



agriculture & environmental affairs

Department:
Agriculture
& Environmental Affairs
PROVINCE OF KWAZULU-NATAL

(For official use only)

EIA File Reference Number:
NEAS Reference Number:
Waste Management Licence Number:
(if applicable)
Date Received:

DC/
KZN/EIA/

BASIC ASSESSMENT REPORT

Submitted in terms of the Environmental Impact Assessment Regulations, 2010 promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998)

This template may be used for the following applications:

- **Environmental Authorization** subject to basic assessment for an activity that is listed in Listing Notices 1 or 3, 2010 (Government Notices No. R 544 or No. R 546 dated 18 June 2010); or
- **Waste Management Licence** for an activity that is listed in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) for which a basic assessment process as stipulated in the EIA Regulations must be conducted as part of the application (refer to the schedule of waste management activities in Category A of Government Notice No. 718 dated 03 July 2009).

Kindly note that:

1. This **basic assessment report** meets the requirements of the EIA Regulations, 2010 and is meant to streamline applications. This report is the format prescribed by the KZN Department of Agriculture & Environmental Affairs. Please make sure that this is the latest version.
2. The report must be typed within the spaces provided in the form. The size of the spaces provided is not indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with text.
3. Where required, place a cross in the box you select.
4. An incomplete report will be returned to the applicant for revision.
5. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it will result in the rejection of the application as provided for in the regulations.
6. No faxed or e-mailed reports will be accepted.
7. The report must be compiled by an independent environmental assessment practitioner ("EAP").
8. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.

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9. The KZN Department of Agriculture & Environmental Affairs may require that for specified types of activities in defined situations only parts of this report need to be completed.
10. The EAP must submit this basic assessment report for comment to all relevant State departments that administer a law relating to a matter affecting the environment. This provision is in accordance with Section 24 O (2) of the National Environmental Management Act 1998 (Act 107 of 1998) and such comments must be submitted within 40 days of such a request.
11. **Please note** that this report must be handed in or posted to the District Office of the KZN Department of Agriculture & Environmental Affairs to which the application has been allocated (please refer to the details provided in the letter of acknowledgement for this application).

DRAFT

DEPARTMENTAL REFERENCE NUMBER(S)

File reference number (EIA):	
File reference number (Waste Management Licence):	

SECTION A: DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER AND SPECIALISTS

1. NAME AND CONTACT DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Name and contact details of the EAP who prepared this report:

Business name of EAP:	Icando		
Physical address:	13 Lahle Crescent, Waterfall, 3610		
Postal address:	P. O. Box 115, Waterfall, 3610		
Postal code:	3610	Cell:	083 255 4638
Telephone:	031 763 3760	Fax:	031 763 3664
E-mail:	june@icando.co.za		

2. NAMES AND EXPERTISE OF REPRESENTATIVES OF THE EAP

Names and details of the expertise of each representative of the EAP involved in the preparation of this report:

Name of representative of the EAP	Education qualifications	Professional affiliations	Experience at environmental assessments (yrs)
June Elizabeth Lombard	BSc Hon, MSc	SFIWMSA, CEAPSA	22 years
Verusha Nadar	BSc	IWMSA	6

3. NAMES AND EXPERTISE OF SPECIALISTS

Names and details of the expertise of each specialist that has contributed to this report:

Name of specialist	Education qualifications	Field of expertise	Section/ s contributed to in this basic assessment report	Title of specialist report/ s as attached in Appendix D
Mr Graham Payne	BSc, PrEng	Civil Engineer	N/A	Shayamoya Landfill: Closure Design Report

SECTION B: ACTIVITY INFORMATION

1. PROJECT TITLE

Describe the project title as provided on the application form for environmental authorization:

Proposed Rehabilitation and Closure of the Shayamoya Landfill Site

2. PROJECT DESCRIPTION

Provide a detailed description of the project:

The project involves the remediation and closure of an existing landfill site. Necessary investigations into site closure include:

- **Site investigations to determine status of the landfill**
- **Site structure works i.e. re-establishment of boreholes**
- **EIA and public participation process for closure of a landfill site**
- **Application for a closure permit or licence**
- **Remedial design to address problem areas including design for passive venting system and leachate management**
- **Final landfill height, final shaping, landscaping and revegetation**
- **Final landfill cover or capping design**
- **Post closure monitoring and maintenance plan for permit holder**

3. ACTIVITY DESCRIPTION

Describe each listed activity in Listing Notice 1 (GNR 544, 18 June 2010), Listing Notice 3 (GNR 546, 18 June 2010) or Category A of GN 718, 3 July 2009 (Waste Management Activities) which is being applied for as per the project description:

Closure and rehabilitation measures proposed in the Closure Design Report compiled by the Geotechnical and Civil Engineers appointed by the applicant.

**Activity triggered as per Listing Notice 1 (GNR 544, 18 June 2010):-
(20) The decommissioning of activities listed in this schedule**

4. FEASIBLE AND REASONABLE ALTERNATIVES

“alternatives”, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

- (a) the property on which or location where it is proposed to undertake the activity;
- (b) the type of activity to be undertaken;
- (c) the design or layout of the activity;
- (d) the technology to be used in the activity;
- (e) the operational aspects of the activity; and
- (f) the option of not implementing the activity.

Describe alternatives that are considered in this report. Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed. The determination of whether site or activity (including different processes etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

Sections B 5 – 15 below should be completed for each alternative.

5. ACTIVITY POSITION

Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees, minutes and seconds. List alternative sites were applicable.

Alternative:	Latitude (S):			Longitude (E):		
	°	'	"	°	'	"
Alternative S1 ¹ (preferred or only site alternative)	30	32	08.03	29	25	55.31
Alternative S2 (if any)	0	'	"	0	'	"
Alternative S3 (if any)	0	'	"	0	'	"

Alternative:	Latitude (S):			Longitude (E):		
	°	'	"	°	'	"
In the case of linear activities:						
Alternative S1 (preferred or only route alternative)						
• Starting point of the activity	0	'	"	0	'	"
• Middle point of the activity	0	'	"	0	'	"
• End point of the activity	0	'	"	0	'	"
Alternative S2 (if any)						
• Starting point of the activity	0	'	"	0	'	"
• Middle point of the activity	0	'	"	0	'	"
• End point of the activity	0	'	"	0	'	"
Alternative S3 (if any)						
• Starting point of the activity	0	'	"	0	'	"
• Middle point of the activity	0	'	"	0	'	"
• End point of the activity	0	'	"	0	'	"

¹ "Alternative S.." refer to site alternatives.

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For route alternatives that are longer than 500m, please provide an addendum with co-ordinates taken every 500m along the route for each alternative alignment.

6. PHYSICAL SIZE OF THE ACTIVITY

Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):

Alternative:	Size of the activity:
Alternative A1² (preferred activity alternative)	84304.7616 m²
Alternative A2 (if any)	m ²
Alternative A3 (if any)	m ²

or, for linear activities:

Alternative:	Length of the activity:
Alternative A1 (preferred activity alternative)	m
Alternative A2 (if any)	m
Alternative A3 (if any)	m

Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):

Alternative:	Size of the site/servitude:
Alternative A1 (preferred activity alternative)	84304.7616 m²
Alternative A2 (if any)	m ²
Alternative A3 (if any)	m ²

7. SITE ACCESS

Does ready access to the site exist?	YES ✓
If NO, what is the distance over which a new access road will be built	m
Describe the type of access road planned:	

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

8. SITE OR ROUTE PLAN

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as Appendix A to this report.

The site or route plans must indicate the following:

- 8.1. the scale of the plan which must be at least a scale of 1:500;

² "Alternative A.." refer to activity, process, technology or other alternatives.

- 8.2. the property boundaries and numbers/ erf/ farm numbers of all adjoining properties of the site;
- 8.3. the current land use as well as the land use zoning of each of the properties adjoining the site or sites;
- 8.4. the exact position of each element of the application as well as any other structures on the site;
- 8.5. the position of services, including electricity supply cables (indicate above or underground), water supply pipelines, boreholes, street lights, sewage pipelines, storm water infrastructure and telecommunication infrastructure;
- 8.6. walls and fencing including details of the height and construction material;
- 8.7. servitudes indicating the purpose of the servitude;
- 8.8. sensitive environmental elements within 100 metres of the site or sites including (but not limited thereto):
 - rivers, streams, drainage lines or wetlands;
 - the 1:100 year flood line (where available or where it is required by DWA);
 - ridges;
 - cultural and historical features;
 - areas with indigenous vegetation including protected plant species (even if it is degraded or infested with alien species);
- 8.9. for gentle slopes the 1 metre contour intervals must be indicated on the plan and whenever the slope of the site exceeds 1:10, the 500mm contours must be indicated on the plan; and
- 8.10. the positions from where photographs of the site were taken.

9. SITE PHOTOGRAPHS

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under Appendix B to this report. It must be supplemented with additional photographs of relevant features on the site, if applicable.

10. FACILITY ILLUSTRATION

A detailed illustration of the facility must be provided at a scale of 1:200 and attached to this report as Appendix C. The illustrations must be to scale and must represent a realistic image of the planned activity/ies.

11. ACTIVITY MOTIVATION

11.1. Socio-economic value of the activity

What is the expected capital value of the activity on completion?

What is the expected yearly income that will be generated by or as a result of the activity?

Will the activity contribute to service infrastructure?

Is the activity a public amenity?

R 5.5 m	
N/A	
	NO✓
	NO✓

How many new employment opportunities will be created in the development phase of the activity?	23
What is the expected value of the employment opportunities during the development phase?	R 212,000.00
What percentage of this will accrue to previously disadvantaged individuals?	87%
How many permanent new employment opportunities will be created during the operational phase of the activity?	
N/A – there is no operational phase for this project	
What is the expected current value of the employment opportunities during the first 10 years?	R
N/A – there is no operational phase for this project	
What percentage of this will accrue to previously disadvantaged individuals?	%
N/A – there is no operational phase for this project	

11.2. Need and desirability of the activity

Motivate and explain the need and desirability of the activity (including demand for the activity):

The Shayamoya Landfill Site currently receives approximately 30 tonnes of domestic solid waste per day as determined from on-site monitoring conducted by the engineering team. The site has been operating since the mid-1980's. During that time, it has received approximately 118 000 m³ of waste. In terms of its future life, the site can no longer continue to receive waste. It may continue for as long as it takes for the new site to be established, however, this it would be impossible for it to receive waste on a long term basis.

With regard to the state of the landfill, it shows signs of not being managed as it should have been. Budget constraints and capacity issues have affected the ability of the Municipality to run the site. The deposition of waste has been done with little supervision and cover material is not always available which results in periods of uncovered waste.

The site is therefore in urgent need of rehabilitation and closure which is also required by law in terms of the National Environmental Management: Waste Act (Act 59 of 2008)

Indicate any benefits that the activity will have for society in general:

A rehabilitated landfill site will benefit society in general as it will be a significantly less risk to the environment and therefore the health of people. When the site is capped, rain will not be allowed to permeate the waste body which will decrease the amount of leachate produced. Leachate can pose a risk to the environment if it manages to contaminate surface and groundwater sources therefore rehabilitation is necessary to mitigate impacts to the surrounding environment.

Indicate any benefits that the activity will have for the local communities where the activity will be located:

The Shayamoya Landfill is not properly managed and is not very far from residential areas which can affect aesthetics and generally be unsightly for the local community. A rehabilitated site can be designed to serve as an open space area that would be much more pleasing for the community. In time, it could also serve as a sports area or park. The closure and capping of the site will also reduce odours and wind scatter of waste,

improving the overall aesthetics of the area. When the site is capped, it will also not attract vermin and disease causing vectors, improving safety and environmental health.

12. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

List all legislation, policies and/or guidelines of any sphere of government that are relevant to the application as contemplated in the EIA regulations, if applicable:

Title of legislation, policy or guideline:	Administering authority:	Date:
National Environmental Management Act, 1998 (Act No. 107 of 1998)	Department of Environmental Affairs and Tourism	1998
<ul style="list-style-type: none"> Waste Management Act, 2008 (Act 59 of 2008) Air Quality Act, 2004 (Act 39 of 2004) 		2008 2004
National Water Act, 1998 (Act 36 of 1998)	Department of Water Affairs and Forestry	1998
The Occupational Health and Safety Act, 1993 (Act 85 of 1993)	Department of Health	1993
Minimum Requirements for Waste Disposal by Landfill (Second Edition)	Department of Water Affairs and Forestry	1998

13. WASTE, EFFLUENT, EMISSION AND NOISE MANAGEMENT

13.1. Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase? NO ✓

If yes, what estimated quantity will be produced per month? m³

How will the construction solid waste be disposed of? (describe)

Where will the construction solid waste be disposed of? (provide details of landfill site)

Waste will be disposed of on-site at Shayamoya Landfill site as it is the only landfill located in the area. Waste will be used in the final shaping of the site before it is capped.

Will the activity produce solid waste during its operational phase? NO ✓

If yes, what estimated quantity will be produced per month? m³

How will the solid waste be disposed of? (provide details of landfill site)

Where will the solid waste be disposed if it does not feed into a municipal waste stream (describe)?

If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine the further requirements of the application.

Can any part of the solid waste be classified as hazardous in terms of the relevant legislation? YES NO

If yes, contact the KZN Department of Agriculture & Environmental Affairs to obtain clarity regarding the process requirements for your application.

Is the activity that is being applied for a solid waste handling or treatment facility? YES NO

If yes, contact the KZN Department of Agriculture & Environmental Affairs to obtain clarity regarding the process requirements for your application.

13.2. Liquid effluent

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system? YES NO

If yes, what estimated quantity will be produced per month? **843 m³**

This figure has been calculated based on estimates from the engineer which they have calculated to be 28,1 m³/day. This is based on water balance calculations. Once the site is capped, ingress of water into the waste body will be stopped which will, over time, reduce the amount of leachate produced.

Will the activity produce any effluent that will be treated and/or disposed of on site? YES NO

Leachate will be stored in a storage facility. If volumes during summer months in particular are such that it requires removal, a tanker truck will transport excess leachate to a municipal waste water treatment works.

If yes, contact the KZN Department of Agriculture & Environmental Affairs to obtain clarity regarding the process requirements for your application.

Will the activity produce effluent that will be treated and/or disposed of at another facility? YES NO

If yes, provide the particulars of the facility:

Facility name:			
Contact person:			
Postal address:			
Postal code:			
Telephone:	Cell:		
E-mail:	Fax:		

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

Contaminated water will be used on site for dust abatement measures; however, there is a limit to which water contaminated with leachate can be used elsewhere. The municipality will use leachate-contaminated water in ways that does not cause damage or harm.

13.3. Emissions into the atmosphere

Will the activity release emissions into the atmosphere? YES NO

If yes, is it controlled by any legislation of any sphere of government? YES NO

If yes, contact the KZN Department of Agriculture & Environmental Affairs to obtain clarity regarding the process requirements for your application.

If no, describe the emissions in terms of type and concentration:

The emissions will be methane and carbon dioxide which are gases associated with landfills. The landfill will be designed with gas sampling points which will be monitored on a regular basis to track the amount and migration of gas on site. Should sample points indicate high methane yields, a flare could be installed to burn the excess gas. Access to the gas monitoring boreholes must be maintained throughout the aftercare period.

13.4. Generation of noise

Will the activity generate noise?

YES ✓	
	NO ✓

If yes, is it controlled by any legislation of any sphere of government?

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If no, describe the noise in terms of type and level:

Low impact level of noise produced by trucks and smaller vehicles during construction phase only.

14. WATER USE

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box(es):

municipal	water board	groundwater	river, stream, dam or lake	other	the activity will not use water ✓
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If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month:	litres
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Does the activity require a water use permit from the Department of Water Affairs?	NO ✓
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If YES, please submit the necessary application to the Department of Water Affairs and attach proof thereof to this report.

15. ENERGY EFFICIENCY

Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

N/A The activity will not use energy

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

N/A The activity will not use energy

SECTION C: SITE/ AREA/ PROPERTY DESCRIPTION

Important notes:

- For linear activities (pipelines, etc) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section C and indicate the area, which is covered by each copy No. on the Site Plan.

Section C Copy No.
(e.g. A):

- Subsections 1 - 6 below must be completed for each alternative.

1. GRADIENT OF THE SITE

Indicate the general gradient of the site.

Alternative S1:

Flat	1:50 1:20	-	1:20 1:15	-	1:15 1:10✓	-	1:10 1:7,5	-	1:7,5 - 1:5	Steeper than 1:5
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Alternative S2 (if any):

Flat	1:50 1:20	-	1:20 1:15	-	1:15 - 1:10	-	1:10 1:7,5	-	1:7,5 - 1:5	Steeper than 1:5
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Alternative S3 (if any):

Flat	1:50 1:20	-	1:20 1:15	-	1:15 - 1:10	-	1:10 1:7,5	-	1:7,5 - 1:5	Steeper than 1:5
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2. LOCATION IN LANDSCAPE

Indicate the landform(s) that best describes the site (Please cross the appropriate box).

Alternative S1 (preferred site):

Ridgeline	Plateau	Side slope of hill/mountain	Closed valley	Open valley✓	Plain	Undulating plain/low hills	Dune	Sea-front
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Alternative S2 (if any):

Ridgeline	Plateau	Side slope of hill/mountain	Closed valley	Open valley	Plain	Undulating plain/low hills	Dune	Sea-front
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Alternative S3 (if any):

Ridgeline	Plateau	Side slope of hill/mountain	Closed valley	Open valley	Plain	Undulating plain/low hills	Dune	Sea-front
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3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

Has a specialist been consulted for the completion of this section?

YES✓

If YES, please complete the following:

Name of the specialist:

Graham Payne

Qualification(s) of the specialist:

BSc PrEng

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Postal address:	P. O. Box 446, Pavilion		
Postal code:	3611		
Telephone:	031 265 1777	Cell:	083 326 4458
E-mail:	graham@tqcengineers.co.za	Fax:	031 265 2727
Signature of specialist:			Date:

Is the site(s) located on any of the following (cross the appropriate boxes)?

	Alternative S1:		Alternative S2 (if any):		Alternative S3 (if any):	
	YES	NO	YES	NO	YES	NO
Shallow water table (less than 1.5m deep)		NO ✓				
Dolomite, sinkhole or doline areas		NO ✓				
Seasonally wet soils (often close to water bodies)		NO ✓				
Unstable rocky slopes or steep slopes with loose soil		NO ✓				
Dispersive soils (soils that dissolve in water)		NO ✓				
Soils with high clay content (clay fraction more than 40%)		NO ✓				
Any other unstable soil or geological feature		NO ✓				
An area sensitive to erosion		NO ✓				

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. (Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted).

4. GROUND COVER

Has a specialist been consulted for the completion of this section? NO ✓

Specialist not required as the site is an existing landfill. There are no pristine areas that will be disturbed as a result of the rehabilitation and closure. Any construction associated with the closure of the site will be limited to the landfill area itself.

If YES, please complete the following:

Name of the specialist:			
Qualification(s) of the specialist:			
Postal address:			
Postal code:			
Telephone:		Cell:	
E-mail:		Fax:	

Are there any rare or endangered flora or fauna species (including red data species) present on any of the alternative sites? NO ✓

If YES, specify and explain:

Are there any special or sensitive habitats or other natural features present on any of the alternative sites? NO ✓

If YES, specify and explain:

Are any further specialist studies recommended by the specialist?	YES	NO
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If YES, specify:			
If YES, is such a report(s) attached in <u>Appendix D</u> ?	YES	NO	
Signature of specialist:	Date:		

The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

Natural veld - good condition ^E	Natural veld with scattered aliens ^E	Natural veld with heavy alien infestation ^E	Veld dominated by alien species ^E	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	Bare soil✓

If any of the boxes marked with an "E" is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

5. LAND USE CHARACTER OF SURROUNDING AREA

Cross the land uses and/or prominent features that currently occur within a 500m radius of the site and give a description of how this influences the application or may be impacted upon by the application:

Land use character			Description
Natural area		NO✓	
Low density residential		NO✓	
Medium density residential		NO✓	
High density residential	YES✓		The Shayamoya residential suburb is located approximately 300 m away from the landfill. Closure of the site will be a positive development for the area.
Informal residential		NO✓	
Retail commercial & warehousing		NO✓	
Light industrial		NO✓	
Medium industrial		NO✓	
Heavy industrial		NO✓	
Power station		NO✓	
Office/consulting room		NO✓	
Military or police base/station/compound		NO✓	
Spoil heap or slimes dam		NO✓	
Quarry, sand or borrow pit	YES✓		Old quarry located west of the landfill.
Dam or reservoir		NO✓	
Hospital/medical centre		NO✓	
School/ creche		NO✓	
Tertiary education facility		NO✓	
Church		NO✓	
Old age home		NO✓	
Sewage treatment plant		NO✓	

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Train station or shunting yard		NO✓	
Railway line		NO✓	
Major road (4 lanes or more)		NO✓	
Airport		NO✓	
Harbour		NO✓	
Sport facilities		NO✓	
Golf course		NO✓	
Polo fields		NO✓	
Filling station		NO✓	
Landfill or waste treatment site		NO✓	
Plantation		NO✓	
Agriculture		NO✓	
River, stream or wetland	YES✓		Umzintlava River approximately 350m downslope of the landfill
Nature conservation area		NO✓	
Mountain, hill or ridge		NO✓	
Museum		NO✓	
Historical building		NO✓	
Protected Area		NO✓	
Graveyard		NO✓	
Archaeological site		NO✓	
Other land uses (describe)		NO✓	

6. CULTURAL/ HISTORICAL FEATURES

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including archaeological or palaeontological sites, on or within 20m of the site?

NO✓

If YES, contact a specialist recommended by AMAFA to conduct a heritage impact assessment. The heritage impact assessment must be attached as an appendix to this report.

Briefly explain the recommendations of the specialist:

Will any building or structure older than 60 years be affected in any way?
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?

YES NO

YES NO

If YES, please submit the necessary application to AMAFA and attach proof thereof to this report.

SECTION D: PUBLIC PARTICIPATION

1. ADVERTISEMENT

The person conducting a public participation process must take into account any guidelines applicable to public participation as contemplated in section 24J of the Act and must give notice

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to all potential interested and affected parties of the application which is subjected to public participation by—

- (a) fixing a notice board (of a size at least 60cm by 42cm; and must display the required information in lettering and in a format as may be determined by the competent authority) at a place conspicuous to the public at the boundary or on the fence of—
 - (i) the site where the activity to which the application relates is or is to be undertaken; and
 - (ii) any alternative site mentioned in the application;
- (b) giving written notice to—
 - (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
 - (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
 - (v) the local and district municipality which has jurisdiction in the area;
 - (vi) any organ of state having jurisdiction in respect of any aspect of the activity (as identified in the application form for the environmental authorization of this project); and
 - (vii) any other party as required by the competent authority;
- (c) placing an advertisement in—
 - (i) one local newspaper; or
 - (ii) any official *Gazette* that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;
- (d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official *Gazette* referred to in subregulation 54(c)(ii); and
- (e) using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desiring of but unable to participate in the process due to—
 - (i) illiteracy;
 - (ii) disability; or
 - (iii) any other disadvantage.

2. CONTENT OF ADVERTISEMENTS AND NOTICES

A notice board, advertisement or notices must:

- (a) indicate the details of the application which is subjected to public participation; and
- (b) state—

- (i) that an application for environmental authorization has been submitted to the KZN Department of Agriculture & Environmental Affairs in terms of the EIA Regulations, 2010;
- (ii) a brief project description that includes the nature and location of the activity to which the application relates;
- (iii) where further information on the application can be obtained; and
- (iv) the manner in which and the person to whom representations in respect of the application may be made.

3. PLACEMENT OF ADVERTISEMENTS AND NOTICES

Where the proposed activity may have impacts that extend beyond the municipal area where it is located, a notice must be placed in at least one provincial newspaper or national newspaper, indicating that an application will be submitted to the competent authority in terms of these regulations, the nature and location of the activity, where further information on the proposed activity can be obtained and the manner in which representations in respect of the application can be made, unless a notice has been placed in any *Gazette* that is published specifically for the purpose of providing notice to the public of applications made in terms of the EIA regulations.

Advertisements and notices must make provision for all alternatives.

4. DETERMINATION OF APPROPRIATE PROCESS

The EAP must ensure that the public participation process is according to that prescribed in regulation 54 of the EIA Regulations, 2010, but may deviate from the requirements of subregulation 54(2) in the manner agreed by the KZN Department of Agriculture & Environmental Affairs as appropriate for this application. Special attention should be given to the involvement of local community structures such as Ward Committees, ratepayers associations and traditional authorities where appropriate.

Please note that public concerns that emerge at a later stage that should have been addressed may cause the competent authority to withdraw any authorisation it may have issued if it becomes apparent that the public participation process was inadequate.

5. COMMENTS AND RESPONSE REPORT

The practitioner must record all comments and respond to each comment of the public before this application is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations (regulation 57 in the EIA Regulations, 2010) and be attached as Appendix E to this report.

6. PARTICIPATION BY DISTRICT, LOCAL AND TRADITIONAL AUTHORITIES

This section will be completed once the comment period has lapsed

Basic Assessment Report

District, local and traditional authorities (where applicable) are all key interested and affected parties in each application and no decision on any application will be made before the relevant local authority is provided with the opportunity to give input. The planning and the environmental sections of the local authority must be informed of this application and provided with an opportunity to comment.

Has any comment been received from the district municipality?

YES NO

If "YES", briefly describe the feedback below (also attach any correspondence to and from this authority with regard to this application):

Has any comment been received from the local municipality?

YES NO

If "YES", briefly describe the feedback below (also attach any correspondence to and from this authority with regard to this application):

Has any comment been received from a traditional authority?

YES NO

If "YES", briefly describe the feedback below (also attach any correspondence to and from this authority with regard to this application):

7. CONSULTATION WITH OTHER STAKEHOLDERS

This section will be completed once the comment period has lapsed

Any stakeholder that has a direct interest in the site or property, such as servitude holders and service providers, should be informed of the application and be provided with the opportunity to comment.

Has any comment been received from stakeholders?

YES NO

If "YES", briefly describe the feedback below (also attach copies of any correspondence to and from the stakeholders to this application):

SECTION E: IMPACT ASSESSMENT

The assessment of impacts must adhere to the requirements in the EIA Regulations, 2010, and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

1. ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

List the main issues raised by interested and affected parties.

Summary of concerns thus far (this section will be completed once comments have been received from stakeholders):

Icando tried to involve as many people in the process as possible. A public meeting was held in the area. Notices in both English and Xhosa were placed in newspapers for the meeting.

There were no major concerns that I&APs brought up during the public participation since most see the closure as positive due to the poor management of the site. The only questions that were asked with regard to closure was for how much longer the site would run.

Response from the practitioner to the issues raised by the interested and affected parties (A full response must be given in the Comments and Response Report that must be attached as Appendix E to this report):

The engineers responded to the question about how much longer the site would continue to accept waste. They had stated that it would continue for as long as the new site takes to develop as the area would still need a place to send waste while construction occurs for the proposed new landfill.

2. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

2.1. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN PHASE

a. Site alternatives

N/A Closure of an existing landfill therefore no site alternatives

List the potential impacts associated with site alternatives that are likely to occur during the planning and design phase:

Alternative S1 (preferred alternative)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Alternative S2 (if any)

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative S1

Alternative S2

b. Process, technology, layout or other alternatives

Basic Assessment Report

List the impacts associated with any process, technology, layout or other alternatives that are likely to occur during the planning and design phase (please list impacts associated with each alternative separately):

Alternative A1 (preferred alternative)

Direct impacts:

- **Displacement of current informal salvagers from landfill.**
There are currently around thirty informal salvagers working in two groups to collect recyclables for two different recyclers. The one group collects plastic, paper and cardboard while the other collects only metals. The workers obviously make a living from the landfill and come from the nearby Shayamoya housing development. If the workers are not accommodated at the new site, the closure of the existing one will have a direct impact on their livelihoods.

Indirect impacts:

None

Cumulative impacts:

None

Alternative A2 (if any)

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

- **Pollution of the macro-environment**
Since the site was not managed adequately in the past, not rehabilitating it could very likely lead to further environmental degradation in through the uncontrolled release of leachate into the environment, polluting surface and groundwater sources.
- **Aesthetics**
The landfill is quite visible from the surrounding area due to a lack of screening measures. The site is not visually pleasing as it is. If it is not rehabilitated, capped and grassed it will continue to be an eyesore for local communities.
- **Public safety and hygiene**
An open landfill will continue to attract vermin and disease vectors. It is essential that a landfill is closed properly or community health may be affected. It is also important that dangerous exposed waste like broken glass, metals etc. is buried completely.
- **Fires and soil erosion**
The presence of methane, a flammable gas, together with the waste body presents a fire hazard. Soil erosion will also continue if bare soil areas are not re-vegetated.
- **Storm and groundwater contamination**
If leachate is not controlled, it could contaminate surface and groundwater sources.

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative A1:

Alternative A2:

<ul style="list-style-type: none"> • The informal salvagers have stated that they would be interested in becoming more formalised and would like to continue to work at the new site. The municipality must organise this with the workers and provide a space that they may work from, away from the working face of the site. 	
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2.2. IMPACTS THAT MAY RESULT FROM THE CONSTRUCTION PHASE

a. **Site alternatives**

N/A closure of an existing landfill therefore no site alternatives

Basic Assessment Report

List the potential impacts associated with site alternatives that are likely to occur during the construction phase:

Alternative S1 (preferred site)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Alternative S2 (if any)

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative S1

Alternative S2

b. Process, technology, layout or other alternatives

List the impacts associated with process, technology, layout or other alternatives that are likely to occur during the construction phase (please list impacts associated with each alternative separately):

Alternative A1 (preferred alternative)

Direct impacts:

- **Noise and dust**
Noise and dust from vehicle movements are to be expected during construction.
- **Increased construction vehicle traffic**
There will also be a slight increase in vehicle traffic from construction vehicles moving to and from site.
- **Road wear**
Some road wear will occur due to the presence of heavy machinery required in any engineering works carried out.
- **Soil erosion**
Some areas may be temporarily stripped of vegetation in order to rehabilitate the site. This can lead to increased soil erosion.
- **Odours resulting from movement of waste.**
Odours may result from waste being moved in order to shape the landfill to acceptable dimensions.

Indirect impacts:

None

Cumulative impacts:

None

Alternative A2

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

- **Pollution of the macro-environment**
Since the site was not managed adequately in the past, not rehabilitating it could very likely lead to further environmental degradation in through the uncontrolled release of leachate into the environment, polluting surface and groundwater sources.

Basic Assessment Report

<ul style="list-style-type: none"> • Aesthetics The landfill is quite visible from the surrounding area due to a lack of screening measures. The site is not visually pleasing as it is. If it is not rehabilitated, capped and grassed it will continue to be an eyesore for local communities. • Public safety and hygiene An open landfill will continue to attract vermin and disease vectors. It is essential that a landfill is closed properly or community health may be affected. It is also important that dangerous exposed waste like broken glass, metals etc. is buried completely. • Fires and soil erosion The presence of methane, a flammable gas, together with the waste body presents a fire hazard. Soil erosion will also continue if bare soil areas are not re-vegetated. • Storm and groundwater contamination If leachate is not controlled, it could contaminate surface and groundwater sources. <p>Indirect impacts: None</p> <p>Cumulative impacts: None</p>

Indicate mitigation measures to manage the potential impacts listed above:

Alternative A1:	Alternative A2:
<ul style="list-style-type: none"> • Best site management practices and compliance with DWAF's Minimum Requirements for landfill closure will be adopted to minimise the effect on the environment and surrounding community. • Construction associated with closure will be for a limited to short term period only. • Construction to occur during normal working hours for minimal disruption to nearby residents. 	

2.3. IMPACTS THAT MAY RESULT FROM THE OPERATIONAL PHASE

a. Site alternatives

N/A – Closure of an existing landfill therefore no site alternatives.

List the potential impacts associated with site alternatives that are likely to occur during the operational phase:

Alternative S1 (preferred alternative)

Direct impacts:
Indirect impacts:
Cumulative impacts:

Alternative S2 (if any)

Direct impacts:
Indirect impacts:
Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:
Indirect impacts:
Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative S1	Alternative S2

b. Process, technology, layout or other alternatives

List the impacts associated with process, technology, layout or other alternatives that are likely to occur during the operational phase (please list impacts associated with each alternative separately):

Alternative A1 (preferred alternative)

Direct impacts:
 There is no “operational phase” for landfill closure, however, maintenance and aftercare is required to ensure that closure is maintained at an adequate level. For impacts that could result from the closure of the landfill, see Table 2.4b below

However, there will be a reduction in current negative impacts of release of leachate and unauthorised access by salvagers.

Indirect impacts:

Cumulative impacts:

Alternative A2

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative A1	Alternative A2

2.4. IMPACTS THAT MAY RESULT FROM THE DECOMMISSIONING OR CLOSURE PHASE

a. Site alternatives

N/A – closure of an existing landfill therefore no site alternatives.

List the potential impacts associated with site alternatives that are likely to occur during the decommissioning or closure phase:

Alternative S1 (preferred alternative)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Alternative S2

Direct impacts:

Indirect impacts:

Cumulative impacts:

Basic Assessment Report

No-go alternative (compulsory)

Direct impacts:

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative S1	Alternative S2

b. Process, technology, layout or other alternatives

List the impacts associated with process, technology, layout or other alternatives that are likely to occur during the decommissioning or closure phase (please list impacts associated with each alternative separately):

Alternative A1 (preferred alternative)

Direct impacts:

- **Landfill Gas**
Landfill gas consists mainly of methane and carbon dioxide which are both colourless and odourless gases that are heavier than air. There is an explosion hazard for methane gas, however, the amounts produced are not expected to be significant seeing that the landfill is relatively small in size.
- **Leachate**
The flow of water through a landfill site typically generates leachate. Leachate is a highly corrosive and contaminated liquid and there will be a risk of possible contamination of groundwater and surface water by leachate infiltration.
- **Improved aesthetics**
The site when closed will no longer resemble a waste disposal facility. Depending on the final shaping, it will more than likely look similar to any grassed open space area which will improve the visual aspects of the area.
- **Reduced risk of soil and water contamination**
Provided that the cap remains intact, the generation of leachate will taper off over the years since there will be no ingress of water into the waste body. This will reduce the risk of contamination by leachate to surrounding areas.
- **Reduced odours and wind scatter**
Odours and wind scatter of waste will no longer be a problem for residents once the site is capped.
- **Vermin and disease carrying vectors**
Once the waste body is sealed, the landfill will cease to provide a place for disease carrying vectors to propagate.

Indirect impacts:

Cumulative impacts:

Alternative A2

Direct impacts:

Indirect impacts:

Cumulative impacts:

No-go alternative (compulsory)

Direct impacts:

- **Pollution of the macro-environment**
Since the site was not managed adequately in the past, not rehabilitating it could very likely lead to further environmental degradation in through the uncontrolled release of leachate into the environment, polluting surface and groundwater sources.
- **Aesthetics**
The landfill is quite visible from the surrounding area due to a lack of screening measures. The site is not visually pleasing as it is. If it is not rehabilitated, capped and grassed it will continue to be an eyesore for local communities.
- **Public safety and hygiene**
An open landfill will continue to attract vermin and disease vectors. It is essential that a landfill is closed properly or community health may be affected. It is also important that dangerous exposed waste like broken glass, metals etc. is buried completely.
- **Fires and soil erosion**
The presence of methane, a flammable gas, together with the waste body presents a fire hazard. Soil erosion will also continue if bare soil areas are not re-vegetated.
- **Storm and groundwater contamination**

Basic Assessment Report

If leachate is not controlled, it could contaminate surface and groundwater sources.

Indirect impacts:

Cumulative impacts:

Indicate mitigation measures to manage the potential impacts listed above:

Alternative A1	Alternative A2
<p>Landfill closure:-</p> <ul style="list-style-type: none"> Closure to be conducted in line with the Minimum Requirements for Waste Disposal by Landfill. Regular monitoring of landfill gas concentration and migration will enable decision makers to take action when levels are high. Monitoring will also help to build a history of the gas on site so that measurements can be compared to real figures. Secure fencing must be erected to avoid damage to wellheads and boreholes. A passive venting system should be included in design. A passive system uses extraction/collection wells to collect landfill gas. The gas will be contained using the impermeable liner which will be used to create preferred gas migration pathways. The impermeable layer will therefore limit uncontrolled venting to the atmosphere by causing the gas to vent through leachate collection wells rather than the cover. Leachate extraction systems have been designed to collect the leachate that will be generated by the landfill. It will be treated and disposed of at a registered sewage treatment facility. There will always be a risk when dealing with leachate on a landfill as leakages could occur. Groundwater monitoring boreholes will be included in the closure design, both up and downstream of the landfill. This will be sampled on a regular basis to ensure that if leakages occur, they are detected and dealt with. The cap will be an impervious layer which will effectively seal the landfill from rainfall. Generation of leachate is increased when water is allowed to filter through the waste. Actual leachate volumes are therefore expected to be quite low. Rainfall will be diverted to stormwater diversionary works. The cap will ensure that waste is contained, leachate production is managed by controlling the ingress of precipitation and surface water, and the escape of landfill gas is prevented. The cap normally consists of a compacted clay layer and geofabric liners. 	

2.5. PROPOSED MONITORING AND AUDITING

For each phase of the project and for each alternative, please indicate how identified impacts and mitigation will be monitored and/or audited.

Alternative S1 (preferred site)	Alternative S2
Alternative A1 (preferred alternative)	Alternative A2
<p>The operator of the site takes final responsibility for the implementation of and compliance with specifications in the permit and environmental authorisation. listed below are the EAP's recommendations:</p> <p>According to the Minimum Requirements for G:S:B+</p>	

<p>landfill site, inspection and monitoring must be carried out every 12 months for the :</p> <ul style="list-style-type: none"> • Cover integrity; • Integrity of drainage; • Control of ponding; • Control of fire; • Monitoring of vegetation; • Monitoring of security and prevention of illegal dumping. <p>In addition to this, the site will be checked against the licence conditions (when issued) to determine if the licence holder is in complying with those conditions. Monitoring of surface water, groundwater and gas levels should occur at a frequency determined by the authorities.</p> <p>The information must be presented to the authorities in a comprehensive report and include the EAP's interpretation of results received from the accredited laboratory used for the analysis of samples taken during monitoring. It must also include recommendations for improvements that could reduce environmental impacts.</p> <p>A proposed monitoring and maintenance plan has been included in Appendix G.</p>	
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3. ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

Alternative S1 (preferred site)

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Alternative S2

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Alternative A1 (preferred alternative)

Landfill closure is unique because the closure phase continues past the actual restoration of the site into ongoing monitoring. In order to prevent pollution the proper control systems must be in place, including:

- The cap;
- The landfill gas control system;
- The leachate collection, treatment and disposal system;
- Groundwater monitoring boreholes;
- Stormwater diversionary works.

There are always risks when dealing with leachate and landfill gases. These are risks which are associated with a landfill and are unavoidable. Final cover and capping must be implemented correctly to avoid future exposure of waste. If a site is well capped and well maintained then the potential for surface exposure is low. Monitoring schedules will ensure that gas migration is tracked. Ongoing leachate management is also required for G:S:B+landfills.

Monitoring of the landfill site post closure is absolutely compulsory. The purpose of monitoring is to indicate any escape of leachate into the water environment. It also serves as an early warning system, so that, any pollution problems that arise can be identified and rectified.

Alternative A2

No-go alternative (compulsory)

The no-go alternative is not a viable option in this case as mitigation measures will not do much to improve the site. As it is, the site will pose a risk to human health and the environment. The only viable option is to proceed with rehabilitation and closure.

SECTION F. RECOMMENDATION OF EAP

Is the information contained in this report and the documentation attached hereto in the view of the EAPr sufficient to make a decision in respect of this report?

YES ✓	

If "NO", please contact the KZN Department of Agriculture & Environmental Affairs regarding the further requirements for your report.

If "YES", please attach the draft EMPr as Appendix F to this report and list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application:

The closure of the landfill must be undertaken in accordance with the Minimum Requirements for Waste Disposal by Landfill. Mitigation measures for expected impacts have been supplied in the Environmental Management Plan included as Appendix F. Furthermore, environmental monitoring must continue in the aftercare period to ensure that systems put in place during closure continue to function. A Monitoring and Maintenance Plan has been included as Appendix G

Provided that the rehabilitation and closure is carried out in accordance with the abovementioned guidelines and post closure maintenance of the site is carried out, the risk of potential impacts to the environment will be greatly reduced.

