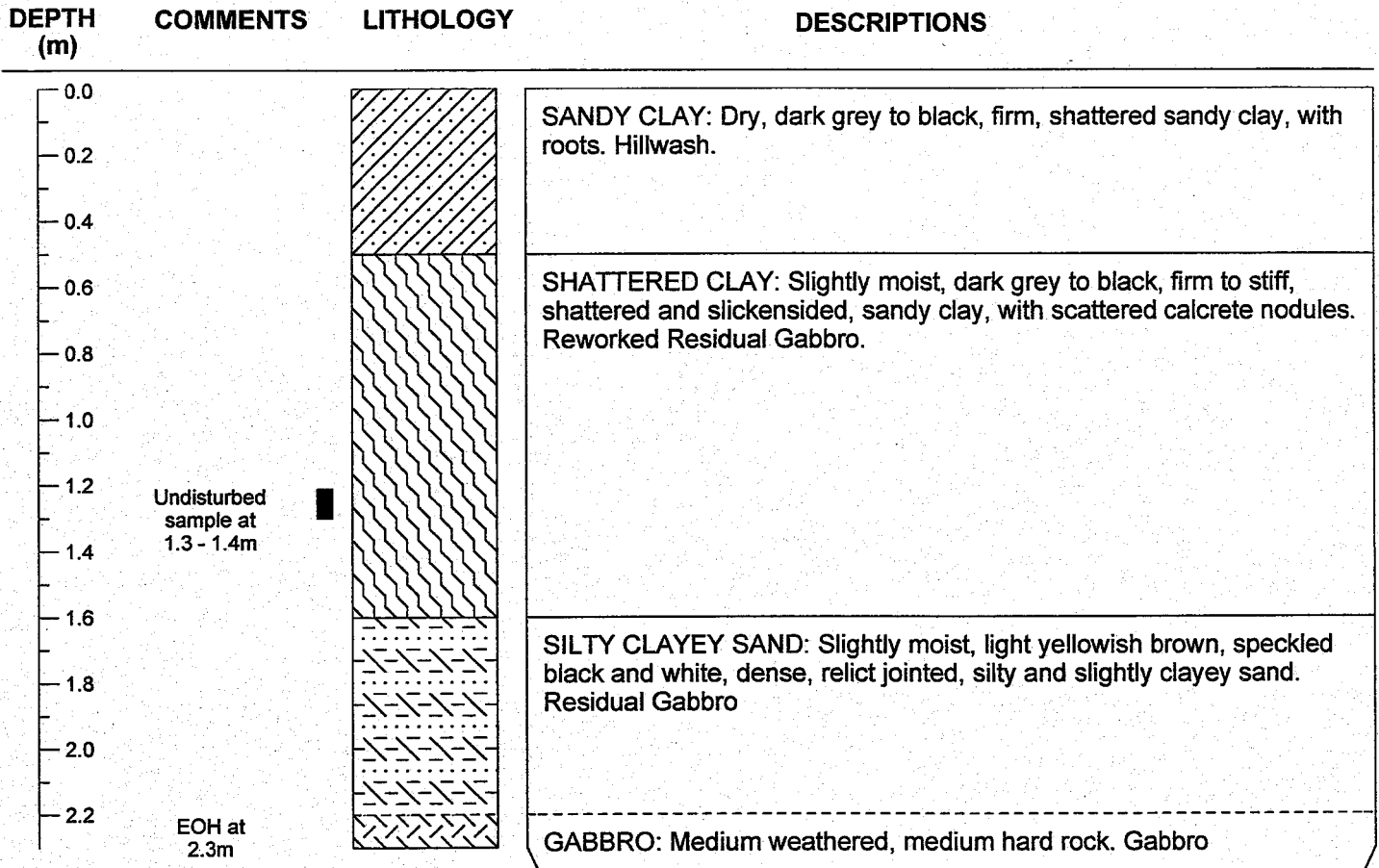
CONSULTING ENGINEERING GEOLOGISTS

P.O. Box 68 Honeydew 2040  
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 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 10



**NOTES**

1. EOH refusal of TLB at 2.3m.
2. No ground water seepage
3. Undisturbed sample taken at 1.3 to 1.4m

**HOLE No.: TP 10**

**JOB No.:** 2503

**DATE:** 27/6/03

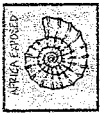
**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench





# AFRICA EXPOSED

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**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 11

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark olive brown, stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4	Disturbed sample at 1.3 - 1.5m		
1.6			SHATTERED CLAY: Slightly moist, dark olive brown speckled black and orange, stiff to very stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
1.8			
2.0			
2.2			
2.4			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.6			
2.8	EOH at 2.9m		GABBRO: Medium weathered, medium hard rock. Gabbro

**NOTES**

1. EOH refusal of TLB at 2.3m.
2. No ground water seepage
3. Disturbed sample taken at 1.3 to 1.5m

**HOLE No.: TP 11**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



# AFRICA EXPOSED

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 Tel: (011) 675-0292  
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**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 12

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			<b>SANDY CLAY:</b> Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			<b>SHATTERED CLAY:</b> Slightly moist, dark olive brown, stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.4			
0.6			
0.8			
1.0			
1.2			
1.4			<b>SILTY CLAYEY SAND:</b> Slightly moist, light yellowish brown, speckled black and white, very dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
1.6	Disturbed sample at 1.5 - 1.7m		
1.8			
2.0	EOH at 2.1m		<b>GABBRO:</b> Medium weathered, medium hard rock. Gabbro

**NOTES**

1. EOH refusal of TLB at 2.1m.
2. No ground water seepage
3. Disturbed sample taken at 1.5 to 1.7m

**HOLE No.: TP 12**

**JOB No.:** 2503

**DATE:** 27/6/03

**PROFILED BY:** J.A

**MACHINE:** CAT 428 TLB

**CONTRACTOR:** TJ Potgieter Plant Hire

**DIAMETER:** Trench



# AFRICA EXPOSED

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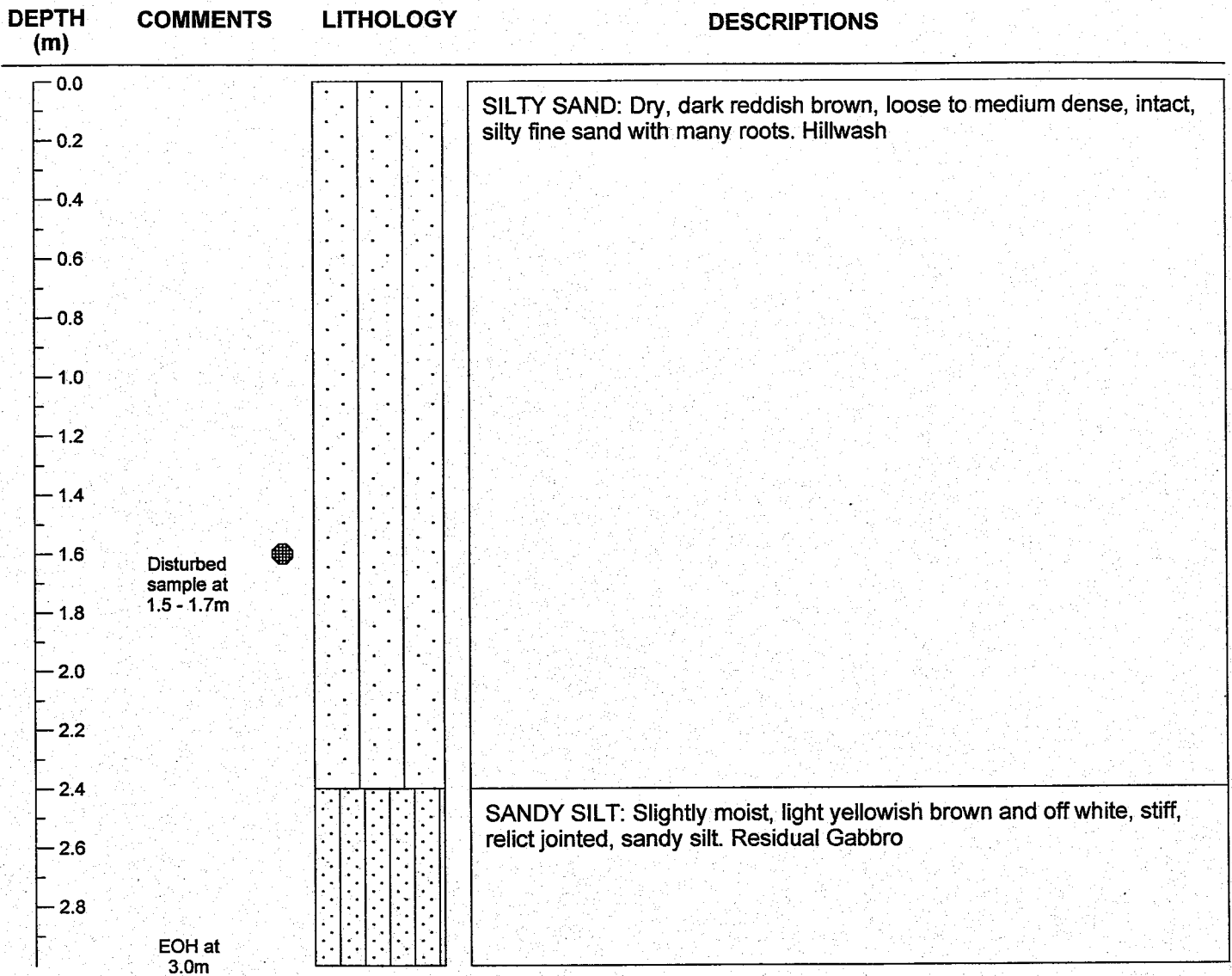
Tel: (011) 675-0292

Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 13

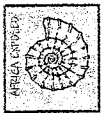


**NOTES**

1. EOH limit of reach of TLB at 3.0m.
2. No ground water seepage
3. Disturbed samples taken at 1.8 to 2.0m and at 2.5 to 2.6m

**HOLE No.: TP 13**

<b>JOB No.:</b> 2503	<b>MACHINE:</b> CAT 428 TLB
<b>DATE:</b> 27/6/03	<b>CONTRACTOR:</b> TJ Potgieter Plant Hire
<b>PROFILED BY:</b> J.A	<b>DIAMETER:</b> Trench



# AFRICA EXPOSED

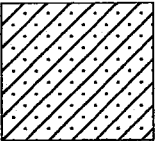
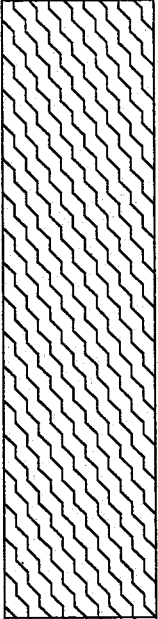


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**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 14

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			SANDY CLAY: Dry, dark grey to black, firm, shattered sandy clay, with roots. Hillwash.
0.2			
0.4			SHATTERED CLAY: Slightly moist, dark olive brown, stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			SHATTERED CLAY: Slightly moist, dark olive brown speckled black and orange, stiff to very stiff, shattered and slickensided, sandy clay, with scattered calcrete nodules. Reworked Residual Gabbro.
2.6			SILTY CLAYEY SAND: Slightly moist, light yellowish brown, speckled black and white, dense, relict jointed, silty and slightly clayey sand. Residual Gabbro
2.8	EOH at 2.9m		GABBRO: Medium weathered, soft rock. Gabbro

**NOTES**

1. EOH refusal of TLB at 2.9m.
2. No ground water seepage
3. No samples taken

**HOLE No.: TP 14**

**JOB No.:** 2503

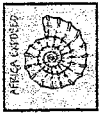
**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



# AFRICA EXPOSED

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**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 15

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS	
0.0			SILTY SAND: Dry, dark reddish brown, loose to medium dense, intact, silty fine sand with many roots. Hillwash	
0.2				
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6			SANDY SILT: Slightly moist, light yellowish brown and off white, stiff, relict jointed, sandy silt. Residual Gabbro	
1.8				
2.0				
2.2				
2.4				
	EOH at 2.5m			GABBRO: Highly weathered very soft rock Gabbro

**NOTES**

1. EOH hard dig of TLB at 2.5m.
2. No ground water seepage
3. No samples taken
4. Extensive isolated outcrops of gabbro bedrock in vicinity of TP

**HOLE No.: TP 15**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench



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CONSULTING ENGINEERING GEOLOGISTS

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 Fax: (011) 675-4159

**CLIENT:** BCHOD Consulting Engineers

**SITE:** Platinum Park

**HOLE No.:** TP 16

DEPTH (m)	COMMENTS	LITHOLOGY	DESCRIPTIONS
0.0			<p><b>SANDY CLAY:</b> Slightly moist, dark reddish brown, stiff, shattered and slickensided, slightly sandy clay, with occasional gravels roots. Hillwash.</p> <p><b>SANDY SILT:</b> Slightly moist, yellowish brown, mottled orange and brown, firm to stiff, relict jointed, sandy silt with occasional gravels. Residual Gabbro.</p>
0.2			
0.4			
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4	EOH at 3.4m		

**NOTES**

1. EOH limit of reach of TLB at 3.4m.
2. No ground water seepage
3. No samples taken

**HOLE No.: TP 16**

**JOB No.:** 2503

**MACHINE:** CAT 428 TLB

**DATE:** 27/6/03

**CONTRACTOR:** TJ Potgieter Plant Hire

**PROFILED BY:** J.A

**DIAMETER:** Trench

**APPENDIX 3**

**LABORATORY TEST RESULTS**

# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0001	+ ———	TP1	0.9-1.1m	
0002	□ - - - - -	TP1	1.4-1.5m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +				100	96	95	77	73	62	53	49	30	20	17	% PASS +
% PASS □					100	99	86	82	72	61	56	31	19	15	% PASS □

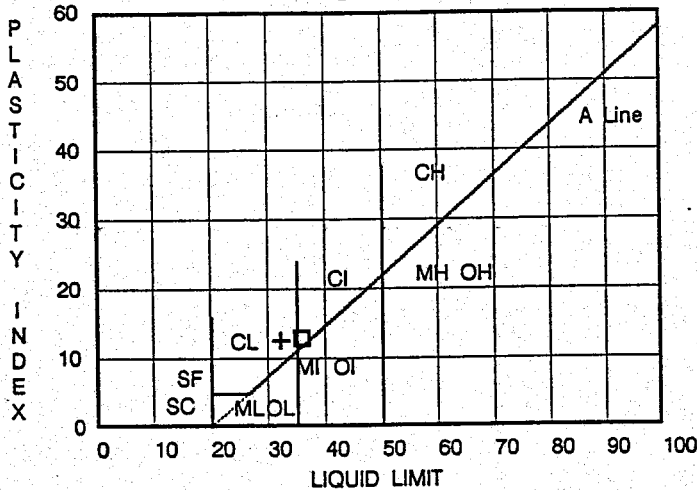
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
32	13	5,5	10	2,650
36	13	6,0	11	2,628

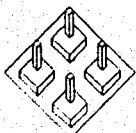
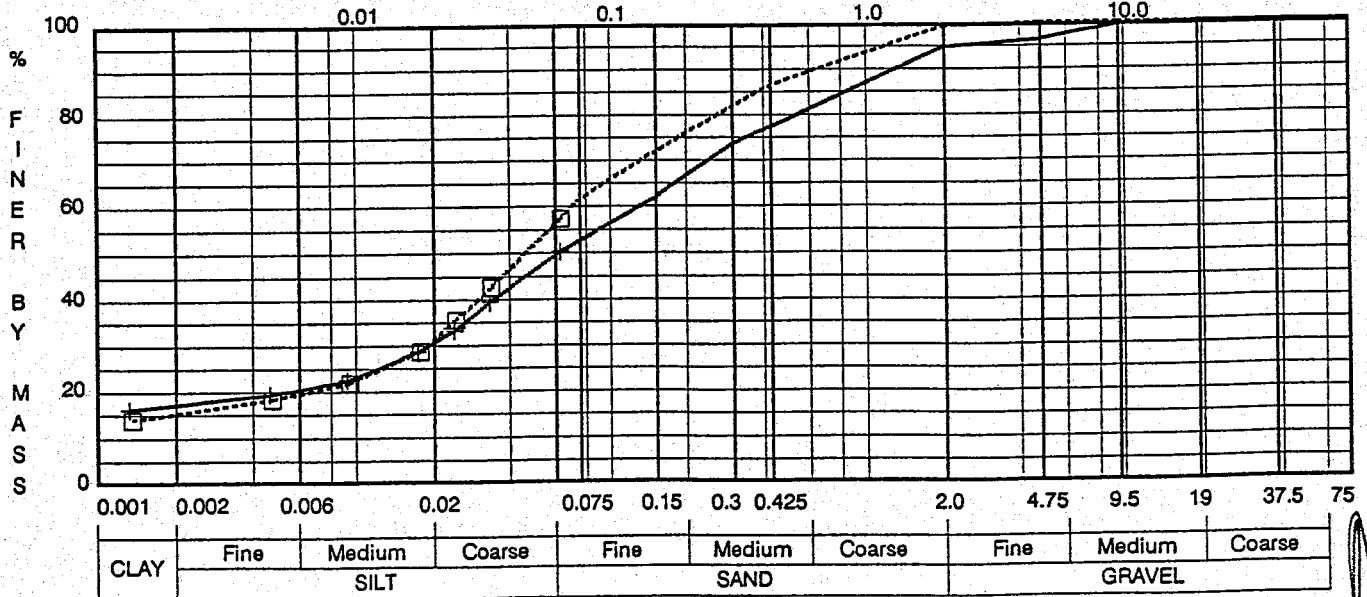
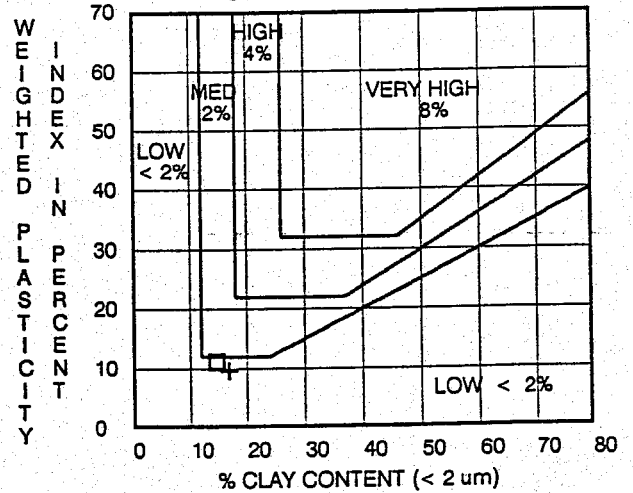
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m <sup>3</sup> )	NMC (%)

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



## MODIFIED VAN DER MERWE SWELL PREDICTION



**GEOPLAN LABORATORIES (Pty) Ltd**

REG No. 78/00337/07  
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# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

### SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0003	+ ———	TP2	1.2-1.4m	
0004	□ ······	TP3	1.3-1.5m	

### PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +						100	90	85	77	68	65	45	31	24	% PASS +
% PASS □					100	98	76	69	59	54	52	46	41	36	% PASS □

