

GROUNDWATER RESOURCE INFORMATION PROJECT EASTERN CAPE PROVINCE

GROUNDWATER INFORMATION SOURCE REFERENCE SHEET

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District Municipality:

Amatola	X	Chris Hani		O.R Tambo
Ukhahlamba		Cacadu		Alfred Nzo

Local Municipality:

MNQUMA				
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Institution where Information is held:

KHULANI VSA GROUNDWATER CONSULTANTS				
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GEOHYDROLOGICAL REPORT FOR THE EXPLORATION PHASE ON THE GROUNDWATER POTENTIAL					
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AMATOLE DISTRICT MUNICIPALITY

MNQUMA LOCAL MUNICIPALITY (EC 122)

CENTANI MAGISTERIAL DISTRICT WATER SUPPLY STUDY

GEOHYDROLOGICAL REPORT FOR THE EXPLORATION PHASE

FOR THE FEASIBILITY STUDY

ON

THE GROUNDWATER POTENTIAL

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Date: 15 July 2003
Technical Report No: TR/KVSA/EC/003/03
Project No: PEC/302/03



**- CENTANI RURAL WATER SUPPLY PROJECT -
AMATOLE DISTRICT MUNICIPALITY
MNQUMA LOCAL MUNICIPALITY
EASTERN CAPE PROVINCE
GEOHYDROLOGICAL EXPLORATION**

PROJECT NUMBER: PEC 302/03

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ABBREVIATIONS

BG	Beaufort Group
CMAAs	Catchment Management Agencies
DWAF	Department of Water Affairs and Forestry
EC	Electrical conductivity
EIA	Environmental Impact Assessment
ESE	East southeast
EVT	Evapotranspiration
GCM	Global Climate Model
GIS	Geographic Information System
I&AP	Interested and Affected Parties
IRB	Iron Related Bacteria
IWRP	Integrated Water Resource Planning
IWRM	Integrated Water Resource Management
k	permeability
Km	kilometre
KSTDLM	King Saba Ta Dalindyabo Local Municipality
m	meter
m ²	square meter
MAI	Mean Annual Infiltration
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
mg/l	milligram per liter
MIC	Microbiologically Influenced Corrosion
Mm ³	Million cubic meters
mS/m	millisiemens per meter
n	porosity
NW	North West
NWA	National Water Act
S	storativity
SACS	South African Committee for Stratigraphy
SE	South East
SFB	Slime Forming Bacteria
SRB	Sulphate Reducing Bacteria
S _s	specific storage
WC	Water Conservation
WDM	Water Demand Management
WMA	Water Management Area
WNW	West northwest
WRC	Water Research Commission
WRYM	Water Resources Yield Model
WSDP	Water Services Development Plan
WUA	Water User Associations



GLOSSARY

Unconfined aquifer: An aquifer in which the water table (i.e. the top of the saturated zone at which pore water pressure is at atmospheric pressure) is free to fluctuate.

Confined aquifer: An aquifer which is overlain by a confining layer of significantly lower permeability which restricts vertical movement of water and contains the groundwater under pressure greater than atmospheric pressure. If the aquifer is penetrated, the water level may rise above the top of the aquifer, and even above the ground surface, to reach its potentiometric level on an imaginary surface representing pressure or hydraulic head in the artesian aquifer, analogous to the water table of an unconfined aquifer.

Aquifer: A consolidated or unconsolidated geologic unit (material, stratum, or formation) or set of connected units that yield a significant quantity of water of suitable quality to wells or springs in economically usable amounts.

Aquitard: a geologic material, stratum, or formation of low permeability (a confining unit) that transmits significant amounts of water on a regional scale or over geologic time.

Aquiclude: a geologic material, stratum, or formation that contains water (i.e. has porosity) but does not transmit it (i.e. has zero or negligible permeability).

Specific storage: The volume of water that a unit volume releases from or takes into storage when the pressure head in the unit volume changes a unit amount.

Storativity: The volume of water an aquifer releases from or takes into storage per unit surface area of aquifer per unit change in the component of pressure head normal to that surface.



REPORT TITLE: The groundwater potential of the Centani Magisterial District

**MNQUMA LOCAL MUNICIPALITY
CENTANI MAGISTERIAL DISTRICT WATER SUPPLY STUDY**

AMATOLE, DISTRICT MUNICIPALITY

**GEOHYDROLOGICAL REPORT FOR THE EXPLORATION PHASE
FOR THE FEASIBILITY STUDY AND PILOT PROJECT
ON
THE GROUNDWATER POTENTIAL**

EXECUTIVE SUMMARY

The already undesirable levels of water supply risk, initiated this study to investigate further options to augment the supply. This report forms part of a feasibility study undertaken by Camdekon Engineers since additional raw water supply sources need to be identified, planned and implemented as soon as possible for the wards.

The purpose of this project was to assess the groundwater potential at a feasibility level as a first phase, and to ensure that all major issues relating to groundwater supply are identified. The results from this study are aimed at enabling recommendations to be made on the development options of future raw water supply sources.

The drilling and pump testing phase utilised three drilling and test pumping rigs, which resulted in the groundwork being completed within six weeks (May3 to June 15). This included geophysics, the drilling of 16 boreholes and test pumping of nineteen boreholes. The project was successfully completed well within the time constraints given by Camdekon.

The results can be summarised as follows:

- Drilling success of 87.5%,
- An average yield (airlift) of 3.96l/s,
- Study areas had average yields (airlift) of 4.8l/s (area2), 9.3l/s (area4), 3.8l/s (area7) and 0.16l/s (area5).



- In general, the quality of the water is good. The turbidity and iron, which is easily resolved does however result in a class 3 to 4 classification.

The well fields (new boreholes) and the existing boreholes tested have a potential to supply 71712 and 24122 people (total = 95834) respectively. The cost of the project, which is calculated on the potential given, amounts to approximately R7.26 per person for this phase. The groundwater potential of the Centani area is high. The norms of 1l/s and exceptional yields of 5l/s that have been given must be questioned. The key success factors contained within the report should be utilised in future exploration projects.

1.0 Introduction

The Centane District has a population of approximately 113000 people. Only 12% have access to a water supply scheme. There exists a significant number of boreholes that can be developed. Some 27 boreholes appear to yield between 4l/s and 0.5l/s. It has been recommended that these be tested especially where no yield data is obtainable. Sixteen boreholes were identified, but due to vandalism, only nine were chosen. It must however be mentioned that there are a further 15 to 20 boreholes with yields > 0.5l/s. The total combined yield of some 3308 cubic meters per day from all of these boreholes is equivalent to the needs of 62% of the district. The yield of nine of these boreholes was determined simultaneously with the exploratory drilling program.

Several high potential target areas were identified where exploratory drilling was to be carried out. Of the nine target areas only four were chosen. These were areas 2, 4, 5 and 7. A total of sixteen boreholes, or four per area was considered sufficient to complete the exploratory phase of the groundwater development in the Centani area. *It must be pointed out that historically the area enjoyed a 40% success rate*

A scheme for groundwater development has the following key purposes:

- To produce water from a large subterranean reservoir (aquifer) and to demonstrate the economic advantage(s) (if any) of this resource;



- To obtain fundamental information about hydrogeological properties and parameters in the aquifer and its interaction with related systems, in preparation for future expansion into a larger scale and wider extent of exploitation;
- To set up a coordinated management and monitoring system to address the medium- to long-term uncertainties about sustainability, impact on the environment and existing usage, either surface or groundwater, and the consequent legal and social impacts of groundwater abstraction;
- Identify go/no-go criteria for incremental expansion of the scheme.

2.0 Area of Investigation

The area (Centani Magisterial District) is located in the northeastern region of the Amatole District Municipality (ADM). It is situated on the eastern side of the N2 national road with the southern border being the Groot Kei river and the eastern border the Indian Ocean (refer to locality map). The region is situated on an elevated coastal plain, which displays all the physiographic features characteristics of a rejuvenated flat landscape, which has been incised by deep valleys. The average elevation above mean sea level decreases from 900m in the vicinity of Butterworth to about 500m near Centani. The Kei, Kobonqaba and Qora River are the primary rivers in the area. In addition the area is well dissected by a dendritic network of deeply incised streams, the bulk of which are perennial.

The region enjoys a temperate climate and rainfall that varies between 800mm and 1000mm per year.

On the maps, the district is indicated as Kentani, but the spelling Kentani or Centani is used interchangeably in correspondence.

Villages are mainly confined to hilltops or moderate slopes. Villages are scattered and differ in size from five (5) houses up.

3.0 Geology / Hydrology of the area of investigation

- The area has a perimeter of approximately 224 km and 1.139-km² surface area. The centre coordinates being 32.483586 latitude and 28.393443 longitudes.



- The Beaufort Group (BG) is the geologically dominant unit in these catchments. This Group (BG) forms part of the Karoo Supergroup. Dolerite intrusions form massive sheets, dykes and ring-shaped intrusions in this Group (BG). The Group (BG) is divided into two subgroups namely the Tarkastad and Adelaide Subgroups. These Subgroups has been divided into formations. The following formations are present in the study area,
 - Burgersdorp Formation (NW part of area)
 - Katberg Formation (Middle section)
 - Balfour Formation (SE part of area)
 (See Figure 2: Geology map)

- The *Burgersdorp Formation* overlies the Katberg formation and reaches a thickness of 600 m in certain areas. This formation is relatively mudstone rich (70 – 80%) and interbedded with sandstone layers of typically 2 to 3 m thickness.

- The *Katberg Formation* is sandstone-rich and is 500 to 1000 m thick. The sandstone is fine-grained to medium grained, horizontally laminated, cross-bedded or massive and on average, comprises approximately 90% of the total thickness.

- Mudstone predominates the *Balfour Formation* but the formation becomes more sandstone rich in depth. The formation is approximately 2000 m deep.

- The area covers six quaternary sub-catchments within the T11, T13, T20, and T80 tertiary catchments.

- The T drainage basin is located in mountainous terrain, where the mean annual precipitation (MAP) is between 600 and 800 mm.

3.1 STRUCTURE OF THE AREA.

- Faulting:** Major faults only occur along the coast to the east of the study area.
- Folding:** Variations in dip steepness and direction occur locally next to some intrusions
- Fracturing:** Localized fracturing associated with dolerite intrusions occur in both the host rock and the dolerite itself. Lithological boundaries often represent



opportunity when there is local flexure and rock competence contrasts.

- Weathering:** The weathered zone rarely exceeds 30 m in depth.
- Stress regime:** NW-SE trending structures are likely to be in tension (open) and those at right angles to this in compression (closed). The NW-SE trending (vertical) fractures are most likely to be open at depth given the NW-SE maximum horizontal stress.

3.2 HYDROGEOLOGY.

Groundwater occurs mainly in the rock matrix. Principal transmissivity is derived from large but infrequent fractures. These fractures have a relatively low storage capacity. Secondary transmissivity occur by numerous micro fissures with higher storativity but lower transmissivity. Hence the name dual porosity aquifers. Deeper fractures often have a higher transmissivity but lower storativity than shallow fractures.

Yields of up to 3 l/s are obtainable but can be as high as 5 l/s in exceptional cases in fractured sedimentary rock. The norm would however be in the order of 1.0 l/s. The influence of dolerite intrusions raises the average yields in fractured sedimentary rock and approximately 20% of the boreholes targeting dolerites yield more than 5.0 l/s.

Several boreholes were drilled and pump tested during the El Nino Mitigation program of the Department of Water Affairs and Forestry (DWAF). The boreholes had an average recommended pump yield of 1.4 l/s for a 12/24-hour pumping period.

4.0 GEOPHYSICAL TECHNIQUES

The choice of instruments are based on the geology and perceived targets. The primary targets for this investigation was (1) the contact zones between the dolerite dykes and sediments and (2) weathered zones in the dolerite sills due to secondary features such as shear zones, faults and secondary younger dolerite dyke intrusions. Considering this the most suitable and cost-effective geophysical techniques for groundwater exploration was deemed to be the Magnetic and Electro-Magnetic methods.

The following methodology was adapted:

Favourable geological structures were identified during the desktop study.

A magnetical survey was conducted over these geological targets.

Favourable anomalies were identified.

GEONICS profiling was done at coil separations of 20 m and 40 m on 10 m station intervals over the anomalies interpreted from the magnetic survey.



4.1 GEOTRON PROTON MAGNETOMETER

This instrument measures the total field component of the earth's magnetic field. The different magnetic susceptibilities of the different rock types result in contrasting magnetic signatures:

Magnetite rich dolerite dykes that are common within the area induce anomalies, which, when interpreted, provide qualitative and quantitative information on these bodies.

Geological contacts and faults may be distinguished by anomalies caused by secondary mineralisation. This phenomenon shows up as steps in the magnetic background.

A default station interval of 5 m was adapted in order to delineate the geological structures.

4.2 EM 34-3 ELECTRO-MAGNETOMETER

The EM-34 is a horizontal loop frequency domain electromagnetic instrument and measures the apparent conductivity of the underlying geology. This property is proportional to the amount of weathering and/or fracturing encountered in the underlying geology:

Anomalies indicate lateral changes in the conductivity and facilitate the detection of steeply dipping conductor type targets such as dolerite dykes.

-The 10, 20 and 40 m spacing can be employed to investigate various "depth's".

The combination of these two geophysical techniques proved to be highly successful in the investigation of groundwater in sedimentary geology.

5.0 METHODOLOGY

5.1 DESKTOP STUDY

A desktop study was conducted to determine the groundwater potential of the area. This study included an evaluation of the existing water sources and the groundwater potential of the area.

Queries were run on the National Groundwater DataBase (NGDB) and Aqua-base. This provided background information regarding (1) average borehole depths, (2) water strikes, (3) blow yields and (4) other relevant geohydrological information, which could aid with the target identification.

Using (1) the geological maps and (2) aerial photo interpretation possible lineaments



(dykes/faults) intersecting the identified areas were distinguished for subsequent field investigation with ground geophysical methods.

5.2 FIELD INVESTIGATION

Four target areas were selected, namely areas 2,4,5 and 7 (refer to locality map).

Geological structures that were identified during the desktop study were verified by means of a geophysical and geological survey. Potential drilling targets were identified on these structures and prioritised based on their accessibility, distance from the villages and topography.

In order to delineate the potential water bearing features geophysical traverses were surveyed at right angles to these geological structures.

A minimum of 2 (two) geophysical traverses per profile was laid out and geophysical data gathered over these traverses. Geophysical data was subsequently interpreted and potential drilling sites identified.