SECTION G: APPENDIXES

The following appendixes must be attached as appropriate:

Appendix A: Site plan(s)

Appendix B: Photographs

Appendix C: Facility illustration(s)

Appendix D: Specialist reports

Appendix E: Comments and responses report

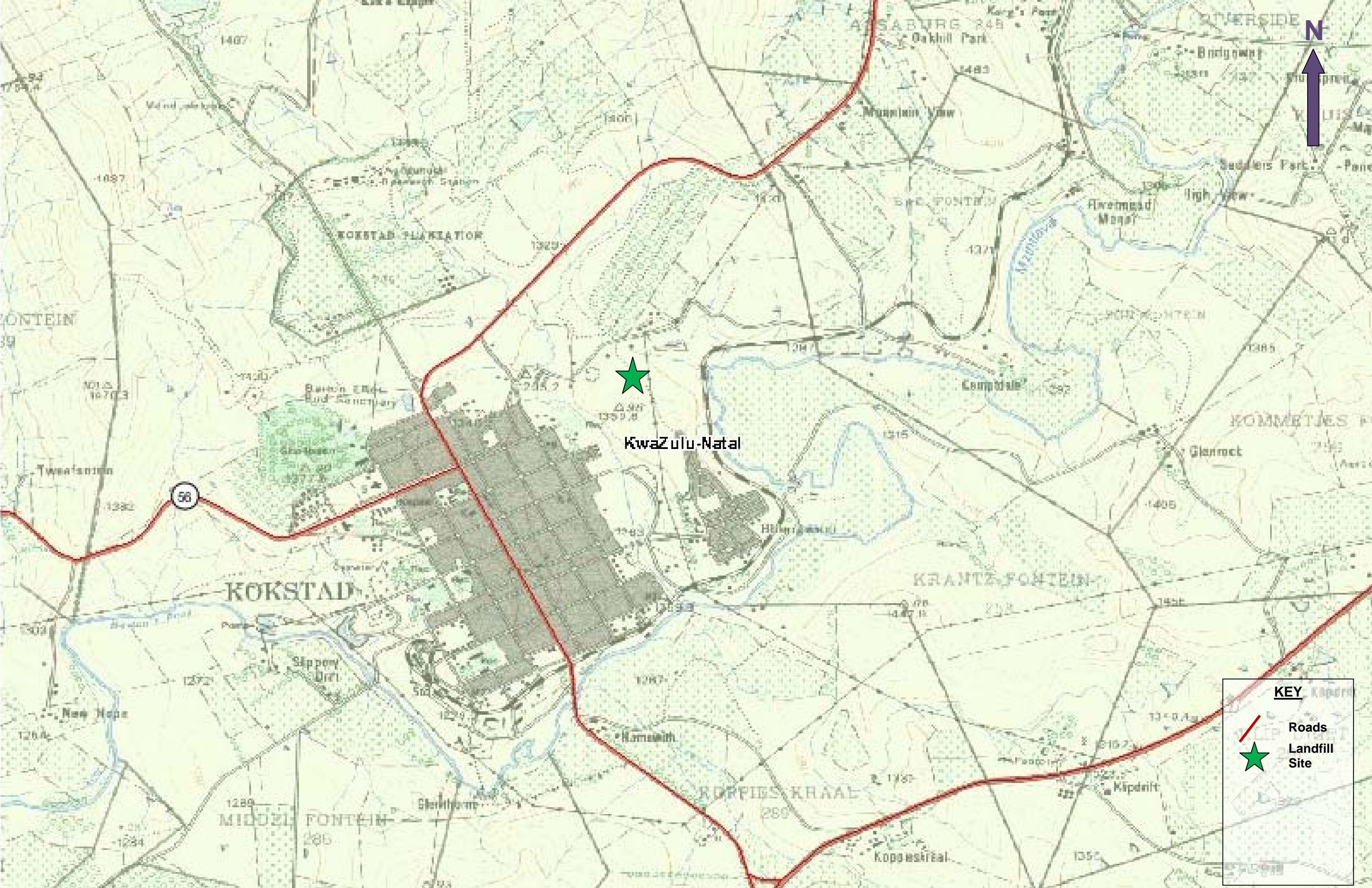
Appendix F: Draft Environmental Management Programme (EMPr)

Appendix G: Other information

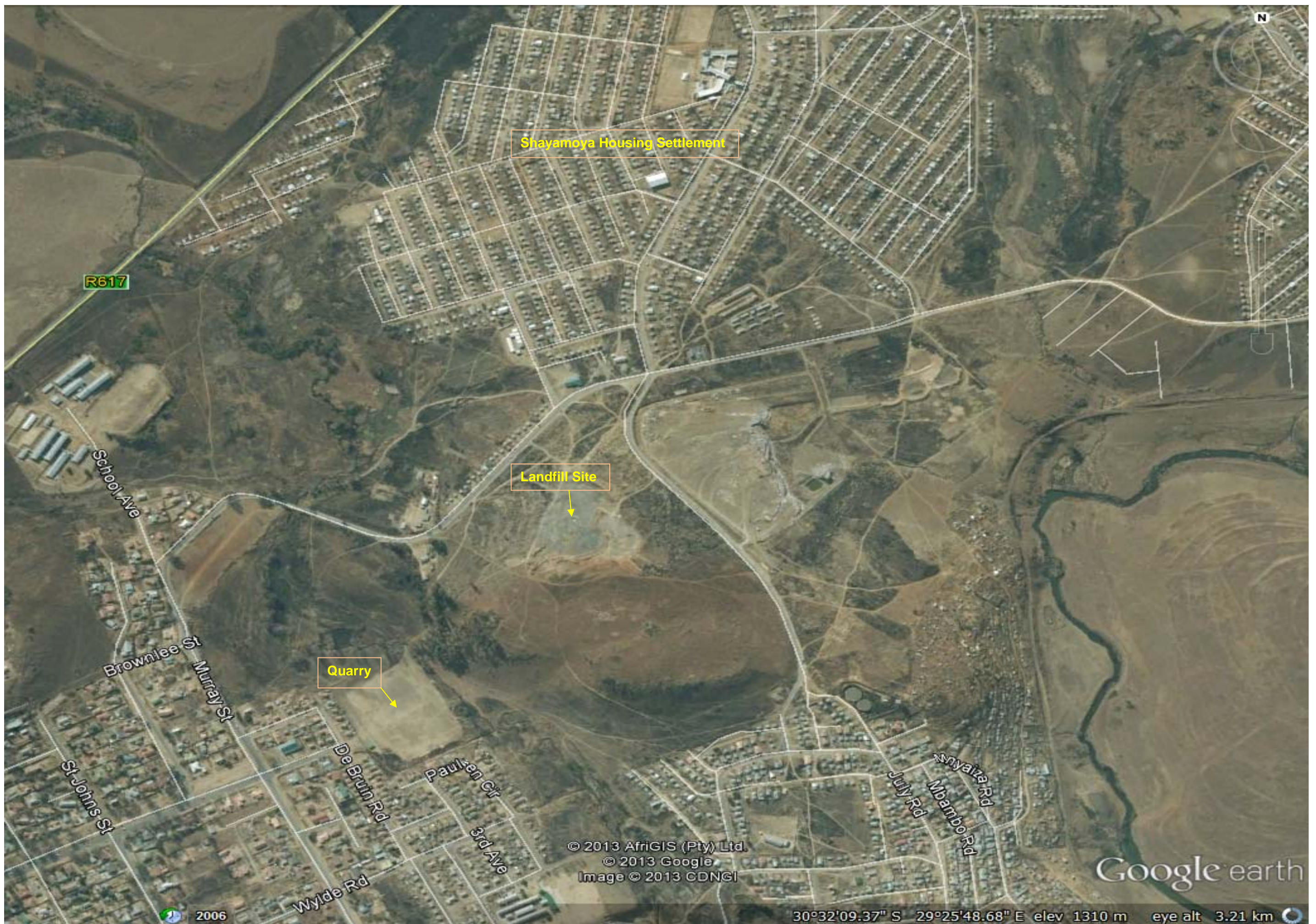
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Appendix A: Site plan

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1:50 000 Topographical map showing location of the Shayamoya Landfill Site in Kokstad



Map showing location of Shayamoya Landfill Site in Kokstad (from Google Earth Imaging)

Appendix B: Photographs

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Figure 1: North view



Figure 2: North-East view



Figure 3: East View



Figure 4: South-East view



Figure 5: South view



Figure 6: South-West view



Figure 7: West view



Figure 8: North-West view



Figure 9: Site entrance with guard hut



Figure 10: Baled recyclables collected by informal salvagers on site



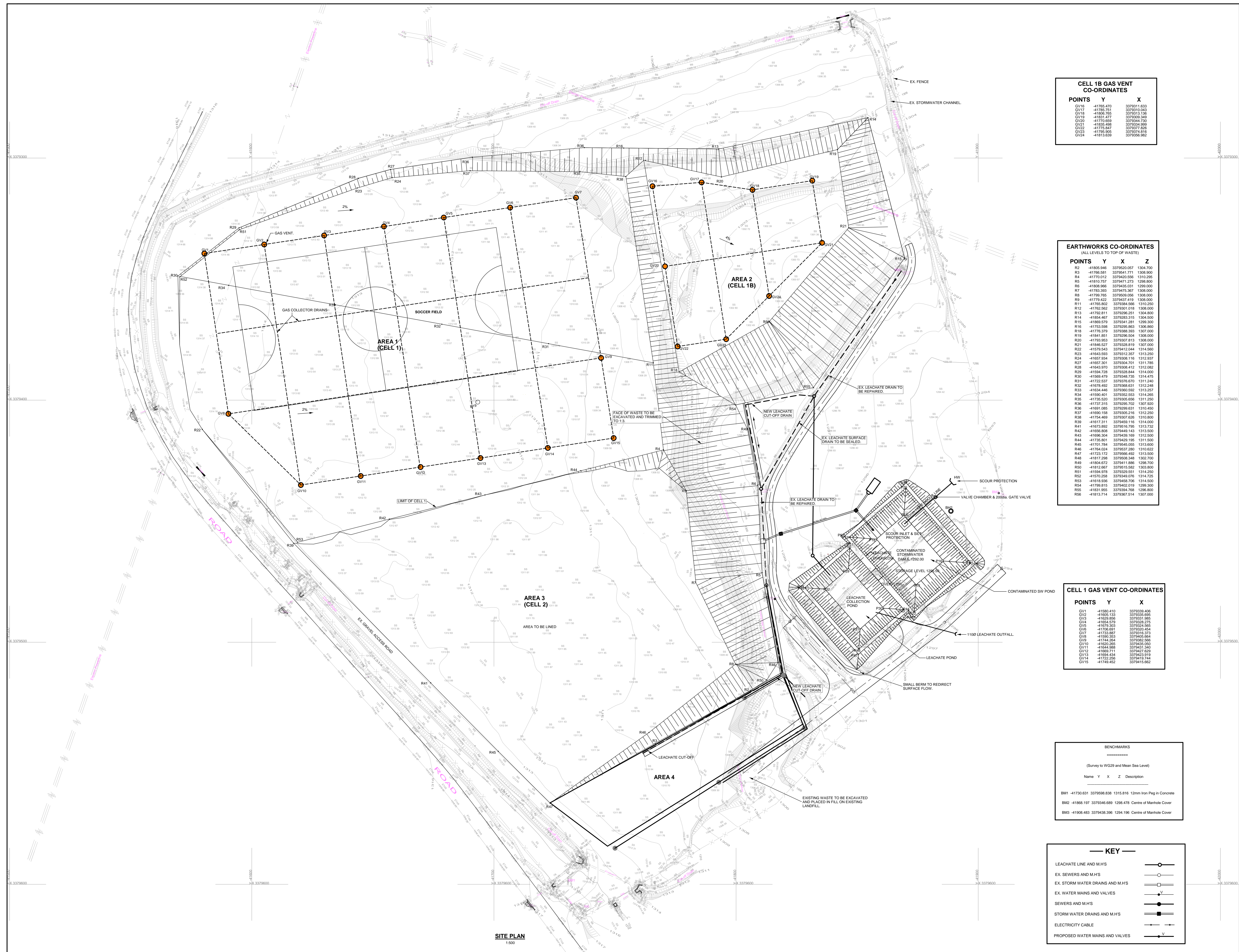
Figure 11: Notice of WML process on site gate



Figure 12: Notice of WML process on site fence

Appendix C: Facility illustration

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CELL 1B GAS VENT CO-ORDINATES

POINTS	Y	X
GV16	-41765.470	3379311.633
GV17	-41766.750	3379310.043
GV18	-41866.795	3379310.386
GV19	-41811.415	3379344.349
GV20	-41770.659	3379344.730
GV21	-41803.816	3379344.816
GV22	-41775.847	3379377.826
GV23	-41776.906	3379378.816
GV24	-41813.639	3379356.982

EARTHWORKS CO-ORDINATES
(ALL LEVELS TO TOP OF WASTE)

POINTS	Y	X	Z
R2	-1805.946	3379620.057	1304.700
R3	-1796.581	3379641.771	1308.500
R4	-1770.912	3379420.556	1310.256
R5	-1810.757	3379471.273	1298.800
R6	-1808.966	3379453.031	1299.600
R7	-1793.393	3379475.367	1308.000
R8	-1799.765	3379509.056	1308.000
R9	-1779.622	3379471.415	1308.000
R10	-1765.802	3379384.566	1310.250
R11	-1762.562	3379301.016	1308.000
R12	-1792.811	3379296.251	1304.800
R13	-1854.467	3379283.315	1304.500
R14	-1869.579	3379541.281	1299.300
R15	-1753.598	3379296.863	1308.860
R16	-1776.379	3379386.393	1307.000
R17	-1841.851	3379296.504	1308.000
R18	-1793.953	3379297.813	1308.500
R19	-1846.527	3379328.819	1307.000
R20	-1679.543	3379412.044	1314.660
R21	-1643.093	3379313.257	1313.250
R22	-1657.034	3379306.116	1312.937
R23	-1657.301	3379304.701	1311.785
R24	-1643.970	3379308.412	1312.882
R25	-1694.728	3379328.844	1314.000
R26	-1699.479	3379466.725	1314.476
R27	-1722.537	3379376.670	1311.240
R28	-1678.462	3379306.631	1312.248
R29	-1634.446	3379300.592	1313.257
R30	-1690.401	3379362.553	1314.286
R31	-1735.200	3379366.656	1311.250
R32	-1737.315	3379296.702	1307.920
R33	-1691.085	3379296.702	1307.920
R34	-1690.158	3379305.216	1312.250
R35	-1754.469	3379307.626	1310.800
R36	-1617.311	3379459.116	1314.000
R37	-1673.692	3379516.795	1313.732
R38	-1656.908	3379449.143	1313.500
R39	-1696.304	3379429.169	1312.500
R40	-1725.801	3379429.169	1311.500
R41	-1701.784	3379545.055	1313.600
R42	-1784.024	3379527.280	1310.622
R43	-1723.172	3379566.462	1313.500
R44	-1817.298	3379508.348	1302.700
R45	-1804.872	3379471.986	1298.700
R46	-1812.667	3379515.582	1303.800
R47	-1598.978	3379328.021	1314.250
R48	-1570.296	3379349.076	1314.725
R49	-1618.936	3379428.796	1314.500
R50	-1799.815	3379405.019	1298.900
R51	-1831.955	3379394.768	1298.800
R52	-1813.955	3379394.768	1298.800
R53	-1813.955	3379394.768	1298.800
R54	-1813.955	3379394.768	1298.800
R55	-1813.955	3379394.768	1298.800
R56	-1813.955	3379394.768	1298.800

CELL 1 GAS VENT CO-ORDINATES

POINTS	Y	X
GV1	-41580.410	3379339.406
GV2	-41606.133	3379339.685
GV3	-41628.169	3379339.845
GV4	-41654.579	3379339.275
GV5	-41706.691	3379339.454
GV6	-41723.887	3379339.571
GV7	-41590.383	3379425.664
GV8	-41744.964	3379425.666
GV9	-41520.265	3379425.666
GV10	-41544.988	3379425.666
GV11	-41669.711	3379427.829
GV12	-41694.434	3379427.829
GV13	-41722.256	3379415.744
GV14	-41722.256	3379415.744
GV15	-41748.402	3379415.662

BENCHMARKS
(Survey to WG29 and Mean Sea Level)

Name	Y	X	Z	Description
BM1	-41730.631	3379598.838	1315.816	12mm Iron Peg in Concrete
BM2	-41866.197	3379346.609	1298.478	Centre of Manhole Cover
BM3	-41908.483	3379438.396	1294.196	Centre of Manhole Cover

KEY

- LEACHATE LINE AND M.H.S.
- EX. SEWERS AND M.H.S.
- EX. STORM WATER DRAINS AND M.H.S.
- EX. WATER MAINS AND VALVES
- SEWERS AND M.H.S.
- STORM WATER DRAINS AND M.H.S.
- ELECTRICITY CABLE
- PROPOSED WATER MAINS AND VALVES

DRAWING REFERENCE		
DRAWING NO.	TITLE	
 NORTH POINT		
NOTES		
E AREA 4 SHOWN	G.P.	27/8/2013
D OVERALL BANKS REVISED, CELL 2 GAS VENTS OMITTED	G.P.	31/5/2012
C CELL 1 & 1B GAS VENTS REVISED AND RE-NUMBERED.	G.P.	12/2/2011
B GAS VENTS, EARTHWORKS SETTING OUT REVISED.	G.P.	30/6/2011
A ISSUED FOR CONSTRUCTION	G.P.	31/5/2011
NO.	AMENDMENT	APPROVED DATE
REVISIONS		
AS BUILT		
SUPERVISING AUTHORITY _____		
DATE: _____		
CLIENT		
GREATER KOKSTAD MUNICIPALITY		
Thekwini Geocivics cc T/A TGC ENGINEERS Geotechnical & Civil Engineers Waste Disposal Consultants/Project Managers JOINT VENTURE		
Sumitomo P.O. Box 445 Scientific Roots (PTY) LTD 4 The Crescent PAVILION 3011 Wesley Office Park 20 Howe Street, Kokstad, 6100 Westville 3611 Tel: 031 27 29200 010 3611 Tel: 031 265 2727 Cell: 082 265 2622 Telephone 265-1777 tgc@tgcengineers.co.za info@scientificroots.com		
PROJECT		
SHAYAMOYA LANDFILL SITE		
TITLE		
LAYOUT - REHABILITATION CLOSURE AND FINAL CELL		
CONSULTING ENGINEER	DESIGNED: MP.	
SIGNATURE: _____	DRAWN: KM.	
PR. NO.: _____	CHECKED: G.P.	
DATE: _____	SCALE: 1:500	
REFERENCE NO.	FIGURE NO.	REVISION
50511	101	E
CAD FILE: S:\50511\CAD\50511_101_CELL_2_CLOSURE.DWG		

Appendix D: Specialist reports

DRAFT



SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

MARCH 2011

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Copy N^o: 1

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GREATER KOKSTAD MUNICIPALITY**SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT**

1. INTRODUCTION

The Shayamoya Landfill is located north-west of the town centre, adjacent to the residential suburbs of Shayamoya. It is the only waste disposal facility for the Greater Kokstad Municipality and is operated by the Municipality's Social Services Department.

The site is not in good condition with little planning. It is impacting on the surrounding environment, in that it is generating leachate, odour and wind blown waste.

In terms of the Environmental Conservation Act № 1989 no person shall establish or operate a disposal site without a License issued by the Department of Environmental Affairs and Rural Development (DEARD). The site is currently not licensed, and the Municipality has been under considerable pressure from DEARD to rehabilitate and if necessary close the site. It is noted that it was a condition in the Record of Decision approving the Shayamaya Township Development by the Department of Agriculture & Environmental Affairs (DAEA), dated 1 October 1999 that the landfill should be closed.

In terms of legislation an unlicensed site still needs to be licensed for closure. To comply with the license requirements the site would have to be rehabilitated and then capped in accordance with the DWA 'Minimum Requirements for the Disposal of Waste by Landfill'.

After assessing their obligations the Municipality has decided to rehabilitate the landfill and prepare a design to provide sufficient airspace for a two year period, during which they will identify and commission a new site.

2. SITE DESCRIPTION**2.1 LOCATION & DESCRIPTION**

The site is located on the north-east outskirts of Kokstad adjacent to the Shayamoya Housing Development. Drawing 50511/101 shows the site layout and topography.

It is situated at the head of a small easterly sloping valley which drains towards the Umzintlava River approximately 350m downslope of the site. The topography is gentle and an average land slope is 5° (1 in 11).

An eroded gully exists approximately 30m downslope of the landfill in the valley axis. Seepage from both the subsoil and waste body is evident in the valley below the landfill.

Access to the site is off an existing asphalt road which runs along the western boundary and provides a link between the Shayamoya and Bhongweni settlements which are north and south of the site respectively.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

The site has existed since the mid 1980's and the estimated volume of waste that has been deposited is 118000m³. The bulk of the waste has been placed to form a terrace extending eastward from the gravel road. At the highest point the depth of the waste is about 6m. Areas of isolated heaps or thinly spread waste exist in areas surrounding the terrace. This includes the old quarry area west of the gravel road.

The terraced waste comprises general municipal waste whilst most of the spread and mounded waste comprises rubble and garden refuse.

Late in the design process, a site inspection revealed evidence of an old trench method of waste disposal in the area between the existing landfill and the old ponds. Consequently it was decided to extend the landfill area to include this area.

2.2 SITE GEOLOGY

A geotechnical investigation was first undertaken by Davies Lynn & Partners in July 1987. It was also referred to in a report prepared by Knight Hall Hendry (Pty) Ltd in July 1999 as part of a report for the Shayamaya Housing Development. The information was confirmed by TGC Engineers in May 2006 as part of the site investigation required to confirm the extent of the waste body.

Generally the site is underlain by mudstones and sandstones of the Beaufort Group which have been extensively intruded by dolerite in the form of inclined sills. The depth to bedrock varies from 1,0m on the upper valley slopes to up to 3,0m in the valley invert and valley head area. The upper soils comprise clayey hillwash/residual mudstone/sandstone.

Seepage areas occur in the valley invert and comprise artificial seepage from the waste (leachate) and natural seepage.

3. CURRENT STATUS

All the municipal waste generated within the Greater Kokstad area is being disposed of at the landfill. On site monitoring, confirms that the current rate of deposition is about 30 tonnes/day.

The waste is being spread over a large levelled terrace which is gradually being extended southward. There is little supervision on site to control the thickness of the waste layer. The availability of cover material is at times sporadic resulting in periods of uncovered waste. Although the Council has decided to close the site, it requires a period of 5 years to identify, permit and commission a new/replacement site. The airspace required to accommodate waste during this period is 65 000m³.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

4. END USE REQUIREMENTS

The landfill is located on land owned by the Municipality. To the west and east the site is bordered by residential townships. The land to the north extending down to the river is vacant. To the south across the gravel road which borders the site exists an old quarry. The land is otherwise vacant. The gravel road forms a busy access road between the two residential areas (Shamayomaya and Bhongweni townships) either side of the site.

No monitoring committee exists which can provide input to the end use of the site. The Municipality have confirmed that in their planning for the area the site has been designated for active open space (i.e. sports fields). A copy of an area development plan is attached.

5. GROUNDWATER MONITORING

Following discussions with DWA regarding the monitoring of water resources, it was agreed that two boreholes would be installed, one up gradient of the landfill and the other down gradient.

Figure 1 shows the position of the boreholes. Both boreholes were drilled into the Beaufort Group sandstone/mudstone bedrock to determine the static ground water level. Details are as follows:

Borehole №	Depth	Static Water level Depth (m)
1	69 m	43,5
2	54 m	23,5

The boreholes were again sampled and tested on 11 February 2011.

A region for monitoring the ground and surface water has been established. This involves sampling each borehole and the Umzintlava River at three points, upstream of the site, near the confluence with the stream from below the landfill and downstream of the site. All these points were sampled on 21 August 2006 and 11 February 2011. The results of tests undertaken are summarised in Table 1 below. The three river samples are and have not changed much between sampling. The borehole samples indicate little or no impact due to the landfill and in some cases the water quality appears to have improved.

The position of the boreholes and sampling points are indicated on the site plan.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

TABLE 1:
RESULTS OF STREAM AND BOREHOLE WATER QUALITY TESTING

PARAMETER	UNIT	CLASS 0 & 1	CLASS 2	CLASS 3	Mzintliava River sampled												Leachate Dam	
					Upstream S1			S2			Downstream S3			Upslope Borehole		Downslope Borehole		
					11/02/11	21/08/06	11/02/11	11/02/11	21/08/06	11/02/11	21/08/06	11/02/11	21/08/06	11/02/11	21/08/06	11/02/11		21/08/06
pH	pH Units	< 5.00 - 9.50	4.00 - 10.00	> 10.00	6.90	7.60	7.20	7.50	7.40	7.40	7.40	7.40	7.80	8.30	7.20	7.40	8.10	
Conductivity	ms/m	< 70.00 - 150.00	> 150.00 - 370.00	> 370.00	11.00	12.00	11.00	12.00	11.00	12.00	11.00	12.00	38.00	18.00	169.00	230.00	575.00	
Total Hardness as Ca CO3	mg/l	ns	ns	ns	60.00	32.00	60.00	42.00	64.00	60.00	64.00	60.00	130.00	18.00	554.00	872.00	830.00	
Calcium Hardness as CaCO3	mg/l	ns	ns	ns	20.00	18.00	28.00	22.00	16.00	20.00	16.00	20.00	90.00	10.00	400.00	530.00	258.00	
Calcium as Ca	mg/l	< 80.00 - 150.00	> 150.00 - 300.00	> 300.00	8.00	7.00	8.00	9.00	6.40	8.00	6.40	8.00	36.00	4.00	160.00	212.00	100.00	
Magnesium as Mg	mg/l	< 30.00 - 70.00	> 70.00 - 100.00	> 100.00	9.60	3.00	9.60	5.00	12.00	10.00	12.00	10.00	9.60	2.00	37.00	82.00	139.00	
Chloride as Cl	mg/l	< 100.00 - 200.00	> 200.00 - 600.00	> 600.00	7.00	11.00	5.00	9.00	5.00	10.00	5.00	10.00	9.60	7.00	350.00	487.00	1,600.00	
p Alkalinity	mg/l					4.00		4.00		4.00		4.00		8.00		28.00		
m Alkalinity	mg/l					42.00		44.00		42.00		42.00		70.00		340.00		
Ammonia as N	mg/l	< 0.20 - 1.00	> 1.00 - 2.00	> 2.00		0.60		0.40		0.40		0.40		0.40		0.20		
Boron as B	mg/l	ns	ns	ns		< 0.10		< 0.01		< 0.10		< 0.10		< 0.10		< 0.10		
Cadmium as Cd	mg/l	< 0.003 - 0.005	> 0.005 - 0.010	> 0.010		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		
Chemical Oxygen Demand	mg/l	ns	ns	ns	19.00	31.00	19.00	24.00	19.00	26.00	19.00	26.00	19.00	60.00	19.00	89.00	560.00	
Chromium VI	mg/l	ns	ns	ns		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		
Chromium Total	mg/l	< 0.05 - 0.10	> 0.10 - 0.50	> 0.50		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		
Cyanide Total as CN	mg/l	< 0.03 - 0.05	> 0.05 - 0.07	> 0.07		0.005		0.004		0.004		0.004		0.003		0.004		
Lead as Pb	mg/l	< 0.01 - 0.05	> 0.05 - 0.10	> 0.10		< 0.01		< 0.01		< 0.01		< 0.01		0.11		0.04		
Mercury as Hg	mg/l	< 0.001 - 0.002	> 0.002 - 0.005	> 0.005		< 0.001		< 0.001		< 0.001		< 0.001		< 0.001		< 0.001		
Nitrates as N	mg/l	< 6.00 - 10.00	> 10.00 - 20.00	> 20.00	0.10	0.14	< 0.01	0.16	0.40	0.23	0.40	0.23	0.70	< 0.01	1.50	2.90	0.78	
Phenolic Compounds	mg/l	< 0.005 - 0.010	> 0.01 - 0.07	> 0.07		< 0.001		< 0.001		< 0.001		< 0.001		< 0.001		0.024		
Potassium as K	mg/l				1.60	2.90	1.70	2.90	1.50	3.00	1.50	3.00	3.30	3.10	5.60	19.00	385.00	
Sodium as Na	mg/l	< 100.00 - 200.00	> 200.00 - 400.00	> 400.00	11.00	20.00	11.00	19.00	11.00	21.00	11.00	21.00	47.00	65.00	91.00	190.00	364.00	
Sulphate as SO4	mg/l	< 200.00 - 400.00	> 400.00 - 600.00	> 600.00	1.77	4.10	2.08	3.50	1.81	3.50	1.81	3.50	15.00	4.00	13.00	201.00	64.00	
Total Dissolved Solids	mg/l	< 450.00 - 1 000.00	> 1 000.00 - 2 400.00	> 2 400.00	138.00	240.00	124.00	232.00	98.00	212.00	98.00	212.00	244.00	252.00	1,334.00	2,068.00	3,564.00	
Borehole - static water level	m														21 m			

Classification system for the assessment of the suitability of water for Domestic use (Institute of Water Quality - Kempster 1996)

ns	Not specified.
Class 0 & 1	Suitable for long term domestic use.
Class 2	Suitable for short term domestic use.
Class 3	Not suitable for domestic use.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

6. CLOSURE DESIGN**6.1 GENERAL**

The Shayamoya Landfill is not licensed, and does not have a liner or leachate collection system now required for all landfills. The situation is exacerbated by the fact that the site has been poorly operated allowing the ingress of water thereby increasing the potential for leachate generation.

In order to enable the Municipality to obtain a license and to close the site it is proposed to rehabilitate the site to as far as practical to conform with the design requirements of the 'Minimum Requirements for the Disposal of Waste by Landfill'. As part of the design sufficient airspace is to be created in a new cell to accommodate the waste stream over the five years required to identify and commission a new site.

6.2 CONCEPTUAL DESIGN

After considering various options and in order to accommodate the proposed end use requirements of active open space the site has been divided into three areas or cells. Sections of the existing waste body outside of these areas is to be excavated and placed in the cell areas. The northern cell comprises previously placed waste which is to be trimmed and graded to create a gentle sloping terrace large enough to accommodate a football field. The final levels are higher than the existing waste levels and the additional height will be achieved by excavating the thin waste isolated heaps around the main waste terrace and placing it on the terrace. The side slopes will be trimmed to a slope of 1 in 3. The final surface of the terrace will be graded at 2% in the area of the football field and greater than 5% over the balance of the area. It is intended that this cell will be capped and closed as part of the remedial works.

The north-eastern cell (№ 1 east) extends from the existing waste body towards the abandoned sewer ponds. The cell will be formed over previously placed waste using the balance of the rubble, garden refuse and excavated waste. Some new waste can be accommodated in the cell to reach the proposed final levels. The side slope will also be trimmed to a slope of 1 in 3 and the final surface graded at 5% towards the valley invert. It is intended that this cell should be completed, capped and closed as soon as possible.

Thereafter the southern cell will continue to receive waste for a period of two years. This cell will be constructed partly over existing waste areas and partly over in-situ ground. As for the northern-eastern cell, the southern cell has been designed to ultimately accommodate a football field. As part of the preparation for the cell it is proposed that the existing waste be spread and trimmed to fall towards the eastern corner.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

A liner will then be constructed for the cell and a leachate collection system installed. Where the liner is to be constructed over existing waste it will be designed to allow for settlement of the underlying waste. The final surface of this cell will be shaped and graded as described for the northern cell.

6.3 REHABILITATION WORKS

The remedial works have been designed to:

- i) Cut-off stormwater
- ii) Capture leachate
- iii) Provide a liner in areas still to be landfilled.

Each of these issues is discussed under the relevant section of the report.

6.4 CAPPING & LINER DESIGN**6.4.1 Classification**

- (a) *Waste Stream*: The waste disposed of at the site comprises general municipal waste (MSW). No hazardous waste is accepted.
- (b) *Size*: The rate of deposit has been checked by on site monitoring. The current estimated rate of deposit (based on 300 kg/m³) is 30 tonnes/day. Allowing for a growth of 5% the maximum rate of deposition over the next five years will not exceed the limit of 150 tonnes per day for a small site. For design purposes, the site is classified as a Small (S) site.
- (c) *Leachate Generation*: Analysis of the climatic water balance based on the term wettest years and the S-pan evaporation reveals that the site is within a water surplus area and hence is likely generate leachate. The site is therefore classified B⁺.
- (d) *Site Classification*: In terms of the minimum requirements the site is classified G.S.B.⁺.

6.4.2 Proposed Liner

As most of the work in the northern cells is trimming and placing old waste, and as the work will be completed within a short period no liner is proposed for these cells as they will be capped and closed in the near future.

A further motivating factor is that the in-situ soils have low permeability as discussed in the geotechnical report effectively providing an in-situ liner.



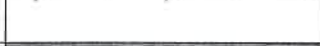

As the southern cell will be landfilled until a new landfill is licensed it is proposed to provide a liner in this area.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

As waste has already been placed in the area and as the integrity of the compacted clay layer would be compromised by settlement of the waste below the liner, it is therefore proposed that the liner in this area be based on a Geosynthetic Clay Liner (GCL). The GCL would be placed over a 150mm support layer comprising selected material. A 150mm protection layer comprising selected clayey material from site would be placed as a protection layer over the GCL.

6.4.3 Proposed Capping

Selected clay suitable to use as a compacted clay layer exists on site and it is therefore proposed to adopt the capping indicated in the Minimum Requirements.

U layer		Topsoil 200mm
V layers		2 x 150 mm (300mm) compacted clay
Base		200mm processed cover soil
		Waste body

6.5 STABILITY

A stability analysis of the landfill has been undertaken along worse case cross-section lines through the landfill and based on the liner configurations shown in drawing 50511/12. Geotechnical parameters used in the stability analysis are:

	Friction Ø (deg)	Cohesion C (kPa)	Unit Weight kg/m ³	
			Dry	Saturated
Waste	15°	20	1000	1200
Stability Berm	30°	1	1850	2200
Clay liner	25°	4	1700	1900
GLC (woven) interface with clay	10°	0	-	-
GLC (woven) interface with sand	17°	0	-	-
GCL (non-woven) interface with clay	15°	0	-	-

Stability analysis indicated that placing GCL X1000 with clay protection layers on the front of the existing landfill material, followed by filling above could lead to instability with a potential failure path occurring between the woven side of the GCL and a clay protection layer (in the front face).

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

Thus, the front face of the existing landfill must either be flattened to a grade gentler than 1 in 5; or alternatively the GCL X1000 (woven side) must be placed on a sandy layer to create sufficient friction to support the waste above, as indicated on drawings 50511/12. The silty sand hillwash in the vicinity of IP20/IP21 may be suitably granular subject to testing.

To improve the stability and assist with the control and capture of leachate a stability berm has been provided along the lower edges of the new Cell.

7. STORMWATER DRAINAGE

Currently stormwater from the access road and the area to the west of the road is discharged into the landfill area through two pipe culverts. It is impractical to regrade the road and relocate the pipe culverts. Consequently it is proposed that stormwater from these culverts be diverted around the waste body by the excavation of surfaced channels between the road and waste body graded to drain south and northward from the middle of the site. The southern drain will be extended down the southern edge of the landfill to ensure runoff from the adjacent open areas does not enter the landfill area.

As required by the Minimum Requirements the surface channels have been designed to accommodate the runoff generated by a 50 year design storm.

8. LEACHATE COLLECTION**8.1 GENERAL**

For design purposes the leachate system has been divided into two components. Large volumes of surface runoff from the cell area as a result of storm events is referred to as contaminated stormwater whilst the continuous concentrated seepage is referred to as leachate.

8.2 LEACHATE

The leachate collection system comprises a 150mm stone chip layer above the liner. Leachate drainage in the site layer is collected into 110m dia. pipes behind the stability berm which drains to a sump at the low point of the lined area. The sump is connected to a liner leachate storage lagoon in the south-east corner of the site.

The estimated average daily leachate flow is 28,1m³. To intercept leachate escaping from the unlined rehabilitated section of the site (northern cell) a subsoil leachate interceptor is to be installed. This drain will also be piped to the leachate pond.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

8.2.1 Collection

Two types of leachate collection systems are envisaged:

1. Areas of previously placed waste: The existing waste is to be cut back away from the seepage area and the new front face stabilised by the construction of a stability berm. At the back of the berm a leachate cut-off drain approximately 1,0m deep will be installed into the existing soils to both collect leachate seepage along the original surface and any sub surface seepage. The cut-off drain connects into solid wall pipes which drain into a leachate collection pond.
2. New areas of waste placed over existing waste: The leachate collection system comprises a 150mm stone chip layer above the liner. The stone layer will drain into a 100mm diameter collector pipe located behind the stability berm. At the low point a sump will be provided which will drain via a solid wall pipe 150mm diameter into the leachate pond and provide 205m³ storage with a free board of 0,5m.

8.2.2 Storage

Based on simple water balance calculations the estimate average rate of leachate flow is 28,1m³/day. The flow will peak during the summer rainfall months and could reach 41m³/day. A leachate storage facility in the form of an open lined pond will be provided at the south-eastern corner of the site. The pond has been sized to accommodate 7 day flow at average flow rates and 4 days at the peak flow. A 0,5m free board is provided. Should the capacity of the pond be exceeded it will overflow into the contaminated stormwater storage pond.

8.2.3 Treatment

At this stage it is anticipated that stored leachate will whenever possible be utilised on site for dust suppression/wetting within the open cell area. Unfortunately as the time of peak leachate flow corresponds with the peak rainfall period it is likely that leachate volume during summer will build up necessitating its removal off site for disposal at the waste water treatment works operated by the District Municipality. The leachate will have to be transported by tanker truck. As the surrounding area is developed and sewer reticulation extended it will be possible to connect the leachate drainage system into the sewer reticulation at a point approximately 300m east of the site. The Sisonke District Municipality, the authority responsible for the Waste Water Treatment Works is to be approached to obtain approval for this connection.

SHAYAMOYA LANDFILL : CLOSURE DESIGN REPORT

8.3 CONTAMINATED STORMWATER

Contaminated stormwater will generally be surface flow from the active landfill area caused by a storm event. Concrete lined surface channels along the lower edges of the landfill will interrupt the runoff and discharge it into a large clay lined pond in the south-east corner of the site. This pond has been sized to accommodate the runoff generated by a 24 hour duration 50 year return storm event. An overflow weir to accommodate larger storms is provided.

9. GAS COLLECTION

As the waste decomposes landfill gas will be generated. A passive ventilating system comprising stone filled gaps through the capping layer will be provided as part of the closure. Lateral gas drains comprising 100mm diameter agricultural pipes surrounded by stone chips will be provided immediately below the capping.

10. CONCLUSION

The works covered by this report include rehabilitation of the existing landfill and the closure of the northern cell. The design has been prepared in accordance with the 'Minimum Requirements for the Disposal of Waste by Landfill'. The site has been classified as GSB⁺ and an appropriate liner and capping design are proposed.

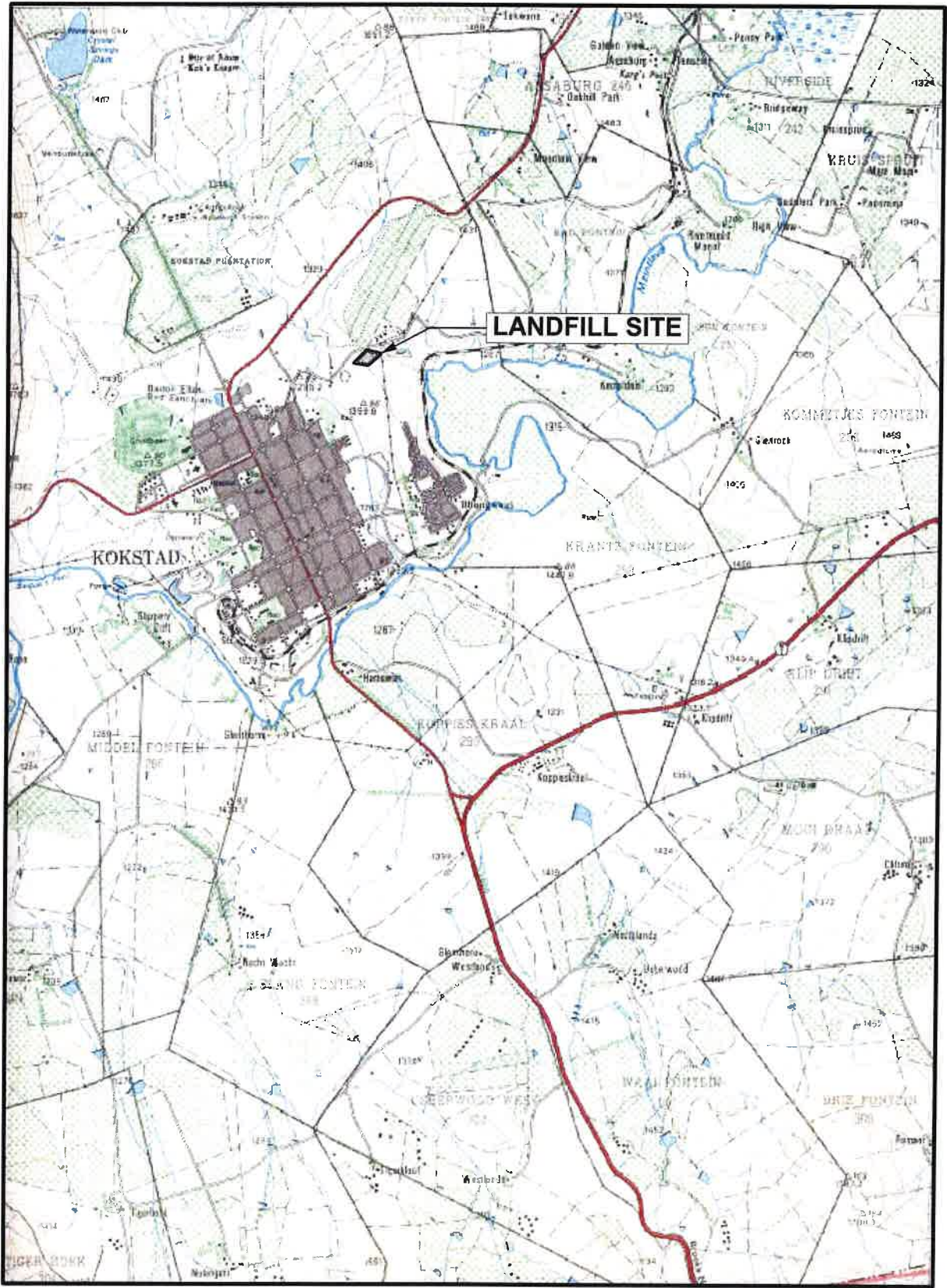
The final profile of the waste body will be shaped to accommodate a football field and the site will be zoned for active open space.



G. J. PAYNE Pr. Eng.

Pr. No 850381

APPENDIX A
LOCALITY PLAN



LANDFILL SITE

KOKSTAD

**LOCALITY PLAN
SHAYAMOYA LANDFILL SITE**

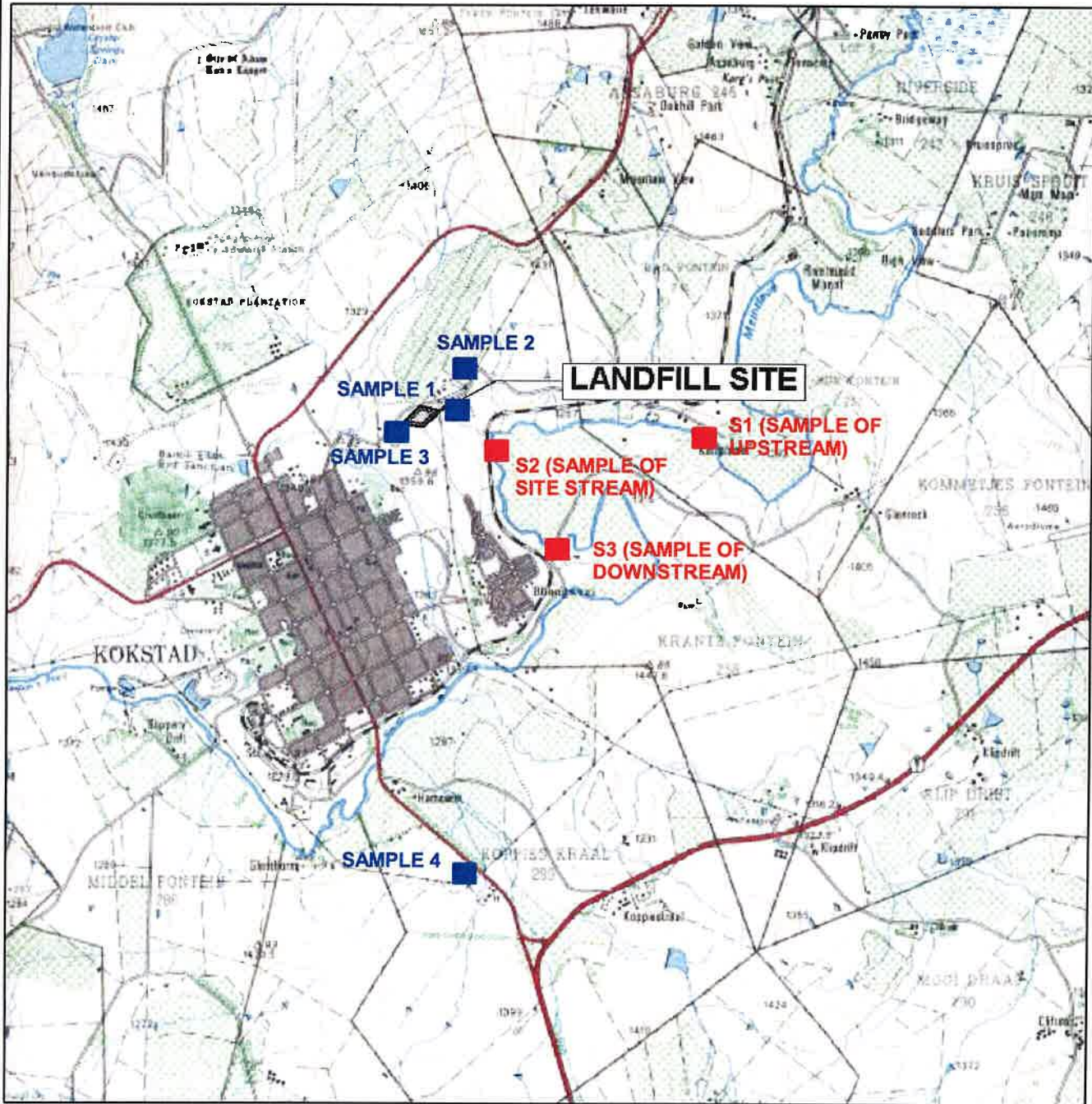
REF. NO.
50511

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DRAWN : K.M.
DATE : FEB 2011
SCALE : N.T.S.
CHECKED : G.P.



KEY

SAMPLE 1



APPROX. POSITION OF SOIL SAMPLES

S1 (SAMPLE OF UPSTREAM)



APPROX. POSITION OF WATER SAMPLES



**LOCALITY PLAN
KOKSTAD LANDFILL SITE
WATER & COVER MATERIAL SAMPLING**



**DRENNAN, MAUD
AND PARTNERS**
Consulting Civil Engineers

DESIGNED : W.R.
DRAWN : S.P.
DATE : 04/03/2011
SCALE : N.T.S.
CHECKED :

REF. NO. 21959
FIG. NO. 1

APPENDIX B
DRAWINGS

APPENDIX C

GEOTECHNICAL REPORTS

- i) Preliminary Report prepared by Davies Lynn & Partners (July 1987)**
- ii) Geological & Geohydrological Conditions Prepared by Thekwini GeoCivils (May 2006)**

(101)

**DAVIES
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812 Sangro House, 417 Smith Street,
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SAL

Prepared

Ref: 2080/19
LB/gm

24 July 1987

Borough of Kokstad
P O Box 8
KOKSTAD
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MUNICIPALITY - MUNISIPALITEIT
TOWN CLERK

307-07-29
STADSKLERK
KOKSTAD

ATTENTION : MR J BUDGE, HEALTH INSPECTOR

Dear Sirs

**PRELIMINARY REPORT OF SITE CONDITIONS FOR PROPOSED
BULK SOLID WASTE DISPOSAL SITE, KOKSTAD**

We hereby report our preliminary observations of the proposed site and our conclusions regarding its suitability for the disposal of bulk solid waste.

1 OBSERVATIONS

1.1 The proposed waste disposal site is located within a gently sloping valley axis with gentle to moderately sloping valley sides. The valley axis drains south eastwards into the Umzintlanga River which is approximately 350 metres downslope of the proposed waste disposal site. The proposed waste disposal site varies in elevation between 1295m and 1315m MSL.

1.2 Approximately 30 metres downslope of the proposed waste disposal site there is a moderately well developed, incised erosion gully with terraced subvertical sides attaining overall depths of between 1,0m and 2,0m below adjoining natural ground levels. Contributing factors to the development of the erosion gully are considered to be sub-surface seepage activity possibly associated with the presence of the Dolomite sill within the lower regions of the valley axis, together with sheet flow of stormwater into the natural drainage trough. Advancement of the head of the erosion gully is considered to have been caused solely by the periodic sheet flow of stormwater during periods of intense rainfall.

1.3 Access to the proposed waste disposal site is from a well maintained, dirt, farm road which leads directly from Kokstad.

Page 2/

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1.4 Electrical powerlines bisect the proposed waste disposal site and pass overhead in a north/south direction.

1.5 The site is situated within an area of the Kokstad Commonage which is presently zoned as conservation.

1.6 On the basis of examination of surface exposures and inspection pits, the area up to a 1km radius from the site, is underlain by fine grained Sandstone and Mudstone of the Beaufort Group which has been extensively intruded by Dolerite in the form of inclined sills.

The Beaufort Mudstone and Sandstone is generally a weathered, yellowish brown and olive grey, close to medium jointed (closed) sub-horizontally bedded, finely laminated, very soft rock which becomes a medium hard rock with depth.

The Dolerite intrusion generally comprises up to 1,2m thickness of residual silt and clay overlying a grey stained orange brown in joints, slightly weathered to unweathered, medium jointed, hard rock Dolerite. An intrusion of resistant, extremely hard rock, coarse grained Dolerite forms an east-west trending ridge approximately 250 metres south of the site.

The proposed waste disposal site is entirely underlain by the Beaufort Mudstone bedrock with the nearest inferred point of the Mudstone/Dolerite contact on natural ground surface being in excess of 80m east of the proposed site. The close to medium jointing in the Beaufort Mudstone bedrock is closed and depth to bedrock below natural ground level varies from less than 1,0m on the hillsides up to 3,0m in the valley bottom and valley head areas.