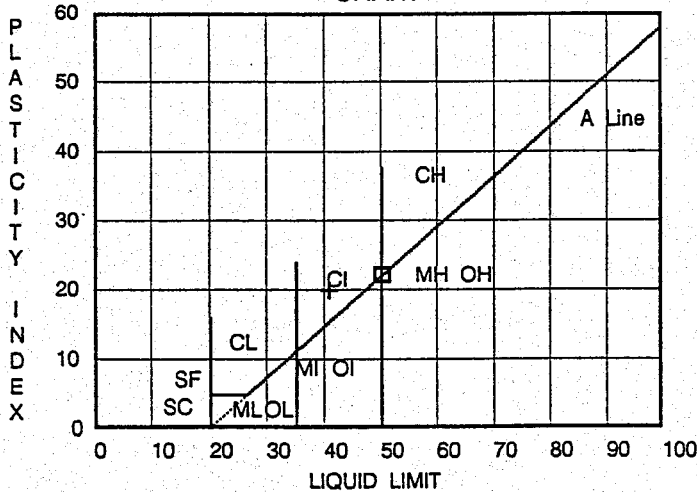
### DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
41	20	8,5	18	2,650
50	22	9,0	17	2,650

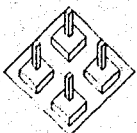
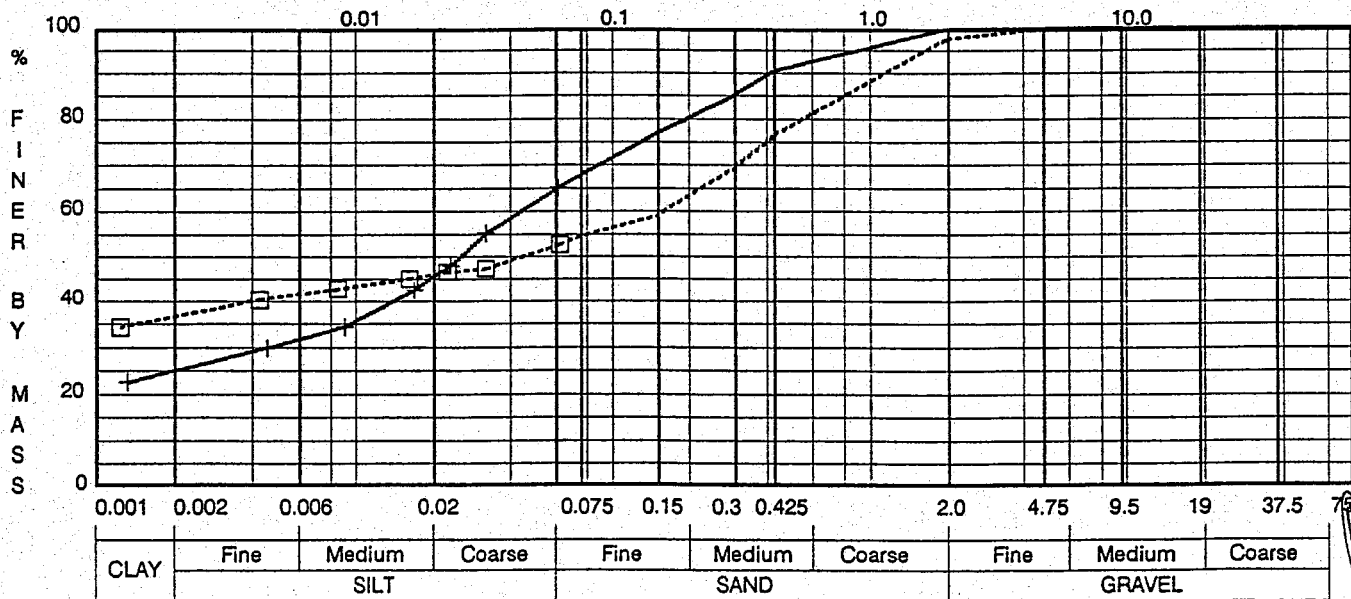
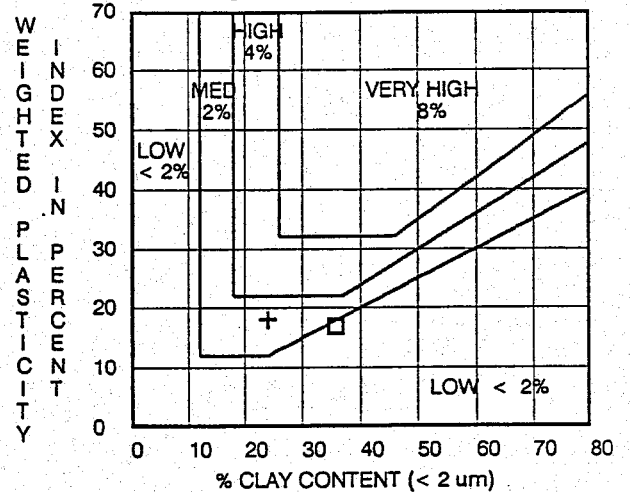
### UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)

### CASAGRANDE PLASTICITY CLASSIFICATION CHART



### MODIFIED VAN DER MERWE SWELL PREDICTION



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# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

### SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0005	+ ———	TP3	2.4-2.6m	
0006	□ ·····	TP4	3.0-3.2m	

### PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +						100	94	92	87	85	84	76	67	58	% PASS +
% PASS □					100	99	91	86	66	53	50	37	27	20	% PASS □

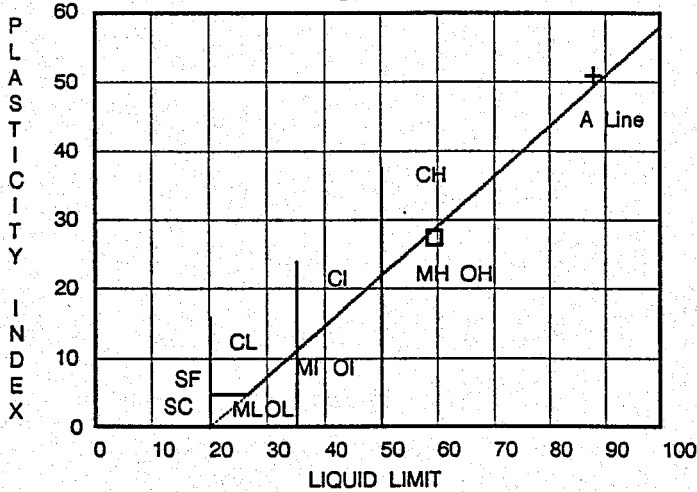
### DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
88	51	20.0	48	2,650
59	27	11.5	25	2,650

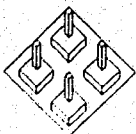
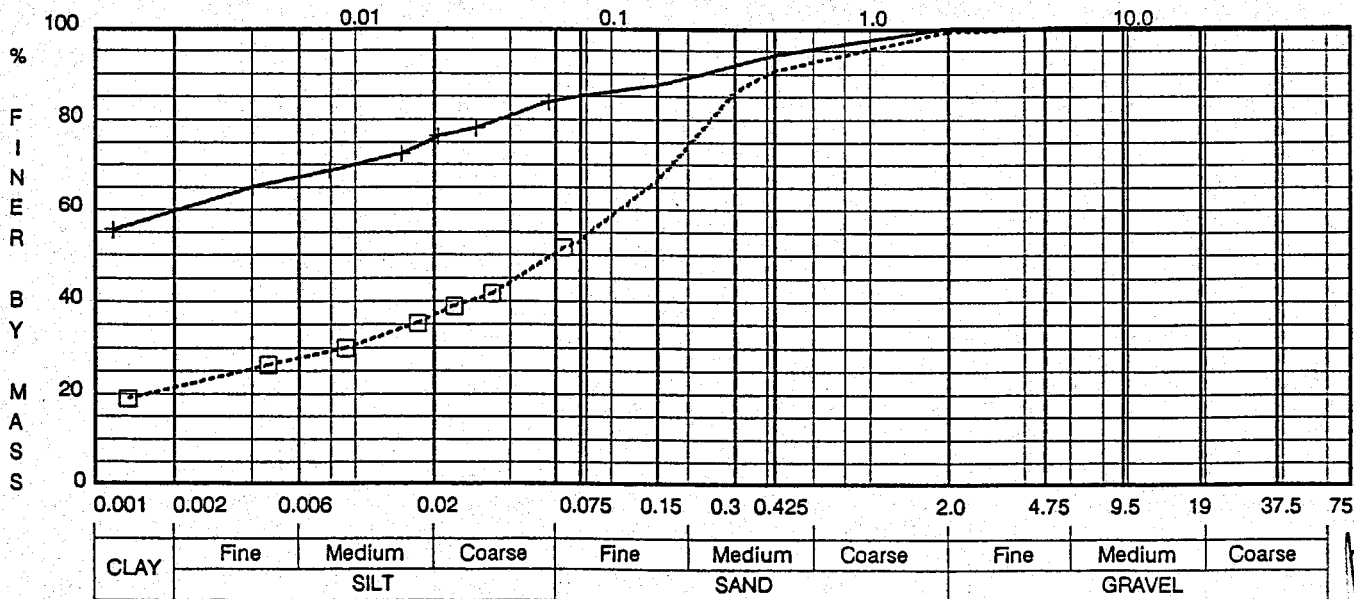
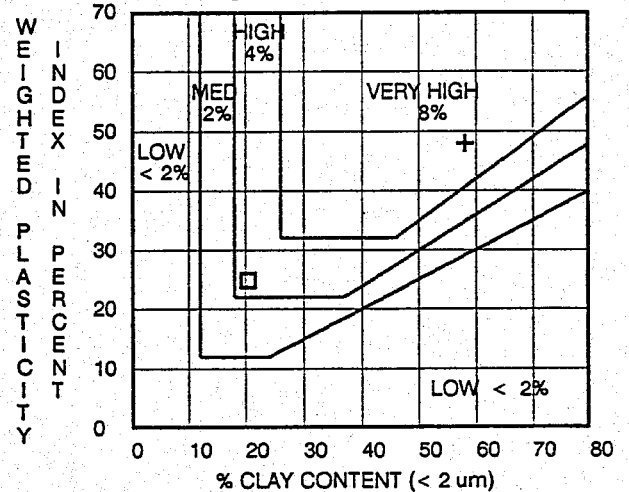
### UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)