One primary drilling site per profile was identified with at least one alternative. Sixteen primary drilling sites were identified during the first phase.

Borehole development by means of air percussion drilling and yield testing concluded the fieldwork.

5.3 BOREHOLE DRILLING

Aboutlife and Cilliers Drilling conducted the borehole drilling by means of air percussion.

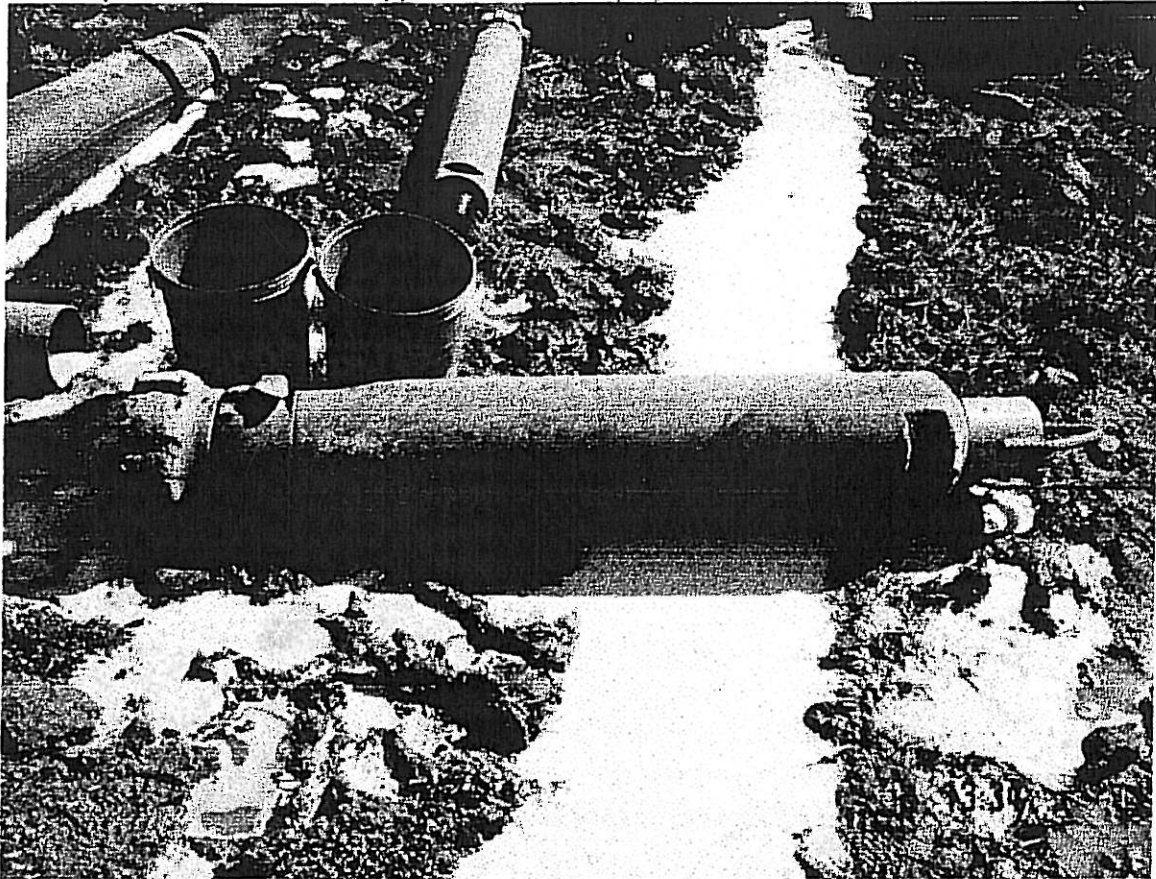
The following information was recorded during drilling:

- Formation descriptions,
- Depth of water strike(s),
- Static water level,
- Construction details,
- Borehole yield (incremental with each water strike) based on airlifted deliveries, and
- Penetration rates.

After completion of each borehole, it was disinfected by means of chloride being introduced into the borehole.

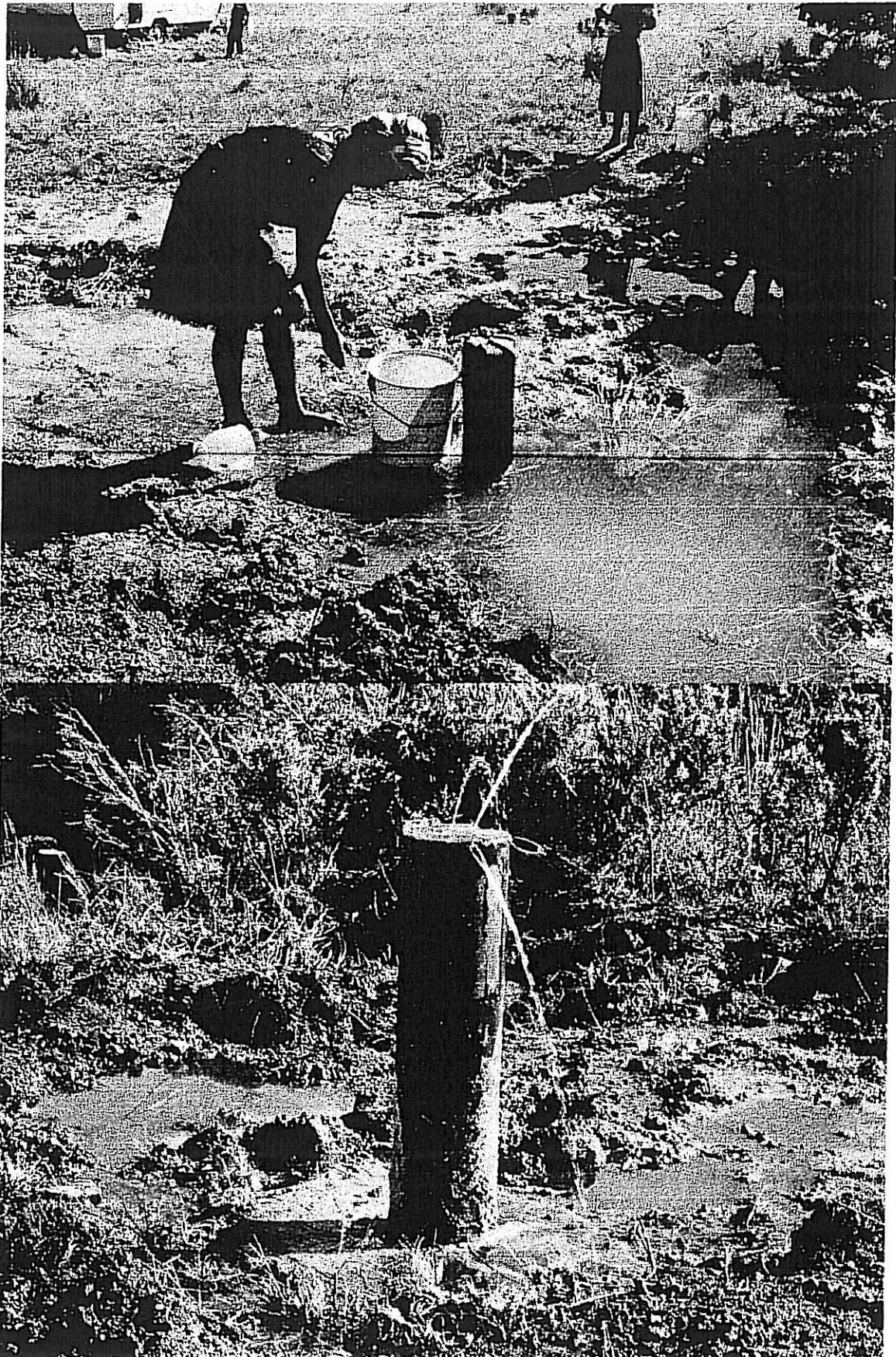
All boreholes that exceeded 3l/s, or where geological chips indicated large and friable fracture zones were reamed to 8.5 inch, cased (slotted) and gravel packed. This procedure ensures that the borehole has a life span of at least 30 to 40 years whilst adding protection against clogging. The development also enhances transmissivity and sustainable yield. Where geophysical interpretation did not match expected

geology, the drilling rigs were moved 10 to 20 meters on the geophysical profile. This determined the eventual success of the project. The above procedures are part of Khulani VSAs approach in all new projects.



PHOTOGRAPH 1: a 10.5-inch bit with the overlock in the background. The use of drilling foam is often a critical part of developing difficult boreholes. It is essential that prospective drillers have the correct experience and equipment. Too often projects are delayed or boreholes have found to have collapsed due to incorrect design and the perceived need to save costs.

In total sixteen new boreholes were drilled. Two were artesian (refer to table) and one was abandoned due to difficult conditions. The position of these boreholes (see **Appendix 2, Locality Maps**) were determined with GPS instruments and confirmed by plotting the positions on 1: 50 000 scale topo-cadastral maps.



PHOTOGRAPHS 2&3: Artesian boreholes 0021 and 0019 in areas 4 and 2 respectively.
CENTANE WATER SUPPLY PROJECT – GEOHYDROLOGICAL INVESTIGATION



The completed borehole logs are attached as **Appendix 4**.

Paragraph 5.7 portrays the quality control measures taken.

5.4 BOREHOLE TESTING

AB Pumps conducted the borehole testing.

Eighteen boreholes were pump tested. Nine of these were newly drilled boreholes and nine were existing boreholes. Four boreholes had yields of less than 0.3l/s and one was dry. The aim of yield testing the boreholes was to assess the production capacity of the boreholes and thus by inference the yield potential of the aquifers.

The boreholes were yield tested with (1) a step-discharge test, (2) if practically possible a constant discharge test and (3) recovery tests after (1) and (2).

Each borehole was disinfected by adding chloride to the borehole at the end of the pumping tests.

The following information was recorded before the pump testing started:

- Static water level,
- Borehole depth,
- Casing depth,
- Casing and borehole diameter, and
- The borehole diameter below the casing.

All the above information served to produce an evaluation of the borehole construction¹.

5.5 WATER QUALITY.

Two water samples were taken, simultaneously, at the end² of each constant discharge test and conveyed to an approved laboratory (**Amatole Water**) for analysis.

Sterilised water sample bottles were used for the samples and stored in a cooler box³.

Samples were analysed for the following parameters:

- Macro analysis, and
- Bacteriological (Faecal Coliforms) analysis.

All chemical analyses were classified according to the *RDP Rural Water Supply Design Criteria Guidelines, First edition; October 1997*.

¹ The evaluation of the borehole construction is important (1) to minimise the risk for the testing contractor's equipment and (2) to ensure the quality of the end product. It serves as a check on the drilling process.

² The samples were taken at the end of the pumping test to get a more representative sample from a wider area and to ensure that the borehole was properly purged.

³ Sample bottles were pre-prepared by the laboratory to ensure sterile conditions.



Piper and Schoeller diagrams were drawn in order to delineate the characteristics of the groundwater (See Appendix 7).

5.6 MANAGEMENT RECOMMENDATIONS

On receiving testing data and chemical analysis of the water samples, detailed borehole management recommendations were compiled.

These management recommendations summarizes the following information:

- General borehole information,
- Drilling information,
- Testing information,
- Water quality, and
- Borehole recommendation (abstraction yield, pump schedule, pump depth, pump type and water class).

The sustainable yields (MR's) of the boreholes were scientifically calculated by means of the Fc and Cooper & Jacob and Theis methods. The Fc method uses derivatives, boundary information and error propagation to evaluate the pump test data.

5.7 QUALITY CONTROL

A Quality Control Plan⁴ has been compiled for this project.

The following quality checks have been incorporated in order to ensure that the work was done to the highest possible standard:

Dummy run:

This test is done in order to ensure (1) that the borehole is vertical and (2) that there are no obstructions in the borehole that could influence the operation and maintenance of the borehole and it's equipment.

Casing detection:

It is the responsibility of the testing contractor to check the depth of the casing by means of a casing detector. This provides a check on the correctness of the information on the borehole construction as per drilling log.

Borehole depth:

The testing contractor verifies the depth of the borehole.

Borehole construction:

During the pump testing of the borehole, the testing contractor documents if the pump sucks sand, etc.

Blow test:

⁴ The aim was to comply with the standards set by the Department of Water Affairs & Forestry in the *Minimum Standards and Guidelines for Groundwater Resource Development for the Community Water Supply and Sanitation Programme, First edition, April 1997.*

The blow test ensures that (1) the borehole is properly developed and (2) provides an indication of the potential yield.

6.0 DRILLING RESULTS

Appendix 1, summary percussion drilling results. Thirty-two drilling targets were identified of which 16 (sixteen) were drilled. Detailed drilling logs are included in Appendix 4.

The following drilling results were obtained as per village / area:

Table1: results	Drilling	Bh. No	Latitude	Longitude	Drilling-depth (m)	Air-lift (l/s)
Village	Area					
Centuli	4	110-0019	32 26 04.0	28 20 42.6	60	24.0
Ngganda	4	110-0021	32 25 59.8	28 20 11.5	98	3.0
Ngganda	4	110-0039	32 26 03.4	28 20 11.0	60	0.9
Mrhanagen	5	110-0024	32 26 11.0	28 31 38.3	80	0.0
Mrhanagen	5	110-0025	32 22 03.6	28 31 09.1	80	0.52
Gqunqe	5	110-0028	32 28 16.3	28 33.870	55	0.1
Gcina	5	110-0029	32 28.698	28 35.944	65	0.1
Gcina	5	110-0030	32 28.690	28 35.940	46	0.1
Centuli	2	110-0020	32 25 29.4	28 21 056	80	17.0
Kwaqhiti	2	110-0023	32 24 12.9	28 22 08.1	100	0.2
Centuli	2	110-0026	32 25 06.9	28 22 07.4	80	0.3
Kwaqhiti	2	110-0035	32 24 28.5	28 22 10.0	90	1.75
Takazi	7	110-0036	32 32 28.5	28 26 16.0	60	6.0
Takazi	7	110-0037	32 32 48.5	28 26 39.1	70	5.0
Takazi	7	110-0038	32 32 27.4	28 24 30.4	60	0.5
N= 16				Total	1084	59.47

Average depth drilled = 72.0m

Average blow-yield = 3.96l/s

Average blow-yield per area:

- **Area 2 = 4.8l/s,**
- **Area 4 = 9.3l/s,**
- **Area 5 = 0.16l/s,**
- **Area 7 = 3.8l/s.**

A few of the low yielding boreholes were tested successfully at yields exceeding 1.5l/s. Blow-yields in the Kentani area cannot be used to gauge the strength of a borehole. This can probably be attributed to the pressure from the rig blowing a portion of the yield back into some of the large fracture zones encountered during the drilling phase.