1.7 The distribution of the soil types and thicknesses may be conveniently divided into three typical soil profiles, namely:

(a) Hillside Areas (Mudstone)

- 0,0 - 0,5m - loose SANDY SILT (Hillwash)
- 0,5 - 1,0m - stiff, gritty SILTY CLAY and partially cemented ferricrete GRAVEL
- 1,0m + (W5/4) olive grey and yellowish brown, completely to highly weathered, close to medium jointed, very soft to soft rock Mudstone Beaufort Group



(b) Valley Bottom/Valley Head Areas (Mudstone)

- 0,0 - 0,5m - loose, SANDY SILT (Hillwash)
- 0,5 - 2,0m - lenses of partially to fully cemented, voided, ferricrete GRAVEL and very stiff clayey SILT
- 2,0 - 2,5m+ - stiff to very stiff, moderately clayey SILT

(c) Dolerite Areas

- 0,0 - 0,4m - loose to medium dense, slightly clayey, sandy SILT (Colluvium)
- 0,4 - 1,5m - (W6) stiff, moderately clayey SILT to SILTY CLAY with large corestones - Residual Dolerite
- 1,5m+ - (W1) grey, slightly weathered to unweathered, medium jointed, very hard rock, coarse grained Dolerite

1.8 The absence of natural springs and sub-surface seepage in inspection pits within the areas underlain by the Beaufort Mudstone, is indicative of the Beaufort Mudstone being a poor groundwater aquifer.

The contact zone between the Dolerite intrusions and the surrounding bedrock is identified as a potential groundwater aquifer and the occurrence of several perennial springs associated with this contact zone were observed within a 1 kilometre radius of the site. The nearest observed perennial spring is approximately 450m northeast of the proposed waste disposal site.

It is considered that a non-perennial spring situated approximately 80m downslope of the proposed waste disposal site, at the Mudstone/Dolerite contact may initially have contributed to the development of the existing erosion gully. Artificial sub-surface seepage was observed in the permeable topsoil horizon adjacent to and downslope of the municipal sludge ponds, the nearest of which is located approximately 35m northeast of the proposed waste disposal site.

No boreholes are located within the area.

2. CONCLUSIONS

On the basis of the foregoing observations, all of which are pertinent to the requirements of the licensing application, it is considered that the site conditions are favourable for the development of a municipal, bulk solid waste disposal site. Relevant points which may be considered are:



- 2.1 The existing electrical powerlines which bissect the proposed site will need to be re-routed so as to bypass the proposed site.
- 2.2 Provided adequate collection and monitoring of leachate emanating from the site is carried out, the danger of water pollution is considered minimal.
- 2.3 Adequate control of the surface runoff by means of stormwater cut-off drains around the perimeter of the site will be required.
- 2.4 The non-perennial spring anticipated to occur downslope of the proposed site and within the erosion gully should, if possible be located and then monitored. Should it be found that there is no spring occurring within the erosion gully or within the area downslope of the proposed site, it is possible that the site may in the future be extended further down the valley axis.
- 2.5 It is anticipated that the highest piezometric level of ground water beneath the proposed waste disposal site will occur at depths in excess of 5 metres below existing ground level.
- 2.6 The dimensions of the proposed waste disposal site are anticipated to be approximately 28 400m² in area and with an elevation difference of about 15 metres.
- 2.7 The estimated life of the proposed waste disposal site is approximately 34 years on the basis of an available airspace of 75 000m³ and an annual compacted volume of refuse of 2 200m³.
- 2.8 Cover material may be obtained from the following sources:
 - (a) Excavation of stormwater cut-off drains.
 - (b) Excavation of topsoil from within the proposed site which may then be infilled.
 - (c) Borrow areas adjacent to prominent Dolerite ridge situated approximately 250m south of the site.
 - (d) Borrow area comprising Alluvial deposits located within the westerly adjoining valley axis.

Importation of cover material will be required either during operation of the site, or at the time of closure.



2.9 The proposed waste disposal site shall need to be surrounded by an adequately constructed fence with lockable gates.

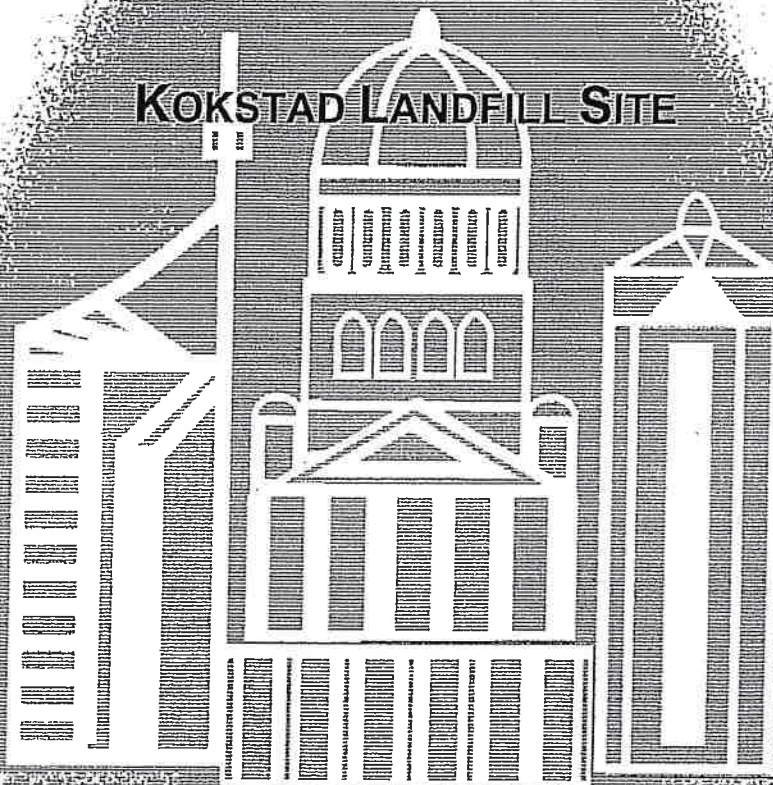
We trust that the above meets with your immediate requirements in this matter and should you have any queries please do not hesitate to contact us.

Yours faithfully
DAVIES, LYNN & PARTNERS

L BOSCH

GEOLOGICAL & GEOHYDROLOGICAL CONDITIONS

KOKSTAD LANDFILL SITE



THEKWINI GEOCIVILS C.C.

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KOKSTAD LANDFILL SITE

GEOLOGICAL & GEOHYDROLOGICAL CONDITIONS

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Appendix 1 - INSPECTION PIT PROFILES

Appendix 2 - BOREHOLE LOGS

Appendix 3 - LABORATORY SOIL TEST RESULTS

GEOLOGICAL & GEOHYDROLOGICAL CONDITIONS KOKSTAD LANDFILL SITE

1. INTRODUCTION

Thekwini GeoCivils cc was recently awarded the contract to perform the "Closure" of the Kokstad Landfill Site. As there is limited existing subsurface information regarding the landfill site, Thekwini GeoCivils performed a testpitting and borehole drilling investigation to determine:

- The existing landfill material thickness, extent and type, i.e. area used for household refuse dumping/builders rubble dumping area/garden refuse placement area, etc.
- The subsoil conditions, i.e. soil/rock type and thickness.
- The geohydrological conditions, especially the water table depth and the presence of seepage zones.

2. FIELDWORK

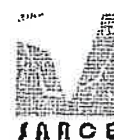
The fieldwork was performed in May 2006 and involved:

- The excavation of 21 № testpits in and around the landfill site to obtain the near surface geology (0-3,0m). Testpits were logged by an Engineering Geologist and soil samples were extracted from testpits where necessary for laboratory soil testing.
- The drilling of 2 № percussion boreholes to 50-70m depth to obtain the geology at depth and allow sampling of the existing water quality immediately upstream and downstream of the landfill site, as requested by the Department of Water Affairs and Forestry. Blow yields were taken at the positions of water strikes. Boreholes were logged by an Engineering Geologist. The boreholes were fitted with well screens to allow periodic water sampling.

Figure 1 shows the site layout and the positions of the boreholes and testpits. The testpit profiles and borehole logs are included as Appendix 1 and 2 respectively. The results of the laboratory soil analysis constitutes Appendix 3.

Limited geotechnical work was performed for the landfill site in 1999/2000 by:

- Knight Hall Hendry : Shayamoya Housing Development, Phase II (Ref KHH756K1/64/1).



- Davies Lynn and Partners : Preliminary report on Site Conditions for the proposed Bulk Solid Waste Disposal Site, Kokstad (Ref 2080/19).

The reports are included in the Kokstad Landfill Closure Report (April 2000) as supplied by the Kokstad Municipality. Information was obtained from these reports where necessary. In particular, the testpit profiles TP27, TP28, TP29, TP30 which are included in Figure 1 and in the appended testpit profiles (Appendix 1).

3. SITE DESCRIPTION

The site is located on the NE outskirts of Kokstad adjacent to the Shayamoya Housing Development. Figure 1 shows the site layout and topography. Gently sloping topography surrounds the landfill. The landfill site is located at the head of a valley which drains east towards the Umzintlava River, some 350m downslope of the site.

An erosion gully is situated approximately 30m downslope of the landfill site in the valley axis. Subsurface seepage (natural) and surface seepage (landfill sponge releasing water slowly) emanates from the lower portions of the landfill.

Access to the site is via an existing gravel road which connects the Bhongweni settlement (south of the site) to the Shayamoya settlement (north of the site). Stormwater from the gravel road is allowed onto the landfill site. Three smaller disused sewage ponds lie adjacent to the NE site boundary. An Eskom power line servitude passes alongside the SE site boundary and a shale Quarry forms the south western boundary.

Grasses generally cover the site with few shrubs and small trees.

4. SITE GEOLOGY AND SOILS

The 1:250 000 geological map Kokstad 3028 shows the regional geology of the area to consist predominantly of grey/green/brown/red mudstone and yellow/grey sandstone of the Beaufort Group intruded by Jurassic aged dolerite dykes and sills.

4.1 NEAR SURFACE GEOLOGY/GEOHYDROLOGY - GEOLOGICAL MAPPING AND TESTPITTING EXERCISE

Geological mapping and testpitting revealed the main landfill footprint and immediate surrounds to be underlain by mudstone siltstone and fine grained sandstone of the Beaufort Group. The general range in geological profile is described below:

- 0 to ± 0,3/0,5m - Slightly moist/moist (occasionally wet below and within landfill footprint); brown/dark brown/orange; firm/stiff; clayey silty fine sand/clayey sandy silt; Hillwash/Colluvium.

- 0,3/0,5m to 0,7/1,5m - Slight moist/moist (occasionally wet below and within landfill footprint); brown/yellow/olive green/orange/grey; firm/stiff, (soft in places within landfill footprint); sandy clayey silt/sandy silty clay/clayey sandy silt/gravelly clayey silt; Residual mudstone/siltstone/fine grained sandstone.
- > 0,7/1,5m - Olive green/grey/yellow weathered orange/brown, highly weathered, horizontally bedded, closely jointed (closed jointing/clay infills), very soft rock becoming medium hard rock with depth, mudstone/siltstone/fine grained sandstone. The following main sub-vertical joint set trends were encountered: 180°/190°/220°/250°/300°/320°.

Exception to the above profile occurs in the lower valley areas (vicinity of IP18, IP19, IP27, BH2) where the colluvial and residual soils are thicker (i.e. > 2,5 to 3,5m to bedrock) and generally described as a clayey silt or silty clay.

There are localised areas around the site where the mudstone/siltstone/fine grained sandstone outcrops at surface which is deemed the result of scraping off cover material for the landfill operations.

A large dolerite intrusion trending NW-SE forms the high lying ridge passing some 150m to the south of the site, as shown in Figure 1. A ± 20m thick large dolerite intrusion was also encountered in BH1, portions of which are likely to extend beneath the landfill. Associated smaller dolerite intrusions were encountered along the eastern site portions (vicinity of IP15, IP17) and in the valley axis downslope of the landfill footprint. The dolerite in the high lying portions to the south of the site is anticipated to comprise ± 0,5/1,5m of clayey silt/silty clay, Hillwash/Residual Dolerite with numerous hard dolerite corestones; overlying hard rock, coarse grained dolerite bedrock. The dolerite on the lower slope portions; as encountered in the vicinity of IP17; is more deeply weathered comprising 2,5/3,5m of sandy clayey silt Residual Dolerite overlying dolerite bedrock. The mudstone bedrock in the vicinity of dolerite intrusions was noted to be indurated (baked/hardened) to shale with occasional steepening of bedding planes along contact zones.

Water is found in the lower site portions creating a marsh area as shown in Figure 1. The water is shown to be derived from:

- i) Artificial seepage in the landfill refuse resulting from a perched water table flowing in the landfill refuse on top of the less permeable in-situ soils/bedrock. This emanates from the base of the landfill terraces in places.
- ii) Natural seepage in the in-situ Hillwash/Colluvium (occasionally in the Residuum) and believed to be the result of a perched water table flowing in the upper soil horizons on top of the less permeable residuum and bedrock.
- iii) Seepage from the SW corner of the western most sewage treatment pond.

4.2 GEOLOGICAL/GEOHYDROLOGICAL CONDITIONS AT DEPTH - RESULTS OF THE BOREHOLE DRILLING

To allow water sampling of the groundwater beneath the site, the Department of Water Affairs and Forestry (DWAF) requested that two boreholes be drilled, one upstream of the landfill site and one downstream. Figure 1 shows the positions of the two boreholes.

Boreholes were drilled by S.A. Drilling in June 2006. Table 1 below summarises the geological and geohydrological conditions encountered in each borehole together with the boreholes well-screen configuration inserted for periodic monitoring/sampling.

Table 1 - Summary of Borehole Conditions

Borehole number	Elevation (approx. msl)	Depth (m)	Geology Summary (general)	Static Water Level Depths (m)	Water Strike Depths (m), and Blow Yields (l/sec)	140mm UPVC blank well-screen depth (m)	140mm UPVC perforated wall screen depth (m)
BH1	1316 msl	69m	0 - 0,5m : Clayey Hillwash / Residuum	43,5m	No water strikes, slight seepage	0-34m	34-69m
			0,5 - 2,0m : Highly weathered, very soft rock siltstone / mudstone / fine sandstone				
			2,0 - 3,0m : Highly to moderately weathered, hard rock, Dolerite				
			3,0 -24,0m : Slightly to moderately weathered, hard rock, Dolerite				
			24,0 -69,0m : Slightly to unweathered, medium hard to hard rock mudstone / siltstone / fine sandstone				
BH2	1293 msl	54m	0 - 3,0m : Clayey Colluvium / Hillwash	23,5m	43m, < 1l/s	0-24m	24-54m
			3,0 - 4,0m : Highly weathered, very soft rock, fine sandstone / siltstone				
			4,0 -42,0m : Slightly weathered, medium hard to hard rock, sandstone / siltstone / mudstone				
			42,0 -50,0m : Moderately to highly weathered, medium hard to soft rock shale				
			50,0 -54,0m : Slightly weathered, medium hard to hard rock, sandstone / siltstone / shale				

For a more detailed description, reference must be made to the appended borehole logs. Borehole BH2 encountered weathered/broken shale bedrock at 42-50m and was thus discontinued at 54m for fear of borehole collapse and loss of equipment. The borehole drilling essentially revealed:

- The site to be underlain by Beaufort group sandstone/siltstone/mudstone/shale intruded by numerous small and large dolerite intrusions.
- The Beaufort group sediments and dolerites encountered in boreholes are a relatively poor aquifer (i.e. fairly impermeable) with only one minor (< 1ℓ/s) water strike encountered in BH2 at 43m.
- The static water level (groundwater level) in the bedrock is fairly deep beneath the landfill ranging from 43,5m in BH1 to 23,5m in BH2, thus providing a suitably thick attenuation zone.

4.3 LANDFILL MATERIAL TYPE/EXTENT/THICKNESS

Two main types of landfill dumping have occurred in the area as shown in Figure 1. These are:

- A) Household refuse - This occurs along the main valley line and comprises a mixture of household refuse and cover soil layers which decrease in thickness from 4-6m in the centre of the footprint to 0,5-1,0m along the edges. Inferred contouring of the refuse landfill thickness (from inspection pits and the previous ground contours) are included in Figure 1.
- B) Dump Mounds - This surrounds the household refuse footprint to the west (between the Bhongweni/Shayamoya gravel road and the Quarry); south and east as shown in Figure 1. The dump mounds are generally 0,5-1,5m high (up to 2m maximum) and include builders rubble, large concrete fragments, soils, shale quarry dumprock, limited garden refuse (i.e. tree stumps/leaves/trees/grass). There are few household refuse mounds in this area but these total an estimated < 1% of the volume.

5. RESULTS OF THE LABORATORY SOIL TESTING

Numerous soil samples were taken from testpits of representative soil horizons for laboratory soil testing. In light of the anticipated landfill closure earthworks, only two of the samples were tested at this stage, the remainder have been retained for testing at a later stage if deemed necessary. The two soil samples which have been tested are of the residual siltstone/mudstone/sandstone soil horizon found beneath the landfill site and sampled in IP2 and IP12.

Grading, permeability and shear strength testing of this material was performed in order to determine its effectiveness as a natural in-situ liner material. Table 1 of Appendix 3 summarises the laboratory test results from which the following conclusions are drawn for the residual mudstone/siltstone/sandstone soil horizon beneath the landfill:

5.1 SOIL TYPE

The material classifies as a clayey silt of low to medium plasticity (CL) according to the Unified Soil Classification System and as A-6 type material after the Revised U.S. Roads Classification.

5.2 SOIL PERMEABILITY

The minimum requirements for waste disposal by landfill (DWAF) require a maximum permeability of 10^{-6} cm/sec for any soil liner used beneath a G:B+ landfill. Laboratory falling head permeability testing was performed on the two soil samples obtained from beneath the landfill (re-compacted to 100% proctor). This revealed that the laboratory permeability of the soil beneath the landfill ranges from 10^{-5} to 10^{-7} cm/sec. In-situ permeabilities can be up to 2 magnitudes higher than laboratory permeabilities. The soil material beneath the landfill is hence likely to range from marginally suitable to marginally unsuitable as an in-situ liner. However, the soils (and bedrocks) ability to retard vertical infiltration is highlighted by the extensive seepage emanating from the base of the waste pile, i.e. the majority of water/leachate is perched in the landfill material on top of the soil/bedrock and flows out at the base of the landfill.

5.3 SHEAR STRENGTH TESTS

In light of the anticipated landfill closure method; which is likely to involve collecting the waste from around the landfill periphery and raising the central waste-pile portions; shear strength tests were performed on the soils beneath the landfill to obtain shear parameters for use in landfill stability modelling. Appendix 3 shows the results of the consolidated drained shearbox tests performed on the soils (compacted to 100% proctor) and revealed the following shear strength parameters:

- IP2 (2,2-3,0m) - Friction (ϕ) = 30° / Cohesion (c) = 4kpa
- IP12 (2,7-3,1m) - Friction (ϕ) = 28° / Cohesion (c) = 6kpa

6. CONCLUSIONS

- Figure 1 shows the landfill material thickness, type and extent. Landfilling presently reaches maximum thicknesses of 4-6m toward the centre of the landfill and 0-2m along the periphery.

- Soils beneath the landfill generally comprise 0,5-1,0m of clayey silt/silty clay Hillwash/Residuum overlying mudstone/siltstone/shale fine grained sandstone of the Beaufort Group. Dolerite intrusions are noted to the south and east of the landfill footprint. Laboratory permeability testing indicates that the soil material beneath the landfill is likely to range from marginally suitable to marginally unsuitable as an in-situ liner.

However, the soils ability to retard infiltration is highlighted by the extensive seepage emanating from the base of the waste pile, i.e. water/leachate is perched in the landfill material on top of the soil/bedrock and flows out at the base of the landfill creating a marsh area. Shear strength testing has been performed on the soils beneath the landfill to obtain shear parameters for use in landfill stability modeling, when necessary.

- The general "dump mound" area surrounding the main landfill varies from soil to builders rubble (concrete) to quarry dump rock to garden refuse. This area can either be:
 - Flattened off and vegetated to create a uniform topography, or
 - Collected as daily cover material for landfill operations. A large portion of the material is generally not suitable for daily cover (i.e. oversized concrete/rock, garden refuse, etc.) however the mixture of soil/rubble/refuse is anticipated to function satisfactorily as a daily cover material. This will also aid in cleaning the landfill periphery and defining the landfill footprint.
- Potential capping/liner/protection layer soils are obtainable from the vicinity of IP17 ($\pm 3,0\text{m}$ thick), IP20/IP21 ($\pm 1,5\text{m}$ thick), IP27 ($\pm 3,0\text{m}$ thick), and the sewage treatment works embankments to the east of the landfill. Shallow bedrock ($< 1,0\text{m}$) was encountered in the remainder of the testpits excavated outside of the landfill footprint.
- Borehole drilling revealed the site to be underlain by Beaufort Group sediments and dolerite intrusions. The poor water strikes (i.e. only one minor strike in BH2 - $< 1\ell/\text{s}$) indicate these materials to be a poor aquifer. The static water level (groundwater level) is fairly deep beneath the landfill (BH1 - 43,5m / BH2 - 23,5m), thus providing a suitably thick attenuation zone.

K. M. RIBBINK Pr. Sci. Nat.
THEKWINI GEOCIVILS CC

APPENDIX 1
INSPECTION PIT PROFILES

SOIL PROFILE

Thekwini GeoCivils cc
Suite 6, 4 The Crescent,
Westway Office Park, Westville



Project Kokstad Landfill Rehabilitation
Site Greater Kokstad Municipality
Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP1
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,70m

SAMPLE AND TEST	DEPTH METRES	LEGEND	SOIL	ROCK	DESCRIPTION		
					Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification.		
					Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.		
	- 0,50	0,00 - 0,20			Dark brown, slightly moist to moist, firm, CLAYEY FINE SAND, (HILLWASH), fibrous roots.		
	- 1,00	0,20 - 1,00			Yellow brown, slightly moist, firm, SANDY CLAYEY SILT, (RESIDUAL MUDSTONE / SILTSTONE).		
	- 1,50	1,00 - 1,70			Olive green, grey, weathered brown / orange, horizontally bedded, closely jointed, highly weathered, very soft rock becoming soft rock at base, (MUDSTONE / SILTSTONE), main vertical joint sets trend 300° and 190°.		
	- 2,00						
	- 2,50						
	- 3,00						
	- 3,50						
	- 4,00						
	- 4,50						
	- 5,00						
	- 5,50						
	- 6,00						
					<p>Note : No water encountered.</p> <p>: Fl / Mod. of 0,20m - 1,00m.</p> <p>: Refusal at base, excavatable at least 1,00m further with large excavator.</p>		
—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

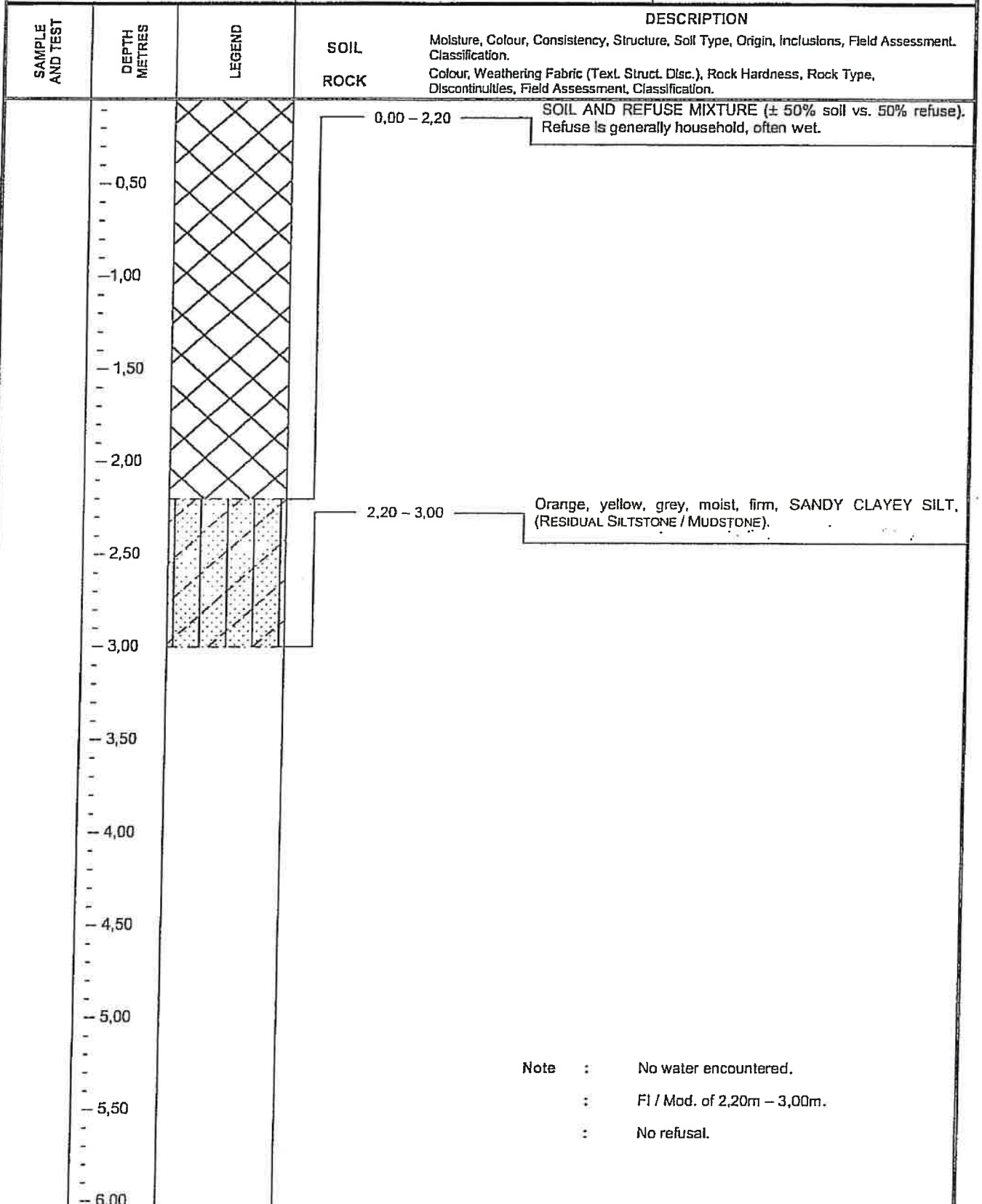
SOIL PROFILE

Thekwini GeoCivils cc
 Suite 6, 4 The Crescent,
 Westway Office Park, Westville



Project Kokstad Landfill Rehabilitation
Site Greater Kokstad Municipality
Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP2
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,00m



Note :

- : No water encountered.
- : Fl / Mod. of 2,20m - 3,00m.
- : No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

SOIL PROFILE

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Project Kokstad Landfill Rehabilitation
Site Greater Kokstad Municipality
Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP3
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 2,70m

SAMPLE AND TEST	DEPTH METRES	LEGEND	SOIL	ROCK	DESCRIPTION		
					Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification. Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.		
	- 0,50	[Cross-hatched pattern]		0,00 - 1,40	SOIL AND REFUSE MIXTURE (20% soil vs. 80% refuse).		
	- 1,00						
	- 1,50	[Dotted pattern]		1,40 - 2,00	Dark brown, olive green, moist, firm, SANDY CLAYEY SILT, (RESIDUAL SILTSTONE / MUDSTONE).		
	- 2,00						
	- 2,50	[Horizontal dashed lines]		2,00 - 2,70	Olive green, grey, weathered brown / orange, horizontally bedded, closely jointed, highly weathered, very soft rock becoming soft rock at base, (MUDSTONE / SILTSTONE), main vertical joint sets trend 300° and 190°.		
	- 3,00						
	- 3,50						
	- 4,00						
	- 4,50						
	- 5,00						
	- 5,50						
	- 6,00						
					Note : No water encountered. : No sample. : Refusal at base.		
—	Approximate Material Changes	[Square with diagonal line]	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	[Square]	Undisturbed Sample	C	CBR		

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Site Greater Kokstad Municipality
Job No. 50511
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Date 04 May 2006
Machine TLB

Pit No. IP4
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,70m

SAMPLE AND TEST	DEPTH METRES	LEGEND	SOIL	ROCK	DESCRIPTION		
	0,50	[Pattern]	0,00 - 0,30		SOIL AND REFUSE MIXTURE (± 50% soil vs. 50% refuse). Refuse is generally household, often wet.		
	1,00	[Pattern]	0,30 - 0,80		Dark brown, orange, slightly moist, firm, SANDY SILTY CLAYEY, (RESIDUAL MUDSTONE).		
	1,50	[Pattern]	0,80 - 1,70		Olive green, weathered orange, brown, highly weathered, closely jointed, very soft becoming soft rock at base, (MUDSTONE), vertical joint trends 190°, bedding dips at ± 40° to the NE (60° dip direction).		
	2,00						
	2,50						
	3,00						
	3,50						
	4,00						
	4,50						
	5,00						
	5,50						
	6,00						
					Note : No water encountered. : No sample. : Refusal at base.		
—	Approximate Material Changes	[Symbol]	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	[Symbol]	Undisturbed Sample	C	CBR		

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Date 04 May 2006
Machine TLB

Pit No. IP5
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,00m

DESCRIPTION

SAMPLE AND TEST

DEPTH METRES

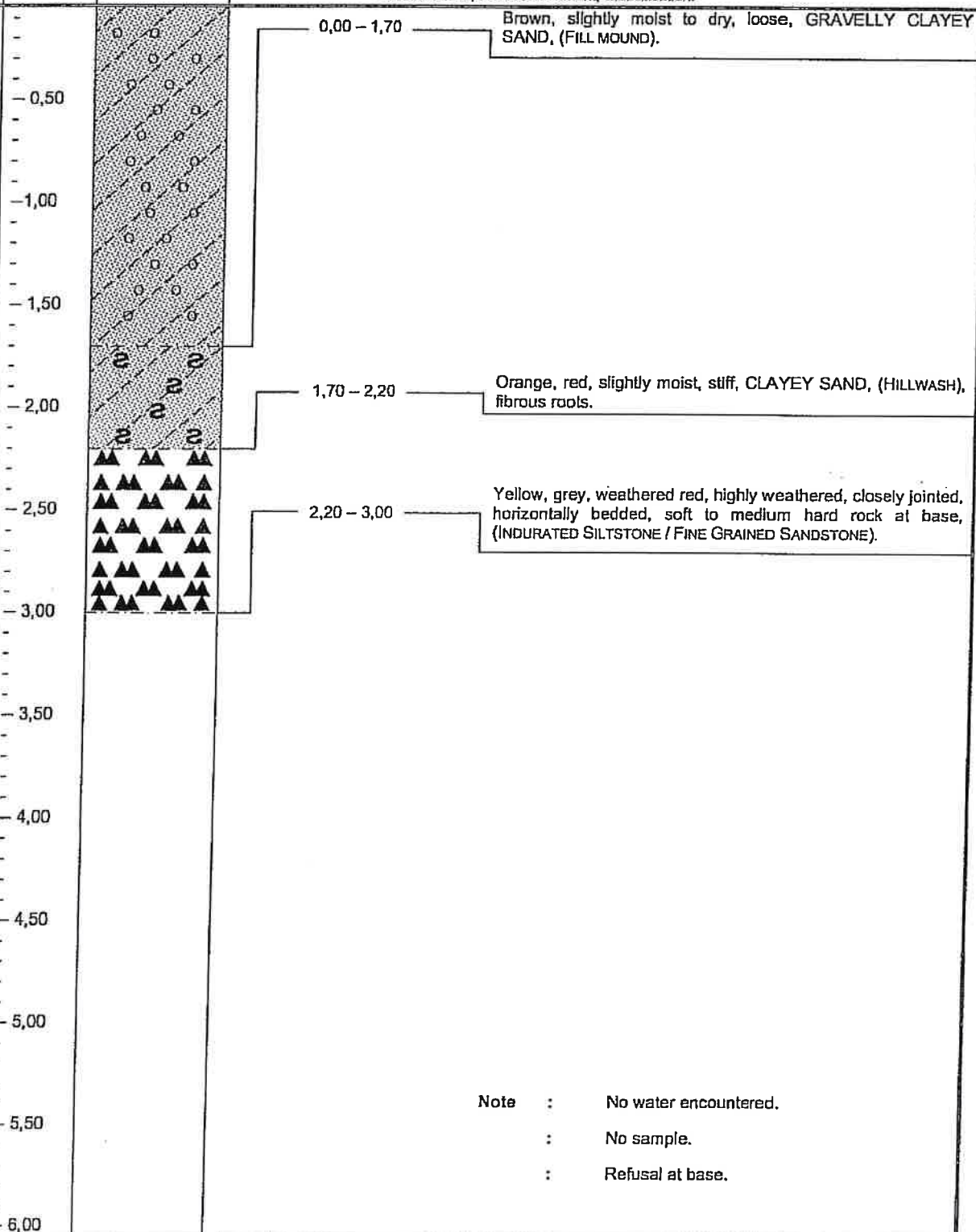
LEGEND

SOIL

Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification.

ROCK

Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.



Note : No water encountered.
 : No sample.
 : Refusal at base.

—	Approximate Material Changes	□	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	□	Undisturbed Sample	C	CBR		

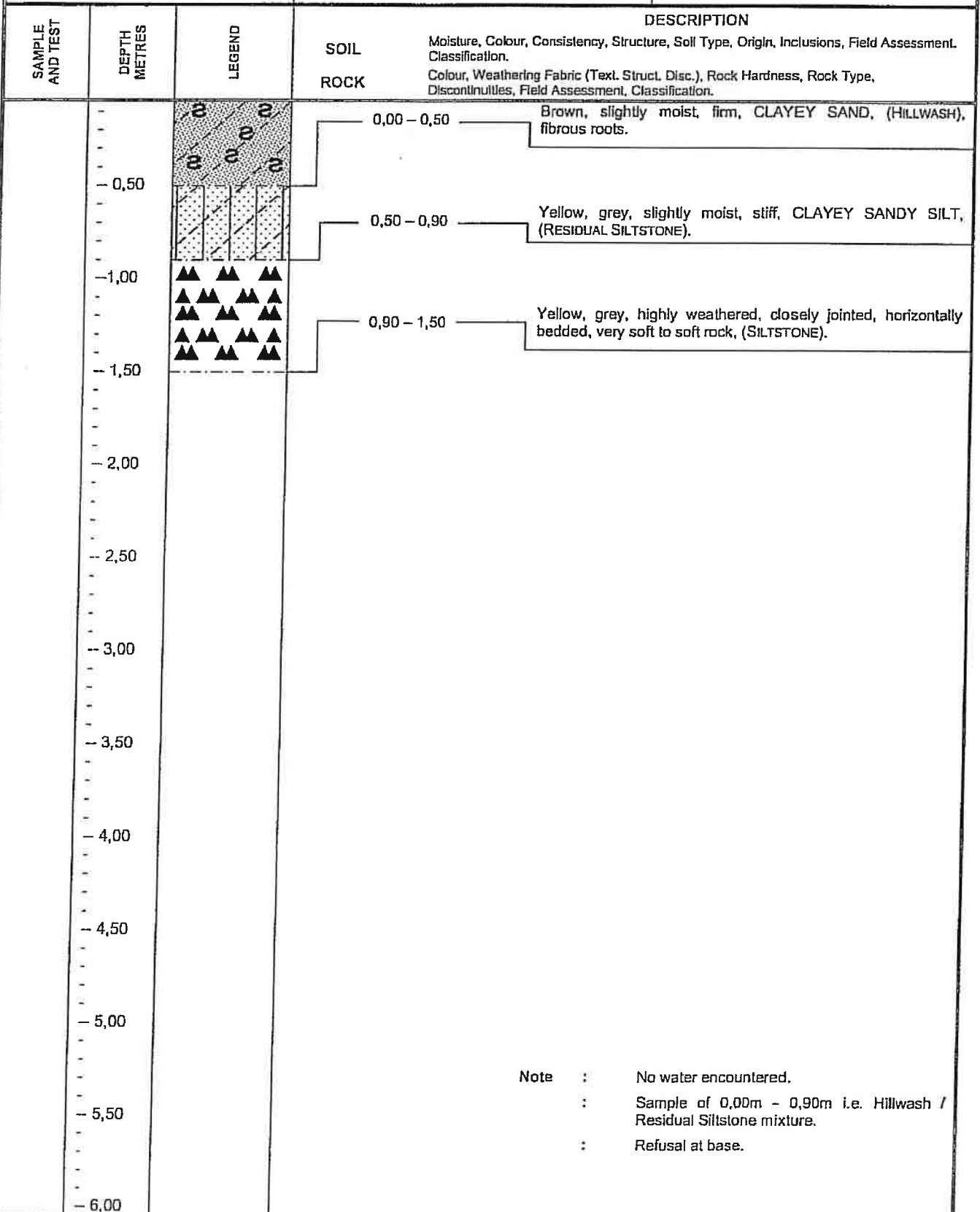
SOIL PROFILE

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Project Kokstad Landfill Rehabilitation
Site Greater Kokstad Municipality
Job No. 50511
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Date 04 May 2006
Machine TLB

Pit No. IP6
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,50m



Note :

- : No water encountered.
- : Sample of 0,00m - 0,90m i.e. Hillwash / Residual Siltstone mixture.
- : Refusal at base.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

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Machine TLB

Pit No. IP7
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 2,00m

SAMPLE AND TEST	DEPTH METRES	LEGEND	SOIL ROCK	DESCRIPTION			
				Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification. Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.			
	- 0,50		0,00 - 0,70	SOIL AND REFUSE MIXTURE (± 50% soil vs. 50% refuse). Refuse is generally household, often wet.			
	- 1,00		0,70 - 1,00	Brown, slightly moist, firm, CLAYEY SILTY FINE SAND, (HILLWASH), fibrous roots.			
	- 1,50		1,00 - 1,30	Grey, yellowy, slightly moist, firm, CLAYEY SANDY SILT, (RESIDUAL SILTSTONE / MUDSTONE).			
	- 2,00		1,30 - 2,00	Yellow, grey, highly weathered, closely jointed, horizontally bedded, very soft to soft rock, (SILTSTONE).			
	- 2,50						
	- 3,00						
	- 3,50						
	- 4,00						
	- 4,50						
	- 5,00						
	- 5,50						
	- 6,00						
				Note : No water encountered. : No sample. : Refusal at base.			
—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

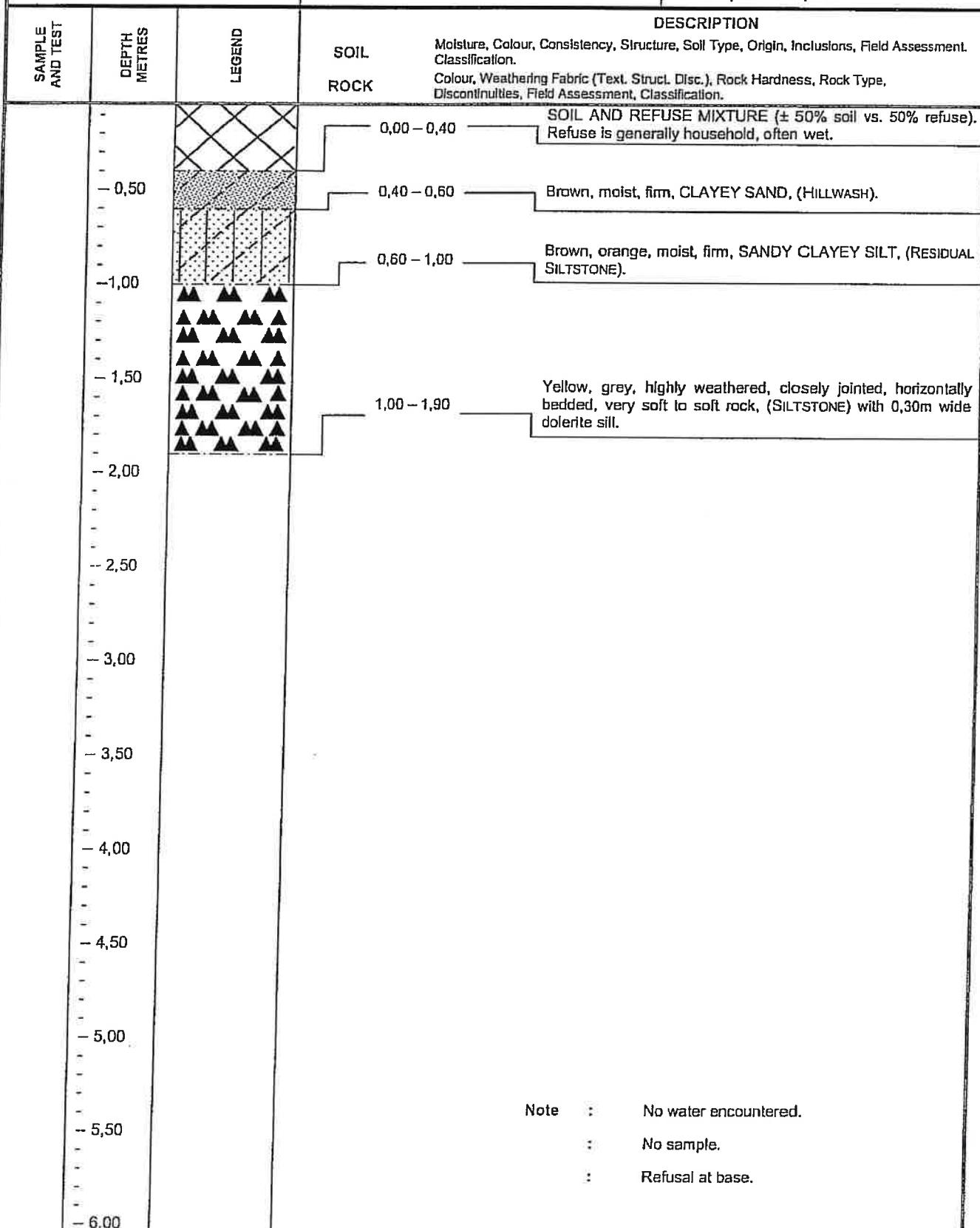
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Site Greater Kokstad Municipality
Job No. 50511
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Date 04 May 2006
Machine TLB

Pit No. IP8
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,90m



Note : No water encountered.
 : No sample.
 : Refusal at base.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

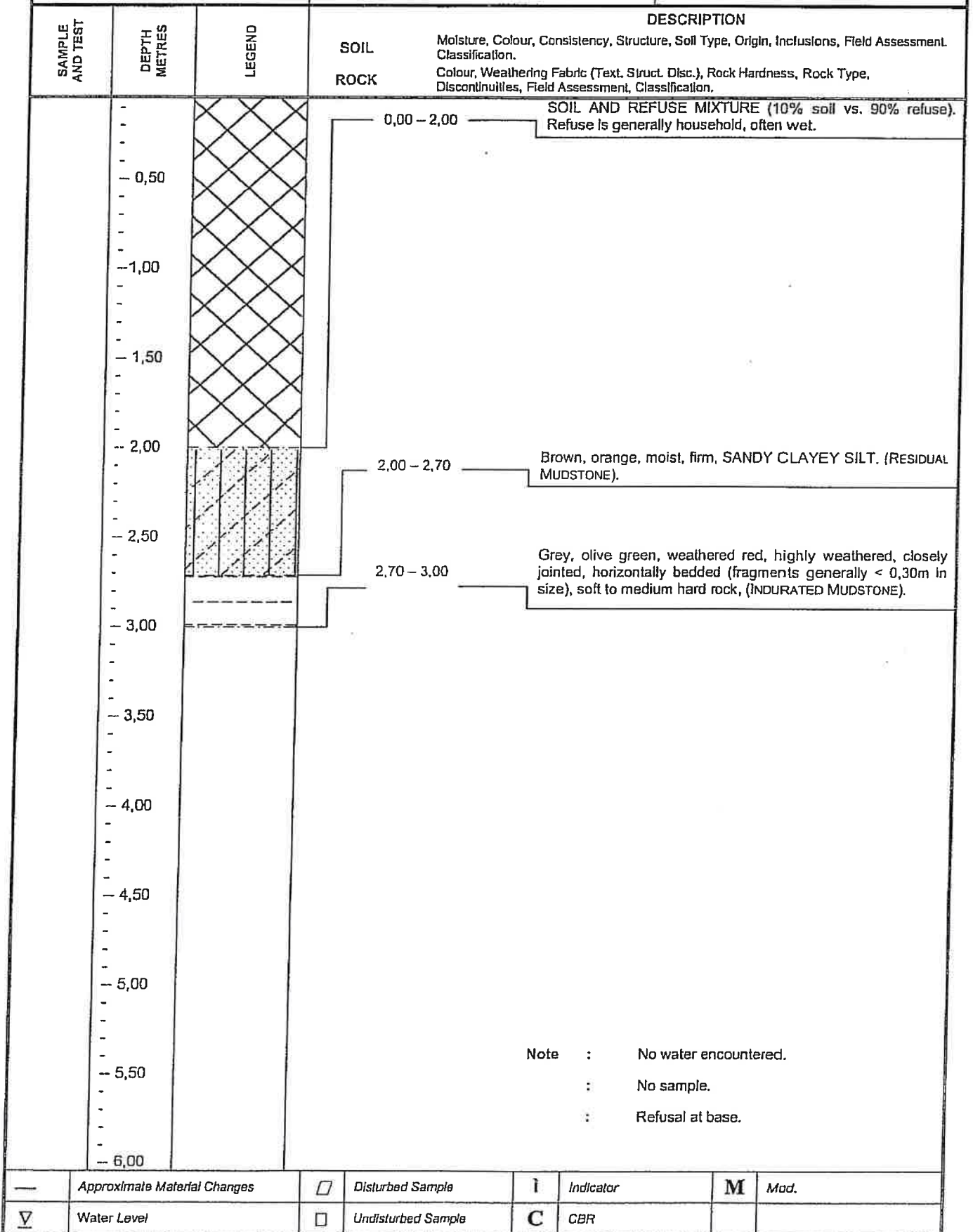
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Pit No. IP9
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,00m



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Site Greater Kokstad Municipality
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Date 04 May 2006
Machine TLB

Pit No. IP10
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,20m

SAMPLE AND TEST	DEPTH METRES	LEGEND	DESCRIPTION
			<p>SOIL Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification.</p> <p>ROCK Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.</p>
	- 0,50 - 1,00 - 1,50 - 2,00 - 2,50 - 3,00 - 3,50 - 4,00 - 4,50 - 5,00 - 5,50 - 6,00		<p>0,00 – 3,20</p> <p>SOIL AND REFUSE MIXTURE (10% soil vs. 90% refuse). Refuse is generally household, often wet.</p>
			<p>Note :</p> <ul style="list-style-type: none"> : No water encountered. : No sample. : No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	I	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