### CASAGRANDE PLASTICITY CLASSIFICATION CHART



### MODIFIED VAN DER MERWE SWELL PREDICTION



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# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0007	+ ———	TP5	2.6-2.8m	
0008	□ ······	TP7	2.0-2.2m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +						100	94	85	65	50	45	30	21	15	% PASS +
% PASS □				100	98	72	40	37	34	30	27	16	11	9	% PASS □

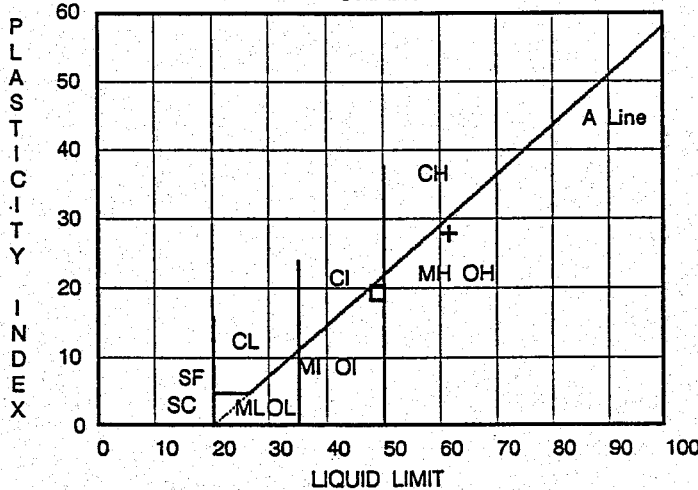
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
62	28	11,5	26	2,630
49	19	8,5	8	2,650

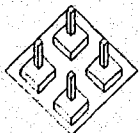
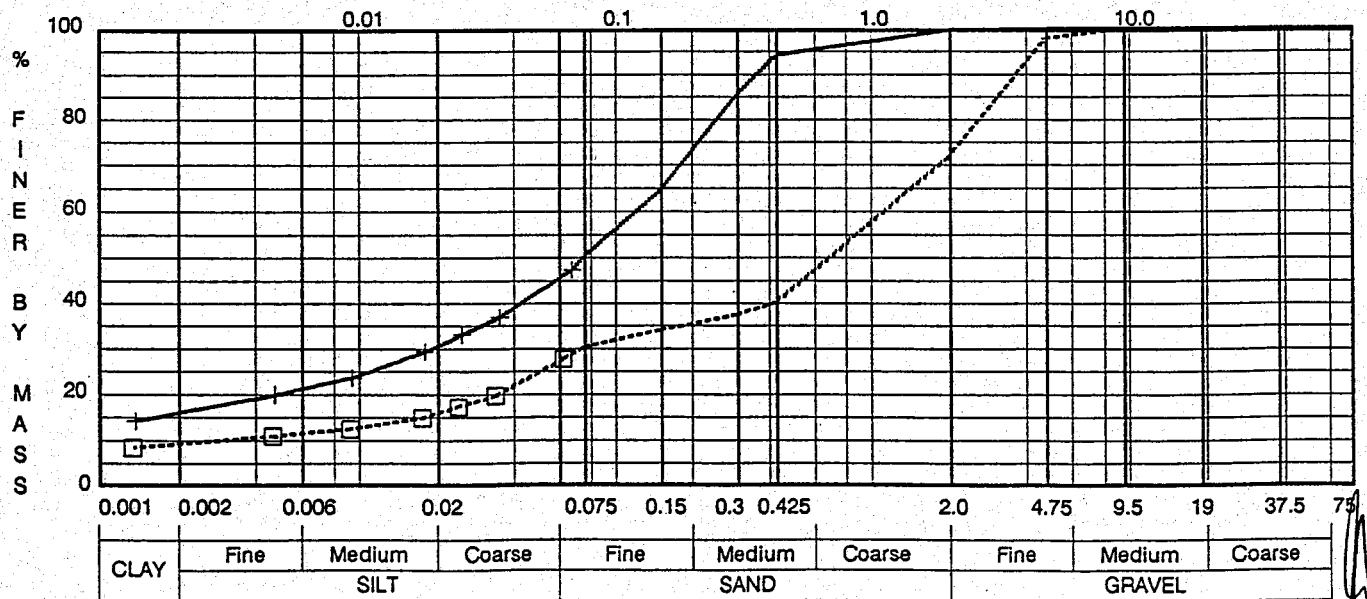
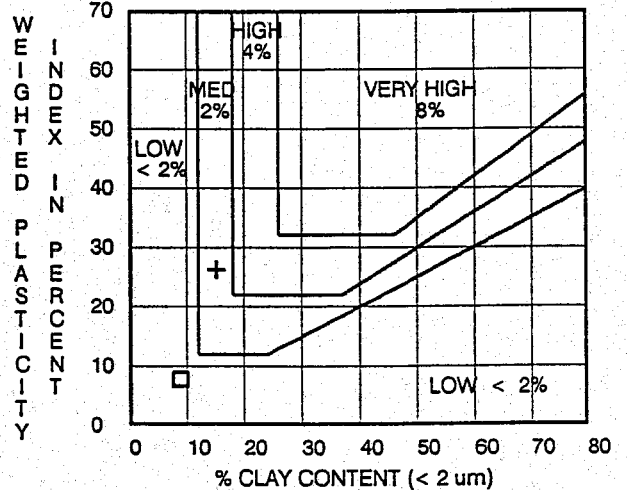
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



## MODIFIED VAN DER MERWE SWELL PREDICTION



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# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0009	+ ———	TP8	1.4-1.5m	
0010	□ ·····	TP8	2.2-2.3m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +			100	99	99	98	96	93	91	88	86	77	66	59	% PASS +
% PASS □		100	82	77	72	63	43	39	31	25	24	20	16	13	% PASS □

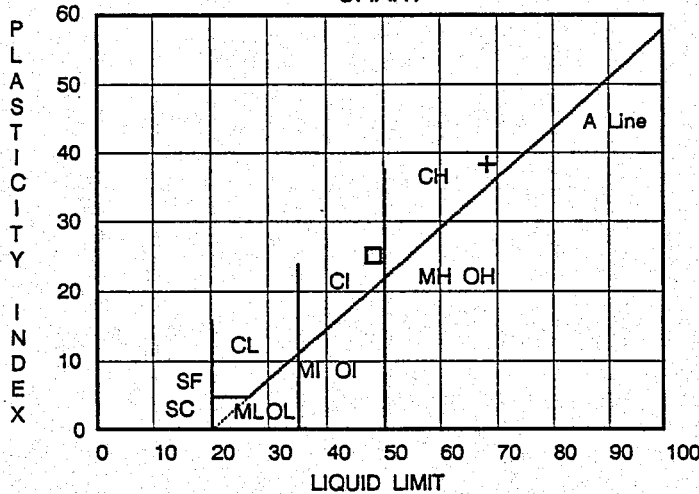
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
68	38	15,5	37	2,650
48	25	10,5	11	2,650

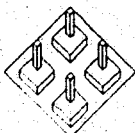
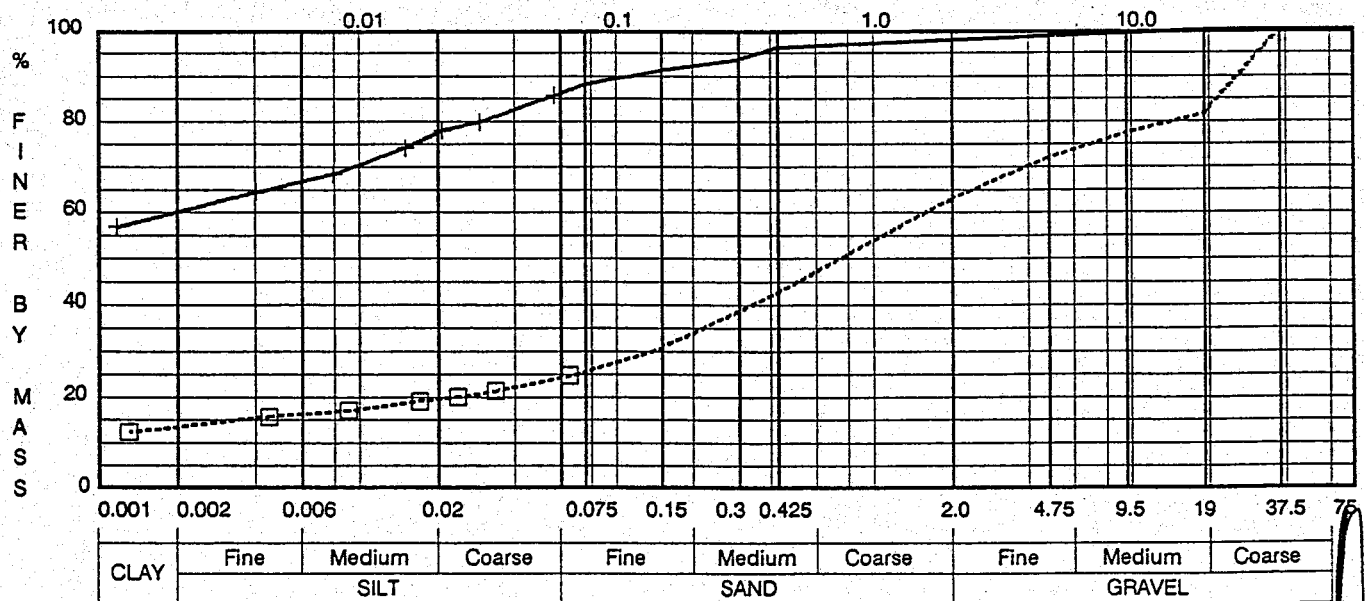
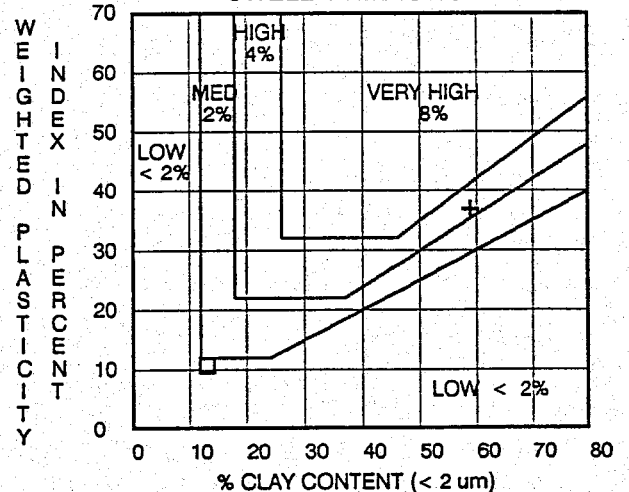
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