6.1 SUCCESS RATE

Sixteen boreholes were drilled of which nine had yields exceeding 0.5l/s. One borehole was completely dry. Three boreholes were drilled in area 4. The success in this area enabled Khulani-VSA to drill one extra borehole in area 5, which was considered the most challenging. This had a negative effect on the overall results, but confirmed that area 5 is a no-go area for future exploitation. The overall success rate for drilling was **87.5%**. **Three out of the four areas can be developed into well fields.**

6.2 PROBLEMS ENCOUNTERED.

The following problems were encountered during the drilling action:

- Access was often difficult resulting in extra kilometers being driven. The local community helped to construct access roads, which resulted in money being channeled back into the communities.
- The time taken to complete certain boreholes (4 days) mayed it necessary to employ a third drilling rig on the project. This was due to the difficult drilling conditions encountered on boreholes exceeding 3l/s.
- The terrain and availability of suitable gravel for the gravel packing of high yielding boreholes (>5l/s) posed a challenge, and resulted in extra costs being incurred.



PHOTOGRAPHS 4&5: Access road works completed by local residents in area 2 is depicted in
CENTANE WATER SUPPLY PROJECT – GEOHYDROLOGICAL INVESTIGATION **13**

the top picture whilst the difficult terrain can be seen below in area 7. Note the caravan and rig tower.

7.0 TESTING RESULTS

Nineteen boreholes were yield tested. Ten of these were newly drilled boreholes and nine existing boreholes.

7.1 STEP-DISCHARGES TESTS

An average of three steps were conducted per borehole. The average yield for the steps is skewed due to the large discrepancies in yields (24l/s to 0.5l/s). It must however be mentioned that there is only one test rig in the Eastern Cape capable of testing yields in excess of 20l/s. This can result in delays.



PHOTOGRAPH 6: Specialized pump testing equipment is needed for high yielding boreholes (>15l/s). The above is a 10-cylinder Deutz engine.

7.2 CONSTANT DISCHARGE TESTS



Ten constant discharge tests were conducted. The following statistics could be derived from these:

Maximum test duration	-	4320	minutes
Minimum test duration	-	720	minutes
Average test duration	-	2880	minutes
Maximum discharge rate	-	20.2	l/s
Minimum discharge rate	-	0.3	l/s
Average discharge rate	-	4.5	l/s

7.3 PROBLEMS ENCOUNTERED

Other than access, there were no problems during the testing program.

8.0 WATER QUALITY

Water quality is fair to poor. Most problems encountered relates to faecal coliform, iron and turbidity.

Table 3 provides a summary of common water treatments.

Element	Treatment
EC	Desalination by iron exchange
Calcium	Precipitation with Sodium Carbonate
Chloride	Desalination by iron exchange
Faecal Coliform	Chlorinating
Iron	Normal coagulation and flocculation, sedimentation and filtration
Magnesium	Desalination by iron exchange
Sodium	Desalination by iron exchange
TDS	Desalination by iron exchange

From the Piper and Schoeler diagrams (**Appendix 7**), it is evident that the water of the area is of a *Ca-Mg-HCO₃* nature and therefore it can be concluded that it is of recent to semi-recent recharge.

9.0 CONCLUSIONS / RECOMMENDATIONS

The summary tables in Appendix 1 portray a summary of all data and actions



completed. The key success factors for the project were:

- Detailed geological and geophysical surveys,
- Continual drilling supervision,
- Probing of potential aquifers,
- Willingness of the drilling company to relocate on a geophysical profile,
- Borehole construction and design must be supervised on site during the drilling phase by a competent hydrogeologist,
- Competent contractors must be utilized,
- Planning and liaison between all parties, together with communication is vital to the success of any project.

The implementation of the above can only be successful if sufficient personnel can be allocated to a project of this nature.

9.1 TARGET IDENTIFICATION

The overall target identification of the areas is perceived to have been successful. Only area 5 posed a problem, which can be attributed to the investigation site being situated on topographically high ground. The possibility of further drilling in this area must not be discounted. Future siting must be confined to lower lying areas.

The primary drilling targets were the contact zones between the dolerite dykes, sills and sheets and the regional mudstones and sandstones. **Gap Dykes** play a major role in groundwater within the area (boreholes 0019,0021 and 0020). It is recommended that further drilling should be completed on these structures in order to define the aquifer and maximise their potential.

Secondary structures within the dolerite sills, proved to be the highest yielding aquifers. This is especially notable in the vicinity of gap dykes. The weathered sandstone proved to be poor aquifers with very low yielding boreholes.

9.2 BOREHOLE CONSTRUCTION

Borehole construction is perceived to have been successful.



PHOTOGRAPH 7: Plasma slotted casing together with gravel packs were utilised on all boreholes with yields >5l/s or where difficult geological conditions were encountered.

9.3 WATER QUALITY

The general quality of the water is acceptable for consumption by humans. Problems encountered can be treated⁵. These should not disqualify a borehole from potable use. It is recommended that boreholes with unsuitable water quality be re-sampled in order to verify the first round samples.

⁵ Standard treatments are provided on the chemical analysis forms.



A facility should be installed close to a production borehole in order to monitor the water quality every six months.

9.4 MONITORING OF WATER LEVELS

All production boreholes should be equipped with water level monitoring facilities. This will entail a small diameter conduit pipe installed into the borehole attached to the equipment. A weekly water level measurement should be taken to ensure continuous monitoring of the groundwater conditions. This will ensure that the aquifer is properly managed and that the borehole does not run dry, which could damage the equipment and the aquifer. The utilisation of well fields will require licensing through DWAF and adherence to the conditions of the licence.

Water level measurements should be recorded and forwarded to the proper authorities.

Khulani-VSA recommend that the following be recorded and graphed for management decision making purposes:

- All abstraction rates,
- Rainfall figures,
- Water levels and,
- E.C on a weekly basis.

This information is necessary for the long-term sustainable use of any well field.



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- Karoo Aquifers, Their Geology, Geometry and Physical Properties, *J.F. Botha, J.P. Verwey, I. van der Voort, J.J.P. Vivier, J. Buys, W.P. Colliston and J.C. Loock*
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APPENDIX 1

Summary tables of drilling and testing and management results

TABLE OF BOREHOLES DRILLED KENTANI

VILLAGE	AREA	DRILLING SITE		BORE HOLE NUMBER	Coordinate		DRILLING DATA						TESTING DATA													
		(trav. No.)	Sta.no		WGS84		Date drilled (during 2003)	Depth (m)	Water strike (m)	Casing installed		Blow yield (l/s)	Date tested	Static water level (mbgl)	Pump depth (m)	Nr of Steps	Constant Rate Test		Recovery		Chemist.	Inst Depth (mbgl)	Crit level (mbgl)	Abstraction Rate (l/s)/12hr		
					S	E				Solid (m)	Perf (m)						Rate (l/s)	Duration (min)	%	Time (min)					Drinking class	
Centuli	4	5	410	110-0019	32 26 04.0	28 20 42.6	02-May	60	54	18	24	24.00	20-May	0.00	24.00	4	15.20	4320	83	4320	2	24.00	15.00	12.50		
Centuli	2	2	100	110-0020	32 25 29.4	28 21 05.6	28-Apr	80	22,32, 62	13.4	53.6	17.00	10-May	4.24	26.00	4	13.00	4320	83	4320	2	26.00	16.00	20.20		
Ngqanda	4	2	160	110-0021	32 25 59.8	28 20 11.5	26-Apr	98	11, 62	12	6	3.00	13-May	0.00	55.00	3	3.00	2880	83	2880	1	45.00	22.00	2.20		
Ngqanda	4	3	45	110-0022	difficult drilling - borehole abandoned. Borehole 303-0039 drilled in place of																					
Kwaqhiti	2	5		110-0023	32 24 12.9	28 22 08.1		100	75			0.2	30-May	1.12	25.00	5	0.93	1440	97	1440	2	25.10	15.12	0.80		
Mrhanageni	5	1	250	110-0024	32 26 11.0	28 31 38.3		80	24	6	18	0.10			68.70	4								0.10		
Mrhanageni	5	4	410	110-0025	32 22 03.6	28 32 09.1		80	62	12		0.22	21-May	20.55	53.00	5	0.52	1440	85	1440	2	53.00	43.00	0.30		
Centuli	2	3	120	110-0026	32 25 06.9	28 22 07.4		80	32	24		0.22	16-May	15.56	48.00	4	0.30	720	70	720	1	48.00	38.00	0.20		
Gcina	5	5	110	110-0027	32 28 43.9	28 35 48.7	09-May	62				0.10	No tests conducted										0.10			
Gqunqe	5	8	155	110-0028	32 28.163	28 33.870'	10-May	55				0.10	No tests conducted										0.10			
Gcina	5	5	380	110-0029	32 28.698'	28 35.944'	12-May	65				0.10	No tests conducted										0.10			
Kwaqhiti	2	4	90	110-0035	32 24 28.2	28 22 10.0	14-May	90	12,45			1.75	25-May	7.14	24.00	4	1.20	720	95	720	4	24.00	14.00	0.70		
Takazi	7			110-0036	32 32 28.5	28 26 16.0	19-May	60	6,16,43			6	26-May	3.05	22.00	3	2.53	2880	98	2880	3	22.00	12.00	1.60		
Takazi	7			110-0037	32 32 48.5	28 26 39.1		70	54			5	30-May	3.57	30.00	4	2.71	2880	92	2880	3	27.60	17.60	2.70		
Takazi	7			110-0038	32 32 27.4	28 24 30.4	24-May	60	44			0.5	29-May	12.50	56.70	4					2			0.50		
Ngqanda	4			110-0039	32 26 03.4	28 20 11.0		60	41			0.9	31-May	5.06	35.00	4	0.63	1440	99	1440	3	35.00	25.00	0.30		
												TOTAL BLOW YIELD		59.19												
												TOTAL RECOMMENDED ABSTRACTION RATE										42.40				

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Existing boreholes - re-tested

Maxhama				T32908	32 34'53.2"	28 19'11.0"							25-Apr	0.76	26.50	4	1.99	2880	97	2880	2	22.00	12.00	1.00
Komkhulu				T32909	32 34'46.1"	28 18'10.6"							26-Apr	1.53	26.50	5	0.52	1440	96	1440	3	18.00	8.00	0.70
Mnyama				T32910	32 30'04.5"	28 15'07.8"							25-Apr	16.29	20.83	4	0.40	1440	70	1440				0.40
Notshivgethafini				T32913	32 35'33.2"	28 23'47.4"							29-Apr	36.74	62.83	3	0.60	1440	79	1440	2	52.00	42.00	0.40
Notshinga				T32916	32 36'26.0"	28 21'09.8"							30-Apr	5.91	32.70	4	0.61	1440	100	1440				0.61
Tekokoma				T32927	32 20'39.0"	28 16'10.0"							05-May	5.25	32.70	4	1.16	1440	92	1440	1	21.60	11.63	0.80
Tekokoma				T32928	32 20'41.2"	28 16'39.0"							02-May	2.20	14.70									0.15
Notshinga				G42272	32 35'40.1"	28 28'53.0"							28-Apr	9.96	74.70	4	5.05	1440	90	1440	3	29.40	19.35	2.50
Mrawuzela				G42273	32 24'54.0"	28 12'22.2"							01-May	6.56	50.00	5	4.93	2880	97	1560	2	20.50	10.50	7.40
												TOTAL RECOMMENDED ABSTRACTION RATE										13.96		

- POTENTIAL ABSTRACTION FROM NEW BOREHOLES = 1 792 800 l/s (1 792 cubic meters per day)
POTENTIAL ABSTRACTION FROM EXISTING BOREHOLES = 603 072 l/s (603 cubic meters per day)
- POTENTIAL WATER SUPPLY IN TERMS OF POPULATION = 71 712 persons (NEW BOREHOLES)
POTENTIAL WATER SUPPLY IN TERMS OF POPULATION = 24 122 persons (EXISTING BOREHOLES)

Table 2**Summary of Target Description****Centane Groundwater Feasibility Study**

Borehole Number	Airlift Yield (l/s)	Target Description
110-0019	24.0	Gap dyke-sedimentary rock contact
110-0020	17.0	Gap dyke-sedimentary rock contact
110-0021	3.0	Dyke weathered sedimentary rock contact
110-0023	0.2	Dyke-sedimentary rock contact
110-0024	0.1	Dyke-sedimentary rock contact
110-0025	0.22	Dyke-sedimentary rock contact
110-0026	0.22	Dyke-sedimentary rock contact
110-0027	0.1	Weathered Sediments
110-0028	0.1	Weathered Sedimentary rocks
110-0029	0.1	Weathered Sedimentary rocks
110-0030	0.1	Weathered Sedimentary rocks
110-0035	1.75	Dyke-sedimentary rock contact
110-0036	6.0	Dyke-sedimentary rock contact
110-0037	5.0	Dyke-sedimentary rock contact
110-0038	0.5	Dyke Weathered Sediments
110-0039	0.9	Dyke Weathered Sediments

N = 16








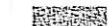





APPENDIX 2

Geological and Locality maps

MNQUMA LOCAL MUNICIPALITY

CENTANI LOCALITY MAP

LEGEND

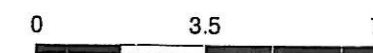
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-  Main road
-  Secondary road
-  Other road
-  Perennial river
-  Community
-  Project community
-  50 000 Map boundary with number
-  Exploration target area with number
-  Existing borehole position
labelled with recommendation [l/s @ 12h/d]
-  New borehole position
labelled with recommendation [l/s @ 12h/d]