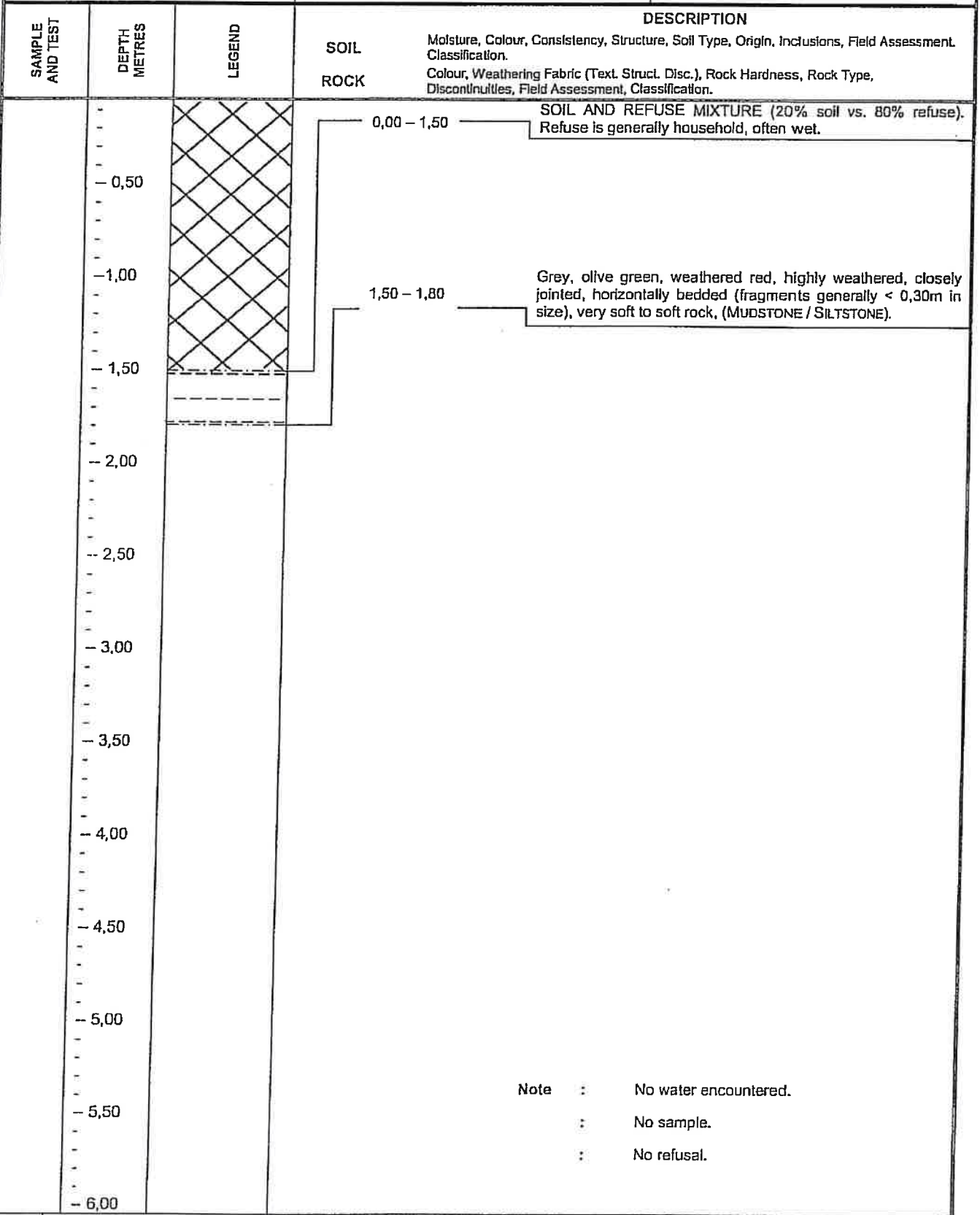
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Site Greater Kokstad Municipality
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Date 04 May 2006
Machine TLB

Pit No. IP11
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,80m



Note : No water encountered.
 : No sample.
 : No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

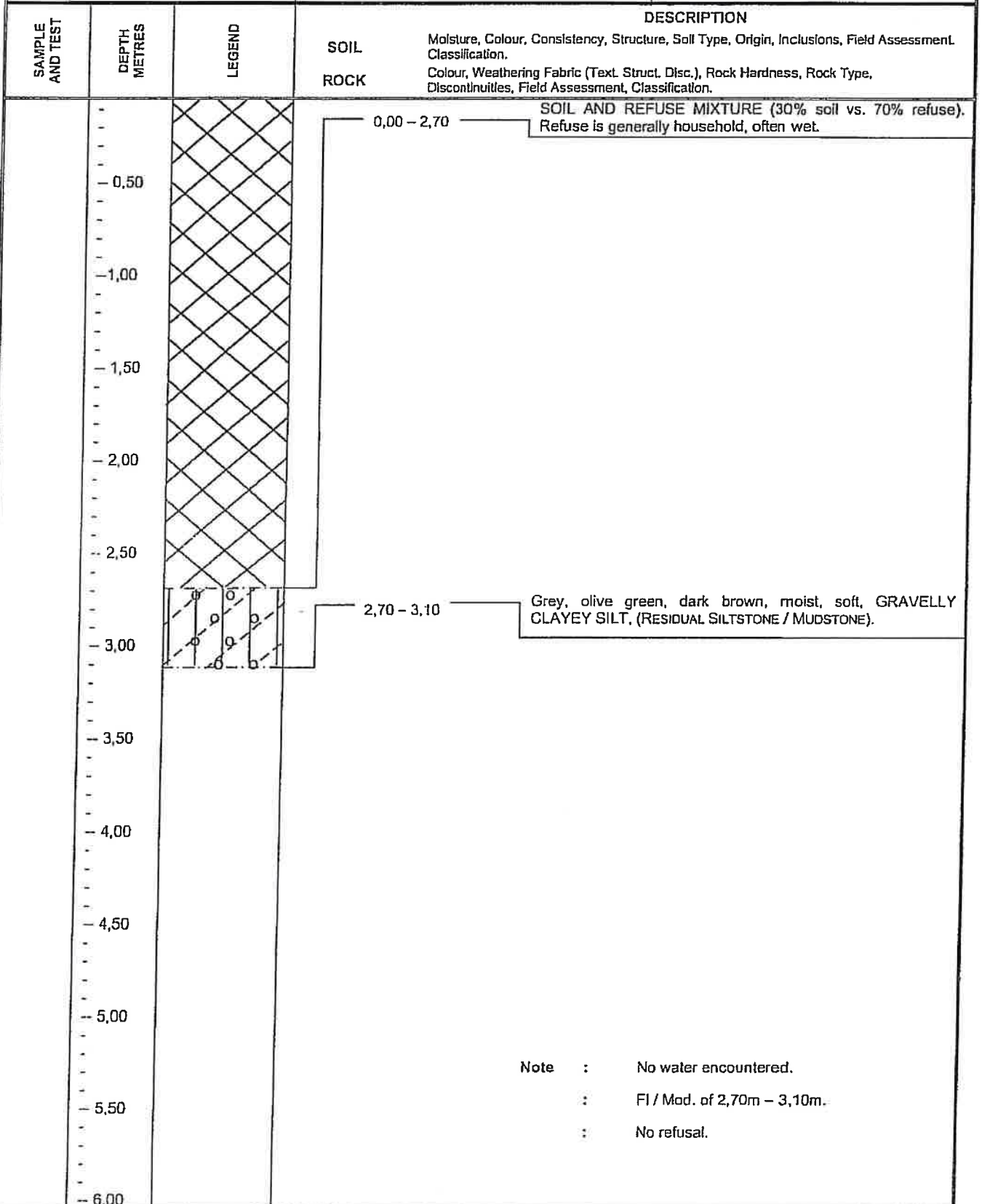
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Machine TLB

Pit No. IP12
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,10m



Note : No water encountered.
: FI / Mod. of 2,70m - 3,10m.
: No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

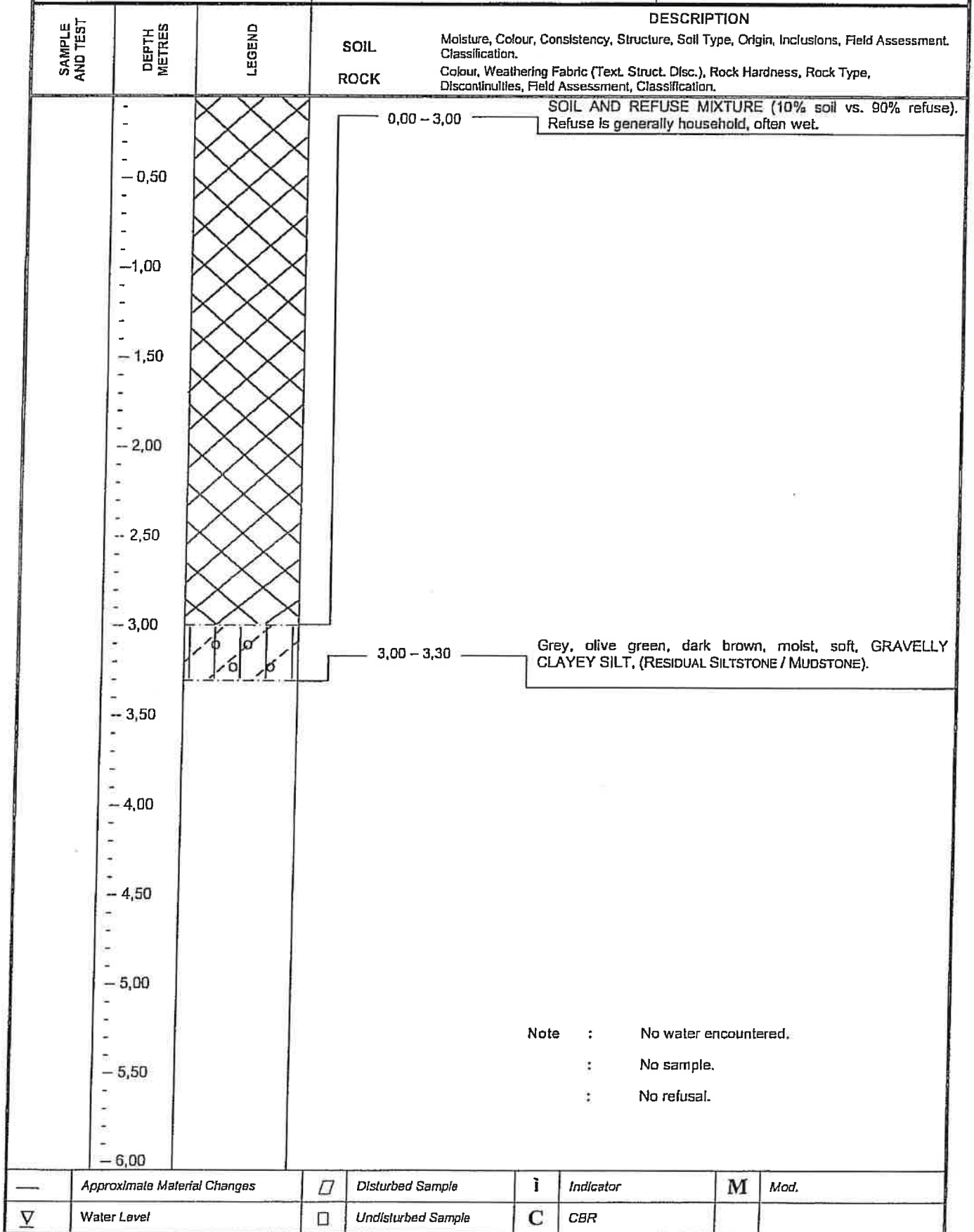
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Pit No. IP13
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,30m



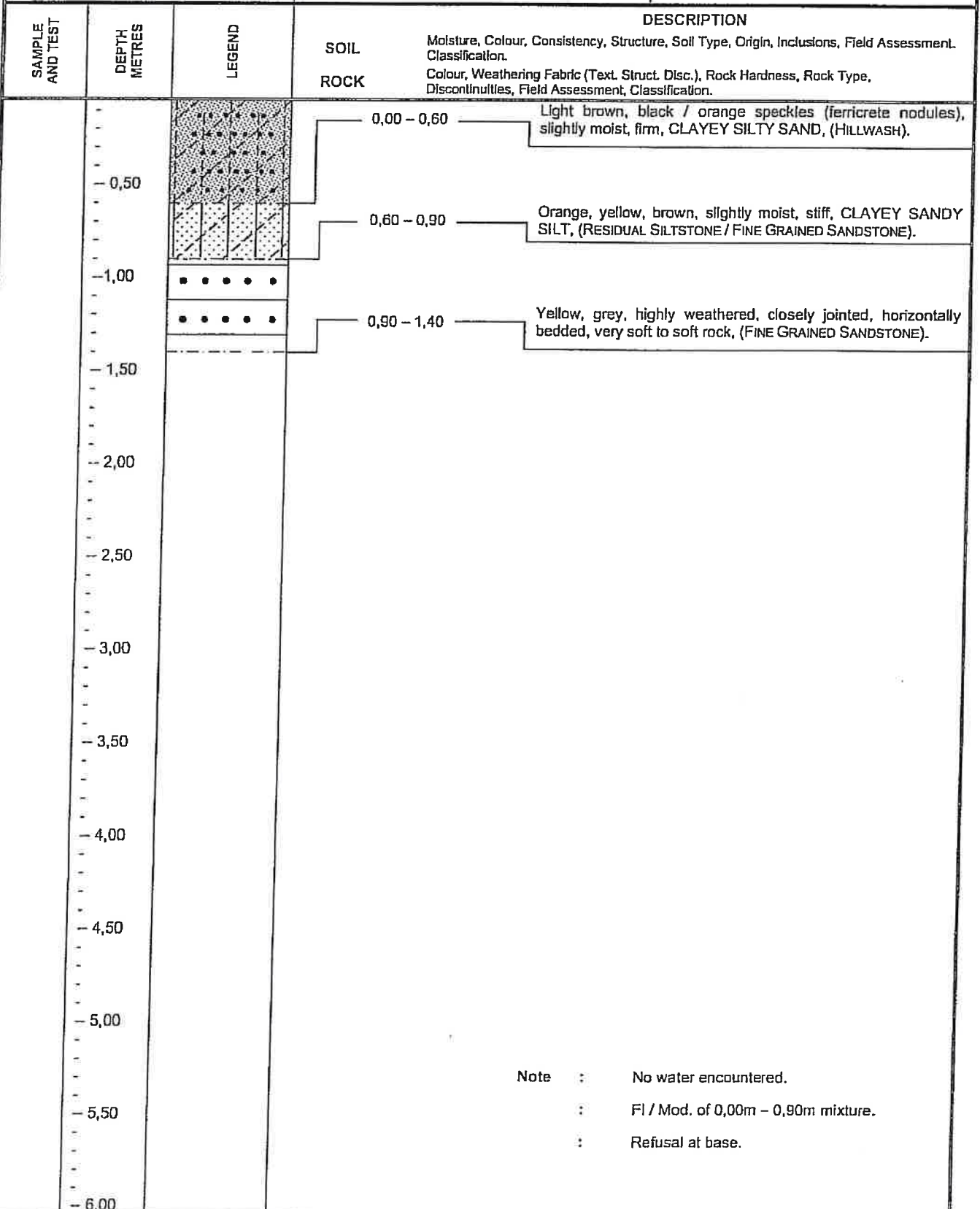
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Date 04 May 2006
Machine TLB

Pit No. IP14
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,40m



Note :

- : No water encountered.
- : Fl / Mod. of 0,00m - 0,90m mixture.
- : Refusal at base.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

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Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP15
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 2,20m

SAMPLE AND TEST	DEPTH METRES	LEGEND	SOIL ROCK	DESCRIPTION				
				Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification. Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.				
	- 0,50		0,00 - 1,00	Builder's rubble fragments in SANDY SOIL mixture.				
	- 1,00		1,00 - 1,50	Brown, slightly moist, stiff, CLAYEY SAND, fibrous roots.				
	- 1,50		1,50 - 1,80	Yellow, brown, orange, slightly moist, stiff, SANDY CLAYEY SILT, (RESIDUAL MUDSTONE / SILTSTONE).				
	- 2,00		1,80 - 2,20	Weathered grey, yellow, highly weathered, closely jointed, soft to medium hard rock with depth, (INDURATED MUDSTONE).				
	- 2,50							
	- 3,00							
	- 3,50							
	- 4,00							
	- 4,50							
	- 5,00							
	- 5,50							
	- 6,00							
				<p>Note :</p> <ul style="list-style-type: none"> : No water encountered. : No sample. : Refusal at base. 				
—	Approximate Material Changes			Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level			Undisturbed Sample	C	CBR		

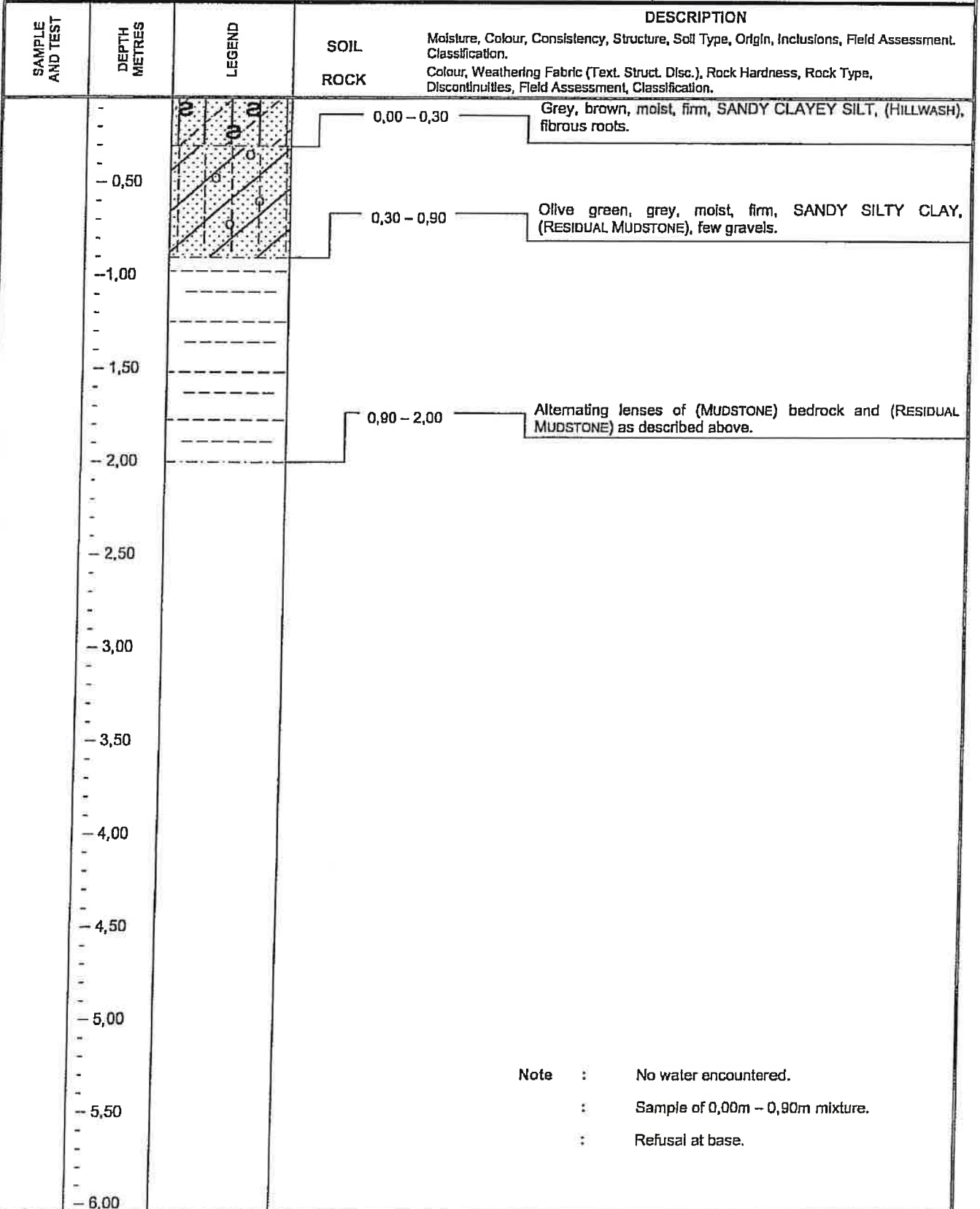
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Site Greater Kokstad Municipality
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Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP16
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 2,00m



Note : No water encountered.
: Sample of 0,00m - 0,90m mixture.
: Refusal at base.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

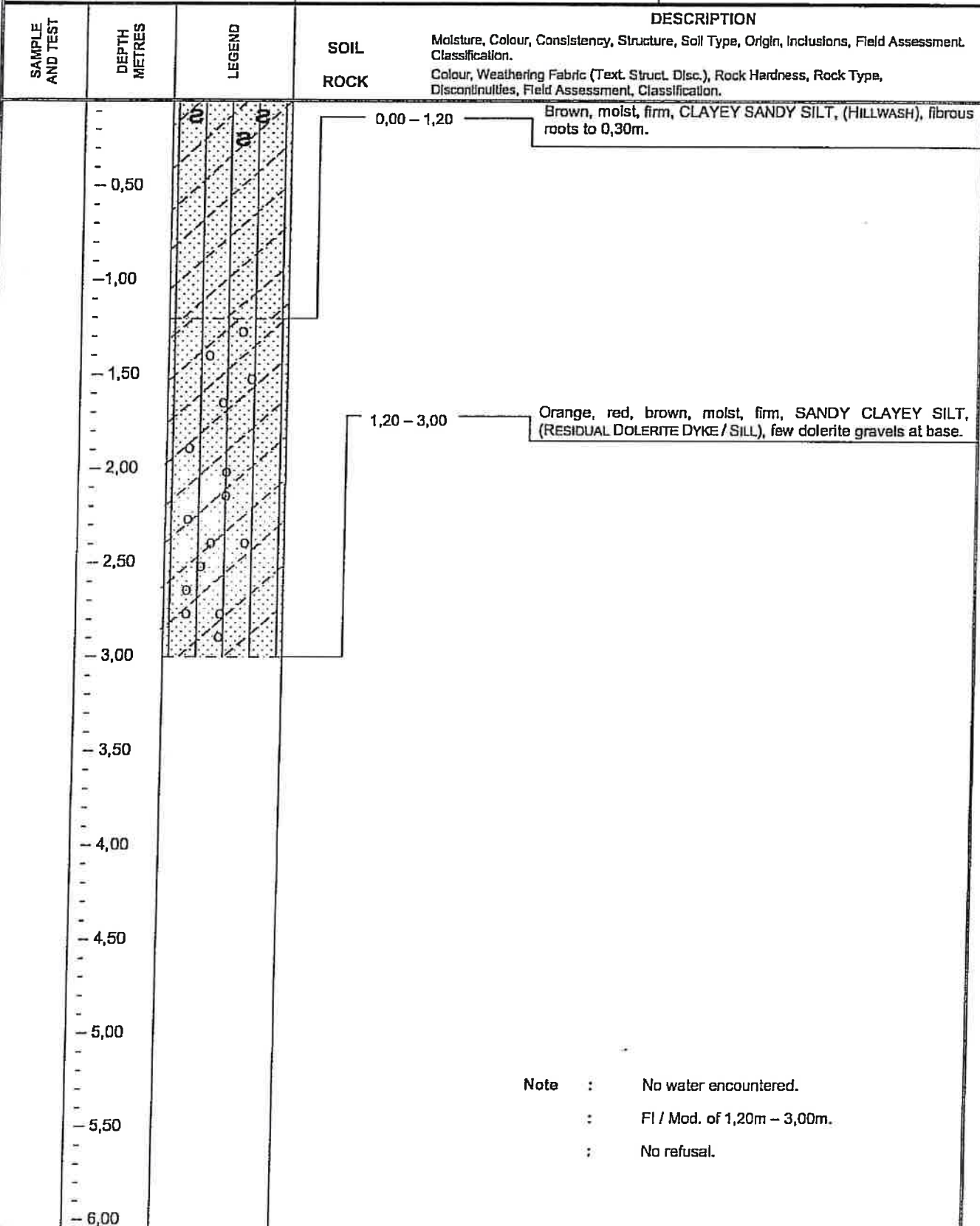
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Site Greater Kokstad Municipality
Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP17
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,00m



Note : No water encountered.
 : FI / Mod. of 1,20m - 3,00m.
 : No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	I	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

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Date 04 May 2006
Machine TLB

Pit No. IP18
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 2,50m

SAMPLE AND TEST	DEPTH METRES	LEGEND	DESCRIPTION
			SOIL Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification. ROCK Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.
	-0,50 -1,00 -1,50 -2,00 -2,50 -3,00 -3,50 -4,00 -4,50 -5,00 -5,50 -6,00		<p>0,00 - 2,20 SOIL AND REFUSE MIXTURE (20% soil vs. 80% refuse). Refuse is generally household, very wet.</p> <p>2,20 - 2,50 Black, grey, yellow, wet, soft, SANDY SILTY CLAY, (RESIDUAL SILTSTONE).</p> <p style="text-align: right;"> Note : Extensive seepage in Fill. Hole stopped due to fill collapse. : No sample. : No refusal. </p>
—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample
i	Indicator	M	Mod.
C	CBR		

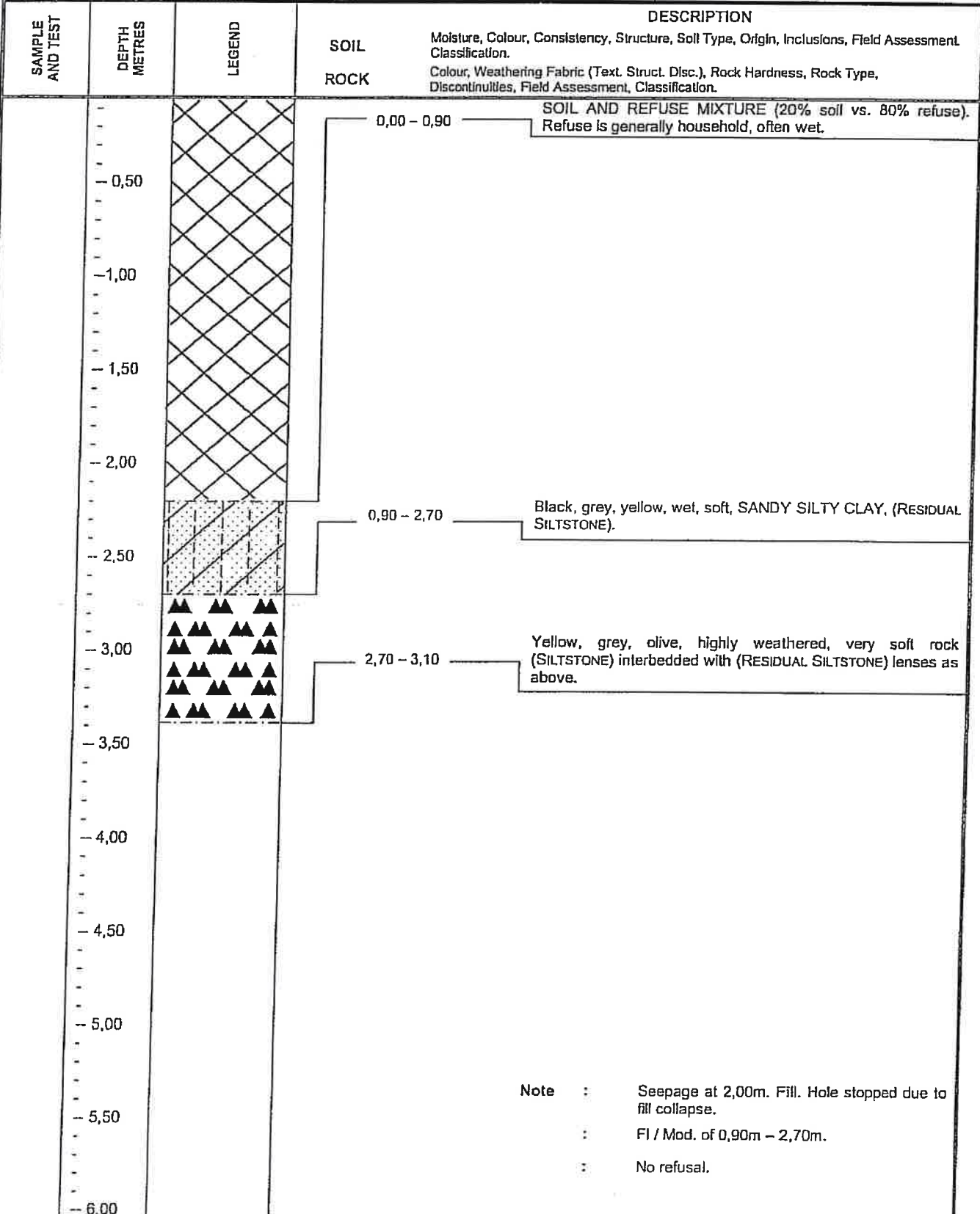
SOIL PROFILE

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Site Greater Kokstad Municipality
Job No. 50511
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Machine TLB

Pit No. IP19
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 3,10m



Note : Seepage at 2,00m. Fill. Hole stopped due to fill collapse.
 : FI / Mod. of 0,90m - 2,70m.
 : No refusal.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

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Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP20
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,80m

SAMPLE AND TEST	DEPTH METRES	LEGEND	DESCRIPTION				
			SOIL Moisture, Colour, Consistency, Structure, Soil Type, Origin, Inclusions, Field Assessment, Classification. ROCK Colour, Weathering Fabric (Text. Struct. Disc.), Rock Hardness, Rock Type, Discontinuities, Field Assessment, Classification.				
	- 0,50		0,00 – 0,60 Dark brown, slightly moist, stiff, CLAYEY SILTY FINE SAND, (HILLWASH).				
	- 1,00		0,60 – 1,00 Orange brown, slightly moist, stiff, CLAYEY SILTY FINE SAND, (HILLWASH).				
	- 1,50		1,00 – 1,40 Yellow, grey, olive green, slightly moist, stiff, SLIGHTLY GRAVELLY SANDY CLAYEY SILT, (RESIDUAL SILTSTONE / MUDSTONE).				
	- 2,00		1,40 – 1,80 Grey, green, weathered red, orange, highly weathered, very soft to soft rock at depth, closely jointed, (MUDSTONE / SILTSTONE) bedrock.				
	- 2,50						
	- 3,00						
	- 3,50						
	- 4,00						
	- 4,50						
	- 5,00						
	- 5,50						
	- 6,00						
			Note : No water encountered. : No sample. : Refusal at base.				
—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

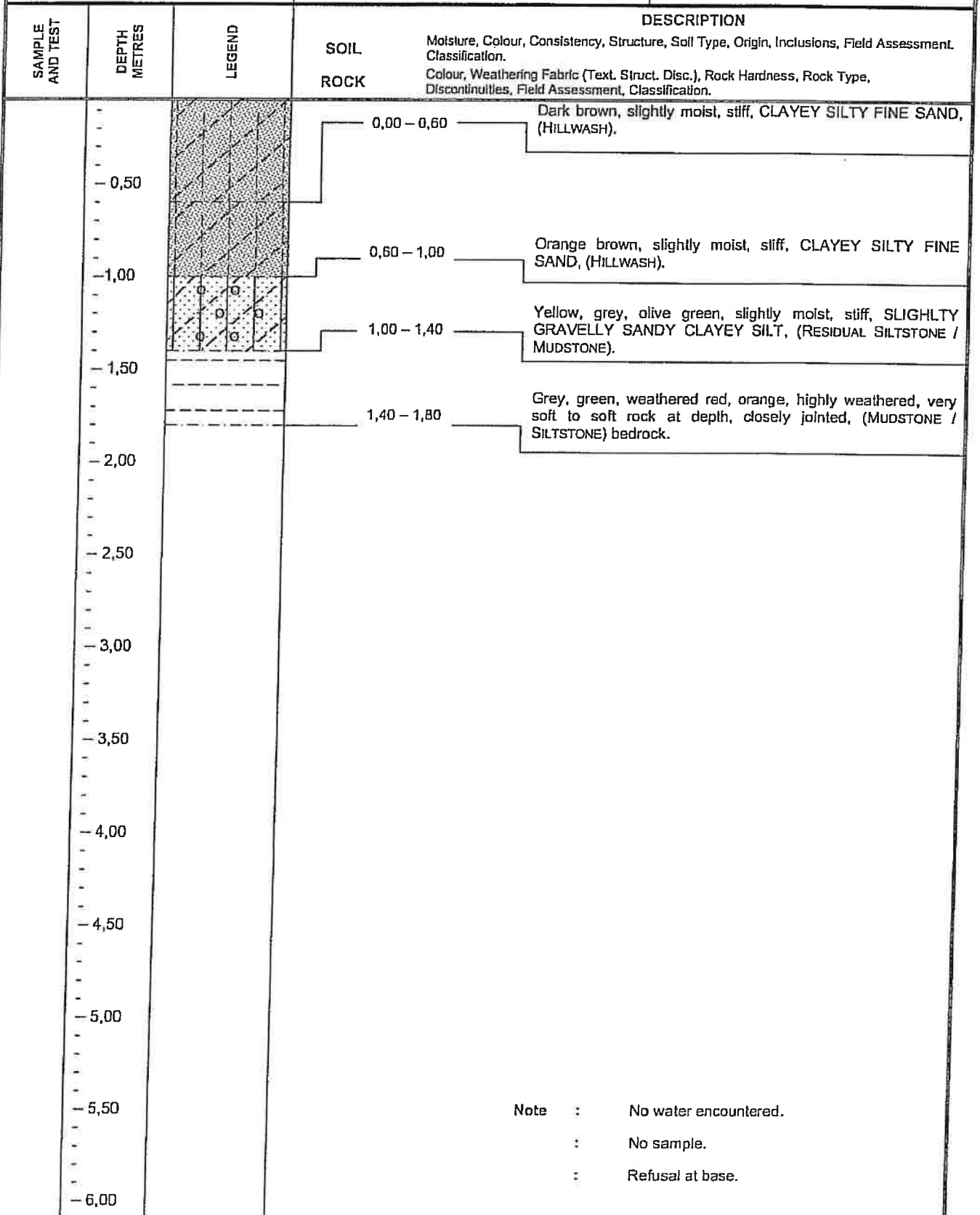
SOIL PROFILE

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Site Greater Kokstad Municipality
Job No. 50511
Logged by K. M. Ribbink
Date 04 May 2006
Machine TLB

Pit No. IP21
Sheet 1 of 1
Location
Elevation
X Co - Ord.
Y Co - Ord.
Total Depth 1,80m



Note : No water encountered.
: No sample.
: Refusal at base.

—	Approximate Material Changes	<input type="checkbox"/>	Disturbed Sample	i	Indicator	M	Mod.
∇	Water Level	<input type="checkbox"/>	Undisturbed Sample	C	CBR		

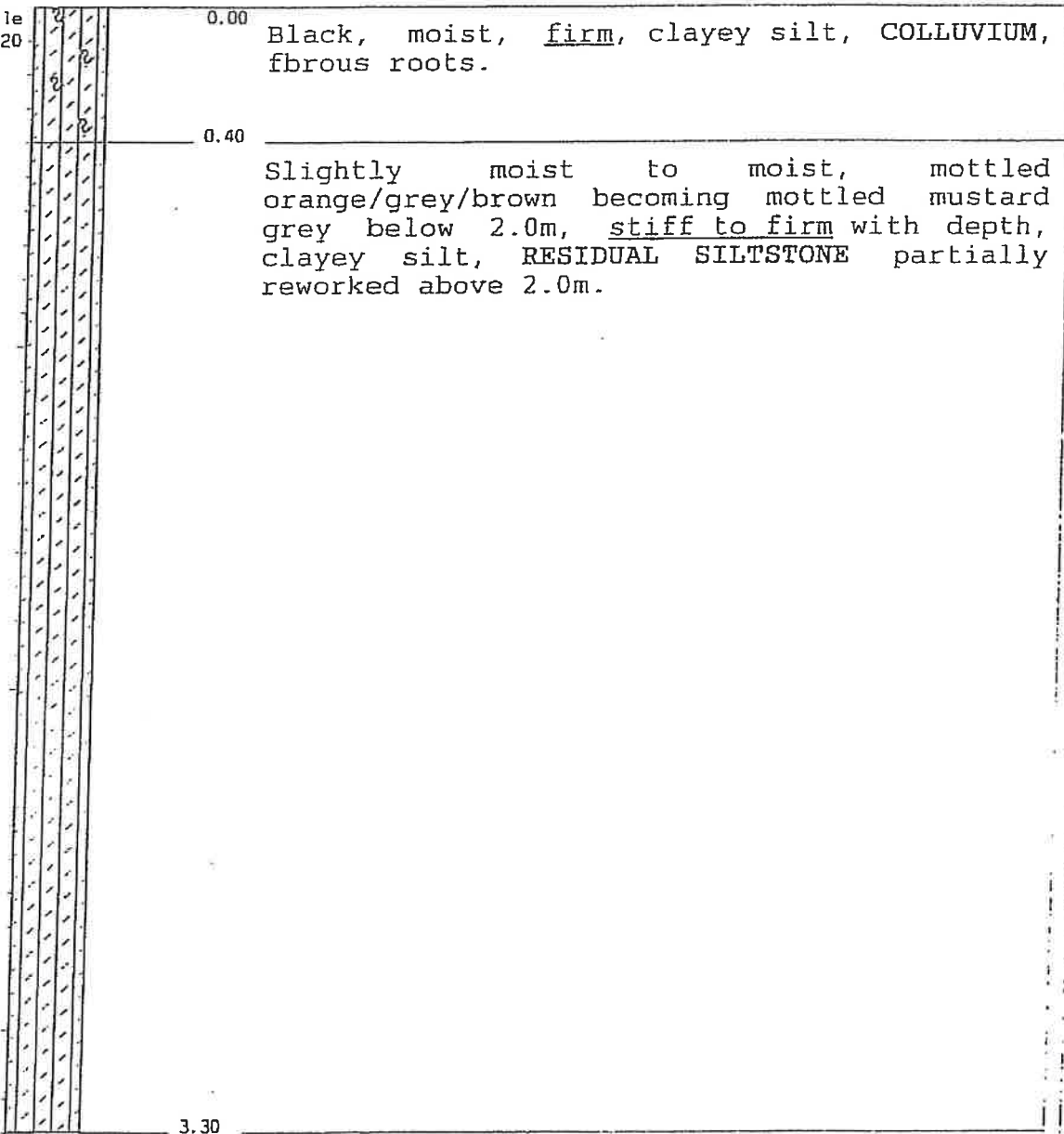
KOKSTAD TOWNSHIP

HOLE No: TP27

Sheet 1 of 1

JOB NUMBER: KT/64/1

Scale
1:20



NOTES

- 1) No water encountered.
- 2) No refusal.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : KP
TYPE SET BY : MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : June 1999
DATE : June 1999
DATE : 14/07/99 09:22
TEXT : A:\KT641DP.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP27

KOKSTAD TOWNSHIP

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: KT/64/1

Scale
1:10



0.00

Yellow becoming orange with depth, dry, dense, gravelly sandy silt, REWORKED RESIDUAL SILTSTONE, fibrous roots.

0.30

Yellow/grey, subhorizontally bedded, closely jointed, very soft rock SILTSTONE/ SHALE, finely laminated, orange/brown joint staining.

1.00

NOTES

- 1) No water encountered.
- 2) Near refusal, excavatable approximately 0.5m further.
- 3) No sample taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : KP
TYPE SET BY : MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : June 1999
DATE : June 1999
DATE : 14/07/99 09:22
TEXT : A:\KT641DP.TXT

ELEVATION :
X-COORD :
Y-COORD :

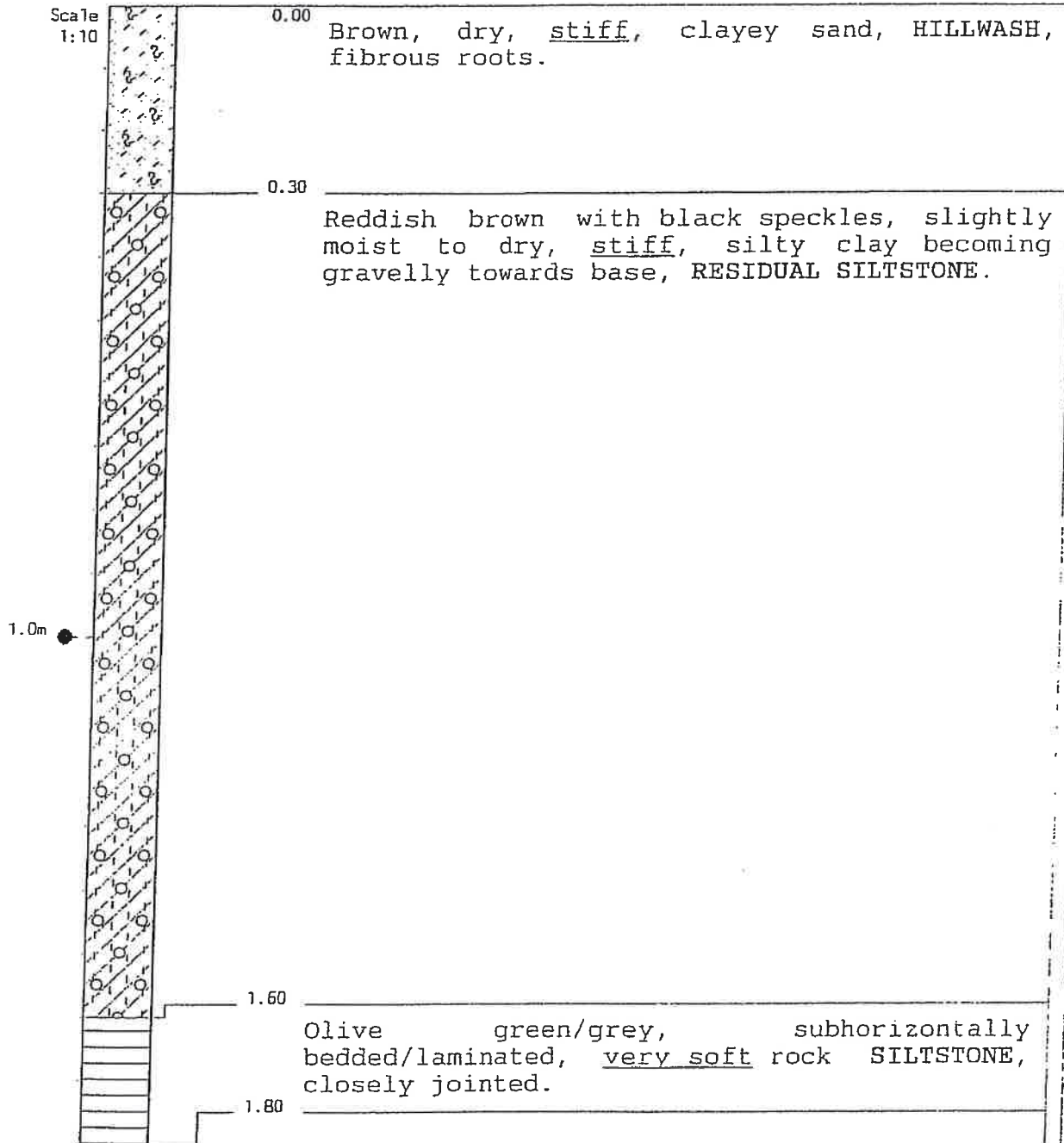
HOLE No: TP28

KOKSTAD TOWNSHIP

HOLE No: TP29
Sheet 1 of 1

JOB NUMBER: KT/64/1

Scale
1:10



NOTES

- 1) No water encountered.
- 2) Mod sample of residual siltstone.
- 3) Grading sample at 1.0m.
- 4) Near refusal, excavatable 0.5-1.0m further.

CONTRACTOR :
 MACHINE :
 DRILLED BY :
 PROFILED BY : KP
 TYPE SET BY : MM
 SETUP FILE : STANDARD.SET

INCLINATION :
 DIAM :
 DATE : June 1999
 DATE : June 1999
 DATE : 14/07/99 09:22
 TEXT : A:\KT6410P.TXT

ELEVATION :
 X-COORD :
 Y-COORD :

HOLE No: TP29

KOKSTAD TOWNSHIP

HOLE No: TP30

Sheet 1 of 1

JOB NUMBER: KT/64/1

Scale
1:10



0.00

Yellow becoming orange with depth, dry, dense, gravelly sandy silt, REWORKED RESIDUAL SILTSTONE, fibrous roots.

0.30

Yellow/grey, subhorizontally bedded, closely jointed, very soft rock SILTSTONE/ SHALE, finely laminated, orange/brown joint staining.