## MODIFIED VAN DER MERWE SWELL PREDICTION



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REG No. 78/00337/07

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 11/07

# FOUNDATION INDICATOR REPORT SHEET

CLIENT : AFRICA EXPOSED  
 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0011	+ ———	TP10	1.3-1.4m	
0012	□ ·····	TP11	1.3-1.5m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +						100	98	96	92	89	87	73	66	54	% PASS +
% PASS □					100	99	98	96	94	90	88	80	71	59	% PASS □

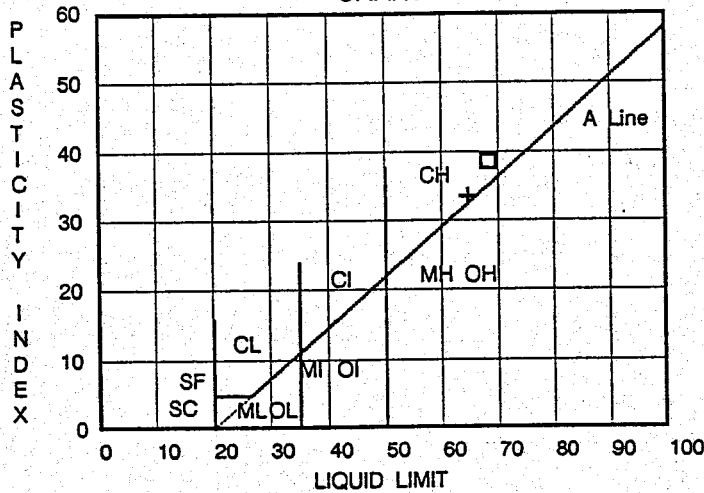
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
65	34	15.5	33	2.631
68	39	16.0	38	2.650

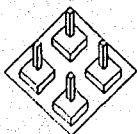
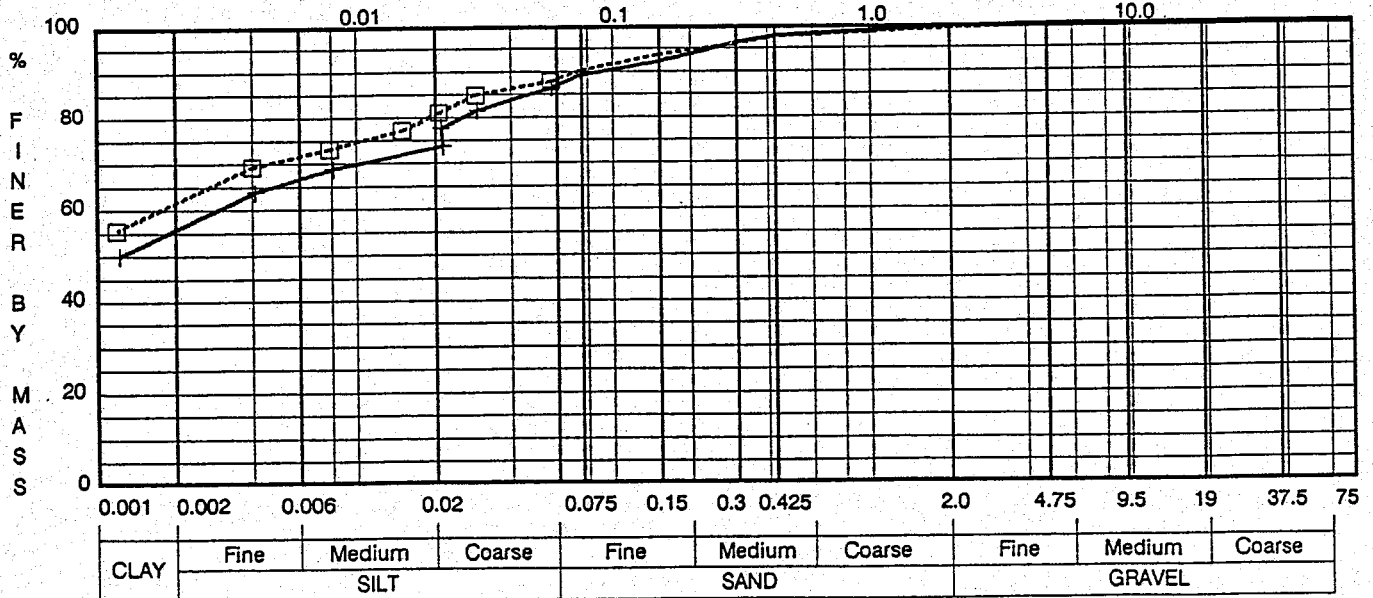
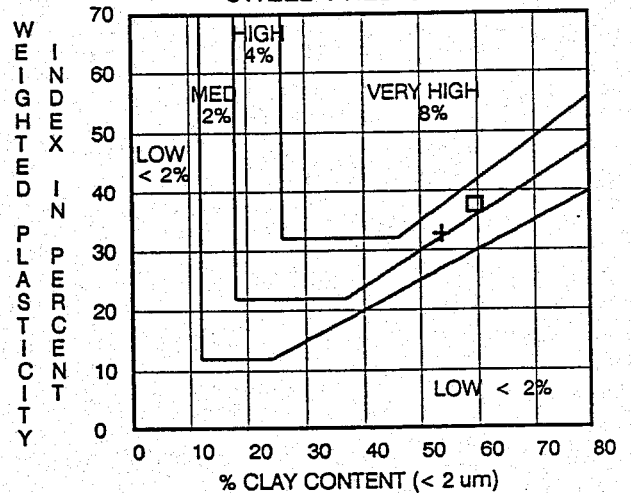
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



## MODIFIED VAN DER MERWE SWELL PREDICTION



**GEOPLAN LABORATORIES (Pty) Ltd**

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 INDUSTRIA NORTH BOX 552, FLORIDA 1710

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DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0013	+ ———	TP12	1.5-1.7m	
0014	□ - - - - -	TP13	1.8-2.0m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +	100	94	61	45	38	28	16	16	14	13	12	11	9	8	% PASS +
% PASS □					100	98	96	95	90	85	80	62	49	40	% PASS □

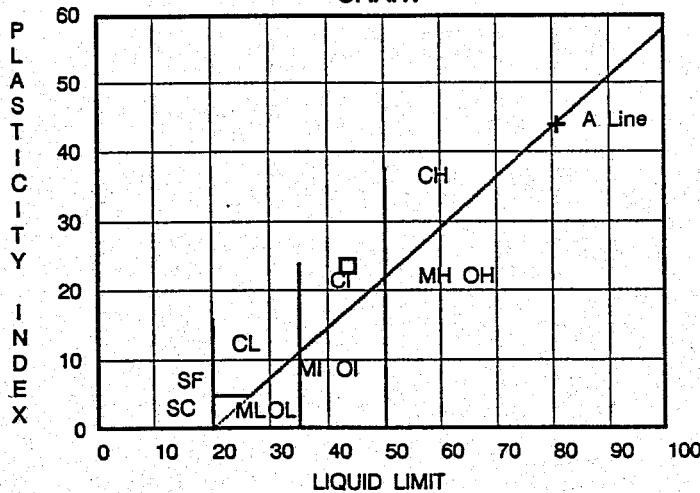
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
81	44	19,5	7	2,650
44	24	10,5	23	2,650