SCALE & PROJECTION

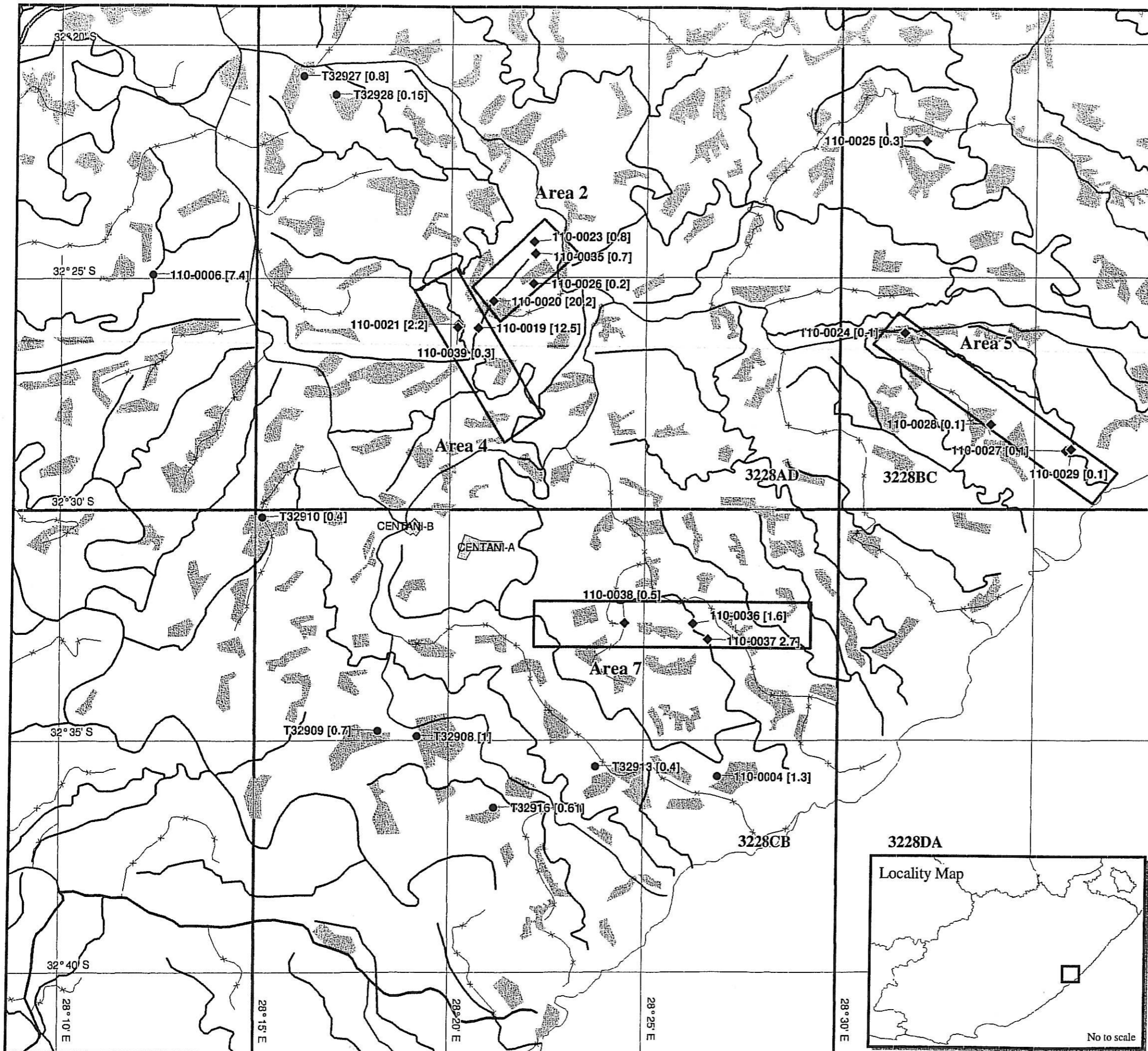
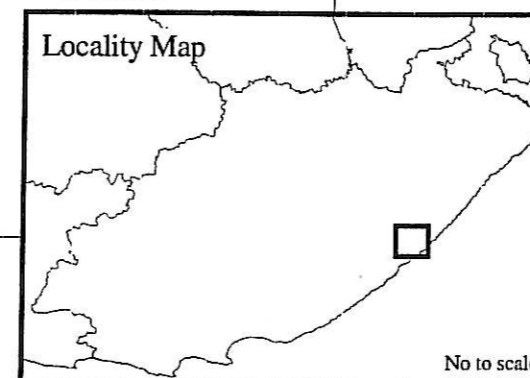
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Transverse Mercator (Gauss-Krüger)
WGS84 Ellipsoid; Hartebeesthoek 94 Datum
Central Meridian 29°



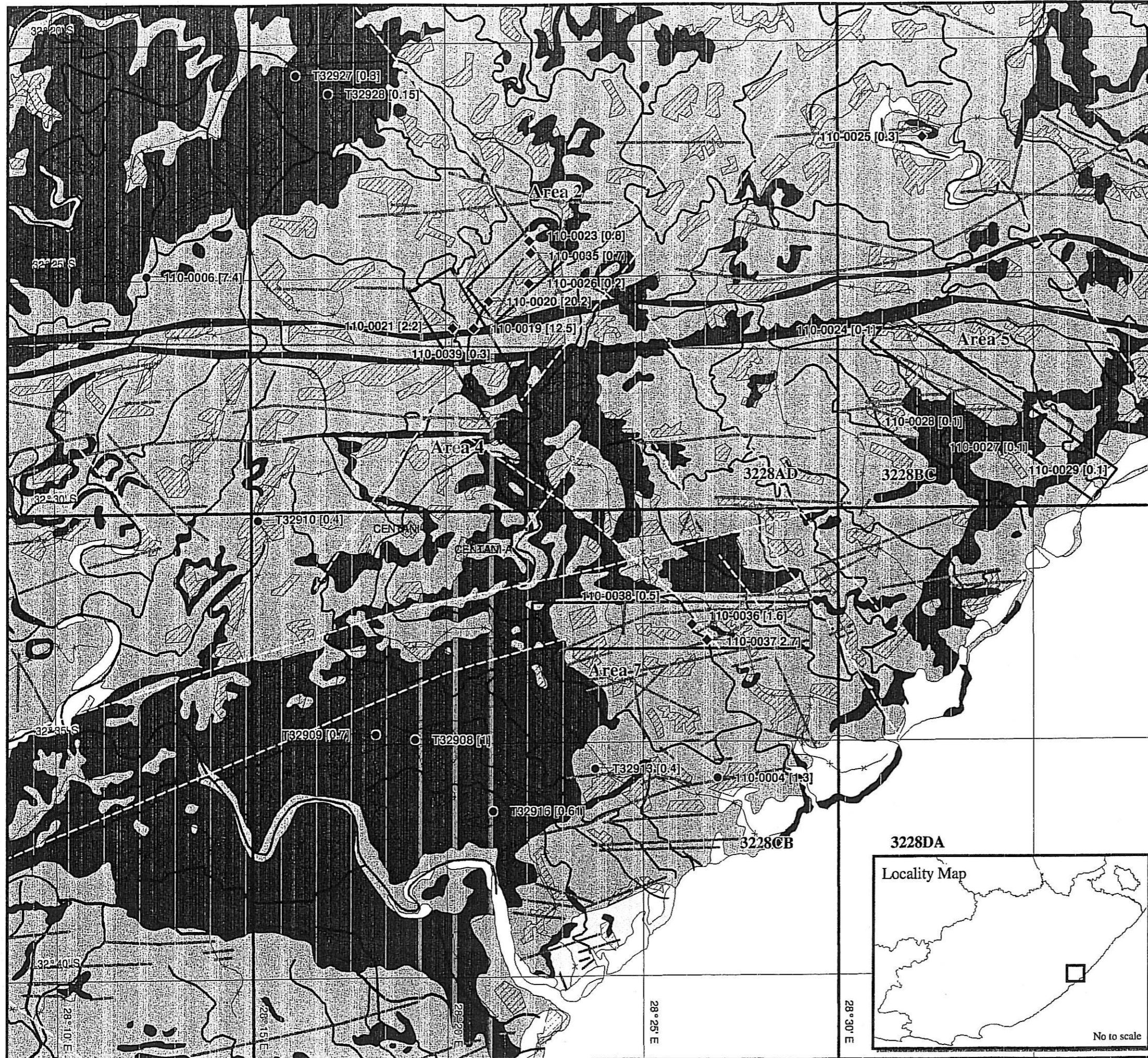
Kilometres



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MNQUMA LOCAL MUNICIPALITY

CENTANI GEOLOGY MAP



LEGEND

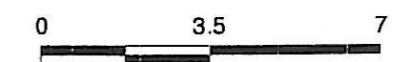
- National road
 - Main road
 - Secondary road
 - Other road
 - Perennial river
 - Community
 - Project community
 - 50 000 Map boundary
 - Exploration target area
 - Existing borehole position labelled with recommendation [l/s @ 12h/d]
 - New borehole position labelled with recommendation [l/s @ 12h/d]
- Geology**
- Dolerite
 - Mudstone / Sandstone
 - Alluvium
 - Dyke
 - Lineament

SCALE & PROJECTION

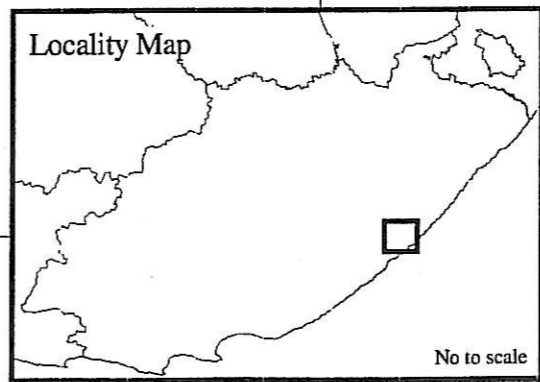
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Transverse Mercator (Gauss-Krüger)
WGS84 Ellipsoid; Hartebeesthoek 94 Datum
Central Meridian 29°



Kilometres



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Groundwater
Consultants

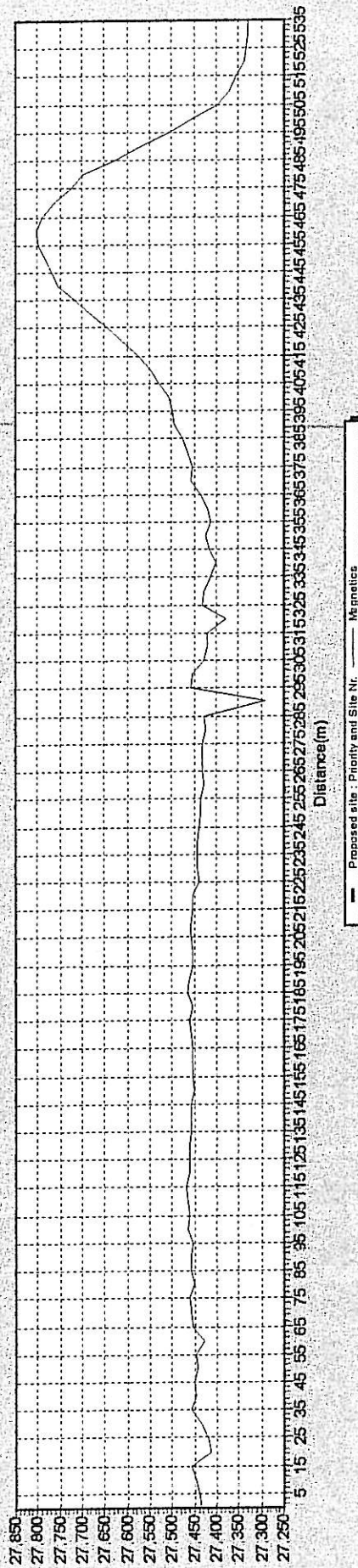


APPENDIX 3
Geophysical Profiles

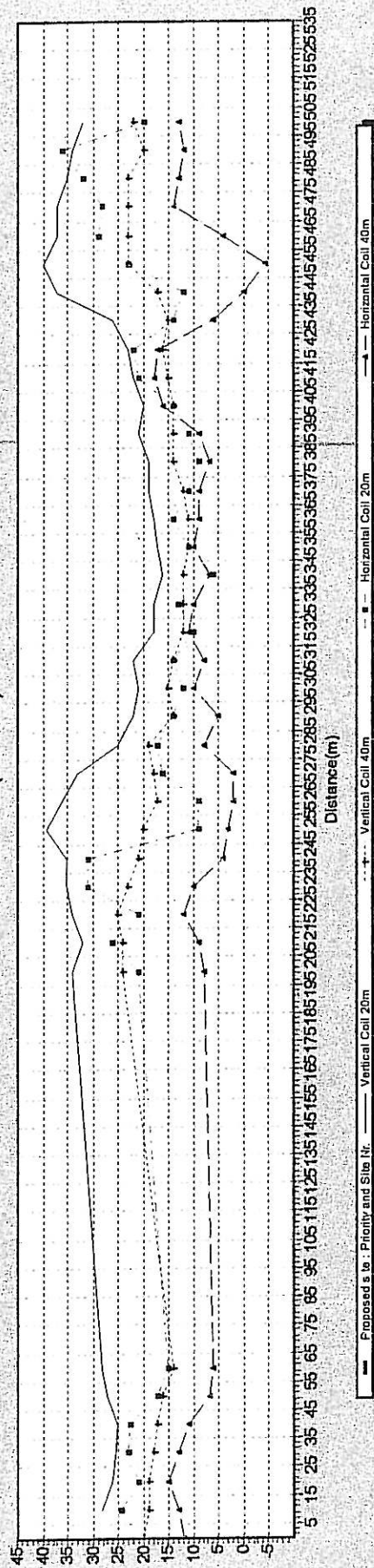
Distance dependent chart(s)

Date compiled: 2003/07/22

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CENTULI K4-T5 (110-0019)



EM34 Traverse: 20030612TRAV0005
CENTULI K4-T5 (110-0019)



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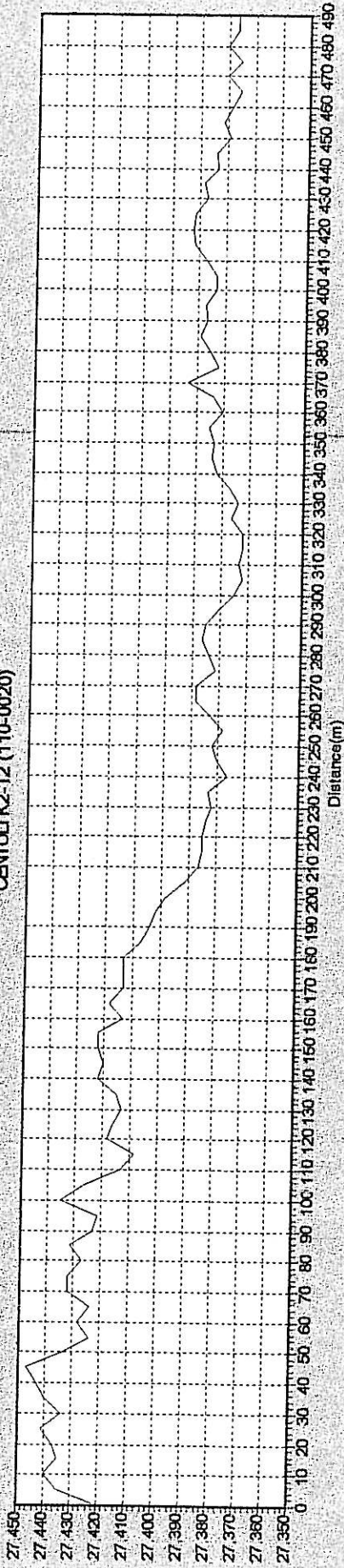