1.00

NOTES

- 1) No water encountered.
- 2) Near refusal, excavatable approximately 0.5m further.
- 3) No sample taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : KP
TYPE SET BY : MM
SETUP FILE : STANDARD.SET


INCLINATION :
DIAM :
DATE : June 1999
DATE : June 1999
DATE : 14/07/99 09:22
TEXT : A:\KT641DP.TXT

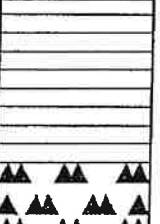
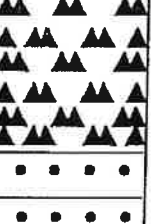
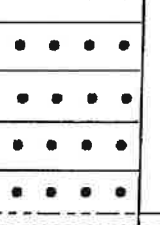

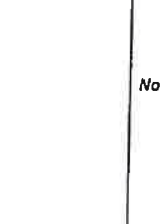

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP30

APPENDIX 2
BOREHOLE LOGS


PERCUSSION HOLE LOG

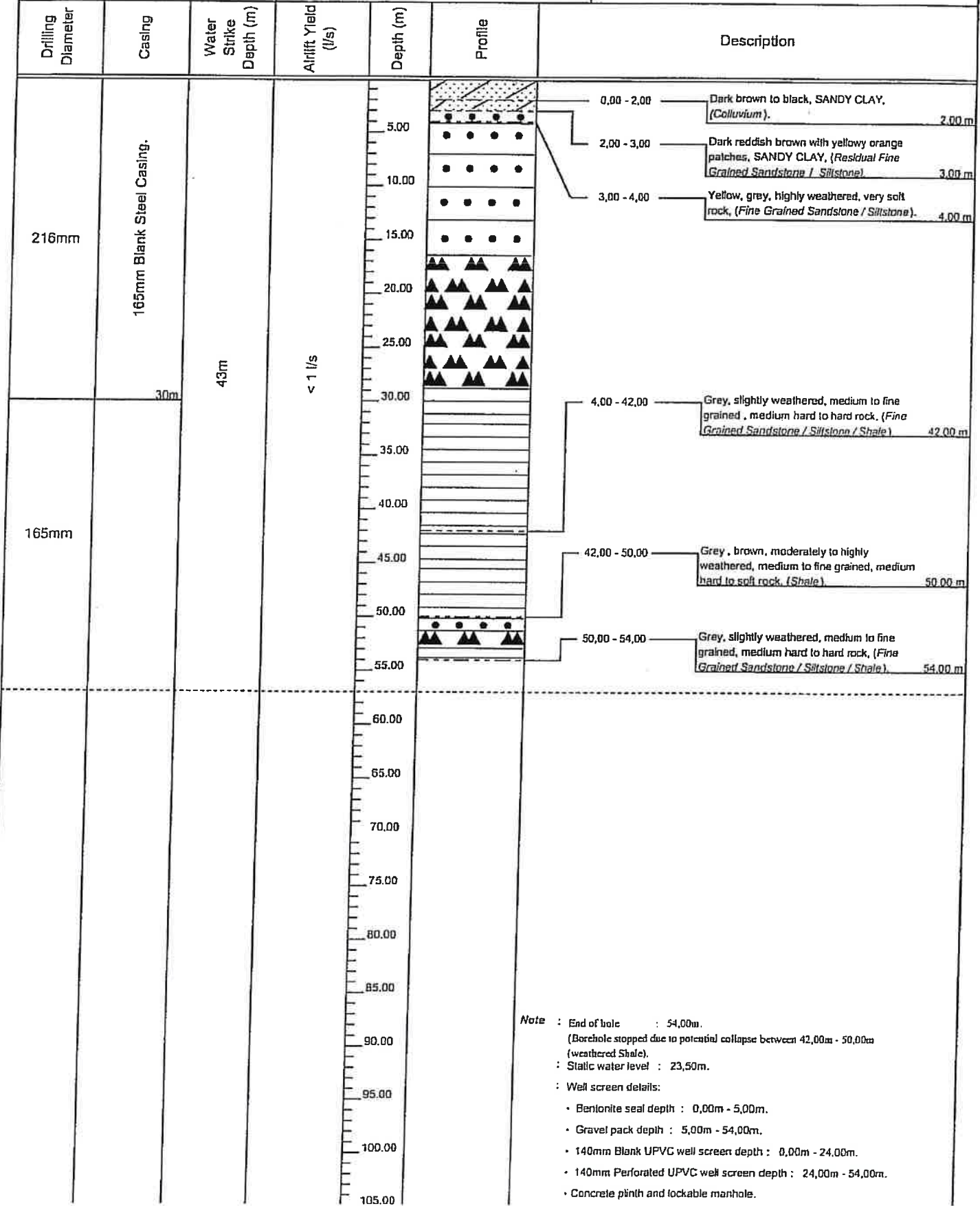
 THEKWINI GEOCIVILS cc Suite 5, 4 The Crescent Westway Office Park, Westville	CONTRACTOR : S. A. Drilling DRILLER : Richard Duckworth JOB No : 50511 LOGGED BY : K. M. Ribbink MACHINE : Schramm T660	HOLE No : BH 1 SHEET : 1 OF 1 LOCATION : Kokstad Landfill ELEVATION : 1316 msl CO - ORD. : 30° 32' 06.2" S / 29° 26' 01.7" E
	PROJECT: Kokstad Landfill DATE STARTED : 29 June 2006 DATE COMPLETED : 29 June 2006	ORIENTATION : Vertical TOTAL DEPTH : 69,00 m

Drilling Diameter	Casing	Water Strike Depth (m)	Airlift Yield (l/s)	Depth (m)	Profile	Description
216mm	165mm Blank Steel Casing.	No water strikes. slight seepage in places.	No water strikes.	5.00		0,00 - 0,50 — Dark brown / orange, SANDY SILTY CLAY, (Hillwash / Residual Siltstone). 0,50 m
				10.00		0,50 - 1,00 — Olive green, yellow, highly weathered, very soft rock, (Siltstone / Fine Grained Sandstone). 1,00 m
	30m			15.00		1,00 - 2,00 — Olive green, brown, highly weathered, very soft rock, (Siltstone / Mudstone). 2,00 m
				20.00		2,00 - 3,00 — Blue to black, weathered brown, highly to moderately weathered, medium to fine grained, hard rock, (Dolerite). 3,00 m
				25.00		3,00 - 24,00 — Blue grey to black, slightly to moderately weathered, medium to fine grained, hard rock, (Dolerite). 24,00 m
				30.00		
				35.00		
				40.00		
				45.00		
				50.00		
				55.00		
				60.00		
				65.00		24,00 - 69,00 — Grey, slightly to un-weathered, medium to fine grained, medium hard to hard rock, (Shale / Siltstone / Fine Grained Sandstone). 69,00 m
				70.00		
				75.00		
				80.00		
				85.00		
				90.00		
				95.00		
				100.00		
				105.00		

- Note :**
- End of hole : 69,00m.
 - Static water level : 43,50m.
 - Well screen details:
 - Bentonite seal depth : 0,00m - 5,00m.
 - Gravel pack depth : 5,00m - 69,00m.
 - 140mm Blank UPVC well screen depth : 0,00m - 34,00m
 - 140mm Perforated UPVC well screen depth : 34,00m - 69,00m.
 - Concrete plinth and lockable manhole.

PERCUSSION HOLE LOG

 THEKWINI GEOCIVILS cc Suite 5, 4 The Crescent Westway Office Park, Westville	CONTRACTOR : S. A. Drilling DRILLER : Richard Duckworth JOB No : 50511 LOGGED BY : K. M. Ribbink MACHINE : Schramm T660	HOLE No : BH 2 SHEET : 1 OF 1 LOCATION : Kokstad Landfill ELEVATION : 1293 msl CO - ORD. : 30° 32' 04.1" S / 29° 26' 12.0" E
	PROJECT: Kokstad Landfill DATE STARTED : 30 June 2006 DATE COMPLETED : 30 June 2006	ORIENTATION : Vertical TOTAL DEPTH : 54,00 m



Note : End of hole : 54,00m.
 (Borehole stopped due to potential collapse between 42,00m - 50,00m (weathered Shale).
 • Static water level : 23,50m.
 • Well screen details:
 • Bentonite seal depth : 0,00m - 5,00m.
 • Gravel pack depth : 5,00m - 54,00m.
 • 140mm Blank UPVC well screen depth : 0,00m - 24,00m.
 • 140mm Perforated UPVC well screen depth : 24,00m - 54,00m.
 • Concrete plinth and lockable manhole.

APPENDIX 3

LABORATORY SOIL TEST RESULTS

PROJECT..... KOKSTAD LAND FILL
 REF NO.....4675...
 DATE... 17 MAY 2006. SHEET1.. OF..1.....

THEKWINI SOILS LAB
 68 RIDGE ROAD, DURBAN
 TEL. : 031-2018992

LABORATORY TEST SUMMARY

LAB & FIELD DATA	LABORATORY NO	05010	05011					
SOURCE..... LOCATION..... DEPTH..... DESCRIPTION.....	BINDER TYPE - %	IP.2 2.2 - 3.0	IP.12 2.7 - 3.1					
PARTICLE SIZE (mm)	75.0 53.0 37.5 26.5 19.0 13.2 9.5 4.75 2.00 0.425 0.250 0.150 0.075 0.050 0.020 0.005 0.002	100 98 97 96 95 94 94 91 86 81 81 79 76 70 51 35 26	-	100 99 99 96 87 74 57 39 29				
SOIL MORTAR	COARSE SAND <2.0 >0.425mm FINE SAND <0.425 >0.05 mm SILTY <0.05 >0.005 mm CLAY <0.005 mm	8 28 33 33 32 15 -	1 26 35 38 35 15 -					
ATTERBERG LIMIT	LIQUID LIMIT PLASTICITY INDEX LIQUIDITY INDEX LINEAR SHRINKAGE N.M.C.	7.7	7.7					
MAX DENSITY & CBR	MOD. AASHO MDD (kg/m ³) O.M.C. (%) C.B.R. at 100% compaction 98% compaction 95% compaction 90% compaction	1756 13.4	1687 17.7					
OTHER TESTS	SWELL (maximum) % Rev. U. S. Classification GRADING MODULUS TRH 14 (1985) F.H. PERMEABILITY cm/sec.	A-6 (10) 0.57 1.07 X 10 ⁻⁵	A-6 (10) 0.14 7.22 X 10 ⁻⁷					

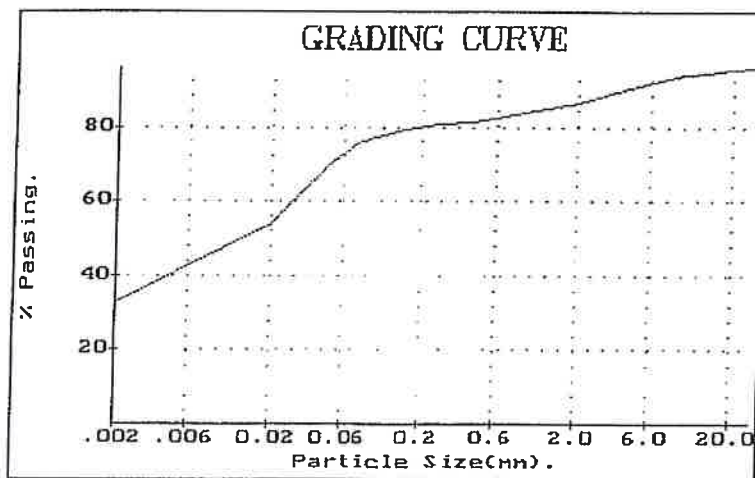
MATERIALS ANALYSIS

Ref.No.: 4675 Lab.No.: 05010 Bore Hole/Pit No.: IP.2 Fig.No.:
 Depth: 2.6m. Unstabilised natural material.

Project: KOKSTAD LAND FILL

SIZE GRADING DATA		'M.I.T.' Size Classification	
Grain Size (mm)	% Passing	Category	(%)
26.500	96.25	GRAVEL	13.78
19.000	95.27	Coarse	4.60
13.200	94.47	Medium	3.65
9.500	93.81	Fine	5.53
4.750	91.02	SAND	13.49
2.000	86.22	Coarse	4.44
0.425	81.23	Medium	1.80
0.250	80.60	Fine	7.25
0.150	79.36	SILT	40.09
0.075	75.71	Coarse	18.55
0.050	70.74	Medium	12.37
0.020	54.18	Fine	9.17
0.005	40.92	CLAY	32.64
0.002	32.64		

Grading Modulus..... 0.5684	Modular Size(mm).....
'D10'-Size(mm)..... 0.0006	Uniformity Coefficient..... 49.86
Liquid Limit..... 32.00	Plasticity Index..... 15.00
Linear Shrinkage(%)..... 7.7	Natural Moisture Content(%)..
Liquidity Index..... -	Group Index..... 10.00
Potential Expansiveness.. Low	Mississippi River Class..... Sty Cl
Unified Classification... CL	Rev.US Roads Classification.. A-6



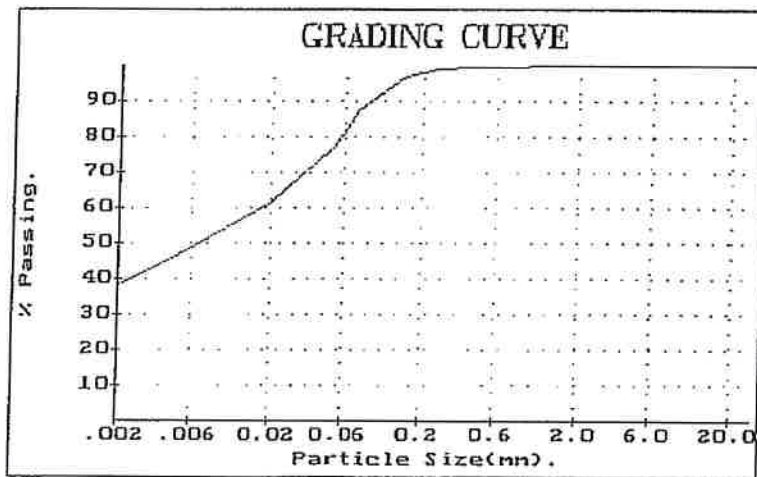
MATERIALS ANALYSIS

Ref.No.: 4675 Lab.No.: 05011 Bore Hole/Pit No.: IP.12 Fig.No.:
 Depth: 2.9m. Unstabilised natural material.

Project: KOKSTAD LAND FILL

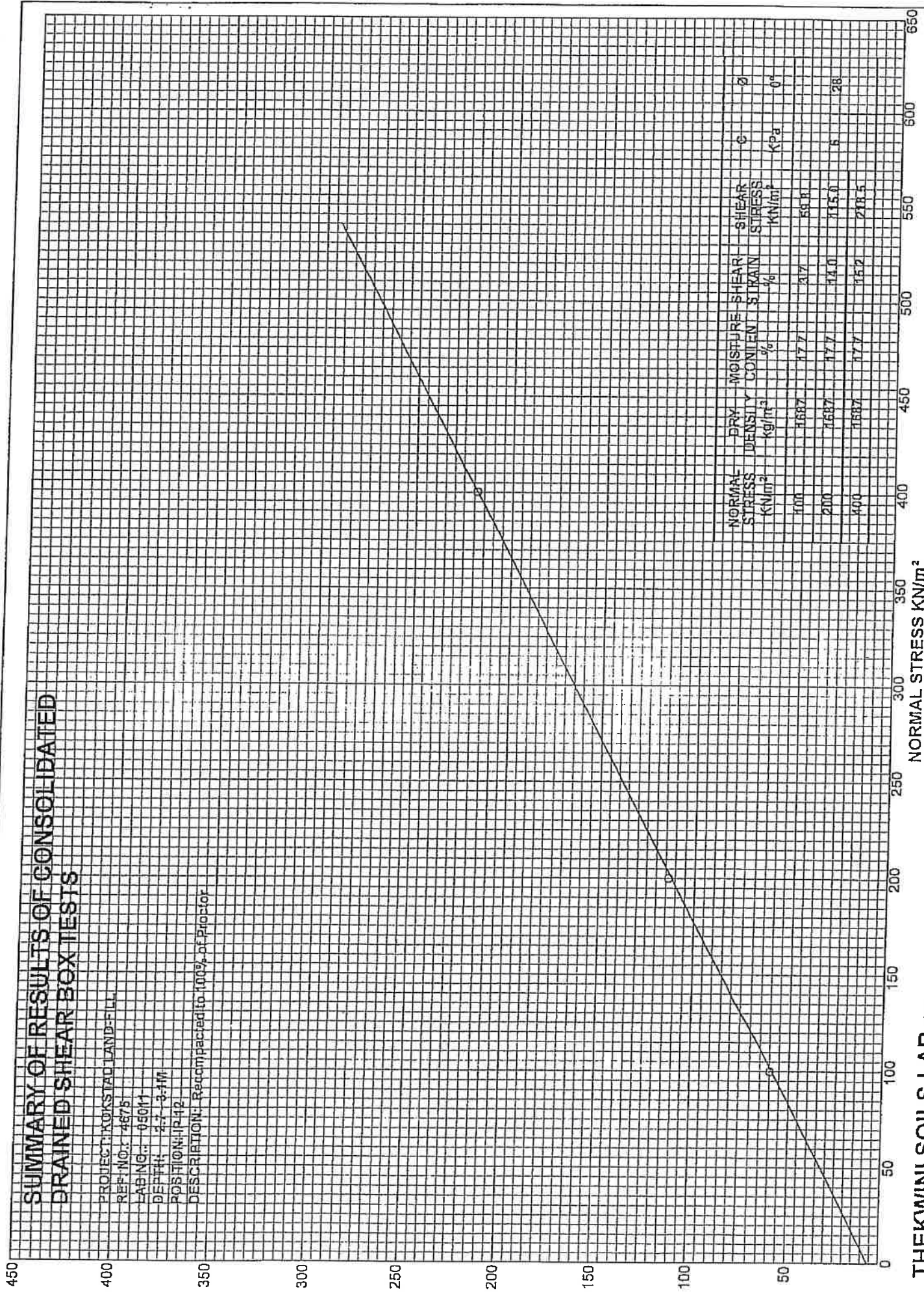
SIZE GRADING DATA		'M.I.T.' Size Classification	
Grain Size (mm)	% Passing	Category	(%)
26.500	100.00	GRAVEL	0.28
19.000	100.00	Coarse	0.00
13.200	100.00	Medium	0.00
9.500	100.00	Fine	0.28
4.750	100.00	SAND	18.84
2.000	99.72	Coarse	0.60
0.425	99.04	Medium	1.50
0.250	98.84	Fine	16.74
0.150	96.40	SILT	42.90
0.075	87.31	Coarse	19.30
0.050	76.59	Medium	14.01
0.020	61.57	Fine	9.58
0.005	46.56	CLAY	37.98
0.002	37.98		

Grading Modulus..... 0.1393	Modular Size(mm)..... 0.0250
'D ₁₀ ' Size(mm)..... 0.0005	Uniformity Coefficient..... 35
Liquid Limit..... 35.00	Plasticity Index..... 15.00
Linear Shrinkage(%)..... 7.7	Natural Moisture Content(%).. -
Liquidity Index..... -	Group Index..... 10.00
Potential Expansiveness.. Low	Mississippi River Class..... Sty Cl
Unified Classification... CL	Rev.US Roads Classification.. A-6



SUMMARY OF RESULTS OF CONSOLIDATED DRAINED SHEAR BOX TESTS

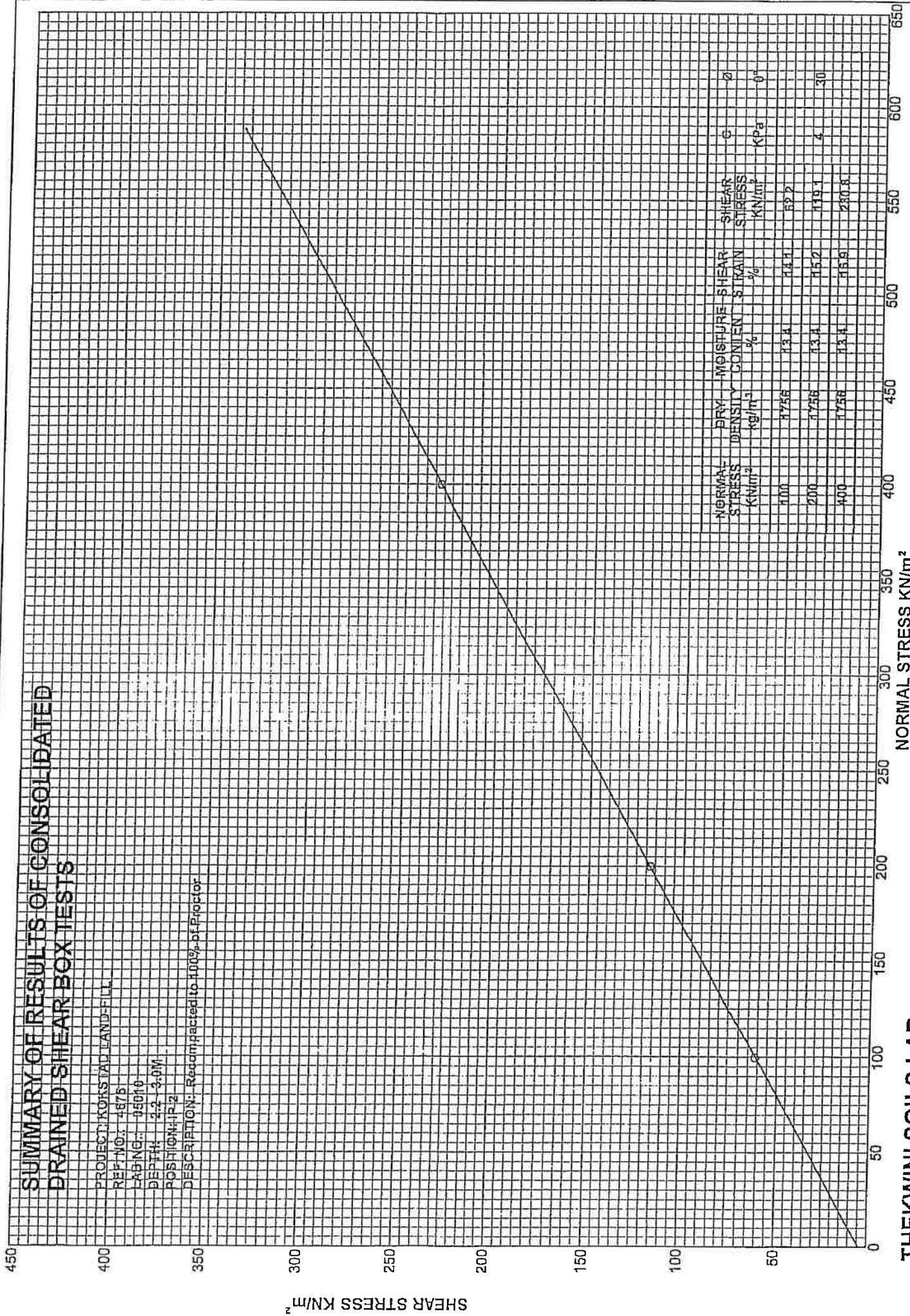
PROJECT: KOKISTAD LAND-FILL
 REF. NO.: 4675
 LABING.: 05011
 DEPTH: 2.7 - 3.1M
 POSITION: IR-12
 DESCRIPTION: Recompactd to 100% of Proctor.



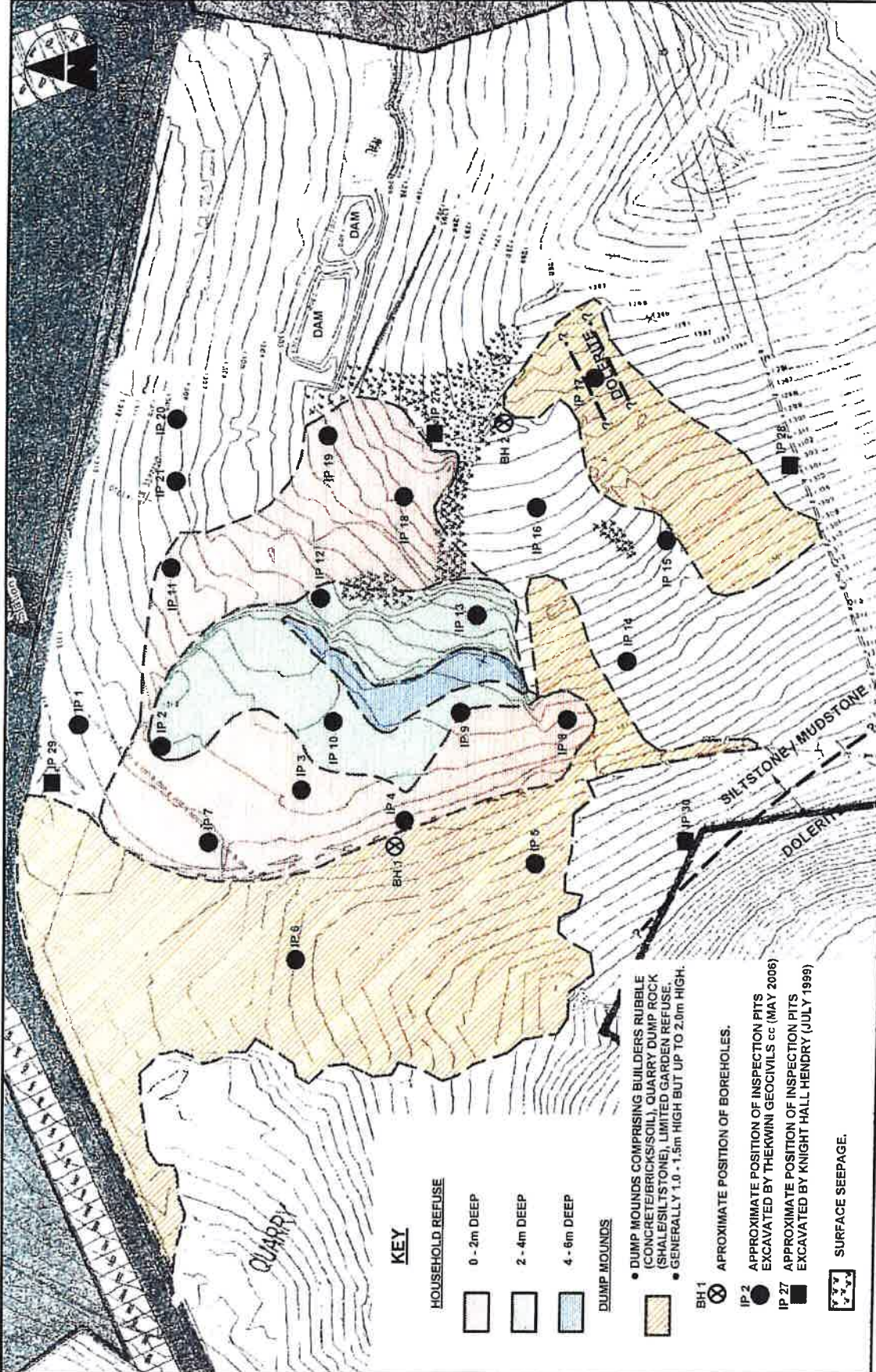
NORMAL STRESS (KN/m ²)	DRY DENSITY (kg/m ³)	MOISTURE CONTENT (%)	SHEAR STRAIN (%)	SHEAR STRESS (KN/m ²)	c (KPa)	φ (°)
100	1687	17.7	11.7	59.1		0°
200	1687	17.7	14.0	115.0	5	28
400	1687	17.7	15.2	218.5		

SUMMARY OF RESULTS OF CONSOLIDATED DRAINED SHEAR BOX TESTS

PROJECT: KOKS TAL LAND-FILL
 REF. NO.: 467B
 LAB. NO.: 05010
 DEPTH: 2.2 - 3.0M
 POSITION: R 2
 DESCRIPTION: Re-compacted to 100% of Proctor



NORMAL STRESS (KN/m ²)	DRY DENSITY (kg/m ³)	MOISTURE CONTENT (%)	SHEAR STRAIN (%)	SHEAR STRESS (KN/m ²)	C (KPa)	ϕ
100	1758	13.4	14.1	63.2		0°
200	1756	13.4	15.2	119.1	4	30
400	1758	13.4	16.9	230.8		



KEY

HOUSEHOLD REFUSE

- 0 - 2m DEEP
- 2 - 4m DEEP
- 4 - 6m DEEP

DUMP MOUNDS

- DUMP MOUNDS COMPRISING BUILDERS RUBBLE (CONCRETE/BRICKS/SCIL) QUARRY DUMP ROCK (SHALE/SILTSTONE), LIMITED GARDEN REFUSE.
- GENERALLY 1.0 - 1.5m HIGH BUT UP TO 2.0m HIGH.

- APPROXIMATE POSITION OF BOREHOLES.

- APPROXIMATE POSITION OF INSPECTION PITS EXCAVATED BY THEKWINI GEOCIVILS cc (MAY 2006)
- APPROXIMATE POSITION OF INSPECTION PITS EXCAVATED BY KNIGHT HALL HENDRY (JULY 1999)

SURFACE SEEPAGE.

	THEKWINI GEOCIVILS cc Geotechnical & Civil Engineers 4 The Overgate Alberton, 1601 T: 011 796-2127 F: 011 796-2177 E: info@geocivils.co.za	DESIGNED: K.R. DRAWN: K.M. DATE: MAY 2006 SCALE: 1:2500 CHECKED: K.R.
	REF. NO. 50511 FIG. NO. 4	

KOKSTAD LANDFILL SITE - GEOTECHNICAL INVESTIGATION

APPENDIX D
WATER SAMPLE TEST RESULTS



THEKWINI GEOCIVILS c.c.

▪ Geotechnical, Structural & Civil Engineers ▪ Waste Disposal Consultants ▪ Project Managers
ck 99/000909/23

Suite 6
4 The Crescent
Westway Office Park
WESTVILLE

P. O. Box 446
PAVILION
3611

Telephone : (031) 265 - 1777
Facsimile : (031) 265 - 2727
 : 086 655 1586
E-Mail : tgc@tgcengineers.co.za

Our Ref: 50511

26 September 2006

KOKSTAD LANDFILL STREAM AND BOREHOLE WATER QUALITY TESTING AUGUST 2006

The following stream and borehole water quality sampling was performed on the 21st August 2006 at the Kokstad Landfill:

- Surface water quality monitoring at three (3) locations shown in the accompanying Figure 10, namely:
 - S1 : The Mzintlava River upstream of the landfill site.
 - S2 : The Mzintlava River just after the seasonal stream emanating from the landfill site.
 - S3 : The Mzintlava River downstream of the landfill site.
- Groundwater sampling from the two (2) recently drilled boreholes, one (1) upstream and one (1) downstream of the site.

Mr. Pat Reddy of the Department of Water Affairs and Forestry was notified of the intended sampling positions on the 21st June 2006.

The results of SABS 241:2001 analysis undertaken by B. N. Kirk (Natal) cc; on water samples from the borehole and stream sampling points is shown in Table 1. For ease of reference, a classification system to assess the suitability of water for Domestic use (after the Institute of Water Quality - Kempster 1996) has been included in Table 1. The water rest level (depth below ground) in each borehole is also included at the end of Table 1.

Dr R. Maud of Drennan, Maud & Partners was requested to comment on the results of the Water Quality Analysis and has noted that there is a definite increase in most variables moving from the upslope borehole to the downslope borehole. This confirms that there is some contamination of the groundwater downslope of the landfill site. However, no action is deemed necessary at present, other than to continue with the water quality monitoring in light of the following:

- Even though the downslope borehole shows definite signs of contamination, the water is still within the limits of Class 2 potable water.

Page 2/...

Members:

G. J. PAYNE Pr. Eng., B.Sc. (Eng), MSAICE
M. S. MOODLEY Pr. Tech. Eng., B. Tech (Eng), TMSAICE
S. GOVENDER Pr. Tech. Eng., B. Tech (Eng), TMSAICE

Associate:

M. J. SHELEMBE



- The river samples (especially S2) shows no signs of contamination and thus the pollution plume is anticipated to be contained in the vicinity of the landfill site, i.e. the groundwater does not appear to be moving significantly. The fine grained bedrocks in the area are likely to be behaving as an effective barrier system.
- The existing landfill cell will soon be capped and any new landfill cells will have an impermeable basal liner thereby reducing the potential of further contamination.



K. M. RIBBINK Pr. Sci. Nat.
THEKWINI GEOCIVILS CC

Enclosed: *Table 1: Results of Borehole and Stream Water Quality Testing (August 2006).*
Figure 10

TABLE 1:

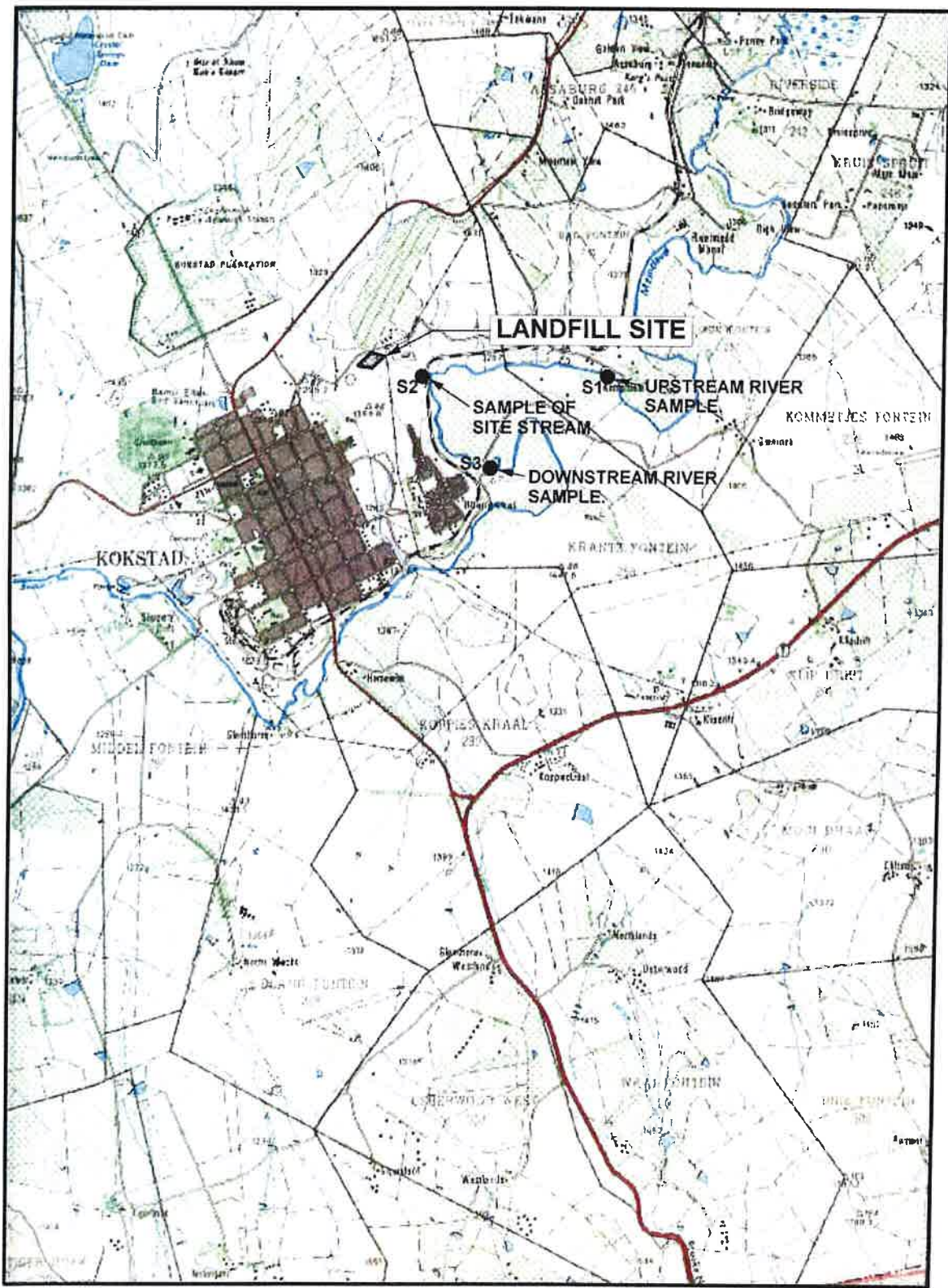
RESULTS OF STREAM AND BOREHOLE WATER QUALITY TESTING

Date: August-2006

PARAMETER	UNIT	CLASS 0 & 1	CLASS 2	CLASS 3	Mzintlaba River sampled			Upslope Borehole	Downslope Borehole
					S1	S2	S3		
pH	pH Units	< 5.00 - 9.50	4.00 - 10.00	> 10.00	7.60	7.50	7.40	8.30	7.40
Conductivity	mS/m	< 70.00 - 150.00	> 150.00 - 370.00	> 370.00	12.00	12.00	12.00	18.00	230.00
Total Hardness as Ca CO3	mg/l	ns	ns	ns	32.00	42.00	60.00	18.00	872.00
Calcium Hardness as CaCO3	mg/l	ns	ns	ns	18.00	22.00	20.00	10.00	530.00
Calcium as Ca	mg/l	< 80.00 - 150.00	> 150.00 - 300.00	> 300.00	7.00	9.00	8.00	4.00	212.00
Magnesium as Mg	mg/l	< 30.00 - 70.00	> 70.00 - 100.00	> 100.00	3.00	5.00	10.00	2.00	82.00
Chloride as Cl	mg/l	< 100.00 - 200.00	> 200.00 - 600.00	> 600.00	11.00	9.00	10.00	7.00	487.00
p Alkalinity	mg/l				4.00	4.00	4.00	8.00	28.00
m Alkalinity	mg/l				42.00	44.00	42.00	70.00	340.00
Ammonia as N	mg/l	< 0.20 - 1.00	> 1.00 - 2.00	> 2.00	0.60	0.40	0.40	0.40	0.20
Boron as B	mg/l	ns	ns	ns	< 0.10	< 0.01	< 0.10	< 0.10	< 0.10
Cadmium as Cd	mg/l	< 0.003 - 0.005	> 0.005 - 0.010	> 0.010	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chemical Oxygen Demand	mg/l	ns	ns	ns	31.00	24.00	26.00	60.00	89.00
Chromium VI	mg/l	ns	ns	ns	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chromium Total	mg/l	< 0.05 - 0.10	> 0.10 - 0.50	> 0.50	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cyanide Total as CN	mg/l	< 0.03 - 0.05	> 0.05 - 0.07	> 0.07	0.005	0.004	0.004	0.003	0.004
Lead as Pb	mg/l	< 0.01 - 0.05	> 0.05 - 0.10	> 0.10	< 0.01	< 0.01	0.01	0.11	0.04
Mercury as Hg	mg/l	< 0.001 - 0.002	> 0.002 - 0.005	> 0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nitrates as N	mg/l	< 6.00 - 10.00	> 10.00 - 20.00	> 20.00	0.14	0.16	0.23	< 0.01	2.90
Phenolic Compounds	mg/l	< 0.005 - 0.010	> 0.01 - 0.07	> 0.07	< 0.001	< 0.001	< 0.001	< 0.001	0.024
Potassium as K	mg/l				2.90	2.90	3.00	3.10	19.00
Sodium as Na	mg/l	< 100.00 - 200.00	> 200.00 - 400.00	> 400.00	20.00	19.00	21.00	65.00	190.00
Sulphate as SO4	mg/l	< 200.00 - 400.00	> 400.00 - 600.00	> 600.00	4.10	3.50	3.50	4.00	201.00
Total Dissolved Solids	mg/l	< 450.00 - 1 000.00	> 1 000.00 - 2 400.00	> 2 400.00	240.00	232.00	212.00	252.00	2 068.00
Borehole - static water level	m							23 m	21 m

Classification system for the assessment of the suitability of water for Domestic use (Institute of Water Quality - Kempster 1996)

ns	Not specified.
Class 0 & 1	Suitable for long term domestic use.
Class 2	Suitable for short term domestic use.
Class 3	Not suitable for domestic use.



THEKWINI GEOCIVILS cc
 Geotechnical & Civil Engineers
 Waste Disposal Consultants • Project Managers
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 3611
 Telephone 265-1777
 P.O. Box 30072
 MAYVILLE
 4058
 Telefax 265-2727
 E-mail: tgc@eject.co.za

DESIGNED : K.R.
 DRAWN : K.M.
 DATE : JUNE 2006
 SCALE : N.T.S.
 CHECKED : K.R.

**KOKSTAD LANDFILL SITE
 WATER SAMPLING**

REF. NO.
50511
 FIG. NO.
10

created with FinePrint

DRENNAN, MAUD & PARTNERS

Consulting Civil Engineers and Engineering Geologists
Registered Member : Consulting Engineers of South Africa

PARTNERS:

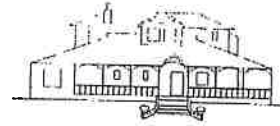
R.D. COLLYER, Pr.Eng., B.Sc.(Eng.), M.Sc.(Eng.), MSAICE.
M.J.F. BÉNEY, Pr.Sci.Nat., B.Sc.(Hons.), M.Sc., FSAIEG.
M.J. HADLOW, Pr.Sci.Nat., B.Sc.(Hons.), MSAIEG.

CONSULTANT:

R.R. MAUD, Pr.Sci.Nat., B.Sc., Ph.D., FGS., FGSSA., FSAIEG., FSAII

OUR REF.: 21959

YOUR REF.:



68 RIDGE ROAD
TOLLGATE
DURBAN 4001

P.O. BOX 30464
MAYVILLE 4058

TELEPHONE (031) 201-8992
TELEFAX (031) 201-7920

E-MAIL dmp@iafrica.com

23rd February 2011

Scientific Roets
96 Hope Street
Kokstad
4700

Attention : Mr. A. Roets

Dear Sir,

**KOKSTAD LANDFILL
STREAM AND BOREHOLE WATER QUALITY TESTING
AND COVER MATERIAL SAMPLING**

1.0 INTRODUCTION

The following stream and borehole water quality sampling was performed on the 11th of February 2011 at the Kokstad Landfill.

- Surface water quality monitoring at three locations shown on the accompanying site plan, Figure 1, namely:
 - S1 : The Mzintlava River upstream of the landfill site.
 - S2 : The Mzintlava River just after the seasonal stream emanating from the landfill site.
 - S3 : The Mzintlava River downstream of the landfill site.

- Groundwater sampling from the two boreholes and from the leachate dam, one upstream (BH1), one downstream (BH2) and one from the leachate dam (Leachate Dam) located on the landfill site.

The results of SABS 241:2001 analysis undertaken by B. N. Kirk (Natal) cc; on the water sampling from the borehole, stream and leachate dam sampling points is included in this report as Appendix A.

The following cover material sampling was also performed on the 11th of February 2011 at the Kokstad Landfill.

- Cover material sampling at the four locations shown on the accompanying site plan, Figure 1, namely:
 - Sample 1 : From the earth berm located 50m east of the landfill site.
 - Sample 2 : From the excavated trench along the dirt road adjacent to the landfill site.
 - Sample 3 : From the quarry located west of the landfill site.
 - Sample 4 : From the road works located at the Engen Truck Stop on the border of the town of Kokstad.

Photographs of each sample location, designated photo 1 to photo 8, have been included in this report as Appendix B.

- Disturbed, bulk material samples were obtained from each sample location and sent to the Thekwini Soils Laboratory for the following analyses.
 - full grading analysis for classification purposes
 - Proctor testing
 - Permeability Testing

The results of the laboratory testing are summarized in Appendix C together with the graphical representation of the materials analyses.

2.0 ANALYSIS & CONCLUSIONS

2.1 STREAM & BOREHOLE SAMPLING

Dr. R. Maud of Drennan, Maud & Partners was requested to comment on the results of the water Quality Analysis and has noted that there is a definite increase in most variables moving from the upstream borehole (BH1) to the downstream borehole (BH2). This confirms that there has been some contamination of the groundwater downstream of the landfill site. However, no action is deemed necessary at present, other than to continue with the water quality monitoring in light of the following:

- There has been no significant change from the water quality test results that were done previously in August 2006.

- Even though the downstream borehole shows signs of contamination, the water quality is still within the limits of Class 2 potable water.
- The borehole and stream samples show no elevated Chemical Oxygen Demand content.
- The river samples, especially S2, show no signs of contamination and thus the pollution plume is anticipated to be contained in the vicinity of the landfill site.
- The existing landfill cell will soon be capped and any new landfill cells will have an impermeable basal liner thereby reducing the potential of further contamination.

2.2 COVER MATERIAL SAMPLING

The results from the laboratory testing of the cover material sampled from each borrow pit location show the following:

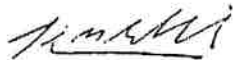
- Sample 1 was taken from the earth berm located east of the landfill site and consists of a very slightly moist, brown to light brown, stiff to very stiff, sandy CLAY (Photo 1 & 2). The laboratory test results show that sample 1 has a maximum particle size of 13.2mm, a plasticity index of 10.8 and a permeability of 4.19×10^{-7} cm/sec. From the investigation at the borrow pit location it is believed that this area has the least material size available.
- Sample 2 was taken from the excavated trench along the dirt road adjacent to the landfill site and consists of a very slightly moist, reddish brown, very stiff, sandy CLAY (Photo 3 & 4). The laboratory test results show that sample 2 has a maximum particle size of 4.75mm, a plasticity index of 16.2 and a permeability of 2.085×10^{-5} cm/sec. From the investigation at the borrow pit location it is believed that this area has the second largest material size available.
- Sample 3 was taken from the quarry located to the west of the landfill site and consists of a very slightly moist, reddish brown, stiff, sandy CLAY (Photo 5 & 6). The laboratory test results show that sample 3 has a maximum particle size of 4.75mm, a plasticity index of 12.2 and a permeability of 6.446×10^{-6} cm/sec. From the investigation at the borrow pit location it is believed that this area has the second least material size available.
- Sample 4 was taken from the road works located at the Engen truck Stop and consists of a very slightly moist, light grey, stiff to very stiff, sandy CLAY (Photo 7 & 8). The laboratory test results show that sample 4 has a maximum particle size of 4.75mm, a plasticity index of 13.6 and a permeability of 2.637×10^{-7} cm/sec. From the investigation at the borrow pit location it is believed that this area has the largest material size available.

For soil material to be an effective clay cover material (V layer), it must have a maximum particle size of 25mm, a plasticity index of between 5 and 15 and a permeability of less than 0,5m/y (1.7×10^{-6} cm/sec).

From the test results only two samples tested may be used as a clay cover layer (V layer) and that is sample 1 and sample 4. Due to the limited material available at the location where sample 1 was taken it is recommended that it also not be used. Therefore it is recommended that the material sampled at the location of sample 4 is the most suitable for use as the cover material for the landfill.