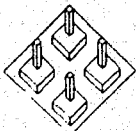
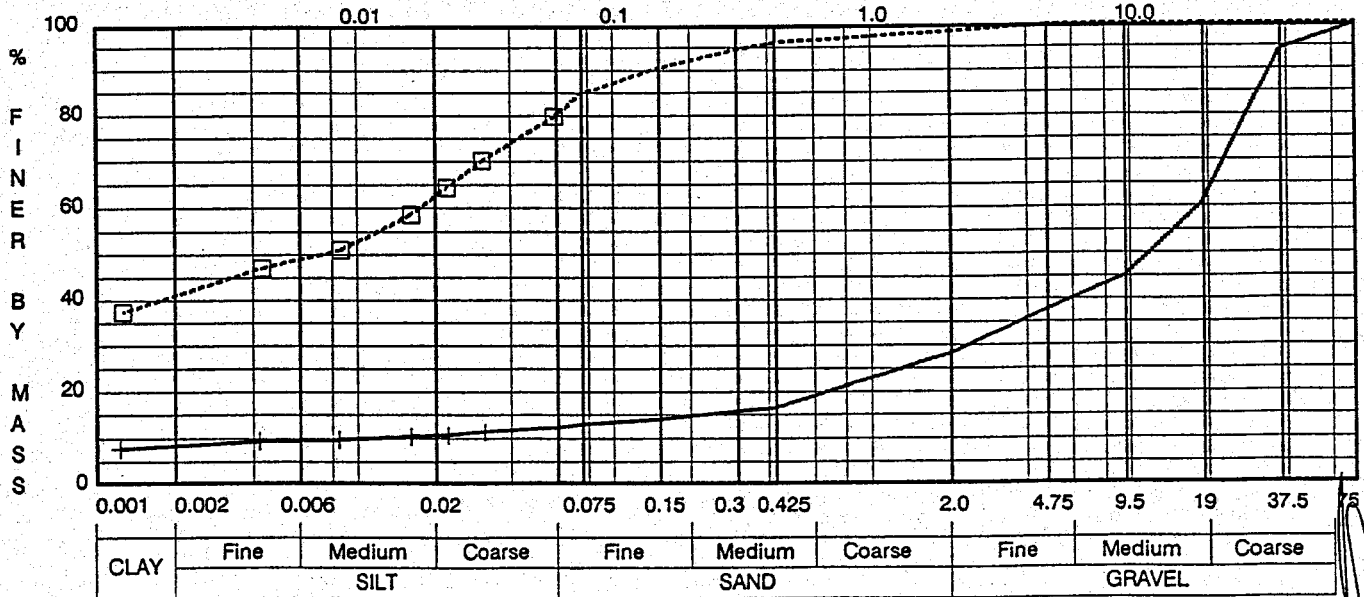
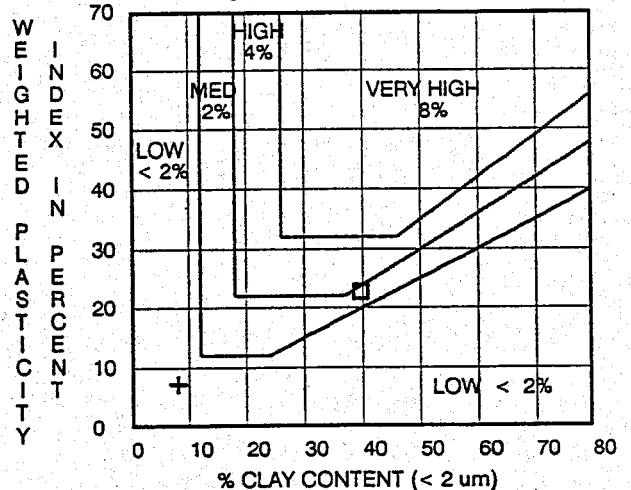
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)
	0,00		

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



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*Handwritten signature/initials*

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 PROJECT : PLATINUM PARK -2503

DATE : 03/07/10  
 PROJECT No. : AE12

## SAMPLE DETAILS

SAMPLE No.	CODES	TRIAL PIT No.	DEPTH	DESCRIPTION
0015	+ _____ □ _____	TP13	2.5-2.6m	

## PARTICLE SIZE ANALYSIS: PERCENTAGE PASS BY MASS

SIZE (mm)	BY SIEVING										BY HYDROMETER				DIAM (um)
	75.0	37.5	19.0	9.5	4.75	2.00	0.425	0.300	0.150	0.075	60	20	6	2	
% PASS +						100	87	83	69	57	54	38	28	20	% PASS +
% PASS □															% PASS □

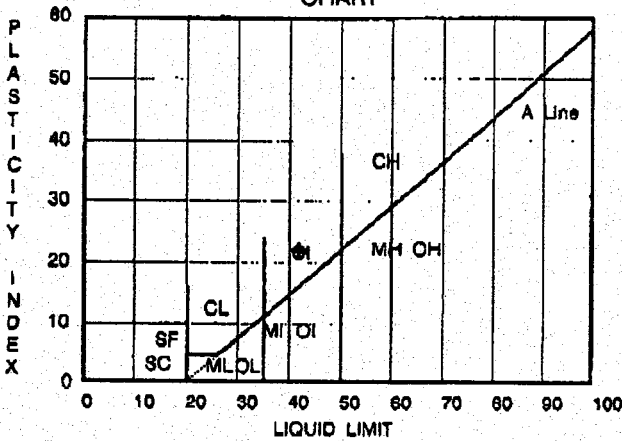
## DISTURBED SOIL PARAMETERS

ATTERBERG LIMITS				SG
LL (%)	PI (%)	LS (%)	WEIGHTED PI (%)	
42	22	9.5	18	2.650

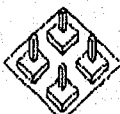
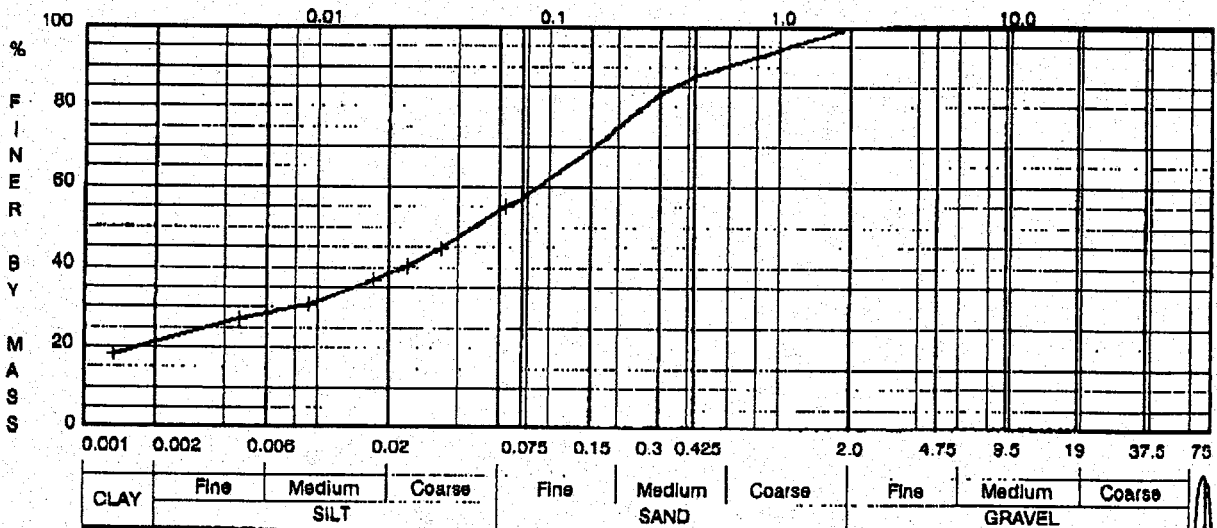
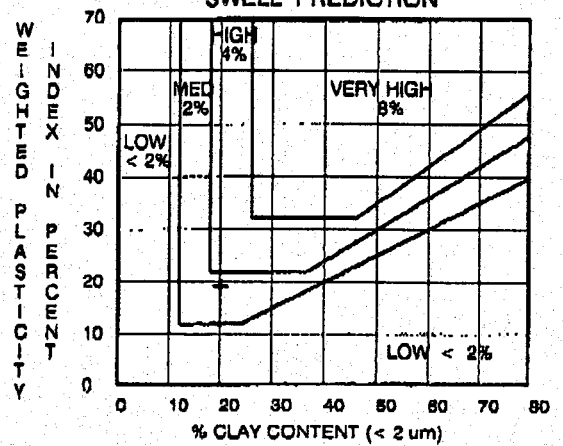
## UNDISTURBED SOIL PARAMETERS

VOIDS RATIO	SATURATION (%)	Dry Dens. (kg/m3)	NMC (%)
+ □			

## CASAGRANDE PLASTICITY CLASSIFICATION CHART



## MODIFIED VAN DER MERWE SWELL PREDICTION



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*[Handwritten signature]*

# Consolidation Test / Konsolidasie Toets

Client : AFRICA EXPOSED  
 Project : PLATINUM PARK -2503  
 Prj. No. : AE12  
 14-Jul-03