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Distance dependent chart(s)

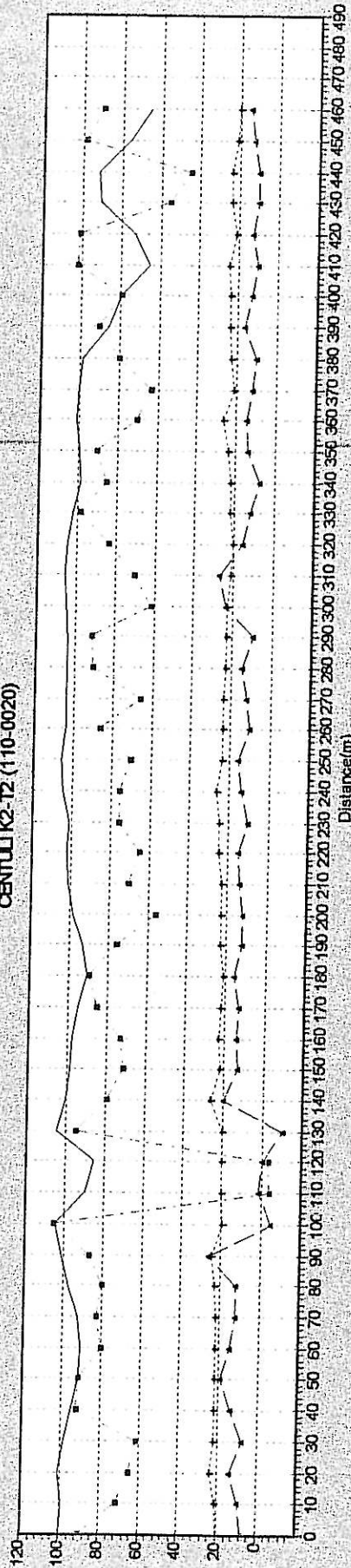
Date compiled: 2003/07/22

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CENTULI K2-T2 (110-0020)



Proposed site: Priority and Site Nr. — Magnetics

EM64 Traverse: 20030612TRAV0009
CENTULI K2-T2 (110-0020)



Proposed site: Priority and Site Nr. — Vertical Coil 20m — Horizontal Coil 20m — Horizontal Coil 40m

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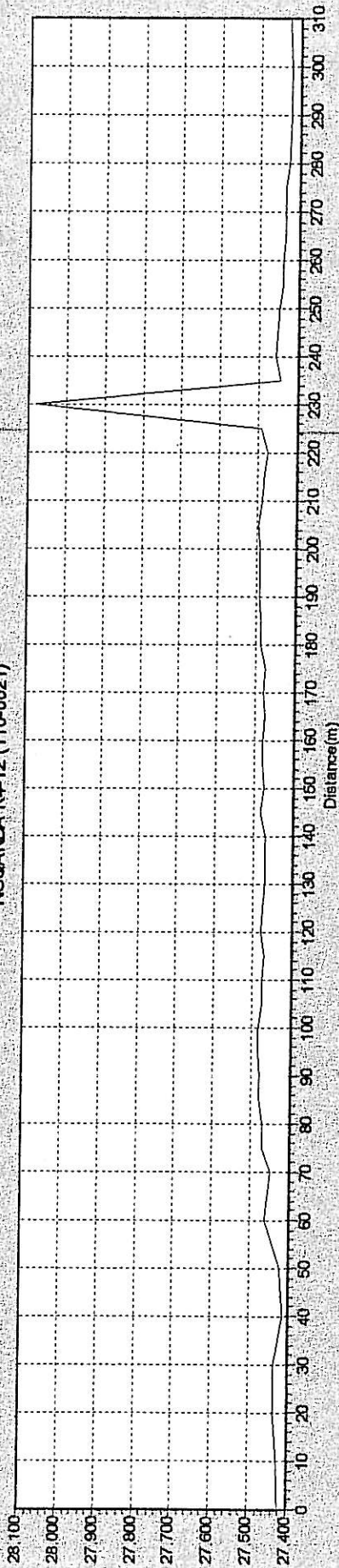


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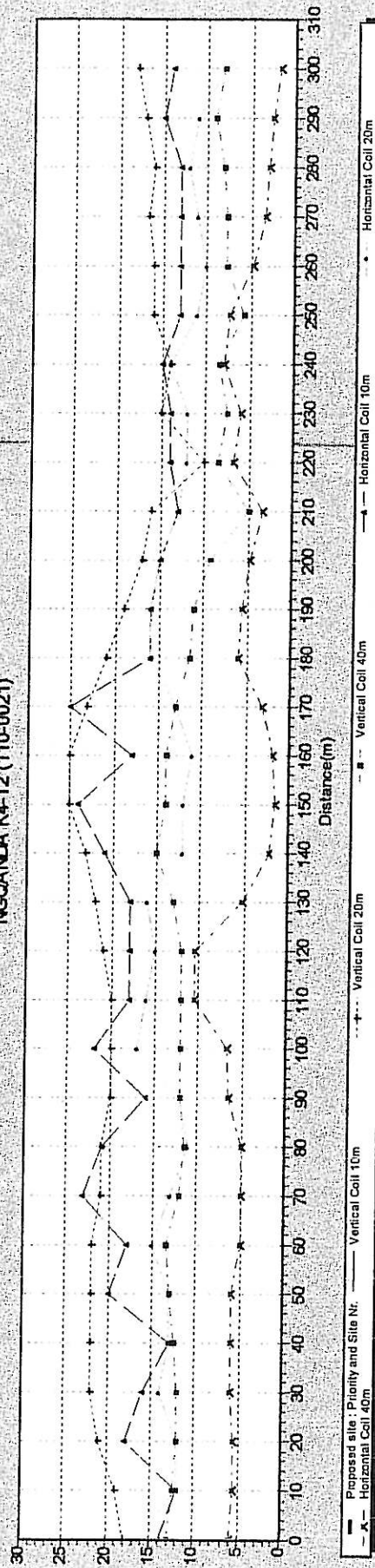
Distance dependent chart(s)

Date compiled: 2003/07/22

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 NGQANDA K4-T2 (110-0021)



EM34 Traverse: 20030612TRAV0004
 NGQANDA K4-T2 (110-0021)



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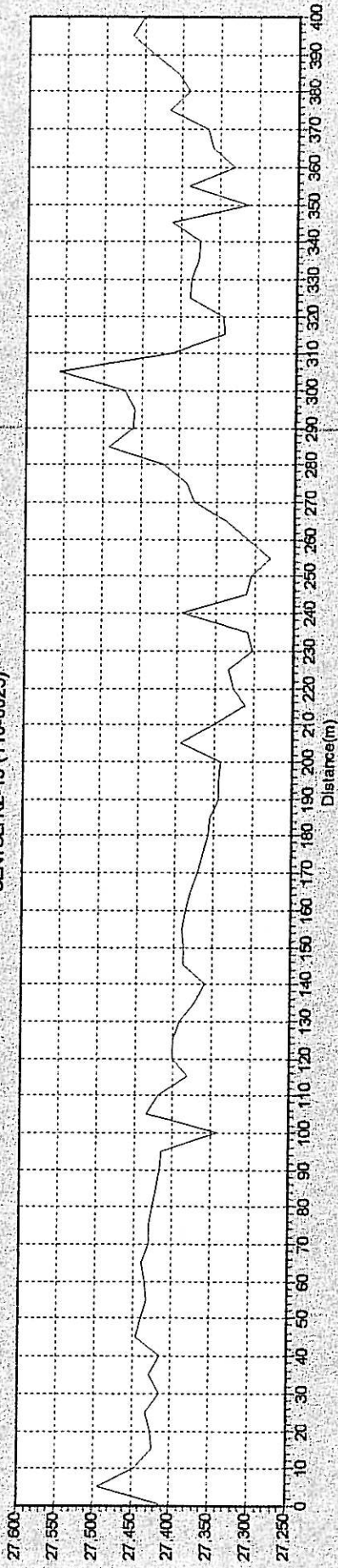


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Distance dependent chart(s)

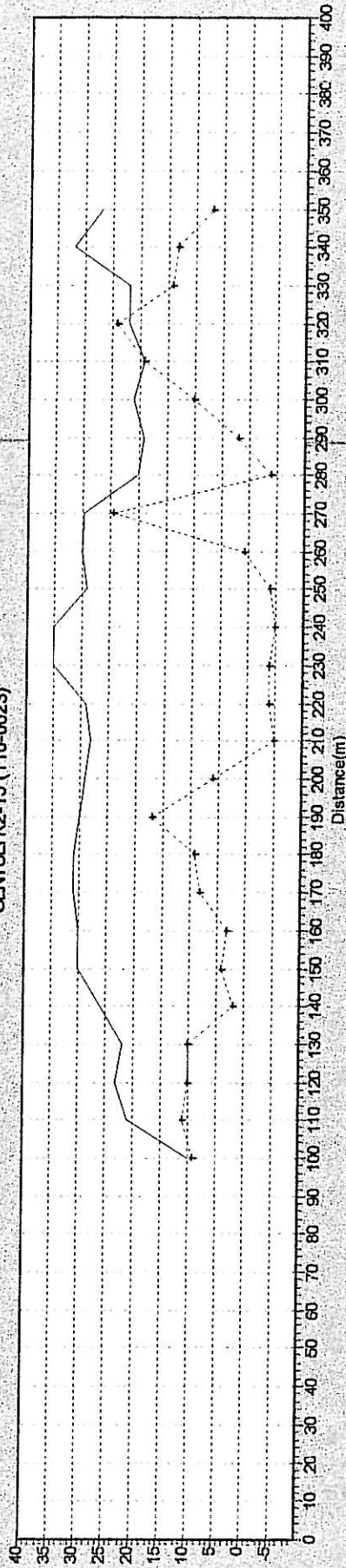
Date compiled: 2003/07/22

Magnetic Traverse: 20030612TRAV0006
CENTULI K2-T5 (110-0023)



Proposed site: Priority and Site Nr. ——— Magnetics

EV34 Traverse: 20030612TRAV0006
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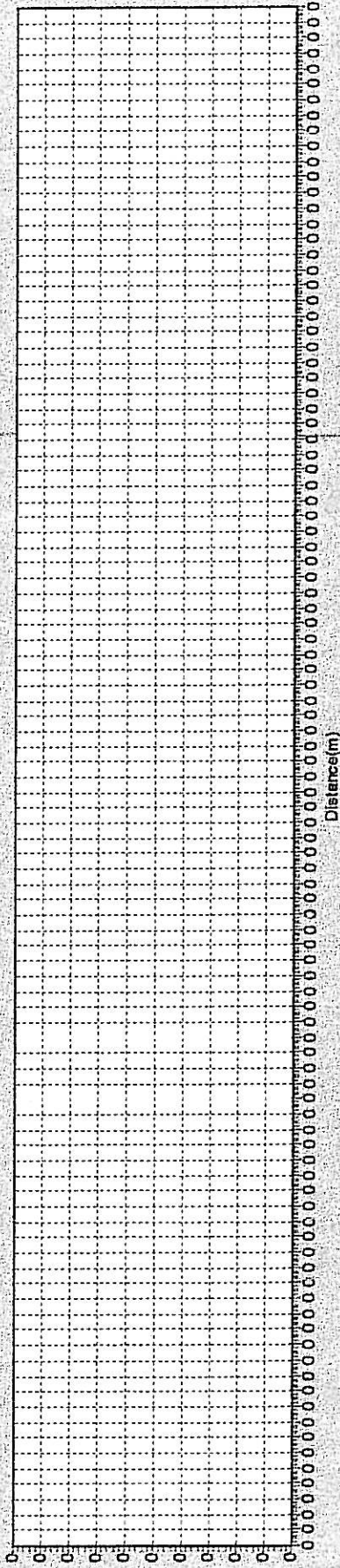


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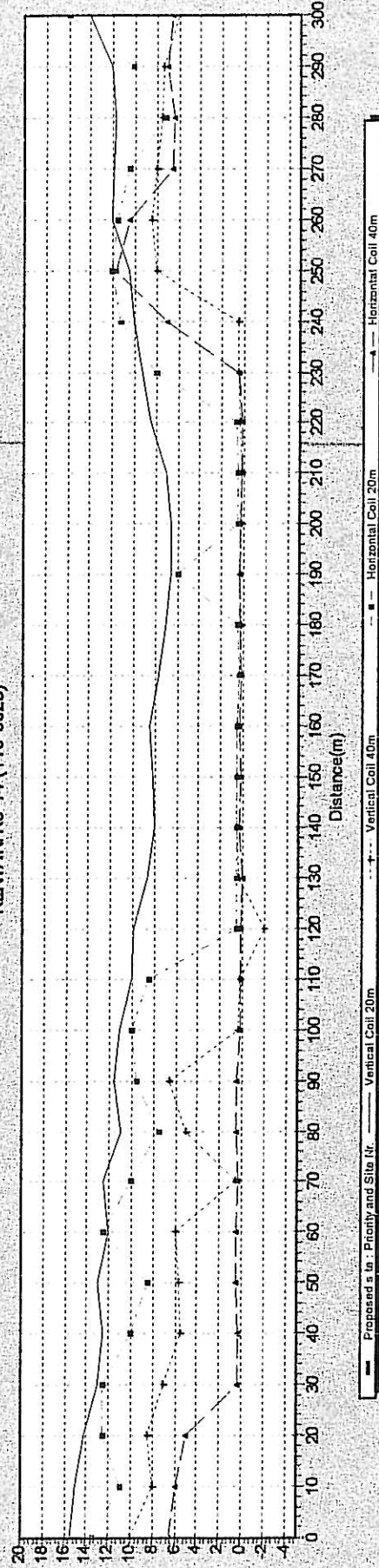
Distance dependent chart(s)