Yours faithfully

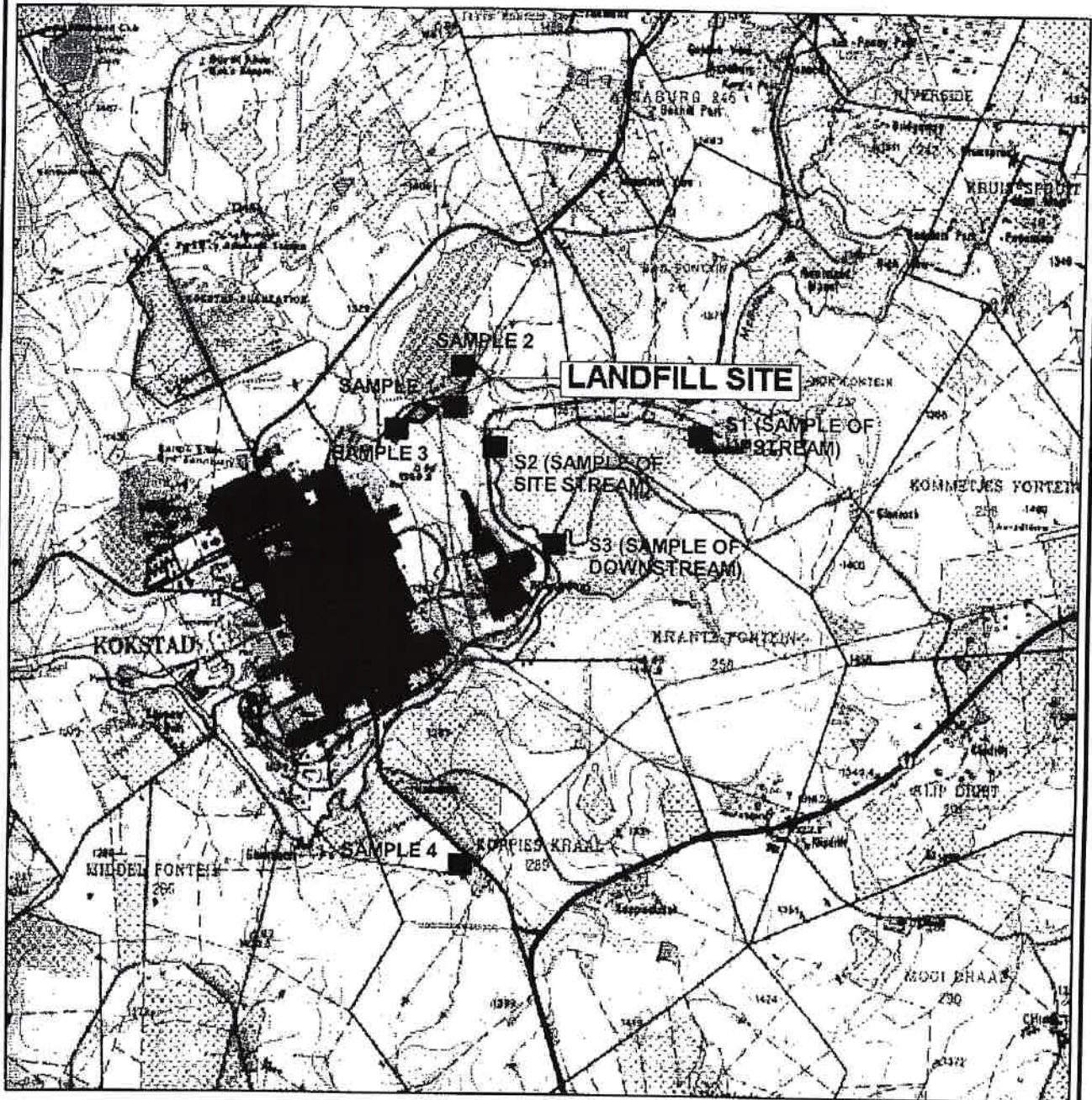
DRENNAN, MAUD & PARTNERS



K. RIBBINK Pr.Sci.Nat.



W. REARDON



KEY

- SAMPLE 1 APPROX. POSITION OF SOIL SAMPLES
- S1 (SAMPLE OF UPSTREAM) APPROX. POSITION OF WATER SAMPLES



**LOCALITY PLAN
KOKSTAD LANDFILL SITE
WATER & COVER MATERIAL SAMPLING**



**DRENNAN, MAUD
AND PARTNERS**
Consulting Civil Engineers

DESIGNED : W.R.
DRAWN : S.P.
DATE : 04/03/2011
SCALE : N.T.S.
CHECKED :

REF. NO. 21959
FIG. NO. 1

APPENDIX A

**BOREHOLE, STREAM & LEACHATE
DAM WATER QUALITY TEST RESULTS**

b.n. kirk (natal) cc

Reg.No. CK 94/15428/23

Water, Sewage & Effluent Treatment Specialists
Consulting Chemists, Process Engineers

45 Eaton Road, Congella, Durban P.O. Box 30140, Mayville, 4058 RSA
Tel : (031) 205 1245 Fax : (031) 205 6904 E-mail: bnkirk@mweb.co.za

CERTIFICATE OF ANALYSIS - B N KIRK (Natal) cc

CLIENT:	Dremman, Maud & Partners	BNK Reference No.:	dmp 14-02-2011
ATTENTION	Wesley	Date Received	14-02-2011
e Mail	Group details	Report Date	21-02-2011

ANALYTICAL RESULTS		Order No					
Parameters	Units	S1	S2	S3	BH1	BH2	Leachate Dam
pH	pH units	6.9	7.2	7.4	7.8	7.2	8.1
Alkalinity as CaCO ₃	mg/l	60	70	60	200	370	750
Ammonia as NH ₃	mg/l	0.2	<0.1	0.2	<0.1	<0.1	16
Chemical Oxygen Demand	mg/l	19	19	19	19	19	560
Chlorides as Cl	mg/l	7.0	5.0	5.0	11	350	1600
Conductivity	mS/m	11	11	11	38	169	575
Nitrates as NO ₃ -N	mg/l	0.1	<0.01	0.4	0.7	1.5	0.70
Potassium as K	mg/l	1.6	1.7	1.5	3.3	5.6	385
Total Hardness as CaCO ₃	mg/l	60	60	64	130	554	830
Calcium Hardness as CaCO ₃	mg/l	20	20	16	90	400	250
Calcium as Ca	mg/l	8.0	8.0	6.4	36	160	100
Magnesium as Mg	mg/l	9.6	9.6	12	9.6	37	139
Fluoride as F	mg/l	0.2	0.11	0.24	0.9	0.33	0.92
Sodium as Na	mg/l	11	11	11	47	91	364
Sulphate as SO ₄	mg/l	1.77	2.08	1.81	15	13	64
Total Dissolved Solids	mg/l	138	124	98	244	1334	3584

KEY: ** = too numerous to count

for and on behalf of B N KIRK (Natal)cc

21-02-2011

D BESTER

DATE

Disclaimer:

1. While every reasonable precaution is taken in obtaining these results the Company does not accept responsibility for any matters arising from the further use of these results.
2. In the case of sample/s submitted by the client, the results expressed in this certificate represent only the sample/s as received.
3. This certificate shall not be reproduced except in full, without the written approval of the Company

APPENDIX B

**PHOTOGRAPHS OF COVER MATERIAL
SAMPLE LOCATIONS
(PHOTO 1 - 8)**

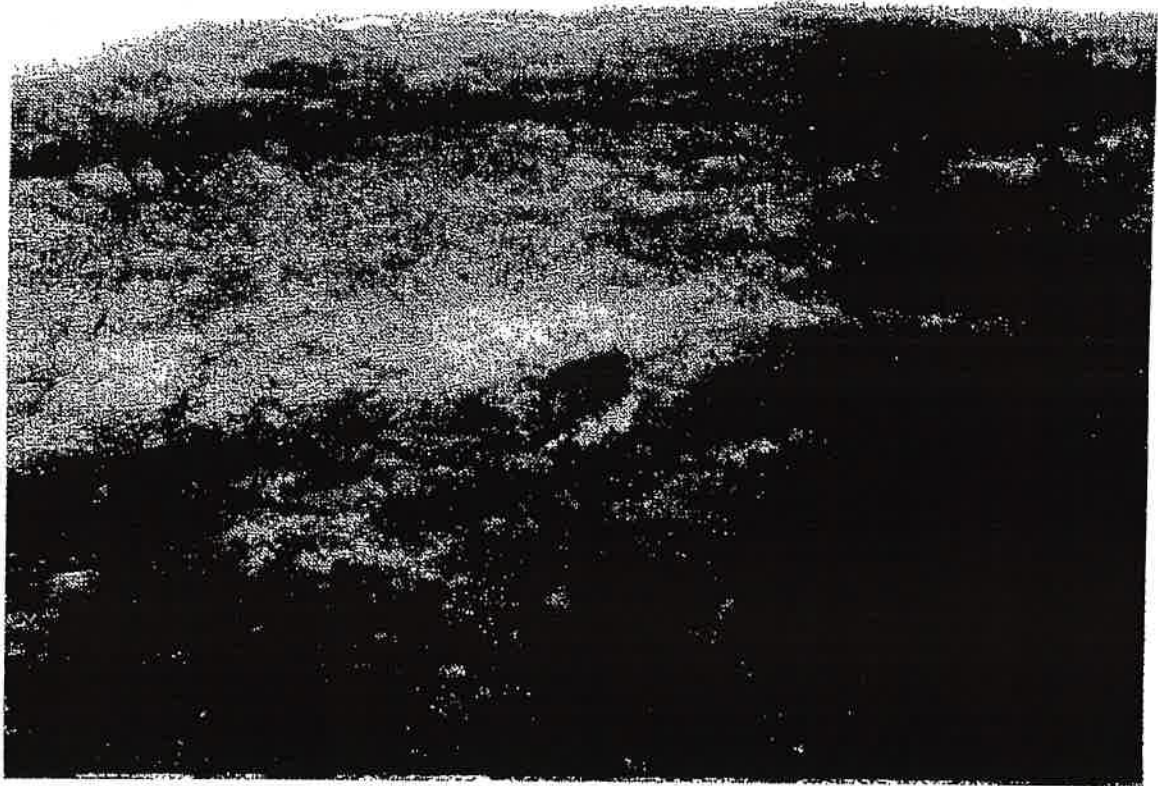


Photo 1 : Location of Sample 1.

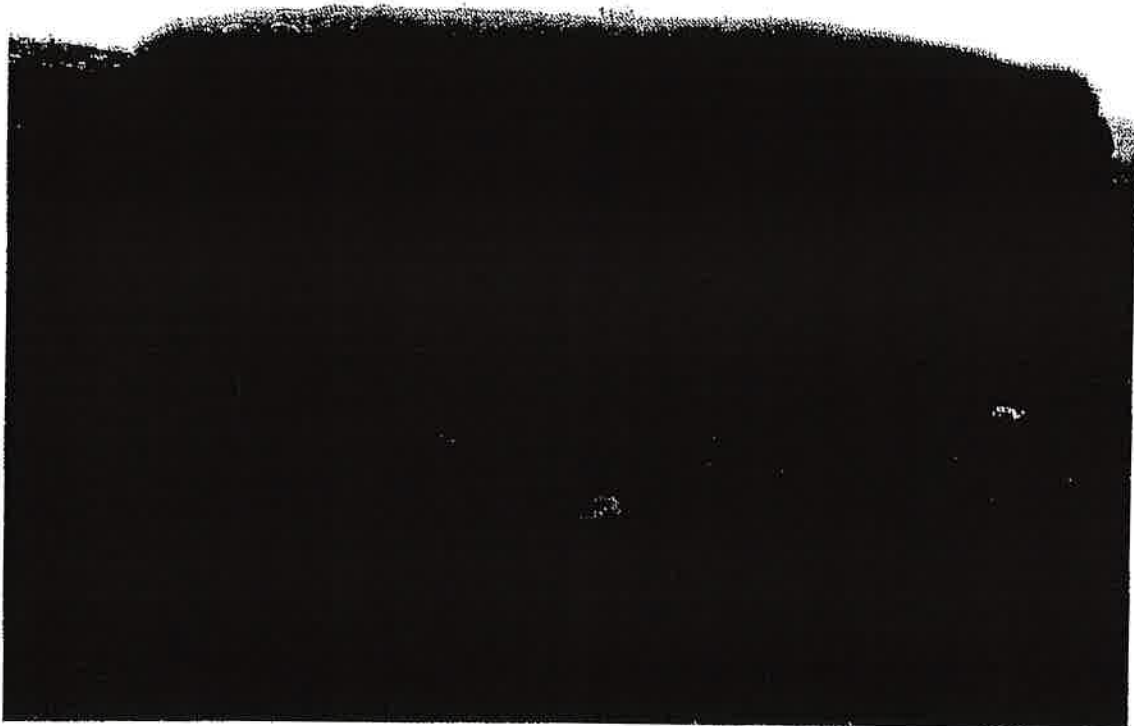


Photo 2 : Location of Sample 1.

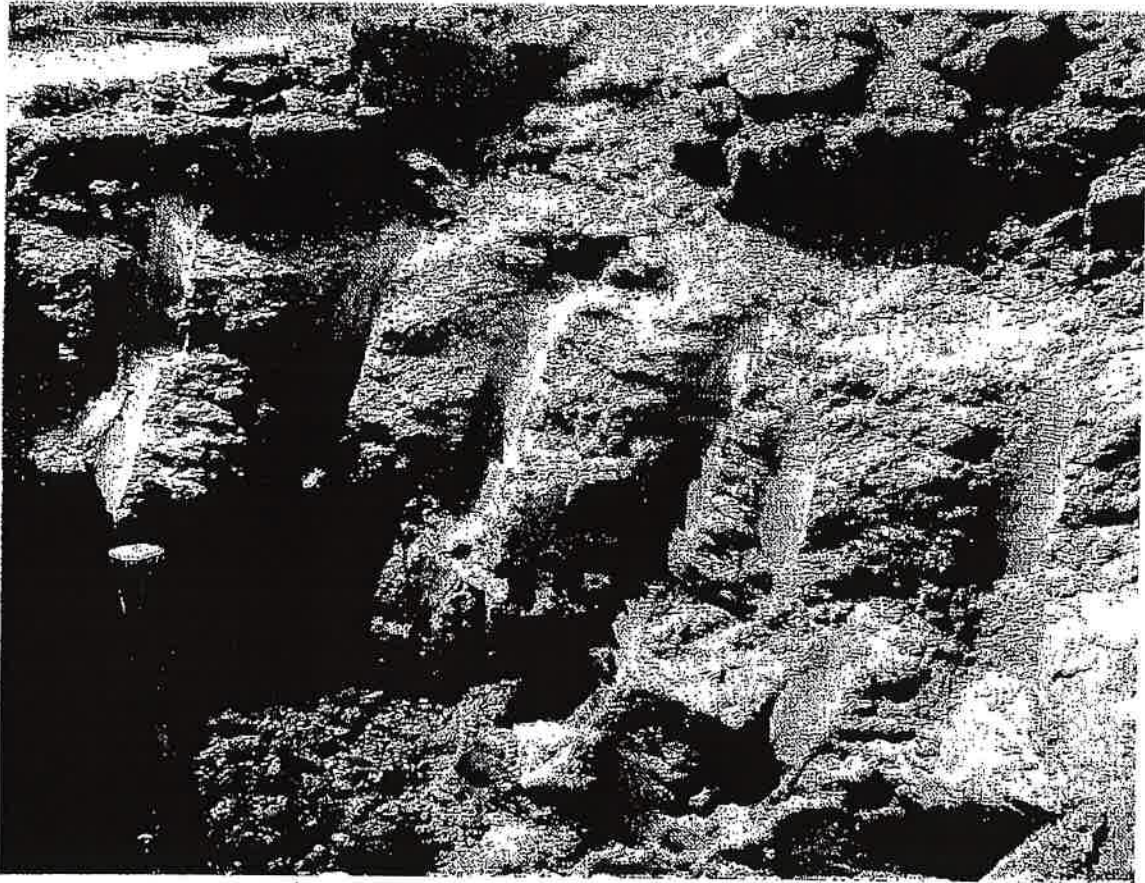


Photo 3 : Location of Sample 2.



Photo 4 : Location of Sample 2.



Photo 5 : Location of Sample 3.



Photo 6 : Location of Sample 3.



Photo 7 : Location of Sample 4.

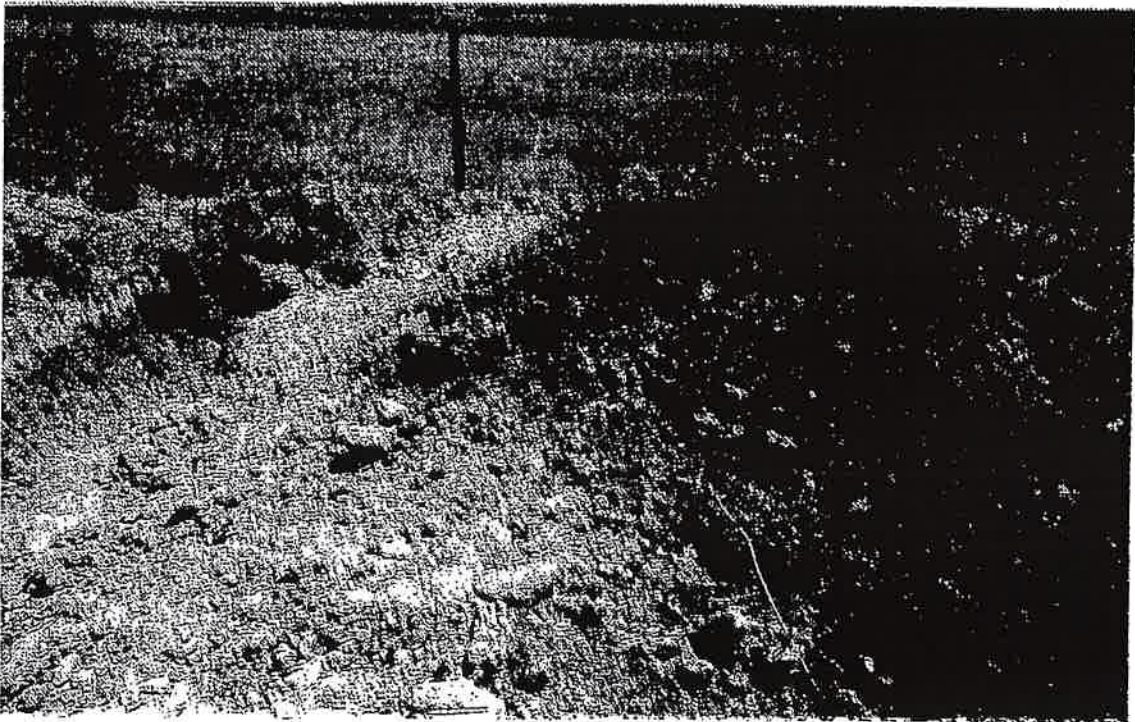


Photo 8 : Location of Sample 4.

APPENDIX C

**LABORATORY TEST SUMMARY
MATERIAL ANALYSES**

Laboratory Test Summary

Job Description: Kokstad Landfill - Ref. 21959
Job no.: 6160
Date: 02-03-2011

THEKWINI SOILS LAB. CC
VALUATION UNIT 400/010/01
 21 Naga Road,
 Thekwini, Durban
 Tel: (031) 281-4192 Fax: (031) 281-7130

Lab no.	02066	D2067	02068	02069	
Location	S/1	S/2	S/3	S/4	
Depth	0.80 - 1.10		0.00 - 0.40		
Description	-		-		
Binder Material	-		-		
Particle Size (mm)	75				
	53				
	37.5				
	26.5				
	19				
	13.2	100			
	9.5	98	100		
	4.75	96	98	100	
	2	92	90	95	99
	0.425	82	82	81	96
	0.25	80	81	76	89
	0.15	78	79	71	85
	0.075	69	69	58	74
	0.05	65	66	55	70
	0.02	47	51	41	53
0.005	30	42	26	37	
0.002	22	35	21	30	
Soil	10.3	8.0	15.2	4.7	
Montar	31.2	31.2	38.3	28.3	
	31.7	22.0	24.3	31.6	
	26.7	37.8	22.2	35.4	
Liquid Limit	27	30.4	34.2	33.3	
Plasticity Index	10.8	16.2	12.2	13.6	
Linear Shrinkage	5.3	8	6	6.7	
Natural MC					
Mod AASHTO	1644	1672	1560	1526	
Density	13.4	18.1	15.6	20.1	
CBR	100%				
	98%				
	95%				
	93% (Interred)				
	90%				
CBR Swell					
AASHTO Soil Classification	A - 6 (5)	A - 6 (9)	A - 6 (5)	A - 6 (9)	
Grading Modulus	0.56	0.58	0.68	0.38	
TRH 14 (1986)					
Permeability k = cm/sec	4.19 x 10 ⁻⁷	2.085 x 10 ⁻⁵	6.446 x 10 ⁻⁶	2.637 x 10 ⁻⁷	

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC

VAT REGISTRATION NO 438270841

68 Ridge Road, P.O. Box 30484,
Tolgens, DURBAN, KAPVILLIE, 4050
Tel: (031) 297-4992 Fax: (031) 201-7820

Project: Kokstad Landfill - Ref. 21959

Ref no.: 6160 **Lab no.:** 02066 **Borehole/Pit no.:** S/1 **Fig no.:** -

Depth: 0.80 - 1.10

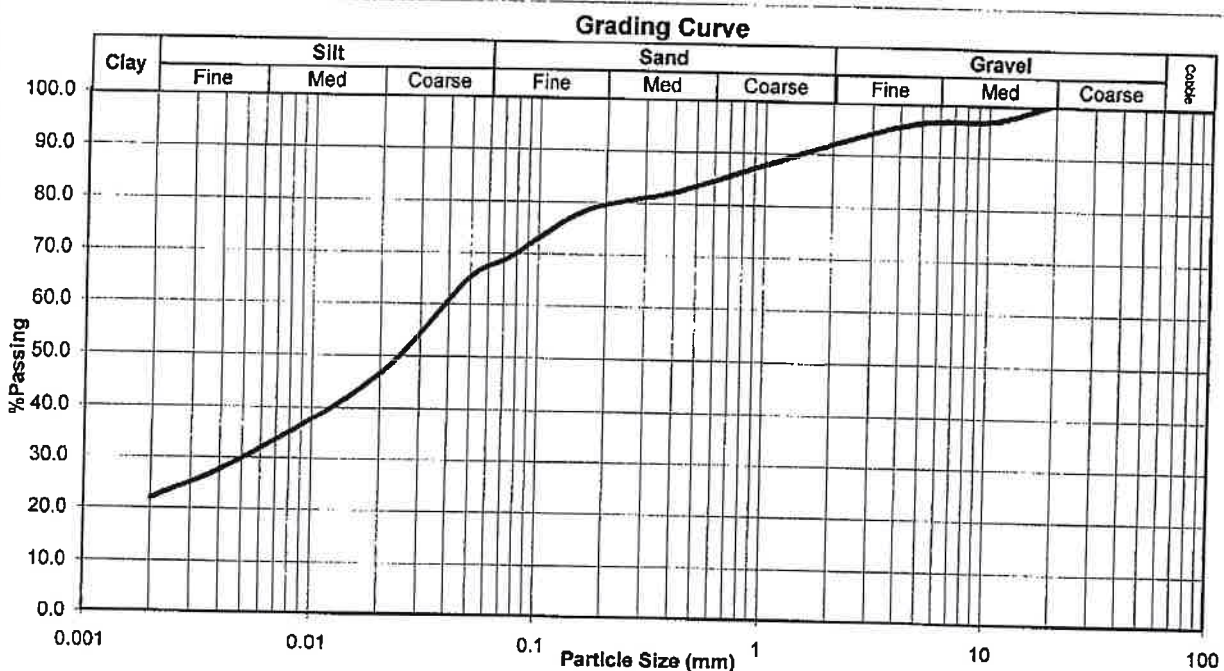
Grading Analysis	
Grain Size (mm)	% Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	97.9
9.5	96.9
4.75	96.3
2	92.0
0.425	82.5
0.25	80.5
0.15	77.7
0.075	69.3
0.05	65.2
0.02	46.5
0.005	29.8
0.002	22.0

M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	8.0
Coarse	0.0
Medium	3.5
Fine	4.5
Sand%	25.2
Coarse	8.5
Medium	4.4
Fine	12.3
Silt%	44.8
Coarse	20.3
Medium	15.6
Fine	8.9
Clay%	22.0

PLASTICITY	
Liquid Limit	27
Plasticity Index	10.8
Linear Shrinkage	5.3

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.56

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	5
AASHTO Soil Classification	A - 6
Unified Classification	CL or OL



Ref no.: 6160

Fig no.: -

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC

V.A.T. REGISTRATION NO. 4500210661

58 Ridge Road,
Tolpeltso, DURBAN P.O. Box 20484,
MAYVILLE, 4068
Tel: (031) 307-8387 Fax: (031) 307-7828

Project: Kokstad Landfill - Ref. 21959

Ref no.: 6160 **Lab no.:** 02067 **Borehole/Pit no.:** S/2 **Fig no.:** -

Depth: 0.90 - 1.20

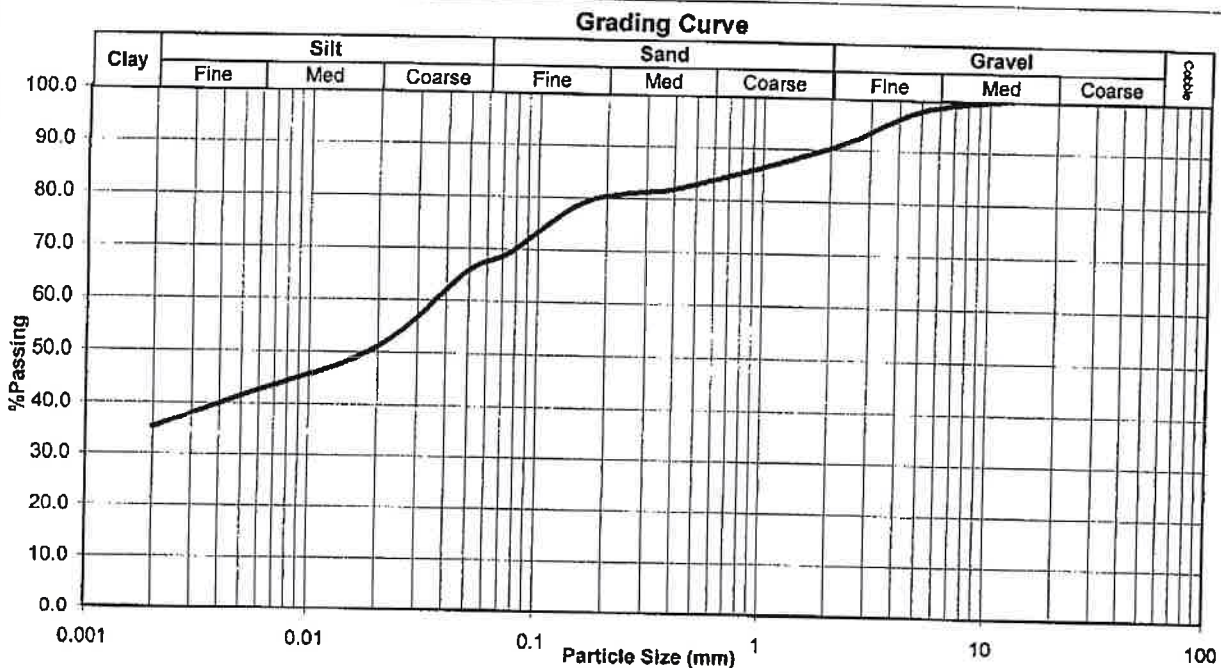
Grading Analysis	
Grain Size (mm)	% Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	100.0
9.5	99.5
4.75	97.5
2	90.3
0.425	82.1
0.25	81.0
0.15	78.5
0.075	69.2
0.05	65.7
0.02	51.0
0.005	41.5
0.002	35.1

M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	9.7
Coarse	0.0
Medium	2.0
Fine	7.8
Sand%	23.2
Coarse	7.3
Medium	3.2
Fine	12.7
Silt%	32.0
Coarse	16.1
Medium	8.9
Fine	7.0
Clay%	35.1

PLASTICITY	
Liquid Limit	30.4
Plasticity Index	16.2
Linear Shrinkage	8

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.58

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	9
AASHTO Soil Classification	A - 6
Unified Classification	CL or OL



Ref no.: 6160

Fig no.: -

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC

N.A.T. REGISTRATION NO. 4902/10661

48 Ridge Road, P.O. Box 30486,
Telipane, DURBAN, MAYVILLE, 4009
Tel: (031) 261-0882 Fax: (031) 261-2920

Project: Kokstad Landfill - Ref. 21959

Ref no.: 6160 **Lab no.:** 02068 **Borehole/Pit no.:** S/3 **Fig no.:** -

Depth: 0.00 - 0.40

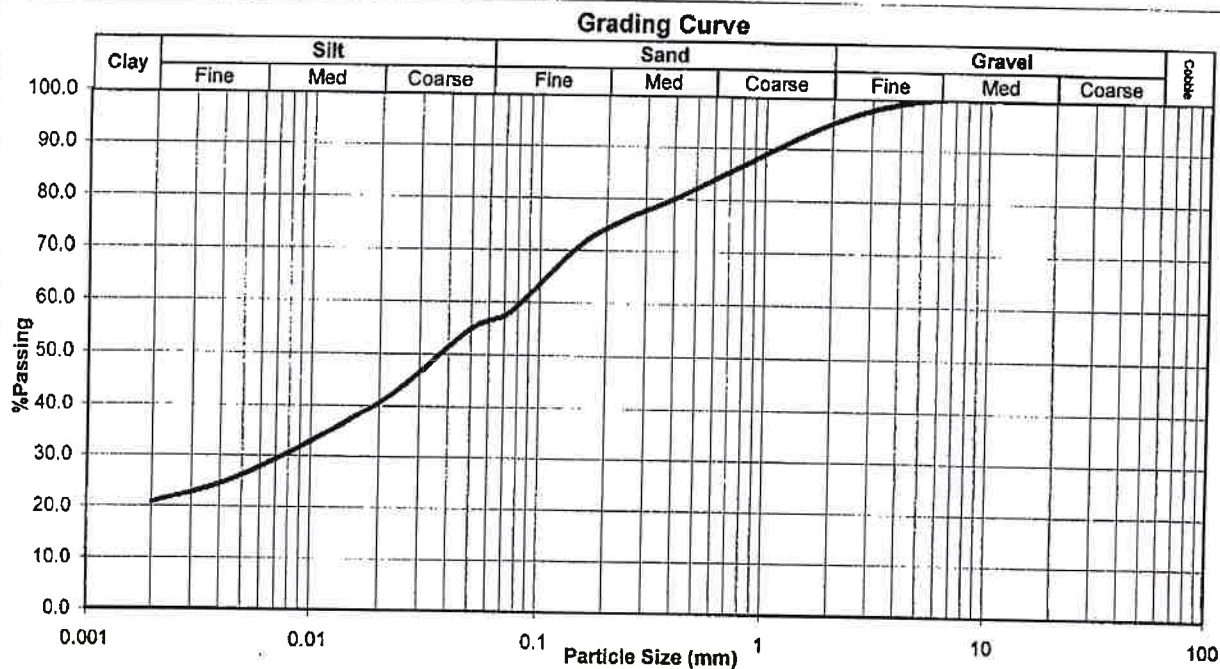
Grading Analysis	
Grain Size (mm)	% Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	100.0
9.5	100.0
4.75	99.5
2	95.1
0.425	80.6
0.25	76.3
0.15	70.7
0.075	58.2
0.05	54.9
0.02	40.6
0.005	26.2
0.002	20.8

M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	4.9
Coarse	0.0
Medium	0.4
Fine	4.5
Sand%	38.9
Coarse	12.9
Medium	8.7
Fine	17.3
Silt%	35.4
Coarse	15.6
Medium	13.4
Fine	6.3
Clay%	20.8

PLASTICITY	
Liquid Limit	34.2
Plasticity Index	12.2
Linear Shrinkage	6

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.66

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	5
AASHTO Soil Classification	A - 6
Unified Classification	CL or OL



Ref no.: 6160

Fig no.: -

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC

V.A.T. REGISTRATION NO. 450911201

88 Ridge Road,
Tolpene, DURBAN
Tel: (031) 201-8882

P.O. Box 30484,
MAYVILLE, 4058
Fax: (031) 201-7330

Project: Kokstad Landfill - Ref. 21959

Ref no.: 6160

Lab no.: 02069

Borehole/Pit no.: S/4

Fig no.: -

Depth: S/Pile

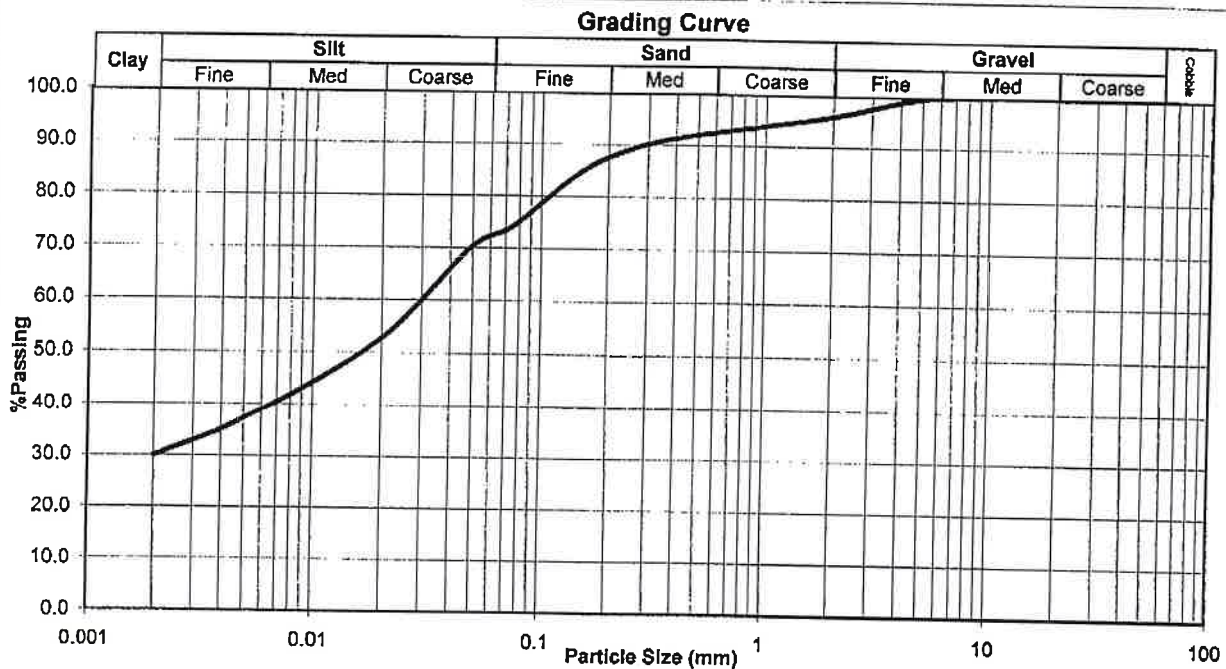
Grading Analysis	
Grain Size (mm)	% Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	100.0
9.5	100.0
4.75	99.4
2	96.0
0.425	91.5
0.25	89.1
0.15	84.6
0.075	74.2
0.05	70.3
0.02	52.7
0.005	37.1
0.002	29.9

M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	4.0
Coarse	0.0
Medium	0.4
Fine	3.6
Sand%	24.1
Coarse	4.0
Medium	5.1
Fine	15.0
Silt%	42.0
Coarse	19.1
Medium	14.6
Fine	8.3
Clay%	29.9

PLASTICITY	
Liquid Limit	33.3
Plasticity Index	13.6
Linear Shrinkage	6.7

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.38

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	9
AASHTO Soil Classification	A - 6
Unified Classification	CL or OL



Ref no.: 6160

Fig no.: -

Appendix E: Comments and responses and Public Participation Information

DRAFT

Background Information Document

DRAFT

**BACKGROUND INFORMATION DOCUMENT
ENVIRONMENTAL IMPACT ASSESSMENT / WASTE LICENCE
APPLICATION FOR CLOSURE OF EXISTING LANDFILL SITE AND
IDENTIFICATION OF NEW LANDFILL SITE IN KOKSTAD**

1 INTRODUCTION

The Greater Kokstad Municipality is in the process of rehabilitating and closing the existing Kokstad Landfill Site. In order for this to occur, alternative arrangements for the disposal of waste generated by the area needs to be investigated. The Municipality is proposing to identify and establish a new waste disposal facility that is in line with the National Environmental Management: Waste Act (NEM: Waste Act), 2008 (Act 107 of 1998)

Any activity identified in terms of Section 19 (1) of the NEM: Waste Act requires Waste Management Licence (WML) Application. The activities that require licensing under the NEM: Waste Act is as follows:

Government Notice Number	Category and Activity Number	Activity Description
GNR 718	Category A, (20)	The decommissioning of activities listed in this Schedule.
GNR 718	Category B, (10)	The disposal of general waste to land covering an area in excess of 200 m ² .
GNR 718	Category B, (11)	The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).

In terms of the NEM: Waste Act, any person wishing to carry out a Category A activity is required to conduct a basic assessment process, as stipulated in the environmental impact assessment (EIA) regulations made under section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as part of a waste management licence application.

Similarly, any person wishing to carry out a Category B activity is required to conduct an environmental impact assessment process as part of the waste management licence application.

This background information document describes the proposed activity and the WML/EIA processes that are required.

2 WHAT IS PROPOSED?

The Greater Kokstad Municipality has recognised the need to rehabilitate and close the existing Kokstad Landfill site. However, in so doing, arrangements must also be made to deal with the waste that will still be generated in Kokstad and its surrounds. A new landfill will therefore be required once the old site stops receiving waste.

The site will only accept general waste which includes domestic refuse, non-hazardous industrial waste, commercial waste, garden refuse and builders' rubble. The site will not accept any hazardous waste i.e. waste which has toxic, chemical or long-lasting properties which may have a negative effect on human health or the environment.

Landfill sites cannot and should not be developed on land that is unsuitable. Sites need to be considered carefully in terms of socio-economic and biophysical characteristics. It is for this purpose that the EIA and WML processes have been developed to ensure that future waste disposal facilities are properly sited which did not always happen in the past.

The EIA/WML processes required for the closure of the old site and the identification of the new one are separate processes and also differ in type of assessment that is required by law. The closure of the landfill requires a Basic Assessment and the identification of the new site requires a full Scoping and EIA process. Although these are separate, the two projects will be run concurrently as they are interlinked.

The processes are described in more detail below.

3 EIA FOR IDENTIFICATION OF NEW SITE

3.1 Scoping Phase

In terms of the EIA Regulations a full Scoping and Environmental Impact Assessment process will be followed.

The main objectives of the Scoping Phase are to:-

- Identify possible issues, impacts and concerns relating to the closure of a landfill site;
- Screen out non-issues; and
- Identify alternative sites for the location of the landfills.

A report on the Scoping Phase will be compiled and distributed to all Interested and Affected Parties (I&APs) for comment. Feedback received during this period will be incorporated into the document and submitted to the provincial environmental authority for approval. The provincial authority is the KwaZulu-Natal Department of Agriculture, Environment and Rural Development (KZN DAEARD). A Plan of Study for EIA will be submitted with the Scoping Report and will outline the steps that will be taken during the EIA phase. The authorities will have to assess the documents and approve and/or provide guidance on the course of action to be followed.

3.2 EIA Phase

The purpose of the EIA phase is to:

- Address issues that have been raised during the scoping phase;
- Assess alternatives to the proposed activity in a comparative manner;
- Assess all identified impacts and determine the significance of each impact; and
- Formulate mitigation measures.

The EIA report will be released for comment and discussion before being submitted to the authorities. It will also include the WML application documents which will need to contain all the information required by the licensing authority for them to be able to draft the actual licence and the conditions on which the landfill will be permitted to operated.

4 BASIC ASSESSMENT FOR CLOSURE OF OLD SITE

The overall purpose of the Basic Assessment is the same as that of the EIA for the new site. The main objectives would be to assess the alternatives for the rehabilitation and closure of the site and identify any social and biophysical impacts from the proposed closure.

The engineering team will also be responsible for the closure design of the landfill site.

This includes:

- Remedial design to address identified problem areas
- Final shaping, landscaping and re-vegetation
- Final landfill cover or cap design
- Permanent storm water diversion measures, run off control and anti-erosion measures
- Any infrastructure relating to the end-use plan

5 PUBLIC PARTICIPATION

Public Participation is a statutory requirement for projects of this nature in terms of the Constitution and NEMA. It establishes an ongoing mechanism for the collection and assimilation of I&AP inputs. The objectives of the public participation process can be summarised as follows:

- To inform I&APs of the proposed development;
- To provide an opportunity for I&APs to raise issues, concerns and suggestions;
- To promote transparency and an understanding of the project and its consequences;
- To facilitate liaison and communication with I&APs;
- To serve as a data gathering mechanism for the Scoping phase; and
- To address the issues and concerns raised by I&APs as far as possible.

6 HOW ARE SITES FOR THE NEW LANDFILL SELECTED?

The project team has identified several candidate sites for the proposed location of the new landfill site. These broad areas will be ranked according to economic, social and environmental suitability, explained below:-

- **Social Aspects**

Densely populated areas will be avoided as a landfill site does have the potential to impact on community health, safety and general well-being. For this reason, the landfill will require a sufficient buffer zone for it to be potentially suitable. A buffer zone is the piece of land between the boundary of the landfill and the nearest residential area.

- **Biophysical Aspects**

The biophysical attributes of an area must be considered in order to determine the type and level of risk the landfill will pose to its surrounding environment. The impact that the landfill may have on nearby water sources is usually of most concern, however, other factors such as topography, geology and climate play an important role in determining site suitability.

- **Economic Aspects**

Site selection is also determined by the financial cost of a landfill site. Factors such as access to major routes and distance to waste generation areas can determine the cost of operating a site. Finding a site that is economically feasible must tie in with other considerations because if the site becomes a burden to manage it can potentially impact on the social and biophysical environment.

7 AUTHORITY INVOLVMENT

The provincial environmental authorities will be consulted and kept informed throughout the process. Once the required documentation and reports are submitted, the respective

departments have a certain period of time in which to review it and issue their respective decisions and conditions of approval.

Waste Management Licences will be applied for from the provincial authority, the KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development (KZN DAEARD). However, other departments are also involved during the process, e.g. the National Department of Water Affairs (DWA) who are required to issue an internal Record of Decision in matters dealing with waste.

8 PROJECT TEAM

The Project Applicant is the Greater Kokstad Municipality. The Project Team involved with the proposed landfill sites consists of the following companies:-

- ❖ **Scientific Roets:** Engineering, Agricultural and Rural Development Specialists
- ❖ **Thekwini GeoCivils:** Civil and Structural Engineers; and
- ❖ **Icando:** Environmental and Waste Management Specialists

9 HOW CAN I BE INVOLVED?

Public involvement is an important aspect of the licensing process to ensure that issues and concerns of individuals who may be affected are taken into account. To register as an interested and affected party, or to raise any concerns or issues, please fill in the attached form and fax or email it to the offices of Icando.

10 CONTACT DETAILS

For further information please contact Icando (contact details are given below).

Verusha Nadar
P.O. Box 115, Link Hills, 3652
Tel: 031-763 3760; **Fax:** 031-763 3664
Email: verusha@icando.co.za



Comment Forms

DRAFT

ENVIRONMENTAL IMPACT ASSESSMENT / WASTE LICENCE APPLICATION

Closure of Existing Landfill Site Identification of New Landfill Site In Kokstad

Registration & Comment Form

Interested & Affected Parties (I&APs) are invited to participate in the EIA/WML process for the proposed closure of the existing Kokstad Landfill site and the identification of a new landfill in Kokstad. To participate, please complete this form and return it via post, fax or e-mail to Icando.

Name	Cathy Robinson		
Organisation	Kokstad Chamber of Commerce		
Address	138 Main Street Kokstad 4700		
Tel. No.	039 727 5170	Cell No.	084 66 99 609
Fax no.			
E-mail	info@ktschamber.co.za		

PLEASE CHECK APPLICABLE BOX (✓)

I am interested in becoming involved in this study	<input checked="" type="checkbox"/>
I am not interested in the project	<input type="checkbox"/>

I would like to participate in this project in the following way:

Receive documentation only	<input checked="" type="checkbox"/>
Receive documentation and attend meetings/workshops	<input checked="" type="checkbox"/>
Receive a copy of the final report summary	<input checked="" type="checkbox"/>

Are there any interested parties whom you feel should be contacted? If so, please give details:

Clarens Diedericks EG Scrap + Waste	
Clarens Diedericks EG Scrap + Waste	

Do you have any comments regarding the project at this stage?

1. Please provide some indication of the feasibility of recycling eg at source, recycling	
2. Building awareness in community.	

Contact details:
 P.O. Box 115, Link Hills, 3652
 Tel: 031 7633760, Fax: 031 7633664
 Email: verusha@icando.co.za



ENVIRONMENTAL IMPACT ASSESSMENT / WASTE LICENCE APPLICATION

**Closure of Existing Landfill Site
Identification of New Landfill Site In Kokstad**

Registration & Comment Form

Interested & Affected Parties (I&APs) are invited to participate in the EIA/WML process for the proposed closure of the existing Kokstad Landfill site and the identification of a new landfill in Kokstad. To participate, please complete this form and return it via post, fax or e-mail to Icando.

Name	Sonica Naudó - Steyn		
Organisation	Kokstad Advertiser		
Address	7 Hawthorne Street, Kokstad		
Tel. No.	039 727 2066	Cell No.	083 349 6216
Fax no.	039 727 2156		
E-mail	news@kokstadadvertiser.co.za		

PLEASE CHECK APPLICABLE BOX (✓)

I am interested in becoming involved in this study	<input checked="" type="checkbox"/>
I am not interested in the project	<input type="checkbox"/>

I would like to participate in this project in the following way:

Receive documentation only	<input checked="" type="checkbox"/>
Receive documentation and attend meetings/workshops	<input checked="" type="checkbox"/>
Receive a copy of the final report summary	<input checked="" type="checkbox"/>

Are there any interested parties whom you feel should be contacted? If so, please give details:

Not at this stage.

Do you have any comments regarding the project at this stage?