Sample No. 0002  
 Test Pit 1

Depth : 1.4-1.5m

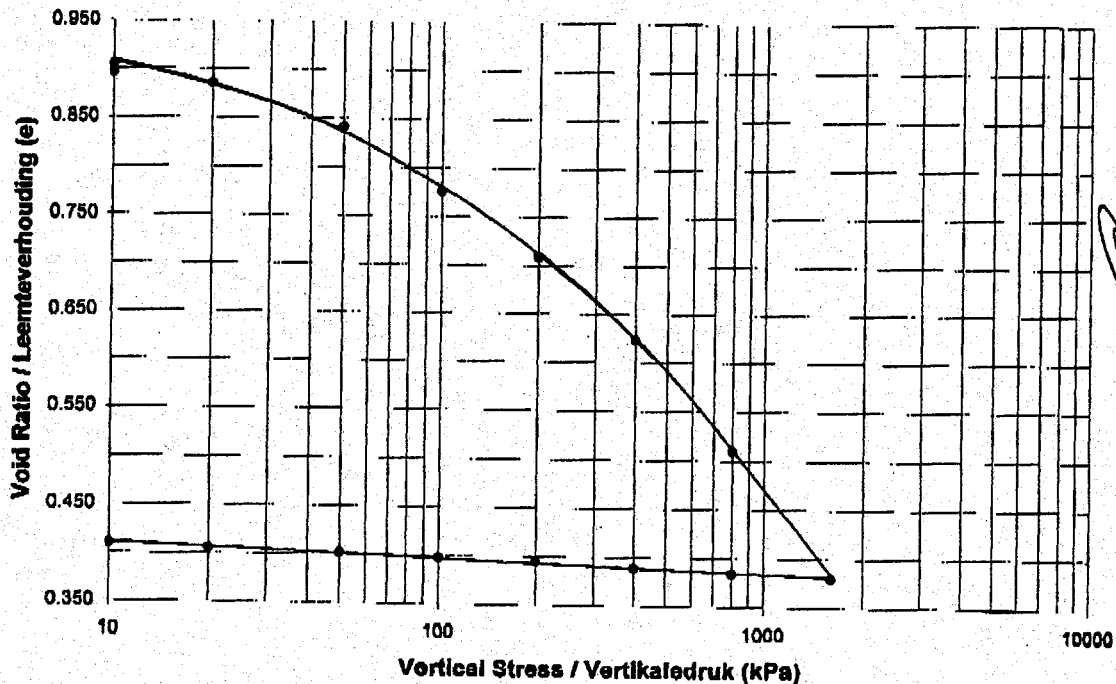
### Sample Parameters

Machine	WF3	Mass of Ring + wet sample (start of test)	252.5 g
Ring No	WF3	Mass of Ring + dry sample	234.0 g
Ring Ht	19.04 mm	Mass of Ring + wet sample (end of test)	251.9 g
Ring Diam.	75.00 mm	Mass of ring	117.8 g
Ring Vol.	84.12 mm <sup>3</sup>	Dry Density	1.381
M/C at Start	15.9 %	M/C at End of Test	15.5 %
Sat. at Start	46.34 %	Sat. at End	100.2 %
Initial Void Ratio	0.903	S.G.	2.828
Initial Ht. of Voids	9.04 mm	Ht. Of Solids	10.00 mm

TEST WAS DONE ON A SPECIMEN PREPARED FROM AN UNDISTURBED SAMPLE AND SATURATED @ 10 kPa

### Test Parameters

V. Strs (kPa)	1	10	10	20	50	100	200	400	800	1600	800	400	200	100	50	20	10
Dial (u)	10000	9924	10004	9822	9384	8720	8046	7194	6058	4764	4808	4854	4914	4942	4982	5018	5086
Strain (%)		0.40	-0.02	0.93	3.24	6.72	10.26	14.74	20.70	27.50	27.28	27.03	26.71	26.57	26.36	26.17	25.91
Void Ratio	0.903	0.896	0.904	0.886	0.842	0.775	0.708	0.623	0.509	0.380	0.384	0.369	0.395	0.398	0.402	0.405	0.410
Cc		0.008		0.060	0.110	0.221	0.224	0.283	0.377	0.430	0.014	0.016	0.020	0.009	0.013	0.009	0.018
Mv (1/Mpa)		0.444		0.956	0.767	0.697	0.354	0.224	0.149	0.085	0.003	0.008	0.016	0.015	0.042	0.063	0.252



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# Consolidation Test / Konsolidasie Toets

Client : AFRICA EXPOSED  
 Project : PLATINUM PARK -2503  
 Prj. No. : AE12  
 14-Jul-03

Sample No. 0007  
 Test Pit 6

Depth : 2.0-2.8m

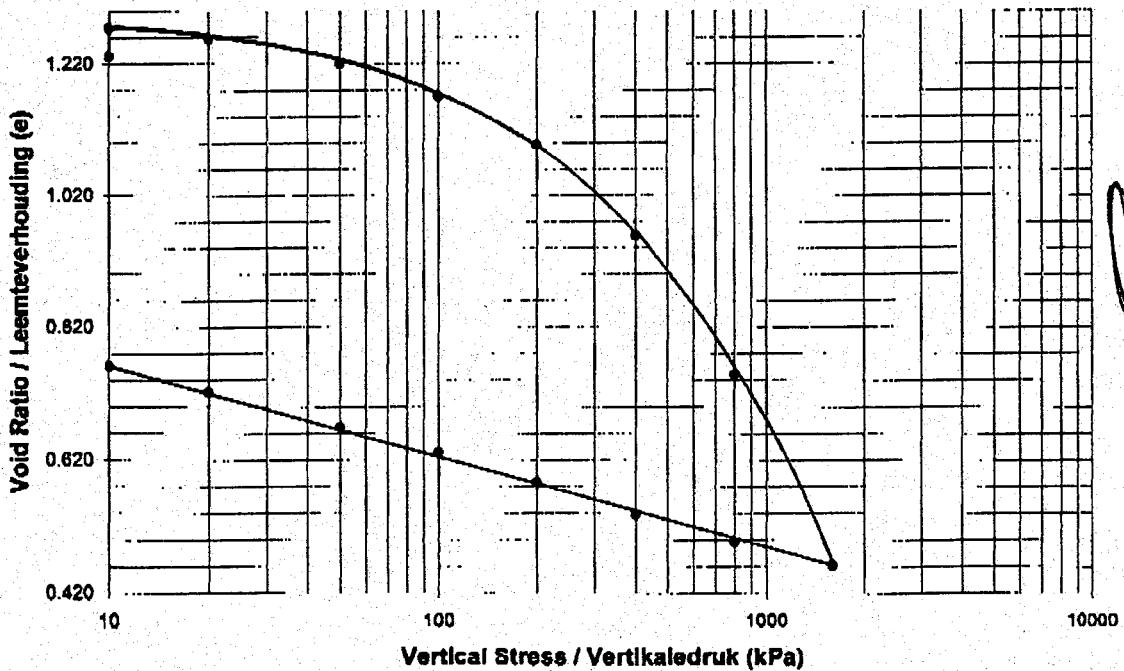
### Sample Parameters

Machine	WF4	Mass of Ring + wet sample (start of test)	255.2 g
Ring No	WF4	Mass of Ring + dry sample	215.9 g
Ring Ht	19.03 mm	Mass of Ring + wet sample (end of test)	242.9 g
Ring Diam.	75.00 mm	Mass of ring	117.8 g
Ring Vol.	84.07 mm <sup>3</sup>	Dry Density	1.167
M/C at Start	40.1 %	M/C at End of Test	27.5 %
Sat. at Start	84.0 %	Sat. at End	100.3 %
Initial Voids Ratio	1.254	S.G.	2.630
Initial Ht. of Voids	10.59 mm	Ht. Of Solids	8.44 mm

TEST WAS DONE ON A SPECIMEN PREPARED FROM AN UNDISTURBED SAMPLE AND SATURATED @ 10 kPa

### Test Parameters

V.Stress (kPa)	1	10	10	20	50	100	200	400	800	1600	800	400	200	100	50	20	10
Dial (u)	10000	9812	10164	10026	9710	9296	8664	7506	5720	3308	3608	3946	4360	4738	5062	5512	5836
Strain (%)		0.99	-0.86	-0.14	1.52	3.70	7.02	13.11	22.49	35.17	33.60	31.61	29.64	27.65	25.95	23.58	21.88
Void Ratio	1.254	1.232	1.274	1.257	1.220	1.171	1.098	0.959	0.747	0.461	0.497	0.537	0.586	0.631	0.669	0.723	0.761
Cc		0.022		0.054	0.084	0.163	0.249	0.456	0.703	0.949	0.117	0.134	0.163	0.149	0.127	0.134	0.127
Mv (1/Mpa)		1.098		0.725	0.554	0.435	0.332	0.304	0.235	0.158	0.020	0.045	0.109	0.199	0.341	0.788	1.703



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# Consolidation Test / Konsolidasie Toets

Client : AFRICA EXPOSED  
 Project : PLATINUM PARK -2503  
 Prj. No. : AE12  
 14-Jul-03

Sample No. 0011  
 Test Pit 10

Depth : 1.4-1.4m

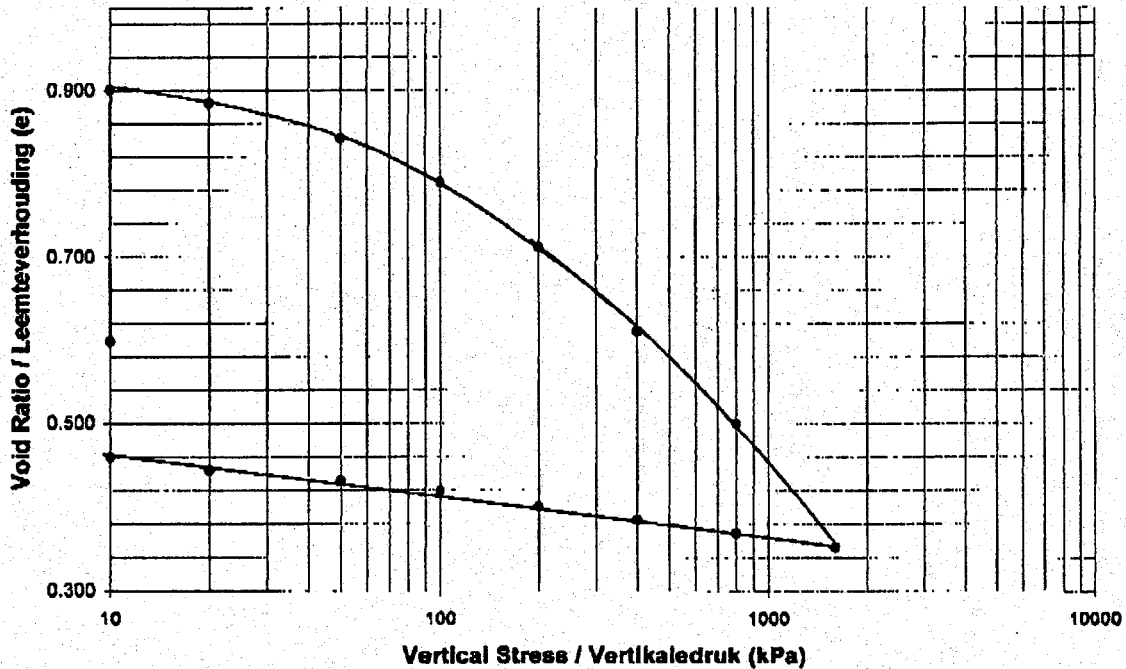
### Sample Parameters


Machine	WF1	Mass of Ring + wet sample (start of test)	282.4 g
Ring No	WF1	Mass of Ring + dry sample	258.0 g
Ring Ht	18.03 mm	Mass of Ring + wet sample (end of test)	279.3 g
Ring Diam.	75.00 mm	Mass of ring	117.6 g
Ring Vol.	84.07 mm <sup>3</sup>	Dry Density	1.644
M/C at Start	19.1 %	M/C at End of Test	16.9 %
Sat. at Start	83.8 %	Sat. at End	100.2 %
Initial Voids Ratio	0.801	S.G.	2.631
Initial Ht. of Voids	7.14 mm	Ht. Of Solids	11.89 mm