Date compiled: 2003/07/22

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KENTAN K5-T4 (110-0025)



EM34 Traverse: 20030515TRAV0013
KENTAN K5-T4 (110-0025)



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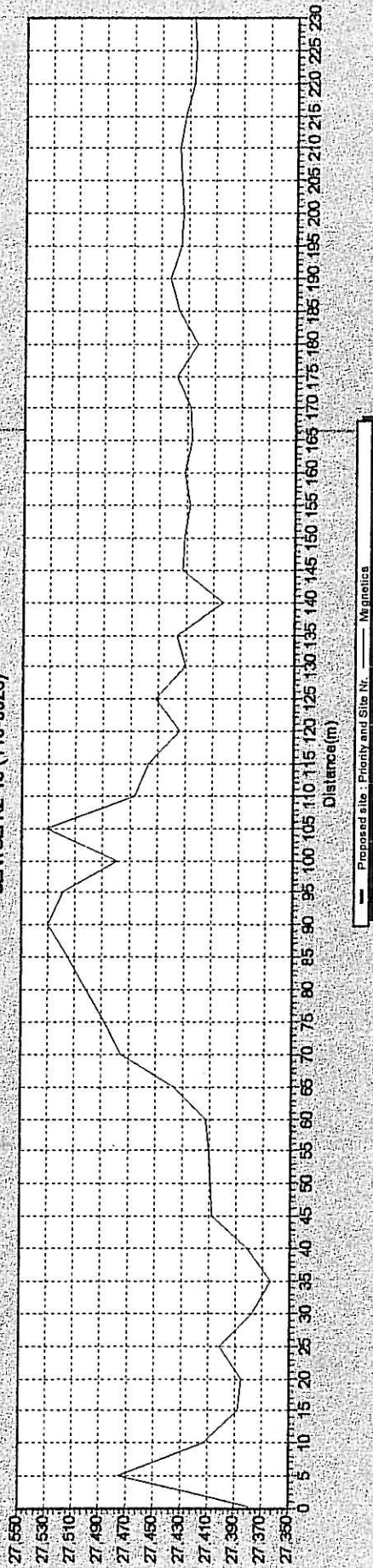


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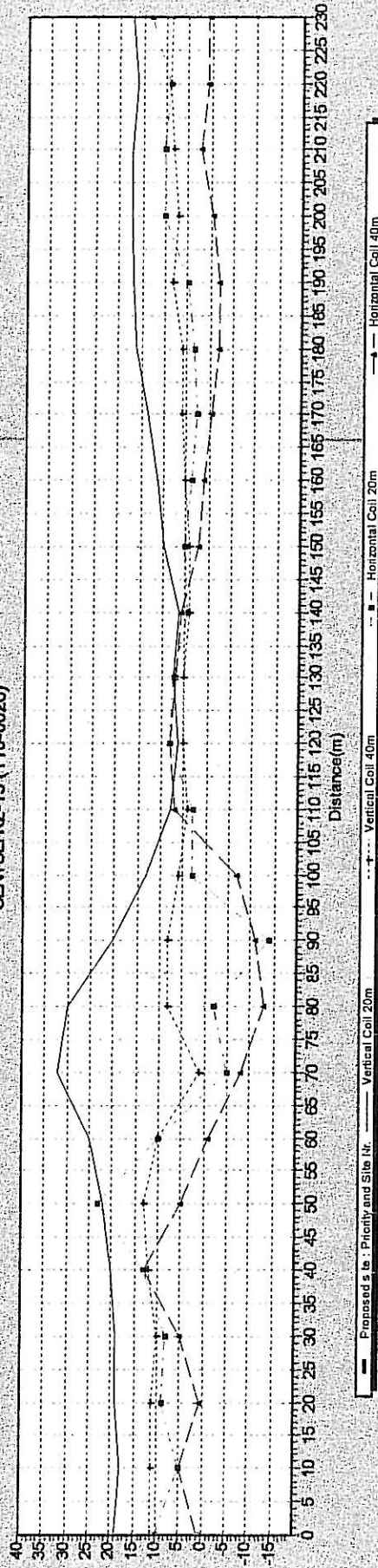
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Date compiled: 2003/07/22

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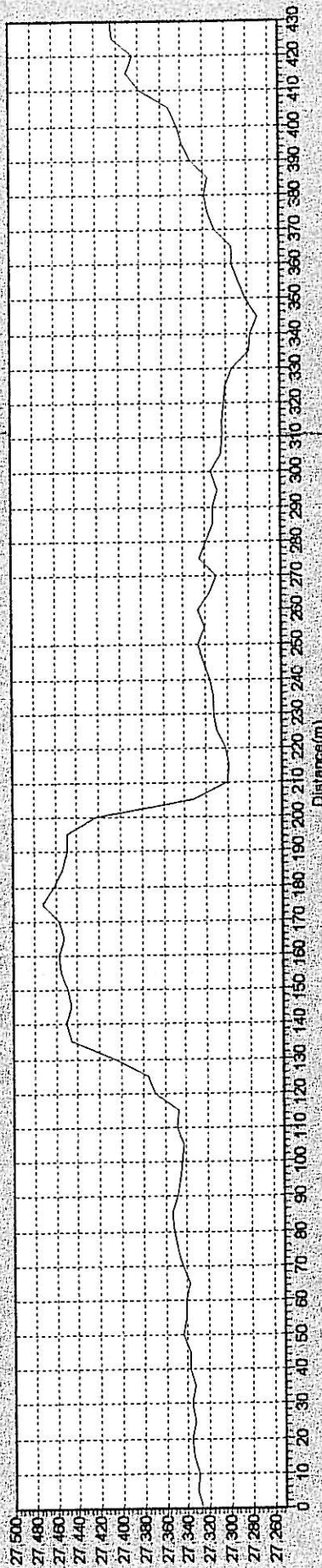


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Distance dependent chart(s)

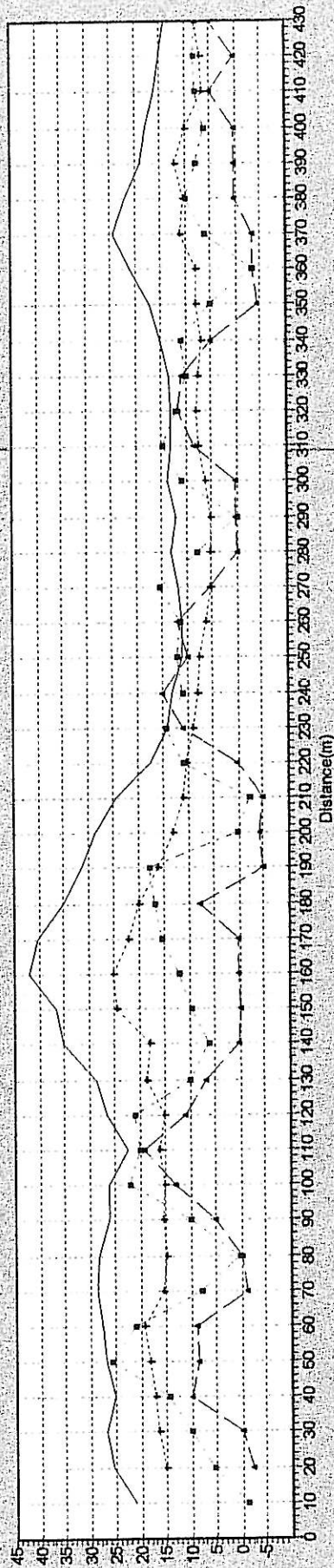
Date compiled: 2003/07/22

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GCNA K5-T5 (110-0027)



Proposed site: Priority and Site Nr. Magnetics

EM34 Traverse: 20030515TRAV0001
GCNA K5-T5 (110-0027)



Proposed site: Priority and Site Nr. Vertical Coil 20m Horizontal Coil 40m

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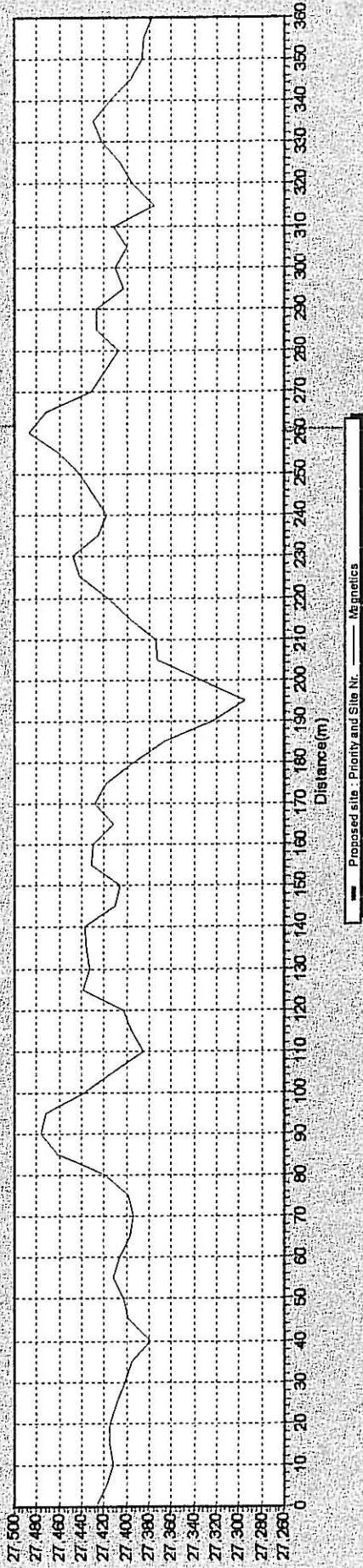


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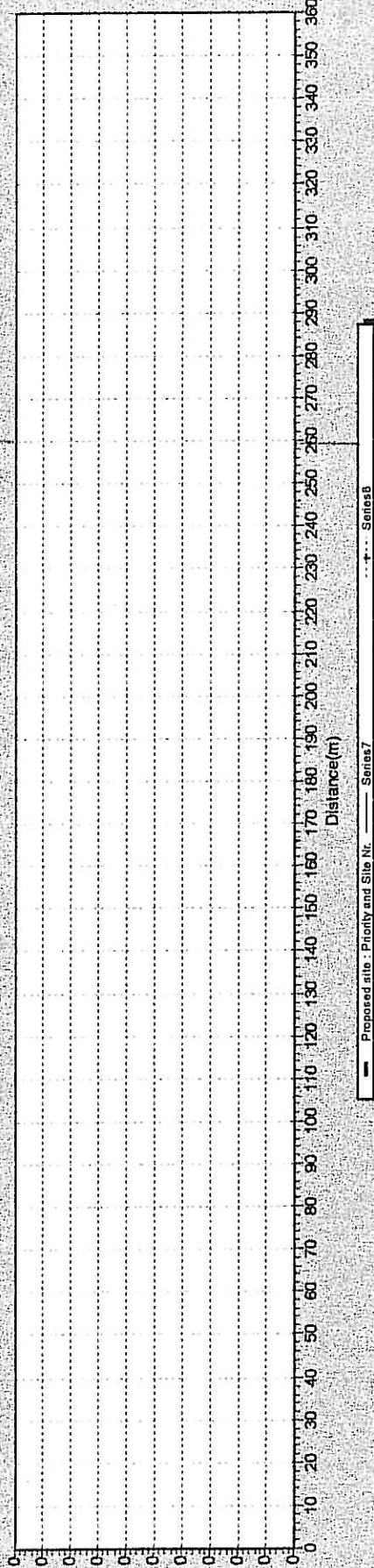
Distance dependent chart(s)

Date compiled: 2003/07/22

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KENTAN K5-T8 (110-0028)



EM34 Traverse: 20030515TRAV0003
KENTAN K5-T8 (110-0028)



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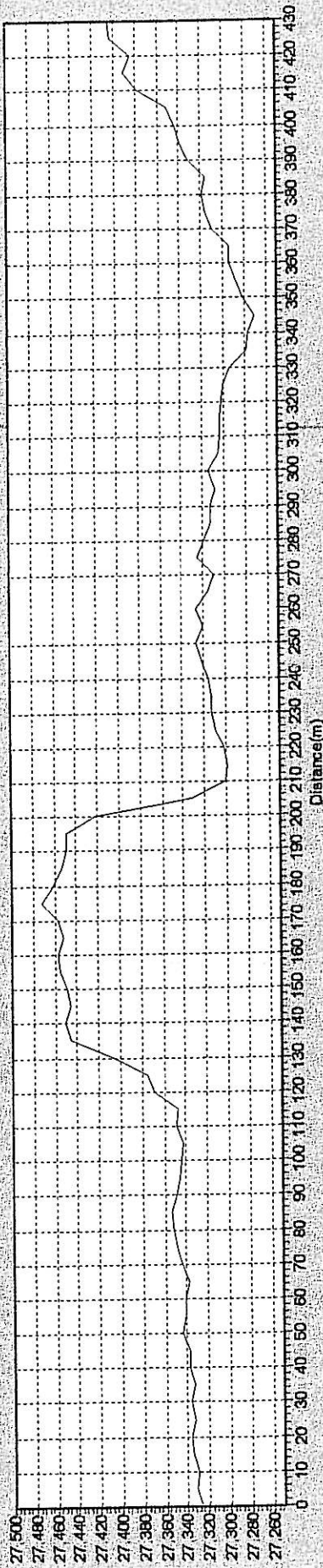


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Date compiled: 2003/07/22

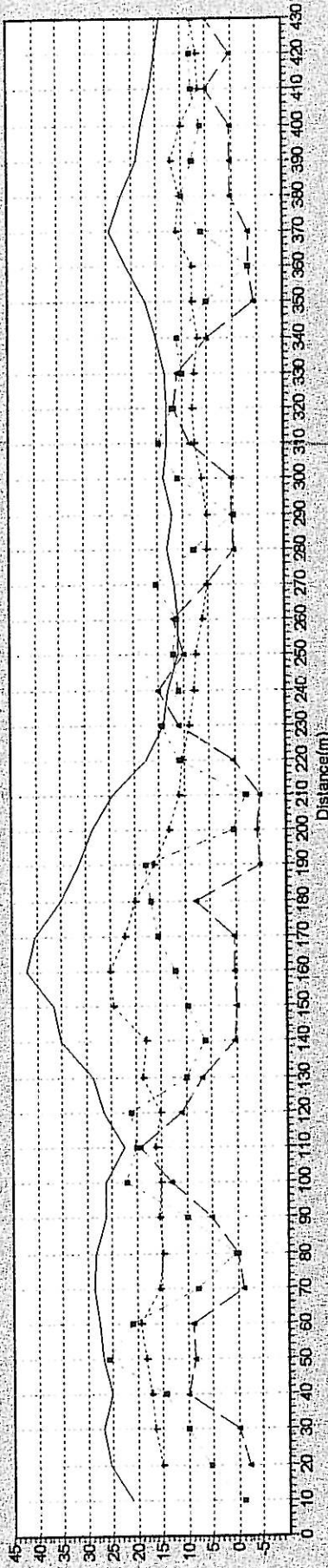
Distance dependent chart(s)