RE: Site 6 = lots of developments in surrounding area. How will it affect property values, development possibilities etc.
--

Contact details:
P.O. Box 115, Link Hills, 3652
Tel: 031 7633760, Fax: 031 7633664
Email: verusha@icando.co.za



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42 SPECIAL CONSENT

IN THE MAGISTRATE'S COURT FOR THE DISTRICT OF MOUNT CURRIE HELD AT KOKSTAD

Case No. 808/09
In the matter between **SHERWOOD PUMPS CC** Plaintiff and **ROBIN SHOESMITH** First Defendant **JUSTIN SHOESMITH** Second Defendant

SALE IN EXECUTION

IN PURSUANCE of a Judgment in the Court of the Magistrate of PIETERMARITZBURG and a Writ of Execution, the good listed hereunder will be sold in execution on **FRIDAY, 26th AUGUST 2011 at 9:30am** at the **LOCK-SLEIGH FARM, KARGES POST, KOKSTAD** to the highest bidder:-
1 X FORD TRACTOR 3000
1 X 4X4 TRACTOR DANMAR
1 X BIG SITE OFFICE CONTAINER (4 WINDOWS)
NB: The sale is for cash or bank guaranteed cheque only.
DATED AT PIETERMARITZBURG ON THIS 11th DAY OF AUGUST 2011
EXECUTION CREDITOR'S ATTORNEY JASAT & JASAT ATTORNEYS
18 Prince Edward Street PIETERMARITZBURG, TEL: 033 3420191 REF: 05: 5350-003:NRK

42 SPECIAL CONSENT

IN THE MAGISTRATE'S COURT FOR THE DISTRICT OF MOUNT CURRIE HELD AT KOKSTAD

Case No. 438/09
In the matter between **SHERWOOD PUMPS CC** Plaintiff and **AVAX SA 204 CC/a JA CONSULTANTS WASH** Defendant

SALE IN EXECUTION

IN PURSUANCE of a Judgment in the Court of the Magistrate of PIETERMARITZBURG and a Writ of Execution, the good listed hereunder will be sold in execution on **FRIDAY, 26th AUGUST 2011 at 9:30am** at the **LOCK-SLEIGH FARM, KARGES POST, KOKSTAD** to the highest bidder:-
1 X FOG 4 HOIST MACHINE
1 X MORELY 3 PHASE INDUCTION MOTOR, EN 60034 MACHINE
1 X MCM STANTET, BRMSON ELECRISK A
NB: The sale is for cash or bank guaranteed cheque only.
DATED AT PIETERMARITZBURG ON THIS 11th DAY OF AUGUST 2011
EXECUTION CREDITOR'S ATTORNEY JASAT & JASAT ATTORNEYS
18 Prince Edward Street PIETERMARITZBURG, TEL: 033 3420191 REF: 05: 5350-003:NRK

42 THANK YOU

The family of the late **Sibusiso Masinyane** would like to thank the following SAPS, RTL GKM, East Griqualand community & surrounding areas for their love, support and prayers through our time of sorrow.
From the Masinyane Family

42 FOR SALE

BORDER COLLIE supplies for sale. 7 weeks old. Contact Patricia on 082 455 9941

2007 Ford Ranger Montang 2.5 TDI. Neat, clean and well looked after. Contact Paddy 082 080 7995

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JP - 28.05.10

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Ardeep Ramsaram also receives a DVD player from Pick N Pay Store Manager Patrick Nkwanyana after he successfully entered the competition.



Nonkuthazo Kumbaca receiving DVD player from Store Manager Patrick Nkwanyana.

Rose Ndela happily receives a R1000 pension grocery from one of the Pick N Pay manager Clifford Pillay

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ISAZISO NGOKULAZIYO LOCHAPHAZELEKO KOKUSINQONGILEYO/IMVUME YENDAWO YOKULAHLA IZIBI ISICELO SOKUVALA INDAWO EKHONA YOKULAHLA IZIBI NOKIKHONGWA KWENDAWO ENTSHA YOKULAHLA IZIBI EKOKSTAD

INHLANGANISO YOLUNTU

Esi saziso sikhutshwe ngokulandela umthetho we 54(2) kwimithetho ecapashwe kwi GNR 543 yemithetho yeNEMA EJA yonyaka ka 2010 ngaphantsi kwamazolontya 24(a) kunye no 24(d) omthetho weNational Environmental Management Act (okungumthetho we107 wonyaka 1998) nakwi GNR 718 yomthetho weNational Environmental Management: Waste Act (umthetho we99 wonyaka 2008), ngenjongo yokokhulwa kwendawo yokulahlala izibi kwindawo yaseKokstad, linkukakacha Ngomsebenzi: Umasepalati waseKokstad ukwiphulo lokulahlala kwendawo ekhona yokutshisa izibi, nokuchanjwa kwendawo entsha yokulahlala izibi, ezihlangabezana nesidlo sikamasipalati sokuphuhlisa inkonzo zokulahlala izibi. Ngoku kulungwa indawo izimbalewa ekuzochongwa kuzo eyona ekuzolehlwile kuyo izibi. Kuzobanjwa Inhlanguaniso yoluntu apho kuzothethwa khona ngawo lo msebenzi. Leyo nhlanguaniso loophinde inike amaqela ananomi a naphaphazela kuyo iThuba lokuthabatha Inxaxheba. Xa lo msebenzi ocebeywayo wenzeka, kufuneka kubekhonane Imvume yokongamelela Indawo yokulahlala izibi. Isicelo sigo mvume sihambisana nohlahlo lochaphazeleko lokusinqongileyo. Onke amaqela ananomi a naphaphazela kuyo ayamenywa ukuba mawabhalise kwi ofisi ze-icando (kwezinkukakacha zingaezandi).

Inhlangano yoluntu imingqulobho lulandelayo:

Umhla: 29 Agasti 2011

Ixshax: 13h00 (ngo 3 wasemalanga)

Indawo: EKokstad Community Hall (eholweni yoluntu)

Olunye ulwazi:
Xa ufuna olunye ulwazi ngeliphulo okanye xa ufuna ukuthabatha Inxaxheba ngokumelele laqela qinomda okanye elichaphazelekayo, nceda uqhakamshelane nequmkathi elikhumalanyayo (ikonsultants) ngokusebenzisa iposi, i-email okanye, i-fax zingekakagithi Inzuku ezili 14 sikhutshwe esi saziso. Umqolo ucacisa ngalo msebenzi luyafumaneka kulawo nalowo umntu awucelayo. Inomboro zemvume ze-waste management ziyafumaneka kwisibe lezolimo, imicimbeyokusinqongile nophuhliso lwazigalilani.
Verusha Nadar
Icando
P.O. Box 115, Link Hills, 3652
Tel: 031-7633 760; Fax: 031-7633 664
Email: verusha@icando.co.za

19 August 2011

**NOTICE OF ENVIRONMENTAL IMPACT
ASSESSMENT / WASTE LICENCE
APPLICATION FOR CLOSURE OF EXISTING
LANDFILL SITE AND IDENTIFICATION OF NEW
LANDFILL SITE IN KOKSTAD**

PUBLIC MEETING

Notice is given in terms of Regulation 54 (2) of the regulations published in GNR 543 of the NEMA EIA regulations of 2010, under Sections 24(2)(a) and (d) of the National Environmental Management Act (Act 107 of 1998) and GNR 718 of the National Environmental Management Waste Act (Act 59 of 2008), of the intention to establish a new landfill site.

Project details: The Greater Kokstad Municipality is in the process of initiating the closure of the existing Kokstad Landfill and the identification of a new landfill that will serve the waste management needs of the municipality. Candidate sites for the new landfill are in the process of being identified. A public meeting will be held to discuss the proposed project and allow any interested and affected parties to become involved. The proposed activity requires a waste management licence and an application subject to an environmental impact assessment process. All interested and affected parties are invited to register with Icando (contact details below).

A Public Meeting will be held as follows:

Date: 29 August 2011

Time: 15h00

Venue: Community Hall, Kokstad

Further information: If you would like to obtain further information about the process or to be identified as an interested and affected party please contact the consultants via email, post or fax within 14 days of the publication. A background information document is also available on request. Waste Management Licence numbers are being obtained from KZN Department of Agriculture, Environmental Affairs and Rural Development.

Verusha Nadar

Icando

P.O. Box 115, Link Hills, 3652

Tel: 031-7633 760; Fax: 031-7633 664

Email: verusha@icando.co.za

Minutes

DRAFT

**Public Meeting
Identification of a New Landfill Site
and Closure of the Existing Shayamoya site in Kokstad.
Kokstad Community Hall
29 August 2011 at 15h00**

1 Welcome and Introductions

Verusha Nadar (VN) from Icando welcomed everyone and thanked them for their attendance. She introduced the project team members.

2 Attendance

Trish Chapman	Trash Busters
June Lombard	Icando
D.R. Mabcote	Kraansdraai Farm Committee
M. Madikizela	Scientific Roets
Thuli Mgenge	DAEA
E. Mtshutshane	Kraansdraai Farm Committee
Graham Payne	TGC Engineers
Verusha Nadar	Icando
Sonica Naude-Steyn	Kokstad Advertiser
Joe Ngubo	DAEA
E. Nhsevu	Kraansdraai Farm Committee
Cathy Robinson	Kokstad Chamber
Adriaan Roets	Scientific Roets
Ndaba Sobuce	Greater Kokstad Municipality

3 Project Background and EIA/WML Process

VN provided a background to the project and explained the Environmental Impact Assessment and Waste Management Licence process. The presentation from the meeting is attached as Annexure 1.

She explained that there were two process being run concurrently – a waste management licence for the closure of the existing landfill and another licence application for the establishment of a new landfill.

Mr Graham Payne (GP) from Thekwini GeoCivils then described each of the sites that were being looked at for the new landfill site. Six areas have been identified as suitable for the development of the landfill.

4 Questions and discussion

1.1. Requests from Kraansdraai Farm Committee:

- The Committee requested a meeting with the Municipality
- The request was noted and the project team would communicate with the committee to set up a meeting.
- The Co-op also requested that a hard copy of the reports concerning the process is made available to them.
- The request was noted and the consultant team agreed to provide a hard copies of the documents.

1.2. Question: How would the land be bought or who would be need to budget for the purchase of the land needed for the landfill?

→ The municipality would need to budget for the land.

1.3. Question: How long can the existing landfill cope with accepting municipal waste
The existing site can be flexible.

→ The engineers have allowed for 18 months of continued landfilling but it could go on.

1.4. Question: How were the six sites chosen?

→ The most important things to look for when siting a landfill is proximity to water, soils, topography, access via roads and the ownership of the land.

5 Way forward

The project team stated that I&APs would be kept informed as developments around the sites occurred. Documentation would also be made available and I&APs would have an opportunity to comment on the reports once they have been drafted.

Annexure 1: Presentation from meeting

ENVIRONMENTAL IMPACT ASSESSMENT / WASTE LICENCE APPLICATION

PROPOSED CLOSURE OF EXISTING KOKSTAD LANDFILL AND IDENTIFICATION OF NEW SITE

29 August 2011
Kokstad Community Hall

Proposed Agenda

1. Welcome and introductions
2. Background and EIA / WML process
3. Questions and discussion
4. Next steps

BACKGROUND

- What is needed?
- Two processes:-
 - Current landfill in Kokstad needs to be closed
 - New landfill site must be identified and established
- NEM Waste Act (Act 59 of 2008): Waste related activities require waste licence application.

Listed activities

Landfill closure:-

- **Category A Activity**
 - The decommissioning of activities listed in this Schedule.

Landfill identification:-

- **Category B Activities**
 - The disposal of general waste to land covering an area in excess of 200 m².
 - The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).

Proposed Activity: Landfill Closure

- Remedial design to address identified problem areas
- Final shaping, landscaping and re-vegetation
- Final landfill cover or cap design
- Permanent storm water diversion measures, run off control and anti-erosion measures

Proposed Activity: Landfill Establishment

- Disposal of general waste – domestic, dry industrial, builders' rubble and garden refuse
- Require site of sufficient size
- Fenced with gate control
- Site office

Do we need another landfill?

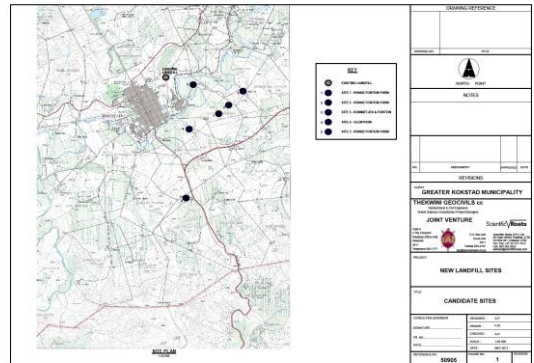
- What is happening now?
 - Waste disposed at Shayamoya landfill – problematic
 - Needs to be closed and rehabilitated
 - Transfer station not viable – distance to nearest landfill – Harding? Too expensive

What areas are suitable?

- Area with suitable geology
- Accessibility
- Transport distance from major centres
- Water quality aspects
- Social aspects

Preliminary Sites

- Six potential candidate sites identified



EIA & WML PROCESSES

- Basic Assessment conducted in one phase
- Environmental Impact Assessment process is in two phases – scoping and assessment phases
- “Environment” : broadly =
 biophysical
 economic
 social aspects

EIA PROCESS: 2 PHASES

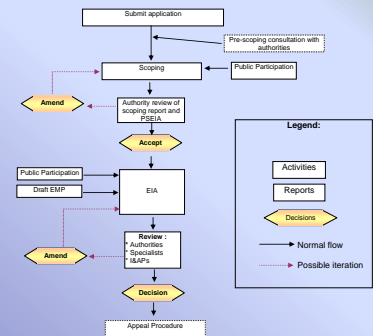


Figure 1: Scoping and EIA Process I.Lo NEMA (1998)

Which laws apply?

- **NEM: Waste Act**
- **National Environmental Management Act**
- **Occupational Health and Safety Act**
- **National Water Act**
- **Bylaws:**
 - Town Planning
 - Rezoning/change of land use

Objectives

- **Assess the impacts associated with proposed activity**
- **Identify alternatives**
- **Identify ways in which any adverse impacts can be minimised**
- **Ensure that Interested & Affected Parties are part of the process**

Public Participation Process

- **Notification of Interested & Affected Parties**
 - Newspaper
 - Stakeholder meeting/s
 - Registration as I&APs
- **I&APs comments & issues gathered & addressed in the Scoping and EIA reports**
- **Ongoing information sharing and documents available for review**
 - Local library
 - Local municipal offices
- **On-site notice once locality known**

Next Steps for Closure of Landfill

1. **I&APs submit issues & concerns in writing**
2. **Assess impacts of proposed activity and address issues (mitigation measures).**
3. **Prepare and submit Draft Basic Assessment Report with WML Application for comment to stakeholders.**
4. **Finalise and submit to DAEARD for decision (authorisation or not)**
5. **Appeal period**

Next Steps for Landfill ID

1. I&APs submit issues & concerns in writing
2. Scoping Report circulated for public comment and submitted to authorities with Plan of Study for EIA
3. Review and amend/acceptance of Scoping Report by authorities
4. Assess impacts of proposed activity and address issues (mitigation measures) – location alternatives
5. Submit Draft EIA Report and WML Application with EMP for comment to stakeholders and DAEARD
6. Finalise and submit to DAEARD for decision (authorisation or not)
7. Appeal period

Issues and Concerns

- Please complete the registration/ comments form and submit to:

Icando

Email: verusha@icando.co.za

Fax: 031 7633 664

Tel: 031 7633 760

Post: P O Box 115, Link Hills, 3652

Comment and Response Report
(to be inserted when Comment Period has lapsed)

DRAFT

Appendix F: Draft Environmental Management Programme (EMPr)

DRAFT

**REHABILITATION AND CLOSURE OF THE SHAYAMOYA LANDFILL
SITE, KOKSTAD
DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME**

Prepared by:



On behalf of:

Greater Kokstad Municipality

P.O. Box 8

Kokstad

4700

For submission to:

KZN Department of Agriculture and Environmental Affairs

Environment: South Region

Private Bag X6005

Hilton

3245

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ACRONYMS

DAEA:	KZN Department of Agriculture and Environmental Affairs
DWA:	Department of Water Affairs
ECO:	Environmental Control Officer
EMPr:	Environmental Management Programme
I&APs:	Interested and Affected Parties
SM:	Site Manager

SECTION 1: INTRODUCTION

1.1 Project Background

Thekwini Geocivils and Scientific Roets Engineering Consulting Services appointed Icando to apply for a closure permit for an unlicensed waste disposal site in Kokstad in terms of the Environment Conservation Act (Act 73 of 1989).

The Shayamoya landfill is located north-west of the town centre, adjacent to the residential suburbs of Shayamoya. It is the only waste disposal facility for the Greater Kokstad Municipality and is operated by the Municipality's Social Services Department.

The site is not in good condition with little planning. It is impacting on the surrounding environment in that it is generating leachate, odour and windblown waste.

In terms of the Environmental Conservation Act No1989 no person shall establish or operate a disposal site without a License issued by the KZN Department of Agriculture and Environmental Affairs (DAEA). The site is currently not licensed and the municipality has been under considerable pressure from DAEA to rehabilitate and close the site. It is noted that it was a condition in the Record of Decision approving the Shayamoya Township development, dated 1 October 1999 that the landfill should be closed.

In terms of legislation an unlicensed site still needs to be licensed for closure. To comply with the license requirements the site would need to be rehabilitated and then capped in accordance with the DWA 'Minimum Requirements for the Disposal of Waste by Landfill'.

After assessing their obligations the Municipality has decided to rehabilitate the landfill and prepare a design to provide sufficient air space for a two year period, during which they will identify and commission a new site.

1.2 Environmental Management Programme (EMPr)

An EMPr is a practical tool, which serves to guide the project implementation through a set of environmental standards. The objectives of the environmental standards are to minimise the risk of damaging or impairing:

- Natural ecosystems and environmental quality
- Existing land use and capability
- The health or quality of life of the public

Sustainability, which encompasses economic, social and biophysical aspects, is the key underlying principle for responsible environmental management. This EMPr is therefore primarily concerned with managing those environmental issues and concerns that have been identified such that the social needs of the local communities are met and the ecological integrity of the area is maintained. The management of these issues may include the following:

- Avoiding impacts by not undertaking certain actions;
- Minimising impacts by limiting aspects of an action;
- Rectifying impacts by rehabilitation or restoration of the affected environment;
- Compensating for impacts by providing substitute resources or environments;
- Minimising impacts by optimising industrial processes, structural elements and other design features.

1.3 Roles and Responsibilities

1.3.1 Developer

The Developer is the Greater Kokstad Municipality

1.3.2 Contractor

The organisation contracted by the Developer to carry out parts of the work for the proposed project. Details of the contractor will be communicated to the Department when a suitable contractor has been sourced and appointed.

1.3.3 Engineer

The person appointed by the Developer to oversee the work of all consultants, contractors and sub-contractors.

1.3.4 Neighbours

Considered to be the people living in properties adjoining the proposed project.

1.3.5 Interested and Affected Parties (I&APs)

The people or organisations within the neighbouring community who may be affected by the proposed development.

1.3.6 Site Manager

The person representing the Contractor, responsible for the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction phase of the project.

1.3.7 Environmental Control Officer (ECO)

The ECO is normally the person appointed by the Developer who will monitor the implementation of the EMPr and will be responsible for conducting the monthly environmental audits of the project during the construction phase. The ECO shall be a senior member of the construction team and have overall environmental management responsibilities on the site.

The Developer (Greater Kokstad Municipality), Engineer and Contractor will be responsible for maintaining communication channels with I&APs throughout the Construction Phase. All communications with I&APs received by the ECO or other members of the Development Team shall be referred to the Developer to ensure that these are properly recorded and the appropriate action taken.

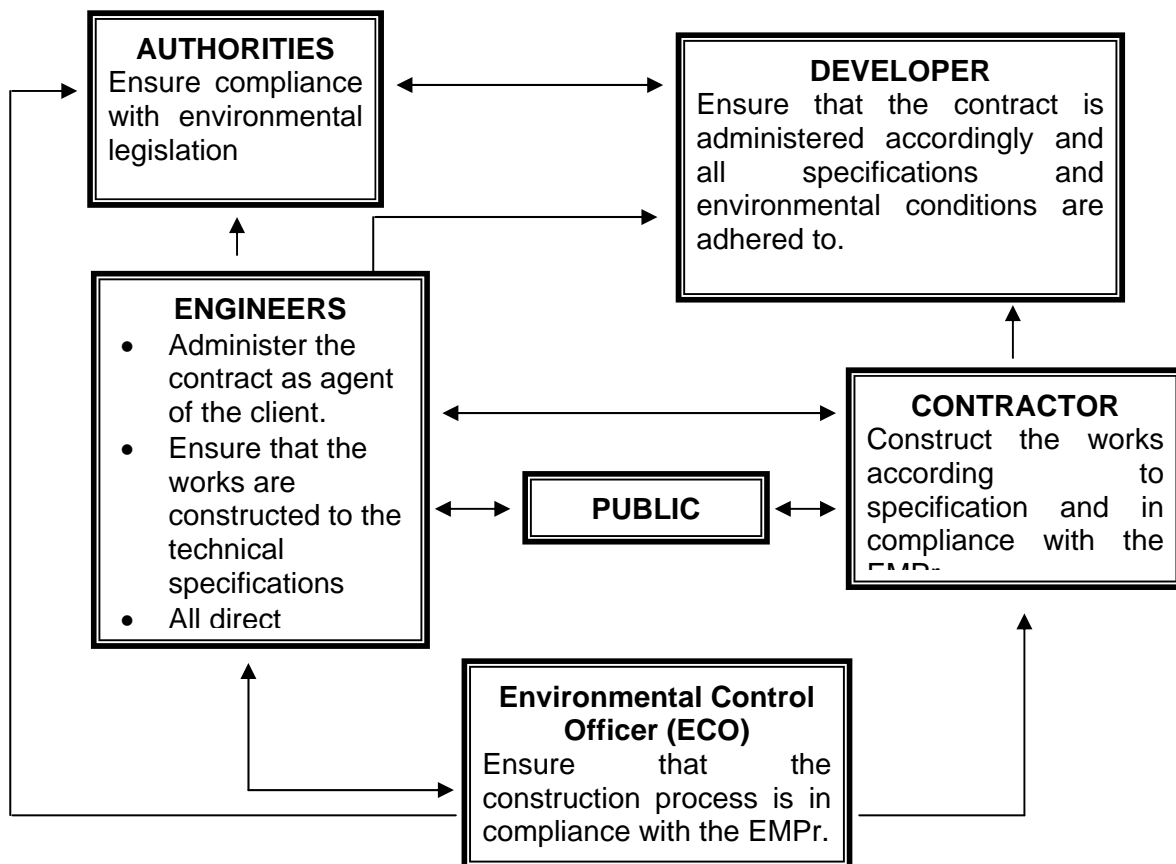


Figure 1: Parties to the construction contract and their interaction.

2 SECTION 2: PHASES APPLICABLE TO IMPLEMENTATION OF THE EMPr

2.1 Pre-Construction/Planning Phase

The main objective of the Pre-Construction phase is to ensure that the events of construction, commissioning and decommissioning run smoothly. This phase is essential in determining the procedures and activities that will prevent or lessen the potential impacts caused by the different phases.

2.2 Construction Phase

Construction phases of projects have the potential to cause the most damage to the receiving environment if best industry practise is not followed. This has led to EMPrs being an essential guideline document to minimise negative impacts during construction. The ECO will be expected to submit monthly audit reports to the Assistant Manager of Compliance, Monitoring and Enforcement at DAEA to this effect.

2.3 Post-Construction Phase

The post-construction phase requires that no residual waste is to be left over from the construction process and stipulates that any damage done to adjacent properties during the construction phase must be repaired before completion of the project.

3 SECTION 3: PRE-CONSTRUCTION PHASE

3.1 Legislation, Permits and Agreements

- The Contractor is responsible for all environmental management during the construction activities for the proposed landfill closure. The Contractor shall comply with all requirements of the following:
 - The DWA Minimum Requirements for Waste Disposal by Landfill, 2nd Edition, 1998.
 - The Environmental Authorisation (when issued by KZN DAEA)
 - The EMPr
 - Project Specifications

- In all instances the developer, Service Providers, Contractor and Project Managers must remain in compliance with relevant local and national legislation. Particular attention must be paid to the requirements of the following national legislation and standards:
 - National Environmental Management Act No. 107 of 1998
 - National Environmental Management Waste Act No 59 of 2008
 - National Water Act No 36 of 1998
 - Occupational Health and Safety Act No 85 of 1993
- All techniques, practices and methods employed will be in compliance with these standards and requirements. In general, the contractor will ensure the following:
 - Minimal environmental damage and nuisance to the adjacent communities.
 - Appropriate waste management practices.
 - Pollution avoidance.
 - Prevention of loss or damage of natural resources.
 - Minimisation of construction impacts on adjacent landowners, occupants and the general public.
- The contractor shall prevent or minimise the occurrences of accidents, which may cause damage to the environment and people and their attendant impacts and shall ensure that the environment is restored to its condition prior to the accident. If an accident causes significant harm to the environment it must be reported to the engineer or ECO within 48 hours of the incident.
- Should it be considered that the construction activities are causing unacceptable environmental damage or nuisance to the adjacent communities, the contractor shall immediately consult with the responsible Engineer to discuss appropriate remedial measures, which will be implemented immediately to prevent further damage.
- The Engineer shall be entitled to monitor and inspect the Contractors' written records to demonstrate compliance with the EMPr.
- This EMPr will be considered an extension of the Conditions of Approval for the authorisation of the closure application as set forth by KZN DAEA. Non-compliance with the EMPr will constitute non-compliance with said Conditions.

- The EMPr will be made binding on all contractors operating on the site and will be included within the Contractual Clauses.
- It should be noted that in terms of the National Environment Management Act, those responsible for Environmental Damage (in this case the Contractor) must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and/or environmental damage (The polluter pays principle).

3.2 Environmental education and awareness

- The Contractor shall ensure that all site personnel have a basic understanding and awareness of environmental issues and concerns, including waste, landfill gas, leachate and their associated dangers and hazards, prior to the project being undertaken.
- Awareness should be provided on; what is meant by the 'environment', why the environment needs to be protected and conserved, how construction activities impact on the environment and mitigatory measures against such impacts. Furthermore all site personnel should be equipped with appropriate reaction procedures to any of the hazards.
- The Engineer should be readily available to explain more technical issues and answer questions.
- The performance of construction workers must be monitored regularly by the Contractor to ensure the environmental consideration is being adhered to.
- It is the Contractor's responsibility to provide the site foreman with no less than one hour's environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff.

3.3 Worker conduct on site

A general regard for the social and ecological well being of the site and adjacent areas is expected from the site staff. Workers need to be made aware of the following general rules:

- No drugs or alcohol are to be allowed on site.
- No firearms or any form of weapon shall be allowed on site, unless carried by security personnel.

- Awareness of their social responsibility during construction such as being considerate of local residents
- All personnel on site should be warned against making excessive noise such as hooting and shouting.
- All construction workers should be encouraged to keep the site as neat as possible.
- Trespassing on private or commercial properties adjoining the site is not to be allowed.
- Construction staff should be warned about the safety hazards of smoking or having fires on site.
- No onsite fires should be allowed.

3.4 Emergency Preparedness

- The contractor shall develop an emergency plan that will enable rapid and effective response to all types of environmental emergencies in accordance with the Occupational Health and Safety Act (Act 85 of 1993). The plan will include an established communication system between all local emergency services such as the police, fire fighters, medical and ambulance services.
- All staff to be made aware of the emergency and spill response provisions prior to work commencing on site
- Emergency numbers should be properly displayed on signs.

3.5 Setting up Construction Camp and Storage Areas

Proper and careful planning of the construction camp areas can ensure minimal environmental impacts, which in turn can result in reduced time and cost implications normally associated with environmental management and rehabilitation. General management and maintenance of the area should be ensured throughout the construction phase.

- The working area of the construction site must be agreed on by the Engineer and Contractor. Details of the location of the camp must be communicated to DAEA prior to establishment.

- The selection of the site should take into account the proximity to local communities and ecologically sensitive areas.
- No area set aside as Public Open Space should be used as the construction camp/storage area.
- Cut and fill must be avoided where possible during the setup of the construction camp/storage area.
- The size of the construction camp/storage area must be minimised as much as possible
- Sufficient space must be allocated for parking.
- The Contractor must ensure proper drainage mechanisms to avoid standing water and/or sheet erosion.
- During site establishment, storm water drains are to be located and covered with metal grids to prevent blockages if deemed necessary by the engineer.
- Storage areas must not be in unstable or high-risk areas and must be designated, demarcated and fenced if necessary.
- Storage areas must be secure to minimise criminal activities and injury to animals and people.
- Fire prevention facilities/equipment must be present.
- The applicant is to ensure that the storage and use of potentially hazardous materials such as diesel, petrol, oil/s or lubricants do not result in soil or water contamination. The choice of location for storage areas must therefore take into account prevailing winds, distances to the water course and general on-site topography. Impervious surfaces must be provided where necessary. Storage areas must be designated.

3.6 Materials Management

- The secure and stable storage/stockpiling of material must be ensured to avoid collapse and possible injury to site workers/local residents, and generally should not exceed 2m in height unless otherwise permitted by the Engineer.
- Stockpiles should not be positioned in an area that will obstruct drivers' line of sight, particularly at intersections and sharp corners.
- Stockpiles should be covered if necessary.

3.6.1 Hazardous Substances Management

- The applicant is to ensure that the storage and use of potentially hazardous materials such as diesel, petrol, oil/s or lubricants do not result in soil or water contamination. The choice of location for storage areas must therefore take into account prevailing winds, distances to the water course and general on-site topography. Impervious surfaces must be provided where necessary. Storage areas must be designated.
- The contractor must have a Hazardous Material and Waste Management Plan which outlines measures to be taken to prevent soil and water contamination, accidental fires and risk/injury to people or animals.
- All hazardous materials to be used should be classified and labelled according to recognised practice codes (Occupational Health and Safety Act, Hazardous Substances Act).
- Safety Data Sheets (SDSs) shall be readily available on site for all chemicals and hazardous substances on site.
- Hazardous storage areas should be bunded with an impermeable liner to protect soil and groundwater contamination.
- The mixing or decanting of all chemicals and hazardous substances must take place on an impermeable surface, and then the waste from these disposed of accordingly.
- Concrete mixing must take place on a designated, impermeable surface.
- No vehicles transporting, placing or compacting concrete or asphalt to the site may be washed on site.
- Only an approved hazardous waste Contractor must dispose of hazardous waste from the site.
- A sump must be created for concrete waste and de-sludged regularly and removed to an approved tip site.

3.6.2 Source of Materials

The Engineer shall be notified of the source of all materials to be used on site for approval prior to commencement of any construction work.

3.7 Ablution

- Temporary chemical toilets must be provided by a company that has been approved by the Engineer.
- Such toilets should be no closer than 50m from any natural water bodies.
- Under no circumstances shall open areas or nearby bushes be used as toilet facilities.
- A registered chemical waste company is to be used to remove waste from chemical toilets on site.

3.8 Waste Management

- The contractor shall prevent littering across the construction site and must ensure that all litter is collected from the work and camp areas daily.
- A fenced area should be provided to allow for waste sorting and disposal.
- Bins and/or skips, with appropriate liner bags to ensure efficient control and disposal, shall be provided for the disposal of waste generated within the camp site. These should be emptied regularly and taken to registered landfill sites.
- Reuse and recycling shall be encouraged and appropriate provisions made to allow for waste separation.
- Burning of waste is forbidden.
- Waybills for all such disposals are to be kept by the Contractor for review by the Engineer/ECO.
- It is important to ensure that run-off from vehicle or plant washing does not enter the ground water system. Wash water must be passed through a three chamber SOG trap prior to being discharged as effluent to a regular municipal sewer.

3.9 Conservation and Protection of the Natural Environment

Every effort should be undertaken to avoid and/or minimise the disruption of the natural environment.

3.9.1 Water Quality Management

- Storage areas for hazardous substances should be bunded with appropriate impermeable liners to avoid groundwater contamination.
- Any spills should be cleaned up immediately and disposed of safely and according to the hazardous materials management procedures.
- Procedures for dealing with and removing all surplus construction materials must be in place for when construction has been completed.
- Under no circumstances are any loose materials to be left on site or near the stream bank.

3.9.2 Soil Erosion and Storm Water Management

The stripping of vegetation and uncontrolled storm water can have serious financial and environmental implications.

- Loose soil should be covered and wind screens placed to minimise soil loss.
- The integrity of the stormwater drainage from the site to be maintained at all times.
- Appropriate drainage system plans have to be prepared by the Contractor for approval by the Engineer.
- Temporary cut off drains and berms may have to be constructed to capture storm water and allow for infiltration.
- During site establishment, storm water drains are to be located and covered with metal grids to prevent blockages if deemed necessary by the engineer.
- Provision should be made during set up for all contaminated run-off to be collected and treated to the satisfaction of the Engineer before being discharged into the storm water drainage system.

3.9.3 Fauna and Flora

- Indigenous species should be marked prior to construction to avoid erroneous removal of natural vegetation.
- Gathering of firewood, fruit, muthi plants, crops or any other natural material on site or the surrounding areas is forbidden.
- The hunting of birds and animals, or the placement of snares and/or traps on site and surrounding areas is prohibited.

- Immediate re-vegetation of stripped areas and removal of alien vegetation must be conducted.
- Alien vegetation encroachment onto the site as a result of construction activities must be controlled during construction. This significantly saves time and money during rehabilitation.
- Areas that have been identified as ecologically sensitive areas by the ECO or engineer should be temporarily fenced during construction to prevent damage by plant and labour.

3.10 Electricity Transmission Lines and Underground Services

- The applicant is required to liaise with the relevant municipal department so that any requirements by the department are met prior to construction.
- The requirements, if any, must be undertaken to the satisfaction of the relevant department.

4 SECTION 4: CONSTRUCTION PHASE

4.1 Landfill Gas Production

Landfill sites are biologically active and behave much like very large anaerobic digesters, where organic materials are being biodegraded producing landfill gas. Landfill gas will migrate along the paths of least resistance. At lower concentrations (5 to 15% by volume in air), landfill gas is explosive, while at higher concentrations it is flammable. It can also cause asphyxiation in confined spaces, making it a potential hazard both on and off the site. Landfill gas can continue to be produced even after a landfill is closed. It is therefore normal practice for the post-closure landfill gas monitoring programme to continue after the closure of the landfill site.

The Shayamoya Landfill site mainly received general municipal and domestic waste which means much of the waste body will decompose, leading to the production of landfill gas. The following precautions should be undertaken to guard against any potential adverse impacts.

- Avoid disturbance of, and ensure protection of the landfill containment.
- All construction must be undertaken in a manner that protects the integrity of the final cover system.

- Care must be taken for potential adverse impacts from increased pathways to vertical upward migration of explosive gases due to the breach of the final cover barrier layer.

4.2 Leachate Production

- The potential volume of leachate generated from a landfill site depends on the following factors, which affect the overall water balance of the site; Precipitation, evaporation, surface run-off, humidity, temperature and air movement.
- Ingress of storm water into the waste body may result in leachate production. It is therefore imperative that all surface stormwater be directed away from the waste body (Details contained in the Preliminary design report compiled by Thekwini GeoCivils).
- The final surface will require a sufficient grade to facilitate drainage across the top and the use of the site as a sports field.
- The layerworks as recommended by the DWAF Minimum Requirements for Waste Disposal by Landfill Volume 2, 2nd Edition should be undertaken.

4.3 Management of Social Impacts

It is important to take cognisance of the immediate social environmental needs to avoid unnecessary delays and conflict, which will result in increased costs.

4.3.1 Dust/Air pollution

The Contractor shall control dust to ensure minimal detrimental impacts to adjacent property owners and residents. Control measures can include the following:

- All vehicles travelling to and from the site must adhere to speed limits to avoid producing excessive dust and accidents.
- All vehicles and machinery should be in good working condition to avoid excessive emissions and for safety reasons.
- The Contractor shall control dust along the construction right of way to ensure minimal detrimental impacts to adjacent property owners, residents, and the general public. Control measures can include adhering to speed limits (30km/hr on dirt roads) on access roads to avoid creating excess dust, covering all loose material, both on site and in transit and the use of water tankers to wet down surfaces which have the potential to generate dust.

- Where dust is unavoidable, screening will be required utilising wooden supports and shade cloth.

4.3.2 Noise and visual impact management

- All vehicles and equipment should be fitted with appropriate noise reduction facilities such as silencers. If instructed to do so, the Contractor shall demonstrate compliance with the noise regulations in terms of the Environmental Conservation Act (Act 73 of 1989).
- Construction should be kept within working hours (7:30 – 17:30).
- Storage facilities or any elevated structures should be located such that their attendant visual impacts are minimised or avoided.
- Highly reflective material should be screened.
- Notice of particularly noisy activities such as drilling must be given to residents/businesses adjacent to the construction site 48 hours prior to the related activity.

4.3.3 Security and safety

- Potentially unsafe areas such as trenches shall be demarcated and clearly marked.
- Securing of the site may be necessary to reduce the opportunity for criminal activity in the locality of the construction site.
- All construction workers will adhere to the worker conduct as outlined in section 3.3.
- Adherence to section 3.5 will also ensure secure and safe storage areas.
- Safety of road users must be taken into consideration.
- Dangerous and hazardous areas must be clearly demarcated to avoid accidents and injury to the public.
- All emergency numbers and the numbers of the responsible contractor and Engineers shall be displayed on signs placed where they can easily be accessed by workers and the general public.

4.3.4 Land owner and occupier relations

Shayamoya Landfill site is located adjacent to the Shayamoya housing development, therefore:-

- The contractor shall respect the property and rights of landowners and tenants at all times.
- The contractor shall comply with all special agreements entered into by the client and affected landowners.
- During the setup of the project, the contractor needs to make contact with the I&APs to discuss the logistics of the construction and the timeframe of work being conducted in the area. This is particularly important for those residents who are directly impacted on.
- Disruption of activities or services for the local residents should be minimised. Where unavoidable, they should be approved by the Engineer.
- The contractor is to inform the neighbours in writing of disruptive activities at least 48 hours prior to commencement of such activities. This can take place in the form of electronic communication or other methods approved by the Engineer.
- Construction staff should direct all members of the public requiring assistance/information to the engineer or Contractor, or provide them with a contract number for one of the above.

4.3.5 Complaints Register

The Contractor shall maintain a register of all complaints raised by landowners, residents and the general public to be periodically reviewed by the ECO and/or Engineer. The register shall include the name and contact details of the complainant, nature of the complaint and any action that was taken and the relevant dates.

4.4 Road Construction

4.4.1 Access Roads

- Contractors must ensure that all side and mitre drains and scour check walls on access roads are functioning properly and are maintained.
- Access roads should be maintained in a good condition and spills cleaned where materials have been spilt.
- Avoidance of unnecessary compaction by heavy vehicles must be ensured.
- Construction vehicles must be restricted to demarcated access/haulage routes and turning areas.

- When using access constructed of certain materials such as paved or cobbled surfaces, cognisance must be taken of the vehicles weight and dimensions.

4.4.2 Construction Plan and Time Frame

- The contractor shall take into account any limitations identified and recommendations or conditions made during the basic assessment exercise when deciding on the construction plans and time frames.
- All underground services and servitudes must be identified.

4.4.3 Design Changes

- In the event that the Contractor considers that a section of the construction plan should be altered a proposal motivating such changes shall be submitted to the Engineer for his review prior to any changes being implemented.
- The Engineer shall evaluate the merit of the proposed change with due consideration of its environmental consequences.
- The proposed changes must be forwarded to DAEA for approval before any of the motivated changes are implemented.

4.4.4 Topsoil

- Topsoil shall not be disturbed more than is absolutely necessary along the construction right of way and it shall not be contaminated with anything that might impair its plant-support capacity.
- If it is necessary to temporarily remove the topsoil, it must be stockpiled in a designated area and all steps taken to avoid its erosion.
- The time that stripped areas are exposed should be minimised wherever possible.
- Cut and fill embankments shall not be steeper than previous natural slopes unless otherwise permitted by the Engineer.
- Cut and fill embankments steeper than previous ground levels shall be re-vegetated immediately on completion of trimming or shall be protected against erosion using stabilisation measures.

4.5 Monitoring and auditing

- The developer is required to appoint an independent Environmental Control Officer (ECO) who will conduct regular environmental audits as a way of monitoring the environmental standards during the life cycle of the project.
- As stated in Section 2.1 the contractor is responsible for environmental management throughout the duration of the activity. It is recommended that the ECO be on site every two weeks during the first two months of construction and every month thereafter.
- The ECO should also be available should the contractor require clarification and assistance on environmental matters or if there is an incident which causes environmental concern.
- The ECO, on the behalf of the Developer is required to submit monthly audit reports to the KZN DAEA unless otherwise specified by the department. The project start-up checklist and monthly audit sheet has been included as Annexure 1 of this EMPr.

4.6 Waste Disposal

- The contractor shall ensure that all litter is collected from the work areas daily.
- Bins/skips must be emptied regularly and waste must be disposed of at a licensed landfill site weekly.
- Contractor is responsible for removal of waste. The Contractor is to supply the ECO with receipts from disposal of waste at the landfill which must be submitted with Compliance Monitoring Reports to DAEA.

4.7 Handling of hazardous Substances

- The mixing or decanting of all chemicals and hazardous substances must take place on an impermeable surface, and then the waste from these disposed of appropriately. Concrete mixing must take place on a designated, impermeable surface.
- No vehicles transporting, placing or compacting concrete or asphalt to the site may be washed on site.
- Only an approved hazardous waste contractor may dispose of hazardous waste from the site.

- A sump must be created for concrete waste and de-sludged regularly and removed to a permitted landfill.

4.8 Worker conduct on site

- All rules as explained in section 3.3 must be followed at all times.
- The contractor shall comply with all special agreements entered into by the client and affected landowners as provided in the Servitude agreements and/or property line list.
- Disruption of access for local landowners/users must be minimised and have the Engineers permission.
- The Contractor is to inform the neighbours in writing of disruptive activities at least 48 hours prior to commencement of such activities. This can take place in the form of electronic communication or other methods approved by the Engineer.
- The Contractor shall maintain a register of all complaints raised by landowners, residents and the general public to be periodically reviewed by the ECO and/or Engineer. The register shall include the name and contact details of the complainant, nature of the complaint and any action that was taken and the relevant dates.

4.9 Water Quality Management

Mitigation measures listed in Pre-construction Section 3.9.1 to be implemented.

4.10 Fauna and Flora

- Gathering of firewood, fruit, muthi plants, crops or any other natural material on site or the surrounding areas is forbidden.
- The hunting of birds and animals, or the placement of snares and/or traps on site and surrounding areas is prohibited.
- Immediate re-vegetation of stripped areas and removal of alien vegetation must be conducted. Also alien vegetation encroachment onto the site as a result of construction activities must be controlled during construction. This significantly saves time and money during rehabilitation.

- Topsoil shall not be disturbed more than is absolutely necessary along the construction right of way and it shall not be contaminated with anything that might impair its plant-support capacity.
- If it is necessary to temporarily remove the topsoil, it must be stockpiled in a designated area and all steps taken to avoid its erosion.

4.11 Erosion Control and Stormwater Management

- Sand bags or Hessian sheets must be used as and when necessary to assist with erosion control.
- Prevent the unnecessary removal of vegetation especially on steep areas.
- Cut and fill embankments shall not be steeper than previous natural slopes unless otherwise permitted by the Engineer. Cut and fill embankments steeper than previous ground levels shall be re-vegetated immediately on completion of trimming or shall be protected against erosion using stabilisation measures.
- Vegetation should only be removed as it becomes necessary for work to proceed.
- Areas that have exposed soil should be revegetated as soon as possible.
- Appropriate stormwater drainage system plans have to be maintained, including temporary measures.

5 SECTION 5: POST CONSTRUCTION

5.1 Construction camp

- All structures comprising the construction camp are to be removed.
- The camp should be checked for spills and these should be cleaned up.
- The Contractor must arrange the cancellation of all temporary services.

5.2 Land Rehabilitation

- The site is to be cleared of all waste products, litter and rubble.
- All embankments shall be capped and grassed to the satisfaction of the Engineer.
- Any damages to adjacent properties shall be repaired.

- Borrow pits are to be closed and rehabilitated.
- Fences, barriers and demarcations associated with the construction phase must be removed, unless otherwise stipulated by the Engineer.
- Any damage to adjacent properties should be repaired.

5.3 Monitoring and Auditing

- The Engineer and/or the ECO shall be entitled to monitor and inspect the Contractor's written records to demonstrate compliance with the EMPr.
- A meeting must be held on site between the Engineer, ECO and Contractor to approve all remediation activities and to ensure that the site has been restored to a condition approved by the engineer.
- Construction audits to be carried out to monitor the compliance of construction phase to the EMPr. The audit reports must be submitted to the Assistant Manager of Compliance, Monitoring and Enforcement at the KwaZulu-Natal Department of Agriculture & Environmental Affairs.

6 SECTION 6: CONCLUDING REMARKS

Provided that the recommendations and mitigation measures contained in the Environmental Management Programme are followed, any potentially adverse environmental impacts, which may arise from the proposed development, can be minimised. On-going environmental monitoring throughout the development will ensure that the recommendations are being implemented.

7 SECTION 7: SCHEDULES FOR PHASES

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
A1: Legislation, Permits and Agreements	<p>In all instances the Developer, Service Providers, Contractors and Project Managers must remain in compliance with relevant local and national legislation. Particular attention must be paid to the requirements of the following national legislation and standards:</p> <ul style="list-style-type: none"> ➤ National Environmental Management Act No. 107 of 1998 ➤ National Environmental Management Waste Act No 59 of 2008 ➤ National Water Act No. 36 of 1998 ➤ Occupational Health and Safety Act No. 85 of 1993 	ECO, SM, Developer, Engineer	Prior to construction on site.
	<p>The Contractor is responsible for all environmental management during the construction activities for the proposed landfill closure The Contractor shall comply with all requirements of the following:</p> <ul style="list-style-type: none"> ➤ The DWA Minimum Requirements for Waste Disposal by Landfill ➤ The Environmental Authorisation (when issued by KZN DAEA) ➤ The EMPr ➤ Project Specifications 	ECO, SM, Developer, Engineer	Prior to construction on site.