TEST WAS DONE ON A SPECIMEN PREPARED FROM AN UNDISTURBED SAMPLE AND SATURATED @ 10 kPa

### Test Parameters

V. Strs (kPa)	1	10	10	20	50	100	200	400	800	1600	800	400	200	100	50	20	10
Dial (u)	10000	9974	13564	13378	12874	12248	11322	10114	8792	7048	7240	7434	7818	7834	7984	8128	8324
Strain (%)		0.14	-18.73	-17.74	-15.10	-11.81	-8.95	-6.80	6.35	15.51	14.50	13.48	12.53	11.38	10.59	9.84	8.81
Void Ratio	0.621	0.598	0.900	0.885	0.842	0.790	0.712	0.810	0.499	0.352	0.368	0.385	0.400	0.418	0.431	0.443	0.460
Cc		0.002		0.053	0.108	0.175	0.259	0.338	0.368	0.487	0.054	0.054	0.051	0.061	0.042	0.030	0.055
Mv (1/Mpa)		0.152		0.988	0.879	0.658	0.487	0.317	0.174	0.115	0.013	0.025	0.048	0.116	0.158	0.252	1.030




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**APPENDIX 4**

**EQUIVALENT CBR VALUES**

**Table for estimating CBR from GM and PI**  
 (Department of Transport (1994). Prediction of CBR from Indicators: Review.  
 Report No. RR 90/278, Pretoria.)

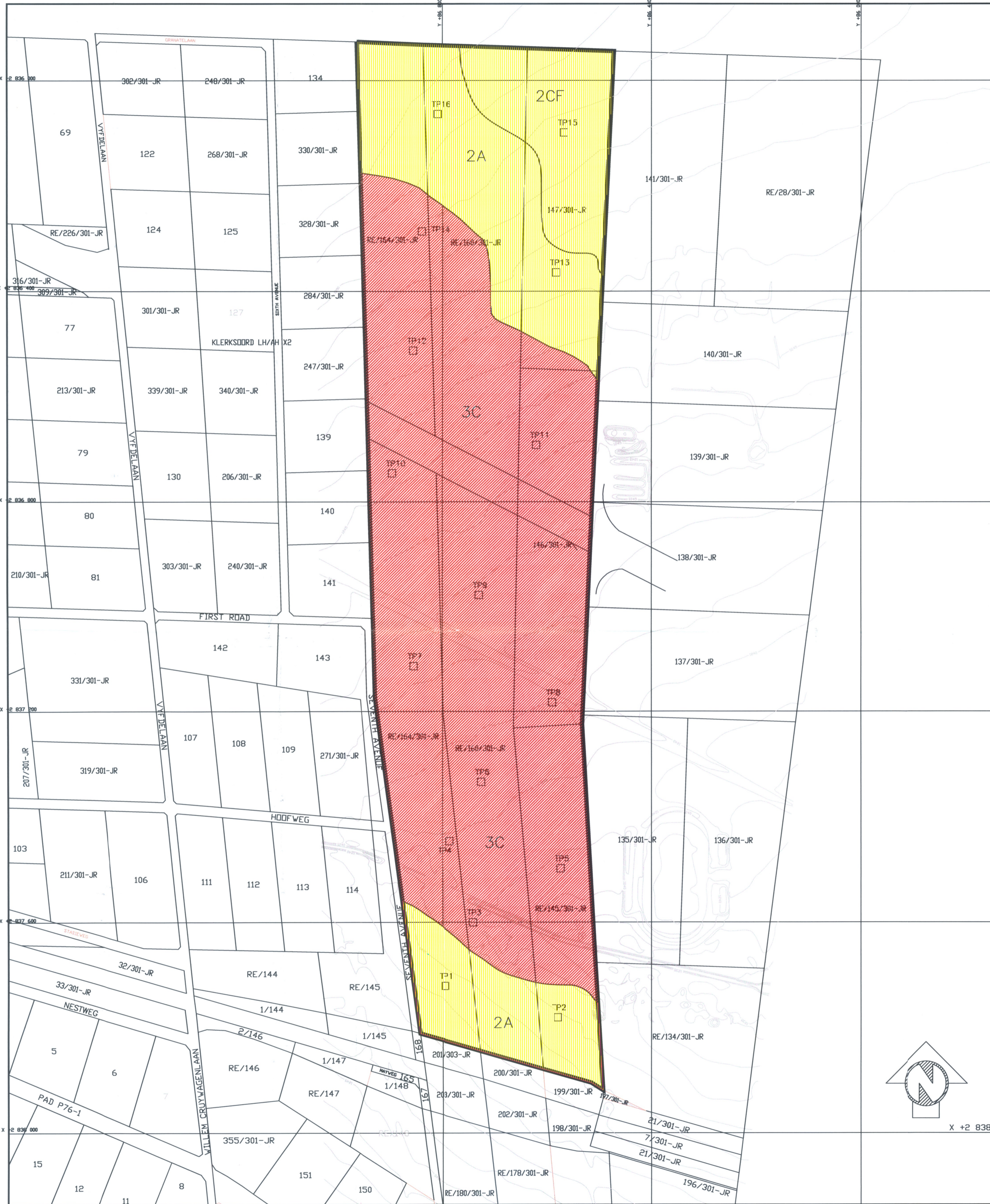
CBR COMPUTED FROM GRADING AND PI										
Grading Modulus	Plasticity Index									
	2	4	6	8	10	15	20	25	30	35
0.25	12	11	10	9	8	5	4	3		
0.5	14	13	12	10	9	7	5	4	3	
0.75	25	22	19	18	16	12	9	5	3	
1.0	30	25	24	21	19	13	10	7	6	
1.1	31	27	25	22	19	15	12	9	7	4
1.2	35	30	27	24	21	16	13	10	7	5
1.3	36	31	28	25	22	18	13	10	7	5
1.4	40	34	30	27	25	18	13	10	7	5
1.5	43	37	33	30	27	19	15	12	9	5
1.6	46	40	36	33	27	21	16	13	9	
1.7	49	43	39	34	30	22	18	13		
1.8	50	45	40	36	33	25	18	13		
1.9	55	49	45	39	36	25	19			
2.0	60	52	48	40	37	27	21			

**Notes:** CBR values correspond approximately to values at 95% Mod AASHTO  
 To be used for borrow pit results only  
 CBR = four day soaked 2.54mm CBR

**APPENDIX 5**

**GEOTECHNICAL SITE PLAN**

PARAMETER	CLASS 1 (Most favourable)	CLASS 2 (Intermediate)	CLASS 3 (Least favourable)
A Collapsible soil	Surface collapsible horizon >750 mm thick	Collapsible horizon >750 mm thick	
B Seepage	Water table permanently deeper than 1.5 m below surface	Permanent or seasonal water table within 1.5 m of surface	Swamp and marshes
C Active Soil	<2.5 mm differential movement expected	2.5-15 mm differential movement	>15 mm differential movement expected
D Highly Compressible Soil	<2.5 mm differential movement expected	2.5 - 15 mm differential movement	>15 mm differential movement expected
E Erodible soil	Low	Moderately dispersive soils, fissured clay, thick coluvium,	Highly dispersive soil, fissured clay, thick coluvium
F Difficulty of excavation to 1.5 m depth	<10% rock or hardpan pedocretes	10-50% rock or hardpan pedocretes	>50% rock or hardpan pedocretes
G Undermined ground	where depth to undermining is >1.00m in reasonably competent rock	Old undermined areas where slope closure has ceased	Where the depth to undermining is <1.00m
H Instability in areas of soluble rock		Possibly unstable	Probably unstable
I Steep slopes	Slope <6%	Slope 6-15%	Slope >15%
J Areas of unstable natural slopes	Low risk	Intermediate risk	High risk
K Areas subject to seismic activity	100 year max probability of <6 Mod Mercalli intensity	100 year max probability of 5-8 Mod Mercalli intensity	100 year maximum probability of >8 Mod Mercalli intensity
L Areas subject to flooding		Areas above 1.50 year flood line but with slope <1%	Areas below 1.50 year flood line



- GREEN 1 MOST SUITABLE FOR DEVELOPMENT (NO OBVIOUS CONSTRAINTS)
- YELLOW 2 LESS SUITABLE FOR DEVELOPMENT (ONE OR MORE CONSTRAINTS IDENTIFIED)
- RED 3 LEAST SUITABLE FOR DEVELOPMENT (CONSTRAINTS IDENTIFIED WITH SIGNIFICANT ECONOMIC IMPLICATIONS)

NOTE: SOIL FACET BOUNDARIES HAVE BEEN INTERPOLATED BETWEEN TRIAL HOLE POSITIONS AND ARE SUBJECT TO REVISION

PLATINUM PARK INDUSTRIAL PARK

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**GEOTECHNICAL SITE PLAN**

compiled by: J.A	drawn by: W.B	date: July 2003
project No: 2503		scale: 1:5000