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Proposed site: Pitchly and Site Nr. Magnetics

EM34 Traverse: 20030515TRAV/0001
GCNA K5-T5 (110-0029)



Proposed site: Pitchly and Site Nr. Vertical Coil 20m Horizontal Coil 40m
Magnetics Vertical Coil 20m Horizontal Coil 40m

PROJECT DESCRIPTION:

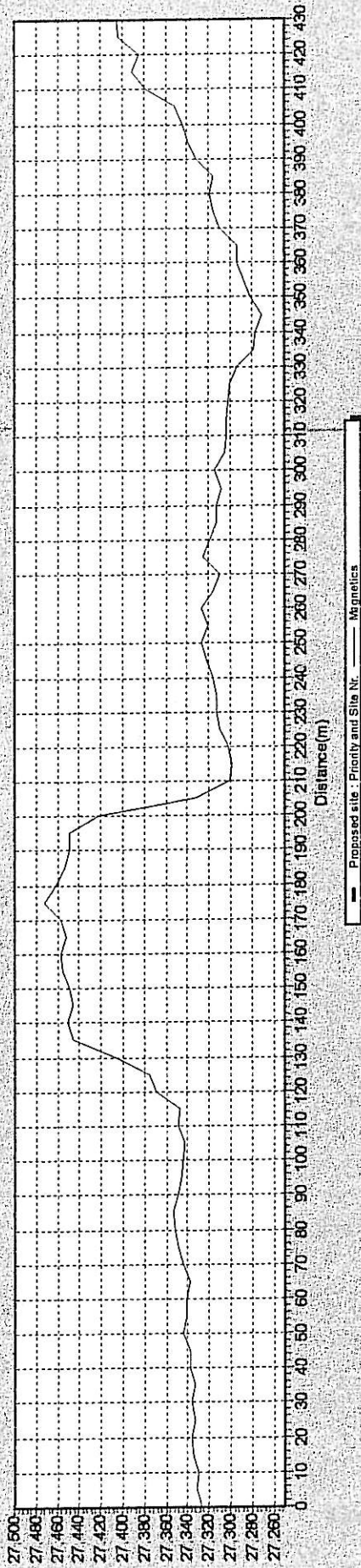


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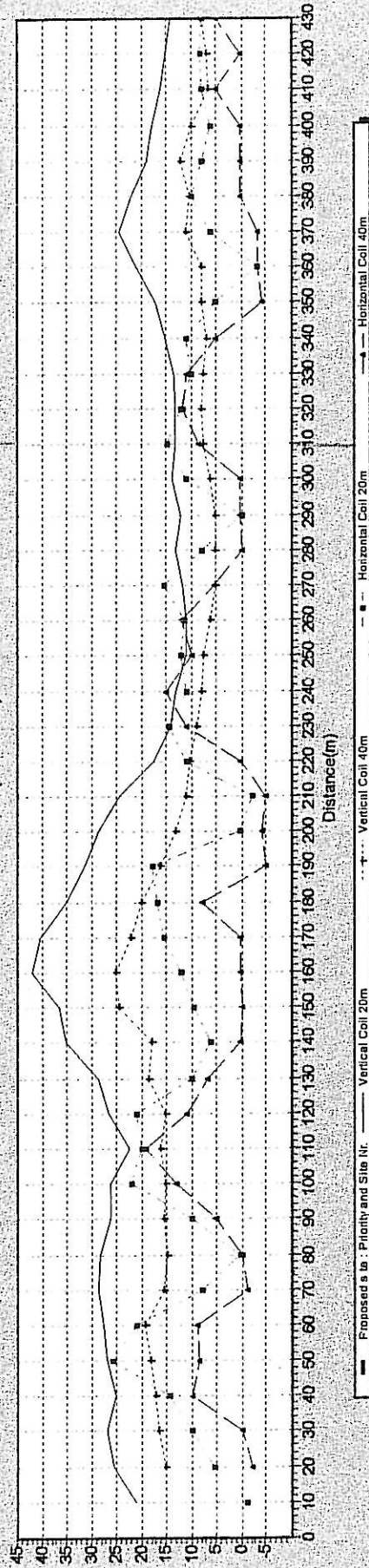
Distance dependent chart(s)

Date compiled: 2003/07/22

Magnetic Traverse: 20030515TRAV0001
GCNA K5-T5 (110-0030)



EM64 Traverse: 20030515TRAV0001
GCNA K5-T5 (110-0030)



PROJECT DESCRIPTION:

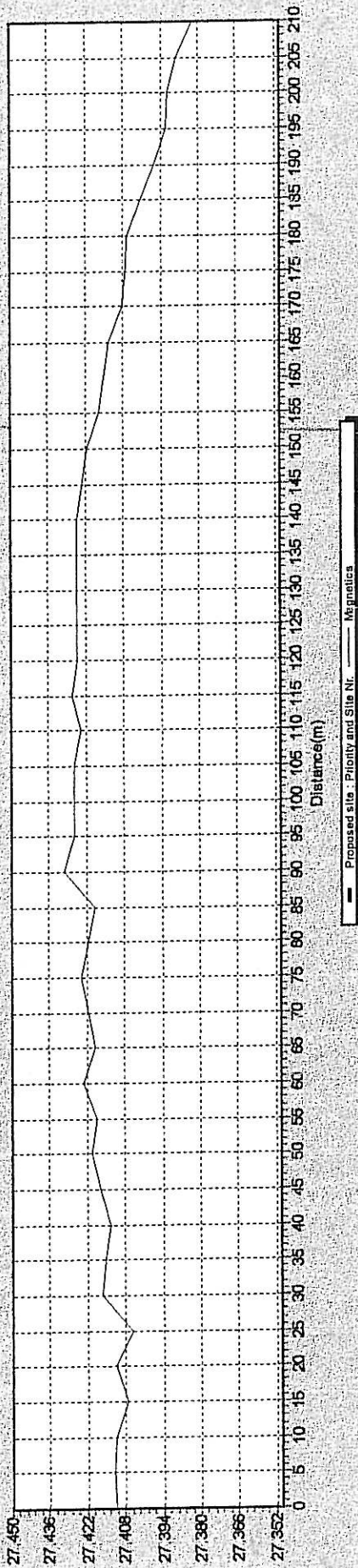


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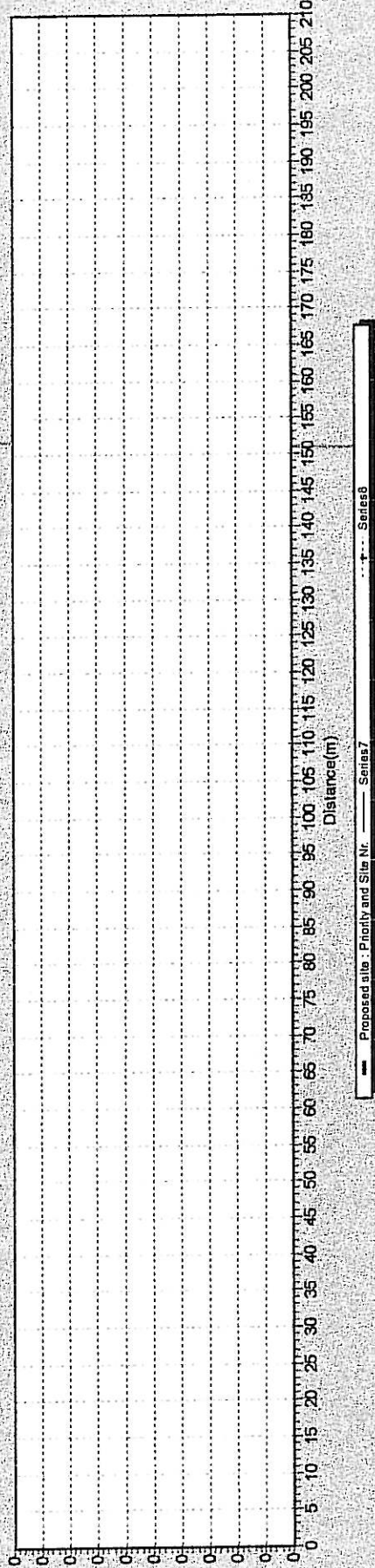
Distance dependent chart(s)

Date compiled: 2003/07/22

Magnetic Traverse: 20030515TRAV0010
KENTAN K7-T5 (110-0031)



EM84 Traverse: 20030515TRAV0010
KENTAN K7-T5 (110-0031)



PROJECT DESCRIPTION:

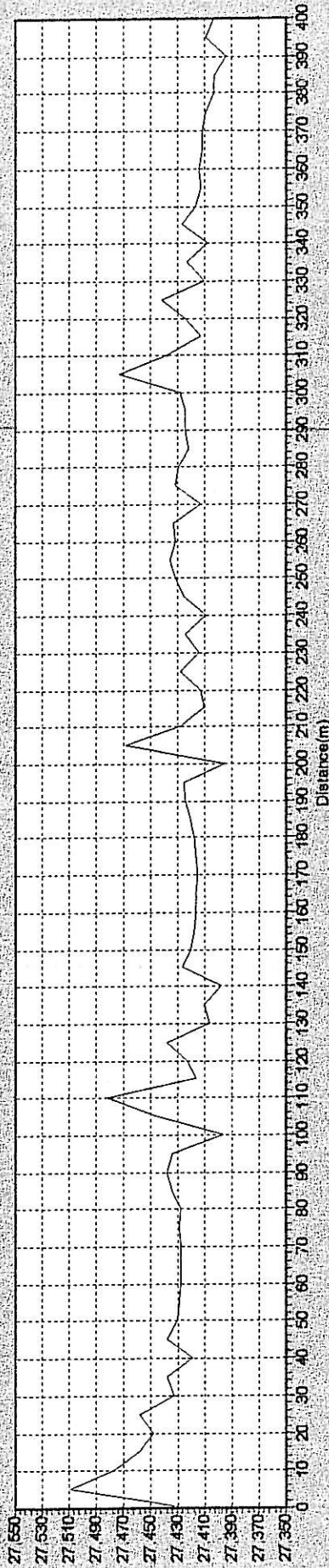


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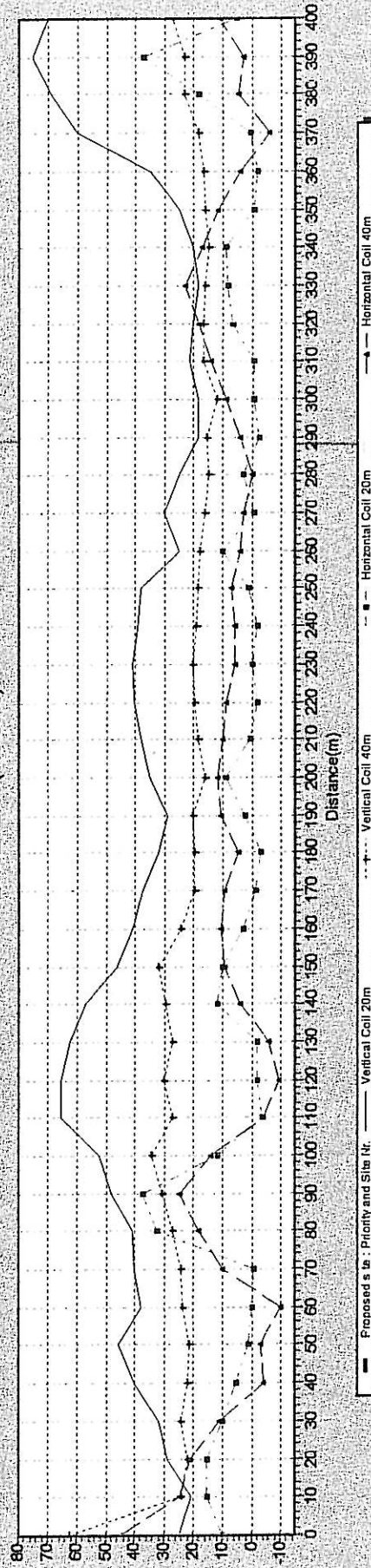
Distance dependent chart(s)

Date compiled: 2003/07/22

Magnetic Traverse: 20030612TRAV0007
CENTULI K2-T4 (110-0035)



EM34 Traverse: 20030612TRAV0007
CENTULI K2-T4 (110-0035)



PROJECT DESCRIPTION:

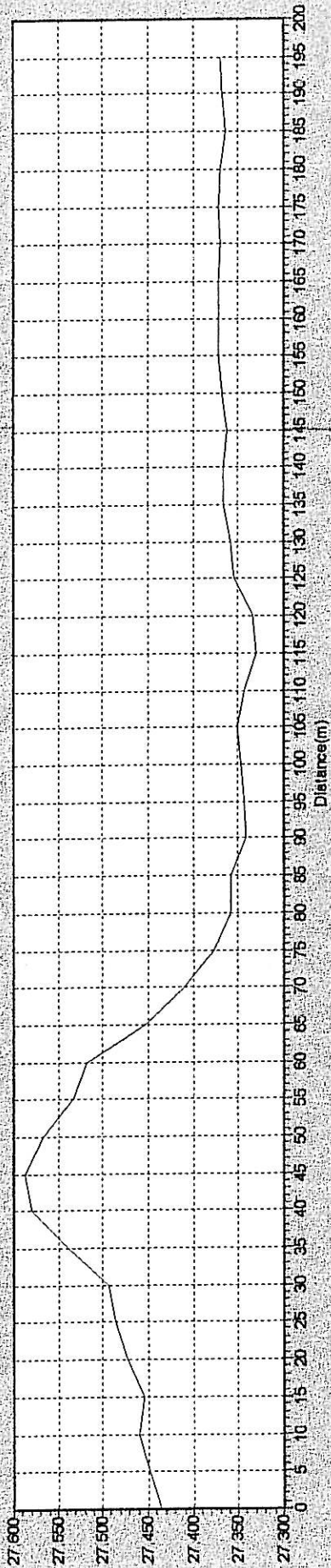


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Distance dependent chart(s)