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	<p>All techniques, practices and methods employed will be in compliance with these standards and requirements. In general, the contractor will ensure the following:</p> <ul style="list-style-type: none"> ➤ Minimal environmental damage and nuisance to the adjacent communities. ➤ Appropriate waste management practices. ➤ Pollution avoidance. ➤ Prevention of loss or damage of natural resources. 	ECO, SM, Developer, Engineer	Prior to construction on site.
A2: Environmental Education and Awareness	All site personnel should have a basic understanding and awareness of environmental issues and concerns, including waste, landfill gas, leachate and their associated dangers and hazards.	ECO, SM	Prior to construction on site.
	All site personnel should be equipped with appropriate reaction procedures to any of the hazards.	ECO, SM	Prior to construction on site.
	Awareness should be provided on; what is meant by the 'environment', why the environment needs to be protected and conserved, how construction activities impact on the environment and mitigatory measures against such impacts.	ECO, SM	Prior to construction on site.

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	The performance of construction workers must be monitored regularly to ensure the environmental consideration is being adhered to.	ECO, SM	Ongoing
	It is the Contractor's responsibility to provide the site foreman with no less than one hour's environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff.	Contractor	Prior to construction on Site
A3: Worker Conduct on site	<p>Workers need to be aware of some general rules while working on site:</p> <ul style="list-style-type: none"> ➤ No alcohol/drugs to be present on site. ➤ No firearms to be allowed, unless used by security personnel. ➤ Awareness of their social responsibility during construction such as being considerate of local residents ➤ All personnel on site should be warned against making excessive noise such as hooting and shouting. ➤ All construction workers should be encouraged to keep the site as neat as possible. ➤ Trespassing on private or commercial properties adjoining the site is not to be 	SM	Ongoing

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	<p>allowed.</p> <ul style="list-style-type: none"> ➤ Construction staff should be warned about the safety hazards of smoking or having fires on site. ➤ No onsite fires should be allowed. 		
A4: Emergency Preparedness	The contractor shall develop an emergency plan that will enable rapid and effective response to all types of environmental emergencies in accordance with the Occupational Health and Safety Act (Act 85 of 1993). The plan will include an established communication system between all local emergency services such as the police, fire fighters, medical and ambulance services.	SM	Prior to construction on Site
	All staff to be made aware of the emergency and spill response provisions prior to work commencing on site	SM	Prior to construction on Site
	Emergency numbers should be properly displayed on signs.	SM	Prior to construction on Site

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
A5: Setting up Construction Camp and Storage areas	The working area of the construction site must be agreed on by the Engineer, Contractor. Details of the location of the camp must be communicated to DAEA prior to establishment.	ECO, SM, Engineer	Arranged during setup
	The selection of the site should take into account the proximity to local communities and ecologically sensitive areas.	ECO, SM, Engineer	Arranged during setup
	No area set aside as Public Open Space should be used as the construction camp/storage area.	ECO, SM, Engineer	Arranged during setup
	Cut and fill must be avoided where possible during the set up of the construction camp/storage area.	ECO, SM, Engineer	Arranged during setup
	The size of the construction camp/storage area must be minimised as much as possible.	ECO, SM, Engineer	Arranged during setup
	Sufficient space must be allocated for parking.	ECO, SM, Engineer	Arranged during setup
	The Contractor must ensure proper drainage mechanisms to avoid standing water and/or sheet erosion.	ECO, SM, Engineer	Arranged during setup

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	During site establishment, storm water drains are to be located and covered with metal grids to prevent blockages if deemed necessary by the engineer	ECO, SM, Engineer	Arranged during setup
	Storage areas must not be in unstable or high-risk areas and must be designated, demarcated and fenced if necessary.	ECO, SM, Engineer	Arranged during setup
	Storage areas must be secure to minimise criminal activities and injury to animals and people.	ECO, SM, Engineer	Arranged during setup
	Fire prevention facilities/equipment must be present.	ECO, SM, Engineer	Arranged during setup
	The applicant is to ensure that the storage and use of potentially hazardous materials such as diesel, petrol, oil/s or lubricants do not result in soil or water contamination. The choice of location for storage areas must therefore take into account prevailing winds, distances to the water course and general on-site topography. Impervious surfaces must be provided where necessary. Storage areas must be designated.	ECO, SM, Engineer	Arranged during setup

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
A6: Materials management	The secure and stable storage/stockpiling of material must be ensured to avoid collapse and possible injury to site workers/local residents, and generally should not exceed 2m in height unless otherwise permitted by the Engineer.	ECO, SM, Engineer	Arranged during setup
	Stockpiles should not be positioned in an area that will obstruct drivers' line of sight, particularly at intersections and sharp corners.	ECO, SM, Engineer	Arranged during setup
	Stockpiles should be covered if necessary.	ECO, SM, Engineer	Arranged during setup
	A Hazardous Material and Waste Management Plan should be put in place which outlines measures to be taken to prevent soil and water contamination, accidental fires and risk/injury to people or animals.	SM	Arranged during setup and ongoing.
	Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances on site.	SM	Arranged during setup and ongoing.
	All hazardous materials to be used should be classified and labelled according to recognised practice codes (Occupational Health and Safety Act, Hazardous Materials Act).	SM	Arranged during setup and ongoing.

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Hazardous storage areas should be bunded with an impermeable liner to protect soil and groundwater contamination.	SM	Arranged during setup.
	The mixing or decanting of all chemicals and hazardous substances must take place on an impermeable surface, and then the waste from these disposed of accordingly.	SM	Arranged during setup and ongoing.
	Concrete mixing must take place on a designated, impermeable surface.	SM	Arranged during setup and ongoing.
	Only an approved hazardous waste Contractor must dispose of hazardous waste from the site.	SM	Arranged during setup and ongoing.
	A sump must be created for concrete waste and de-sludged regularly and removed to an approved tip site.	SM	Arranged during setup and ongoing.
A7: Ablution	Under no circumstances are open areas or nearby shrubs and bushes to be used as toilet facilities.	SM	ongoing

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Temporary chemical toilets must be provided by a company that has been approved by the Engineer. Such toilets should be no closer than 50m from any natural water bodies.	SMEngineer	Arranged during setup and ongoing.
	A registered chemical waste company is to be used to remove waste from chemical toilets on site.	SM, Engineer	Arranged during setup and ongoing.
A8: Waste Management	Litter should be prevented across the construction site and must ensure that all litter is collected from the work and camp areas daily. A fenced area should be provided to allow for waste sorting and disposal. Bins and/or skips, with appropriate liner bags to ensure efficient control and disposal, shall be provided for the disposal of waste generated within the camp site. These should be emptied regularly and taken to registered landfill sites.	SM	Arranged during setup and ongoing.
	Reuse and recycling shall be encouraged and appropriate provisions made to allow for waste separation.	SM	Arranged during setup and ongoing.
	Burning of waste is forbidden.	SM	Ongoing

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Waybills for all such disposals are to be kept by the Contractor for review by the Engineer/ECO.	SM	Ongoing
	It is important to ensure that run-off from vehicle or plant washing does not enter the ground water system. Wash water must be passed through a three chamber SOG trap prior to being discharged as effluent to a regular municipal sewer.	SM	Arranged during setup and ongoing.
A9: Water quality management	Storage areas for hazardous substances should be banded with appropriate impermeable liners to avoid groundwater contamination.	SM	Arranged during setup
	Any spills should be cleaned up immediately and disposed of safely and according to the hazardous materials management procedures.	SM	Ongoing
	Procedures for dealing with and removing all surplus construction materials must be in place for when construction has been completed. Under no circumstances are any loose materials to be left on site or near the stream bank.	SM, Engineer	Arranged during setup and ongoing.

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
A10: Soil erosion and stormwater management	Loose soil should be covered and wind screens placed to minimise soil loss.	SM	Arranged during setup and ongoing.
	The integrity of the stormwater drainage from the site to be maintained at all times. Appropriate drainage system plans have to be prepared by the Contractor for approval by the Engineer.	SM, Engineer	Arranged during setup and ongoing.
	Temporary cut off drains and berms may have to be constructed to capture storm water and allow for infiltration.	Engineer	Arranged during setup
	During site establishment, storm water drains are to be located and covered with metal grids to prevent blockages if deemed necessary.	Engineer	Arranged during setup
	Provision should be made during set up for all contaminated run-off to be collected and treated to the satisfaction of the Engineer before being discharged into the storm water drainage system.	Engineer	Arranged during setup

PRE-CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
A11: Fauna and flora	Indigenous species should be marked prior to construction to avoid erroneous removal of natural vegetation.	ECO	Arranged during setup
	Gathering of firewood, fruit, muthi plants, crops or any other natural material on site or the surrounding area is forbidden.	SM, ECO	Ongoing
	The hunting of birds and animals, or the placement of snares and/or traps on site and surrounding areas is prohibited.	SM, ECO	Ongoing
	Areas that have been identified as ecologically sensitive areas by the ECO or engineer should be temporarily fenced during construction to prevent damage by plant and labour.	ECO, SM	Arranged during setup
A12: Electricity Transmission Lines and Underground Services	The applicant is required to liaise with the relevant municipal department so that any requirements by the department are met prior to construction.	SM, ECO, Engineer	Arranged during setup
	The requirements, if any, must be undertaken to the satisfaction of the relevant department.	SM, ECO, Engineer	Arranged during setup

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
B1: Landfill Gas Production	Post-closure landfill gas monitoring programme to continue as per requirements of KZN DAEA. This could be for a period of 20 years or more.	Developer	Ongoing
	Avoid disturbance of, and ensure protection of the landfill containment.	SM, Engineer	ongoing
	All construction must be undertaken in a manner that protects the integrity of the final cover system.	SM, Engineer	Ongoing
B2: Leachate Production	All surface stormwater be directed away from the waste body (Details contained in the Preliminary design report compiled by Thekwini GeoCivils).	Engineer	Arranged during setup
	The final surface will require a sufficient grade to facilitate drainage across the top and the use of the site as a sports field.	Engineer	Arranged during setup
	The layerworks as recommended by the DWAF Minimum Requirements for Waste Disposal by Landfill Volume 2, 2 nd Edition should be undertaken.	Engineer	Arranged during setup

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
B3: Dust/Air Pollution	All vehicles travelling to and from the site must adhere to speed limits to avoid producing excessive dust and accidents.	SM	Ongoing
	All vehicles and machinery should be in good working condition to avoid excessive emissions and for safety reasons.	SM	Ongoing
	The Contractor shall control dust along the construction right of way to ensure minimal detrimental impacts to adjacent property owners, residents, and the general public. Control measures can include adhering to speed limits (30km/hr on dirt roads) on access roads to avoid creating excess dust, covering all loose material, both on site and in transit and the use of water tankers to wet down surfaces which have the potential to generate dust.	SM	Ongoing
	Where dust is unavoidable, screening will be required utilising wooden supports and shade cloth.	SM	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
B4: Noise and visual impact management	All vehicles and equipment should be fitted with appropriate noise reduction facilities such as silencers. If instructed to do so, the Contractor shall demonstrate compliance with the noise regulations in terms of the Environmental Conservation Act (Act 73 of 1989).	SM	Ongoing
	Construction should be kept within working hours (7:30 – 17:30).	SM	Ongoing
	Storage facilities or any elevated structures should be located such that their attendant visual impacts are minimised or avoided.	SM	Ongoing
	Highly reflective material should be screened.	SM	Ongoing
	Notice of particularly noisy activities such as drilling must be given to residents/businesses adjacent to the construction site 48 hours prior to the related activity.	SM	Ongoing
B5: Security and Safety	Potentially unsafe areas such as trenches shall be demarcated and clearly marked.	SM	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Securing of the site may be necessary to reduce the opportunity for criminal activity in the locality of the construction site.	SM	Ongoing
	All construction workers will adhere to the worker conduct as outlined in section 3.3.	SM	Ongoing
	Adherence to section 3.5 will also ensure secure and safe storage areas.	SM	Ongoing
	Safety of road users must be taken into consideration.	SM	Ongoing
	Dangerous and hazardous areas must be clearly demarcated to avoid accidents and injury to the public.	SM	Ongoing
	All emergency numbers and the numbers of the responsible contractor and Engineers shall be displayed on signs placed where they can easily be accessed by workers and the general public.	SM	Arranged during setup and ongoing
B6: Land owner occupier relations	The contractor shall respect the property and rights of landowners and tenants at all times.	SM	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Disruption of activities or services for the local residents should be minimised. Where unavoidable, they should be approved by the Engineer.	SM, Engineer	Ongoing
	The contractor is to inform the neighbours in writing of disruptive activities at least 48 hours prior to commencement of such activities. This can take place in the form of electronic communication or other methods approved by the Engineer.	SM, Engineer	Ongoing
	Construction staff should direct all members of the public requiring assistance/information to the engineer or Contractor, or provide them with a contract number for one of the above.	SM, Engineer	Ongoing
B7: Complaints register	The Contractor shall maintain a register of all complaints raised by landowners, residents and the general public to be periodically reviewed by the ECO and/or Engineer. The register shall include the name and contact details of the complainant, nature of the complaint and any action that was taken and the relevant dates.	SM, ECO, Engineer	Ongoing
B8: Access Roads	Contractors must ensure that all side and mitre drains and scour check walls on access roads are functioning properly and are maintained.	SM, Engineer	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Access roads should be maintained in a good condition and spills cleaned where materials have been spilt.	SM	Ongoing
	Avoidance of unnecessary compaction by heavy vehicles must be ensured.	SM	Ongoing
	Construction vehicles must be restricted to demarcated access/haulage routes and turning areas.	SM	Ongoing
B9: Topsoil	Topsoil shall not be disturbed more than is absolutely necessary along the construction right of way and it shall not be contaminated with anything that might impair its plant-support capacity.	SM	Ongoing
	If it is necessary to temporarily remove the topsoil, it must be stockpiled in a designated area and all steps taken to avoid its erosion.	SM, Engineer	Ongoing
	The time that stripped areas are exposed should be minimised wherever possible.	SM, Engineer	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Cut and fill embankments shall not be steeper than previous natural slopes unless otherwise permitted by the Engineer. Cut and fill embankments steeper than previous ground levels shall be re-vegetated immediately on completion of trimming or shall be protected against erosion using stabilisation measures.	SM, Engineer	Ongoing
B10: Monitoring and auditing	The Developer is required to appoint an independent Environmental Control Officer (ECO) who will conduct regular environmental audits as a way of monitoring the environmental standards upheld during the life cycle of the project.	Developer	Ongoing
	As stated in Section 2.1 the contractor is responsible for environmental management throughout the duration of the activity. It is recommended that the ECO be on site every two weeks during the first two months of construction and every month thereafter.	SM	Ongoing
	The ECO should also be available should the contractor require clarification and assistance on environmental matters or if there is an incident which causes environmental concern.	ECO	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	The ECO, on the behalf of the Developer is required to submit monthly audit reports (or at a frequency otherwise specified by DAEA) to the KZN DAEA. The project start-up checklist and proposed monthly audit sheet has been included as Annexure 1 of this EMPr.	ECO	Ongoing
B11: Waste Disposal	The contractor shall ensure that all litter is collected from the work areas daily.	SM	Daily
	Bins/skips must be emptied regularly and waste must be disposed of at a licensed landfill site weekly.	SM	Weekly
	Contractor is responsible for removal of waste. The Contractor is to supply the ECO with receipts from disposal of waste at the landfill	SM	Ongoing
B12: Handling of hazardous substances	The mixing or decanting of all chemicals and hazardous substances must take place on an impermeable surface, and then the waste from these disposed of appropriately.	SM	Ongoing
	Concrete mixing must take place on a designated, impermeable surface.	SM	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	No vehicles transporting, placing or compacting concrete or asphalt to the site may be washed on site.	SM	Ongoing
	Only an approved hazardous waste Contractor must dispose of hazardous waste from the site.	SM	Ongoing
	A sump must be created for concrete waste and de-sludged regularly and removed to a permitted landfill.	SM	Ongoing
B13: Worker conduct on site	All rules as explained in the worker conduct section of the Pre-Construction Section A3 must be followed at all times.	SM	Ongoing
	Disruption of access for local landowners/users must be minimised and have the Engineers permission.	SM	Ongoing
	The Contractor is to inform the neighbours in writing of disruptive activities at least 48 hours prior to commencement of such activities. This can take place in the form of electronic communication or other methods approved by the Engineer.	SM	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	The Contractor shall maintain a register of all complaints raised by landowners, residents and the general public to be periodically reviewed by the ECO and/or Engineer. The register shall include the name and contact details of the complainant, nature of the complaint and any action that was taken and the relevant dates.	SM	Ongoing
B14: Water Quality management	Mitigation measures listed in Pre-Construction Section A9 and A10 to be implemented.	SM, ECO	Ongoing
B15: Fauna and Flora	Gathering of firewood, fruit, muthi plants, crops or any other natural material on site or the surrounding areas is forbidden.	SM, ECO	Ongoing
	The hunting of birds and animals, or the placement of snares and/or traps on site and surrounding areas is prohibited.	SM, ECO	Ongoing
	Immediate re-vegetation of stripped areas and removal of alien vegetation must be conducted. Also alien vegetation encroachment onto the site as a result of construction activities must be controlled during construction. This significantly saves time and money during rehabilitation.	SM, ECO	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Topsoil shall not be disturbed more than is absolutely necessary along the construction right of way and it shall not be contaminated with anything that might impair its plant-support capacity.	SM, ECO	Ongoing
	If it is necessary to temporarily remove the topsoil, it must be stockpiled in a designated area and all steps taken to avoid its erosion.	SM, ECO	Ongoing
B16: Erosion control and stormwater management	Sand bags or Hessian sheets must be used as and when necessary to assist with erosion control.	SM, ECO	Ongoing
	Prevent the unnecessary removal of vegetation especially on steep areas.	SM, ECO	Ongoing
	Cut and fill embankments shall not be steeper than previous natural slopes unless otherwise permitted by the Engineer. Cut and fill embankments steeper than previous ground levels shall be re-vegetated immediately on completion of trimming or shall be protected against erosion using stabilisation measures.	SM, Engineer	Ongoing
	Vegetation should only be removed as it becomes necessary for work to proceed.	SM, ECO	Ongoing

CONSTRUCTION PHASE			
ACTIVITY/ISSUE	MANAGEMENT/MITIGATION	RESPONSIBILITY	FREQUENCY
	Areas that have exposed soil should be revegetated as soon as possible.	SM, ECO	Ongoing
	Appropriate stormwater drainage system plans have to be maintained, including temporary measures.	SM	Ongoing

POST CONSTRUCTION PHASE			
ACTIVITY / ISSUE	MANAGEMENT / MITIGATION	RESPONSIBILITY	FREQUENCY
C1: Construction Camp	All structures comprising the construction camp are to be removed.	SM	Upon completion of construction
	The camp should be checked for spills and these should be cleaned up.	SM, ECO	Upon completion of construction
	The Contractor must arrange the cancellation of all temporary services.	SM	Upon completion of construction

POST CONSTRUCTION PHASE			
ACTIVITY / ISSUE	MANAGEMENT / MITIGATION	RESPONSIBILITY	FREQUENCY
C2: Land Rehabilitation	The site is to be cleared of all waste products, litter and rubble.	SM, ECO	Upon completion of construction
	All embankments shall be capped and grassed to the satisfaction of the Engineer.	SM, ECO	Upon completion of construction
	Any damages to adjacent properties shall be repaired.	SM, ECO	Upon completion of construction
	Borrow pits are to be closed and rehabilitated.	SM, ECO	Upon completion of construction
	Fences, barriers and demarcations associated with the construction phase must be removed, unless otherwise stipulated by the Engineer.	SM	Upon completion of construction
C3: Monitoring and Auditing	The Engineer and/or the ECO shall be entitled to monitor and inspect the Contractor's written records to demonstrate compliance with the EMPr.	SM, Engineer, ECO, Developer	Upon completion of construction
	A meeting must be held on site between the Engineer, ECO and Contractor to approve all remediation activities and to ensure that the site has been restored to a condition approved by the engineer.	Engineer, SM, ECO	Upon completion of construction

Annexure 1: Audit Sheet

PROJECT START-UP CHECKLIST

PROJECT NAME: Rehabilitation and Closure of the Shayamoya Landfill Site

DATE:

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
All method statements required before commencement of the works have been submitted and approved.		
Has approval been obtained for the location of the construction camp?		
Copies of the Contract Document, Environmental Authorisation and EMP are on Site.		
Complaints register on site.		
Environmental Awareness education course has been given to everyone on Site and the attendance register given to ECO.		
Telephone numbers of emergency services are available on Site.		
List of hazardous materials on Site with storage, handling and disposal procedures, and relevant MSDS sheets.		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Location and type of boundary fencing has been erected and complies with the specification		
Solid waste management system has been established.		
Wastewater management system has been established.		
Location of construction camp and working area infrastructure comply with specifications.		
All necessary fire-fighting equipment is on Site and in good working order.		
Are there sufficient ablution facilities and are they of an acceptable standard.		
Are there any special designated areas for smoking or is it totally prohibited on site?		
Are fires permitted on site?		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Are chemicals and materials being stored on concrete or impermeable surfaces to prevent seepage?		
Has the relevant permits for the storage and usage of these been applied for and received?		
Is there a clean-up protocol in place in case of a spill or leakage?		
Are storage areas for hazardous material clearly signed?		
Have the vibration management measures been implemented?		

Completed by: **Sign:** **Date:**

MONTHLY ENVIRONMENTAL IMPACT ASSESSMENT AUDIT

CONTRACT NAME: Shayamoya Landfill Site

DATE:

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Construction camp		
Is the contractor's camp neat and tidy?		
Are the ablution facilities kept clean?		
Is the waste control and removal system maintained?		
Is sufficient fire-fighting equipment available on site?		
Is the stormwater control system (where applicable) being maintained?		
Is the wastewater control system being maintained		
Are boundary and other fences being maintained?		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Are bunds/drip trays are being emptied on a regular basis especially after rain?		
Is there an emergency plan on site with all the relevant emergency numbers (Police, ambulance, Fire department) displayed?		
Hazardous Materials		
Is the hazardous materials management system established maintained?		
Neighbour relations		
Are all affected people notified in time of any disruptive activities?		
Are the affected and neighbouring people aware of the construction and the procedure to lodge a complaint?		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Are contractor's movements restricted to designated construction areas only, without intruding on adjacent properties?		
Where access on private property is necessary, has the owner of the property given permission for the contractor to occupy the property?		
Equipment, Machinery and Vehicles		
Are all machinery and vehicles in good working condition?		
Are there any excessive emissions from any of the machinery or vehicles?		
Are any of them leaking fuel, oil etc.?		
Are fuel tanks placed in bunded areas?		
Are the oils, fuels etc. from workshops being disposed off properly?		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Worker Conduct		
Are there any non-compliances from workers?		
Dust/Noise Control		
Are effective dust control management measures practised?		
Are effective noise control measures being applied?		
Soil stockpiles less than 2m high?		
Natural and built environment		
Did the Engineer give permission for the destruction or relocation of any structures including vegetation?		
Are there any structures which have been impacted, but which were not previously identified to be impacted?		

ENVIRONMENTAL ASPECT	YES/NO	COMMENTS
Have the vibration mitigation measures been maintained?		
Has there been monitoring of vibration levels in the agreed areas?		
General Construction Operations		
Are all construction procedures according to the Engineering specification?		
Has all the relevant authorisations required been granted by the relevant authority (e.g. for blasting and/or drilling)?		
Are there any changes made to the proposed upgrade as explained in the EIA submitted to the DAEA?		

Completed

by:.....**Sign:**.....**Date:**.....

Appendix G: Other information

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Impact Assessment

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1.1 Methodology for assessing impacts

There are many different methods for determining the significance of impacts. The methodology contained in the guideline developed by the Department of Environmental Affairs was used to determine the nature of the anticipated impacts in terms of their respective intensity, extent, duration, probability and significance¹.

Key issues and impacts associated with the proposed landfill site are described and assessed in Table 4 according to the following criteria:

1.1.1 Extent

- Local - extending only as far as the activity itself.
- Limited to the site and the immediate surrounding areas.
- Having an impact on a regional, national and international scale.

1.1.2 Duration

- Short to medium term effects occurs only during the active phase.
- Long term effects will extend to the closure of the activity and beyond.

1.1.3 Intensity

- Low: Natural/cultural/social functions are not affected. Disturbance of degraded which have little conservation value.
- Medium: Natural/cultural/social function or processes continue but are modified. Disturbance of areas that have potential conservation value.
- High: Functions and processes are temporarily or permanently altered. Disturbance of pristine areas that have important conservation value.

1.1.4 Likelihood or probability

- Improbable
- Probable
- Highly probable
- Definite

1.1.5 Significance

- Low (no influence on the decision to authorise the site).
- Medium (unless mitigated against, it will affect the decision).
- High (the impact will affect the decision regardless of any mitigation measures)

¹ DEAT,(2002) Impact Significance, Integrated Environmental Management, Information Series 5, Department of Environmental Affairs and Tourism (DEAT), Pretoria

POTENTIAL IMPACTS	NATURE OF IMPACT	PHASE WHEN RELEVANT	EXTENT OF IMPACTS	DURATION OF IMPACTS	INTENSITY OF IMPACTS	PROBABILITY OF IMPACTS	SIGNIFICANCE OF IMPACTS
Biophysical and Technical							
Alien species invasion	Alien species invasion in areas where there is stockpiling or clearing of vegetation.	Construction	Local	Short term	Low	Probable (Previously disturbed area)	Low (negative)
	Alien species invasion after closure.	Post closure	Local	Long term	Low	Probable	Low (negative)
Soil erosion	Potential soil erosion from areas where vegetation has been cleared.	Construction	Local	Short term	Low	Probable	Low (negative)
Soil contamination	Oil spills and other leakages could result in contamination of the soil.	Construction	Local	Short term	Medium	Probable (without mitigation)	Low (negative)
	Contamination of soil from leachate.	Post closure	Regional	Long term	High	Probable	High (negative)
Air pollution	Dust from stock piles or vehicle movement and emissions from machinery and vehicles used during construction	Construction	Limited	Short term	Low	Highly Probable	Low (negative)
	Emissions in the form of methane (CH ₄) and carbon dioxide (CO ₂)	Post closure	Limited	Long term	Low	Highly Probable	Medium (negative)
Ground and surface water impacts	Leachate from a landfill has the potential to contaminate ground and surface water sources	Post closure	Regional	Long term	High	Probable	High (negative)
	Oil spills and other leakages could result in contamination of ground and surface water.	Construction	Limited	Short term	High	Probable	Medium (negative)
Site accessibility and traffic impact	Construction vehicles accessing the site may have an impact on traffic.	Construction	Limited	Short term	Low	Probable	Low (negative)
Socioeconomic							

POTENTIAL IMPACTS	NATURE OF IMPACT	PHASE WHEN RELEVANT	EXTENT OF IMPACTS	DURATION OF IMPACTS	INTENSITY OF IMPACTS	PROBABILITY OF IMPACTS	SIGNIFICANCE OF IMPACTS
Noise, dust and visual impacts	Dust from stock piles or vehicle movement and the attendant noise impacts.	Construction	Limited	Short term	Low	Highly probable	Low (negative)
Litter and wind scatter	Poorly managed waste produced during the construction phase could result in wind scatter which has visual impacts.	Construction	Local	Short term	Low	Probable	Low (negative)
Illegal dumping	Inadequate security on site could result in the site being used for illegal dumping.	Post closure	Local	Long term	Medium	Probable	Medium (negative)
Employment	Provision of employment opportunities for locals from the landfill and the recycling area during construction.	Construction	Limited	Short term	Medium	Highly Probable	Medium (positive)
Property prices	Property values are likely to increase after the landfill is closed.	Post closure	Limited	Long term	Medium	Highly Probable	Medium (positive)
End use	A landfill continues to produce gas and leachate when it is closed and no longer accepting waste. The end use must therefore take this into account as an incompatible land use could be potentially dangerous.	Post closure	Local	Medium – Long term	High	Highly Probable	Low (negative)
Visual Impacts	Closure of the site will improve local aesthetics.	Post closure	Limited	Long term	Medium	Highly Probable	Medium (positive)
Cost of transport of waste to alternative landfill.	If a landfill is closing, costs of transportation to an alternative site must be considered.	Post closure	Regional	Long term	Medium	Highly Probable	High (negative)
Odour	Shaping of the landfill site may temporarily expose waste, which will generate odour.	Construction	Limited	Short term	Medium	Probable	Low (negative)

POTENTIAL IMPACTS	NATURE OF IMPACT	PHASE WHEN RELEVANT	EXTENT OF IMPACTS	DURATION OF IMPACTS	INTENSITY OF IMPACTS	PROBABILITY OF IMPACTS	SIGNIFICANCE OF IMPACTS
	The site will be capped upon closure. This will eradicate bad odours.	Post closure	Limited	Long term	Medium	Probable	Medium (positive)
Informal Salvagers	Collect recyclables on site and sell them to independent contractors. Closure of the site may impact on their livelihood.	Post closure	Local	Long term	High	Probable	Medium (negative)
Reduction of leachate over time	The site will be lined by an impermeable layer and sealed with a capping system which will prevent the ingress of water into the waste body. Therefore, resulting in a reduction in the generation of leachate.	Post closure	Local	Long term	High	Highly Probable	High (positive)
Vermin and disease vectors	The absence of waste on the site will reduce the amount of vermin and disease vectors that will be attracted to the area.	Post closure	Limited	Long term	Medium	Highly Probable	Medium (positive)

Phase	Impact	Mitigation Measure
	Biophysical and technical	
Construction	Alien species invasion	Immediate top soiling and re-vegetation with grass species indigenous to the area, with removal of alien plant species.
	Soil erosion	Covering of any loose soil; construction of temporary cut off drains and berms to capture storm water; stockpiles of soil to be stored so as to minimise erosion; top soiling and re-vegetation immediately following construction.
	Soil contamination	Hazardous storage area (for any hazardous materials used during construction only) bunded with impermeable liner; any spills cleaned up and safely disposed of immediately; no washing of equipment and/or vehicles within the construction area.
	Ground and surface water impacts	Hazardous storage area (for any hazardous materials used during construction only) bunded with impermeable liner; any spills cleaned up and safely disposed of immediately; no washing of equipment and/or vehicles within the construction area.
	Air pollution	Vehicles and machinery to be in good working condition to avoid excessive emissions; no fires on site; dust control measures to be implemented.
	Site Accessibility and Traffic	Construction vehicles to be well maintained to avoid unnecessary disruption of traffic. Disruption of traffic during peak periods should be avoided.
Post Closure	Alien species invasion	Regular maintenance of vegetated areas, including removal of weeds and alien invasive species, to be in effect.
	Soil contamination	Site will be capped once closed, which will effectively seal the landfill from rainfall; leachate volume will therefore decrease over time. Leachate collection system will be in place to capture leachate that is generated.
	Air pollution	Post closure monitoring will ensure that landfill gas is monitored on a regular basis. A flare might be installed if deemed necessary.
	Ground and surface water impacts	Site will be capped once closed, which will effectively seal the landfill from rainfall; leachate volume will therefore decrease over time. Leachate collection system will be in place to capture leachate that is generated.
	Socio-economic	
Construction	Noise, dust and visual impacts	Vehicles and machinery must be in good working order and to be fitted with silencers; vehicles to keep to a speed limit of 30km/h; dust control measures to be implemented; site to be kept tidy; site storage structures to be located to minimise unsightly visual impacts. Construction to take place within normal working hours.
	Litter and wind scatter	Bins and/or skips must be provided for litter; all litter to be collected within the construction area daily.
	Odours from movement of waste	Movement of waste may take place during the final shaping of the site. Waste should not be left exposed for a longer period than is essential. Once the site is lined and capped there should be no significant odour impacts.
Post Closure	Illegal dumping	Municipality must enforce by-laws for illegal dumping.

Phase	Impact	Mitigation Measure
		Security measures to be put in place to ensure that these laws are enforced.
	End use	Choice of end use to take into consideration landfill gas emissions and leachate production.
	Cost of transport of waste to alternate landfill	The proposed site is approximately 3km from the centre of Kokstad Town. An extensive site investigation process was followed to ensure that th new site would not be too far away from the largest generator of waste.
	Informal salvagers	A recycling area will be included in the design of the new site to allow informal salvagers to continue working. Interviews with the salvagers has indicated that they would be willing to travel to and work at the new site.

Monitoring and Maintenance Plan

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Shayamoya Landfill Site

Post Closure Monitoring and Maintenance Plan

Undertaken by:

i`can~do

June Lombard & Associates
environmental management/training since 1985

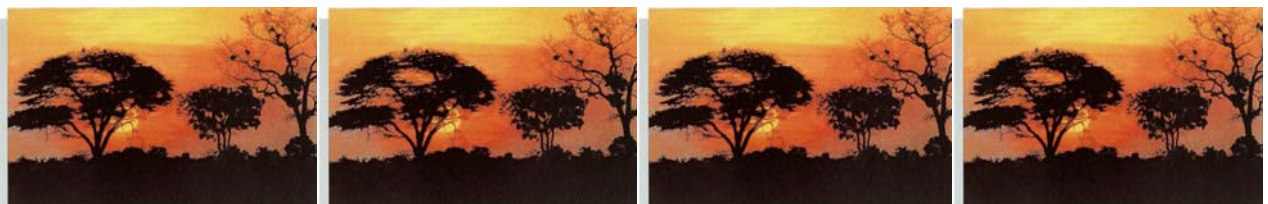
July 2013

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Shayamoya Landfill Site

Post Closure Monitoring and Maintenance Plan

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For:

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Abbreviations

DAEA:	KZN Department of Agriculture and Environmental Affairs
DEA:	Department of Environmental Affairs
EAP:	Environmental Assessment Practitioner
EIA:	Environmental Impact Assessment
GKM:	Greater Kokstad Municipality
LFG:	Landfill gas
NEMA:	National Environmental Management Act 1998 (Act No 107 of 1998)
NEMWA:	National Environmental Management: Waste Act 2008 (Act 59 of 2008)
MR:	Minimum Requirements for Waste Disposal by Landfill

1. INTRODUCTION

1.1. Project Background

The Shayamoya landfill is located north-west of the town centre, adjacent to the residential suburbs of Shayamoya. It is the only waste disposal facility for the Greater Kokstad Municipality and is operated by the Municipality's Social Services Department.

The site is not in good condition with little planning. It is impacting on the surrounding environment in that it is generating leachate, odour and windblown waste.

In terms of the NEMA no person shall establish or operate a disposal site without a License issued by the KZN Department of Agriculture and Environmental Affairs (DAEA). The site is currently not licensed and the municipality has been under considerable pressure from DAEA to rehabilitate and close the site. It is noted that it was a condition in the Record of Decision approving the Shayamoya Township development, dated 1 October 1999 that the landfill should be closed.

In terms of legislation an unlicensed site still needs to be licensed for closure. To comply with the license requirements the site would need to be rehabilitated and then capped in accordance with the DWA 'Minimum Requirements for the Disposal of Waste by Landfill'.

After assessing their obligations the Municipality has decided to rehabilitate the landfill and prepare a design to provide sufficient air space for a two year period, during which they will identify and commission a new site.

1.2. Guidelines and Legislation

The closure of a landfill site must be conducted in accordance with applicable national legislation and guidelines. This includes the:-

- National Environmental Management Act, 1998 (Act No. 107 of 1998)
 - Waste Management Act, 2008 (Act 59 of 2008)
 - Air Quality Act, 2004 (Act 39 of 2004)
- National Water Act, 1998 (Act 36 of 1998)
- The Occupational Health and Safety Act, 1993 (Act 85 of 1993)
- Minimum Requirements for Waste Disposal by Landfill (Second Edition)

From the abovementioned list, the Waste Act and Minimum Requirements have the most relevance to the closure of a landfill site as they were specifically developed for the improvement of waste management practices in South Africa.

1.2.1. National Environmental Management: Waste Act 2008 (Act 59 of 2008)

The National Environmental Management: Waste Act (NEMWA) was signed into law on 10 March 2008 and took effect on 01 July 2009. The Act is expected to have a significant effect on how government and the private sector manage waste. A paradigm shift has taken place with emphasis now being placed on waste minimisation in order to reduce the long term environmental impacts associated with waste. Another change brought about by the NEMWA is the Waste Licence procedure for registering any waste handling, treatment, storage or disposal facility which now replaces the NEMA EIA regulations ECA Section 24 Permit process.

In terms of the NEMWA every waste licence application for closure of a landfill site must be accompanied by a suite of documents containing supporting information. One of these required documents is a Post Closure Monitoring and Maintenance Plan. The effects of a landfill site continue past the closure phase and it is therefore important that a plan is put in place so that the long term problems associated with landfill sites can as far as possible be prevented or rectified should something occur.

1.2.2. Minimum Requirements for Waste Disposal by Landfill, Second Edition

The Minimum Requirements for Waste Disposal by Landfill, produced by the Department of Water Affairs and Forestry, established criteria for the selection, investigation, design, permitting, preparation, operation, closure and monitoring of waste disposal sites. Any activity concerning the management of waste should utilise this document as a reference point and guide for achieving the best practicable environmental option. This Monitoring and Maintenance plan has therefore been informed by the MR so that environmental standards for post closure aftercare of a landfill site are upheld.

2. DETERMINATION OF END USE

Due to ongoing settlement and possible generation of landfill gas, the end use of a former landfill site is very restricted. Currently no monitoring committee exists which can provide input to the end use of the site. The municipality have confirmed that in their planning for the area the site has been designated for active open space i.e. sports field.

3. INSPECTIONS AND MAINTENANCE

The GKM must conduct regular internal site inspections with the goal of maintaining the site in the aftercare period. This involves developing a system to monitor and maintain the capping

layer, drainage, landscaping and security of the site. Monthly site inspections are recommended.

3.1. Integrity of cover

The cover of the landfill site must be inspected for areas of exposed waste, cracks or depressions which could be caused by settlement, erosion or fires. If the landfill cap has been damaged it could provide a pathway for gas to vent and/or accumulate which can result in odours and pose a fire hazard. It would also result in the excessive generation of leachate as water would infiltrate the waste body. If any damage or erosion is detected, the GKM must make take the necessary steps to have the landfill surface repaired.

3.2. Drainage systems

Landfill rehabilitation will include establishment or upgrading of stormwater diversion works, run-off control and erosion measures. If the infrastructure put in place is not checked on and maintained it could lead to surface water contamination and exposure of waste by erosion. Drains must not be excessively eroded or filled with silt, vegetation, litter or debris.

3.3. Vegetation

The landfill site will be capped which includes 200 mm of topsoil as the final layer. These areas should be vegetated, preferably with a grass such as *Cynodon dactylon* (common kweek grass). Vegetation will assist with erosion control. The vegetation will also serve as a warning sign for escaping landfill gas (LFG). A passive venting system will be used for the management of LFG, which has been developed by estimating the preferential pathway for gas flow. Areas on the capped surface where vegetation is dying or refuses to grow could be an indication of uncontrolled gas escape.

3.4. Security

The site fences and gates must be checked on a regular basis. Places where fencing is damaged must be fixed immediately. Unauthorised access to the site could result in illegal dumping and theft of infrastructure that had been established for the rehabilitation of the landfill. The replacement of equipment is costly and takes time which could inadvertently allow environmental damage to continue until such time as the equipment is replaced.

4. POST CLOSURE MONITORING

The GKM must appoint an independent Environmental Assessment Practitioner (EAP) with experience in waste disposal monitoring to conduct external environmental audits in the post closure phase. In cases where the landfill is a B+ site, post closure monitoring is usually required annually for a period of thirty years after closure¹ unless otherwise stated by the Competent Authority.

4.1. Landfill Gas (LFG)

The GKM will be required to implement adequate measures for the control and monitoring of landfill gas in order to:-

- Ventilate methane gas generated in the site;
- Prevent the accumulation of flammable gas; and
- Prevent the lateral migration of methane gas.

After taking the composition of the waste body and the lack of noticeable landfill gas odours into consideration, the engineers propose that a passive venting system will be sufficient for the management of landfill gas.

However, even with the expected low LFG yields, gas monitoring is still required in terms of the MR. In the case of Shayamoya, annual sampling should be conducted for monitoring purposes unless the competent authorities state that more frequent monitoring is required.

Monitoring of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) can be carried out through the network of boreholes, including groundwater monitoring boreholes that will be established around the site. The levels in the atmosphere by volume in air, amended for Standard Temperature and Pressure, of:-

- Carbon dioxide must not exceed 0.5%; and
- Methane must not exceed 1%

Measurements that exceed the above mentioned limits must be reported to the administering authority who may decide that further investigation is needed.

¹ Department of Water Affairs and Forestry, Second Edition, 1998, Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.

4.2. Leachate

Provided that the capping layer remains intact, leachate should gradually decrease over time. At the time of background investigations, engineers estimated that leachate was flowing at an average of 28.1m³ per day. Flow rates must be monitored over time to ensure this is decreasing.

Environmental monitoring should include leachate sampling in order to determine the quality of the leachate.

4.3. Water Quality Monitoring

4.3.1. Surface water

Surface water quality monitoring must take place at points identified during the investigation period and at any others deemed necessary by the competent authority. The Umzintlava River is downslope to the landfill site. Audits carried out in 2006 and 2011 have shown no signs of contamination of the river. It is thus anticipated that the pollution plume is contained within the landfill site.

Stormwater drainage will be updated during rehabilitation. Currently stormwater from the access road and the area to the west of the road is discharged into the landfill area through 2 pipe culverts. It is proposed that stormwater from these culverts be diverted around the waste body by the excavation of surfaced channels between the road and waste body graded to drain south and northward from the middle of the site. The southern drain will be extended down the southern edge of the landfill to ensure runoff from the adjacent open areas does not enter the landfill area.

Surface water monitoring must be performed in all stormwater drains in order to test the water quality of the runoff that is allowed to discharge to the environment. Provided that the integrity of the cap is maintained, runoff should be within the limits specified by the DWAF standards. The limits for water being allowed to discharge to the environment are listed in the table below.

Table 1: DWAF limits for runoff to discharge to environment

Determinant	Value
pH	5.5 – 8.5
Electrical conductivity (mS/m)	40
Chemical oxygen demand (COD in mg/l)	40
Manganese (Mn in mg/l)	0.05
Sulphate (SO ₄ in mg/l)	200

Chloride (Cl in mg/l)	100
Calcium (Ca in mg/l)	32
Sodium (Na in mg/l)	100
Mercury (Hg in µg/l)	0.001
Phenol (mg/l)	0.001
Ammonia (NH ₄ in mg/l)	1.0

4.3.2. Groundwater

The engineers have designed a monitoring system for groundwater. This comprises two boreholes drilled to a depth of 69m and 54m respectively into sandstone/mudstone bedrock.

The person responsible for taking samples must ensure that the sampling method is accordance with the Minimum Requirements for Monitoring at Waste Management Facilities. This is to ensure that laboratory results are not distorted as a consequence of incorrect sampling procedure.

4.3.3. Analysis of samples

Samples taken during monitoring must be analysed by a laboratory accredited by the South African Bureau of Standards, referred to in the Standards Act, 1993 (Act 29 of 1993). Water quality monitoring should include but is not limited to the following variables:-

Table 2: Water quality determinants for monitoring

Aluminium (Al)	Fluoride (F)
Alkalinity (as mg CaCO ₃ /l)	Iron (Fe)
Free & saline ammonia as N (NH ₄ -N)	Lead (Pb)
Arsenic (As)	Manganese (Mn)
Calcium (Ca)	Mercury (Hg)
Chemical oxygen demand (COD)	Nitrate (as N) (NO ₃ -N)
Chloride (Cl)	Total organic carbon (TOC)
Chromium (Total) (Cr)	pH
Total free cyanide (CN)	Total phenol (Phen)
Dissolved organic carbon (DOC)	Potassium (K)
Total dissolved solids (TDS)	Sodium (Na)
Electrical conductivity (EC)	Sulphate (SO ₄)

4.3.4. Evaluation of results

Based on the results obtained from the accredited laboratory, the EAP is required to determine the quality of the water samples obtained. The EAP should utilise the South African Water Quality Guidelines, Second Edition, published by DWAF in 1996 in order to classify the quality of water.

In addition, the 'Quality of Domestic Water Supplies - Volume I: Assessment Guide, 2nd Edition 1998' published by the DWAF, the Department of Health and the Water Research Commission should be used to classify the ground water in terms of 'fitness for domestic use'.

Table 3: Classification of water in terms of fitness for use

CLASS 0 – Ideal water quality	Suitable for lifetime use.
CLASS 1 – Good water quality	Suitable for use, rare instances of negative effects.
CLASS 2 – Marginal water quality	Conditionally acceptable. Negative effects may occur in some sensitive groups
CLASS 3 – Poor water quality	Unsuitable for use without treatment. Chronic effects may occur.
CLASS 4 – Unacceptable water quality	Totally unsuitable for use. Acute effects may occur.

4.4. Reporting

The independent environmental practitioner appointed by the GKM must compile a written report on the findings of the post closure environmental audits. The report must include an assessment of the current condition of the landfill site as well as provide recommendations for improvement where possible. Hard copies of the report must be submitted to the provincial environmental authority, DAEA as well as the national Department of Environmental Affairs (DEA).

5. COMPLIANCE WITH WASTE LICENCE

In addition to observing the requirements in the Post Closure Monitoring and Maintenance Plan, the GKM must also comply with the conditions of the Waste Licence (when issued). The conditions may include some of the processes given in this report for the post closure management of the site. It will also have further considerations and will dictate the frequency of

internal investigations and external monitoring. The EAP who is appointed by the GKM will be required during an audit to carefully go through the conditions and report on whether the status of the landfill adheres to the conditions of the licence.

Appendix A: Location of Boreholes and Wellpoints

(to be inserted when Engineer's plans received)