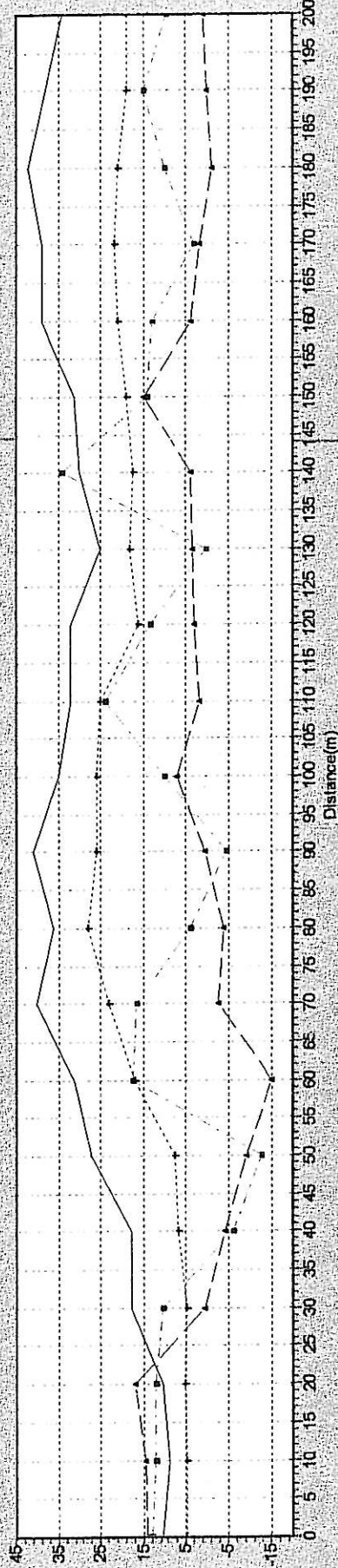
Date compiled: 2003/07/22

Magnetic Traverse: 20030612TRAV0002
TAKAZI K7-T10 (110-0036)



Proposed site: Priority and Site No. Magnetics

EM34 Traverse: 20030612TRAV0002
TAKAZI K7-T10 (110-0036)



Proposed site: Priority and Site No. Vertical Coil 20m

Proposed site: Priority and Site No. Vertical Coil 40m

Proposed site: Priority and Site No. Horizontal Coil 40m

PROJECT DESCRIPTION:

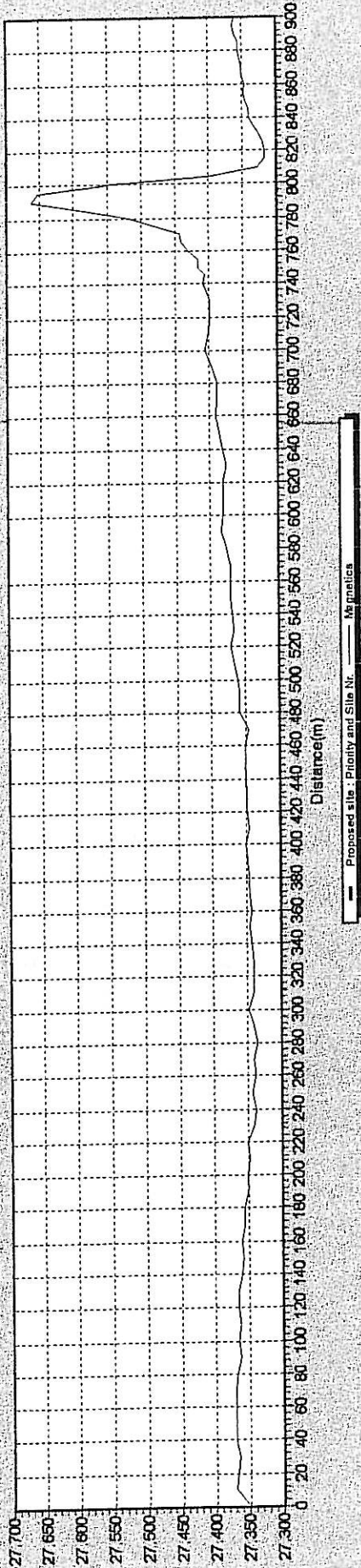


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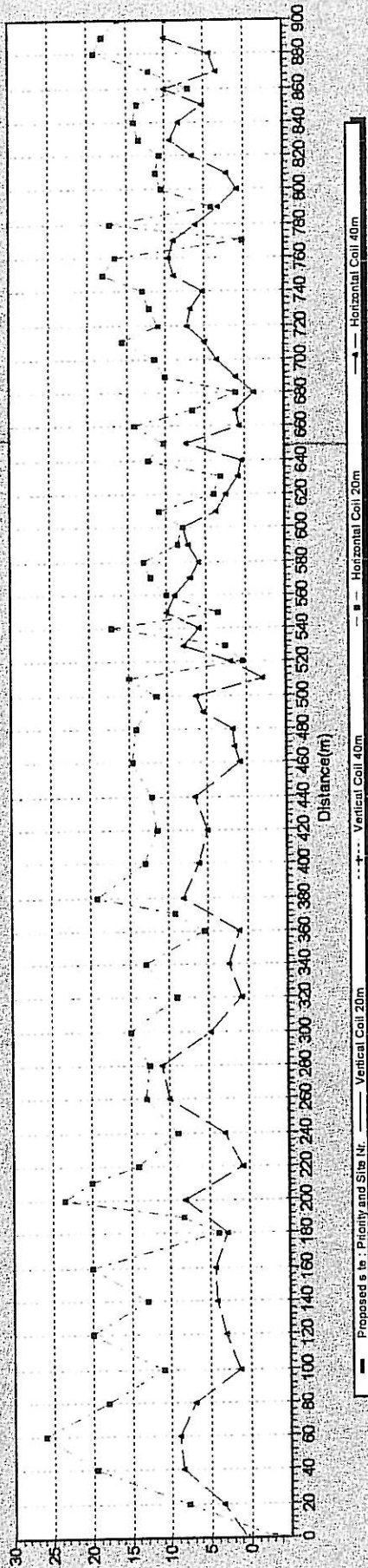
Distance dependent chart(s)

Date compiled: 2003/07/22

Magnetic Traverse: 20030612TRAV0001
TAKAZIK7-T11 (110-0037)



EM64 Traverse: 20030612TRAV0001
TAKAZIK7-T11 (110-0037)



PROJECT DESCRIPTION:

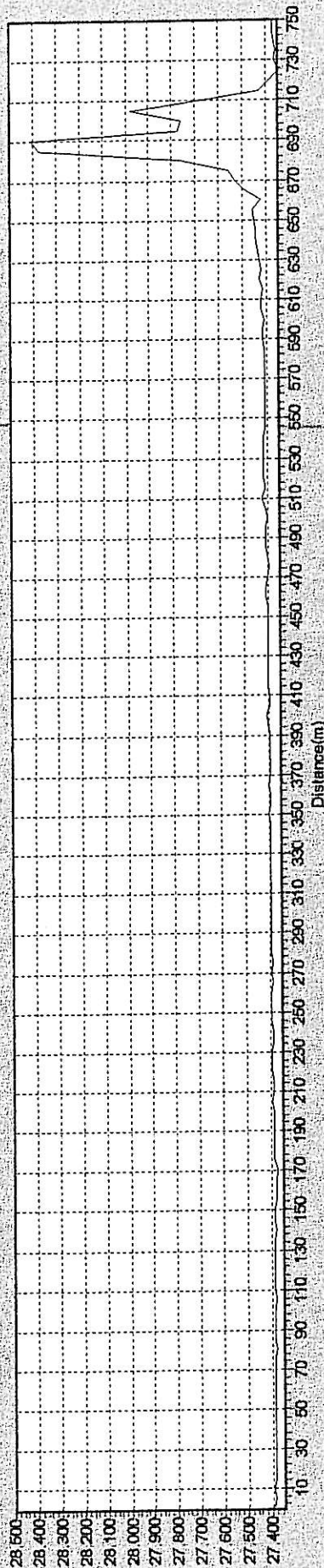


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Distance dependent chart(s)

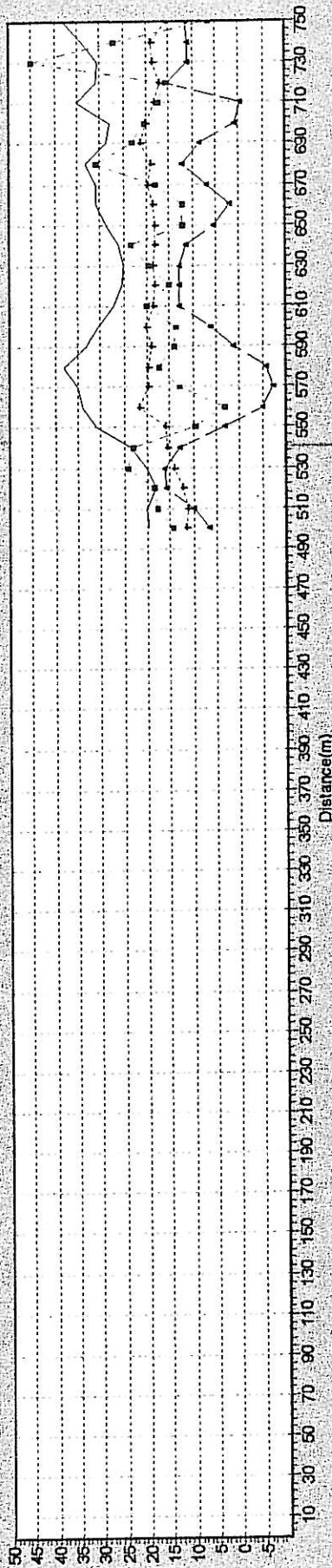
Date compiled: 2003/07/22

Magnetic Traverse: 20030515TRAV0006
KENTAN K7-T1 (110-0038)



--- Proposed site Priority and Site Nr. --- Magnetics

EM64 Traverse: 20030515TRAV0006
KENTAN K7-T1 (110-0038)



--- Proposed site Priority and Site Nr. --- Vertical Coil 20m

--- Proposed site Priority and Site Nr. --- Horizontal Coil 40m

PROJECT DESCRIPTION:

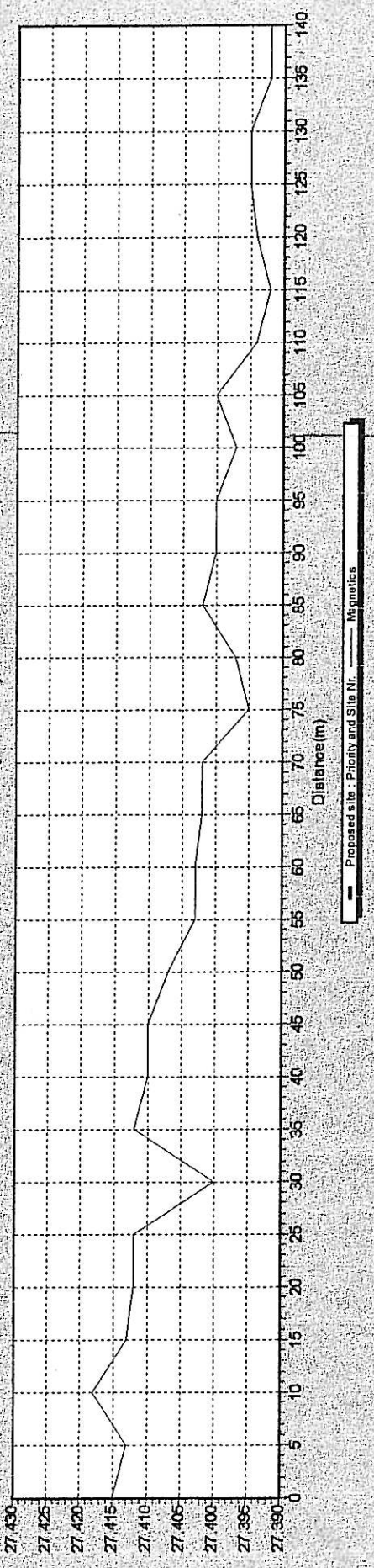


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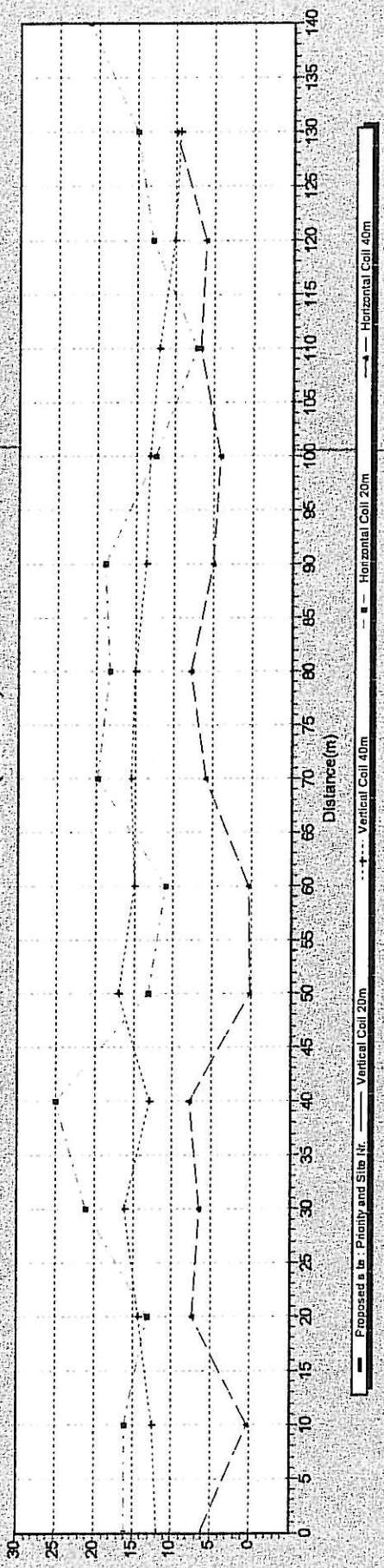
Distance dependent chart(s)

Date compiled: 2003/07/22

Magnetic Traverse: 20030515TRAV0009
TAKAZIK7-T4 (110-0039)



EM84 Traverse: 20030515TRAV0009
TAKAZIK7-T4 (110-0039)



PROJECT DESCRIPTION:



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APPENDIX 4

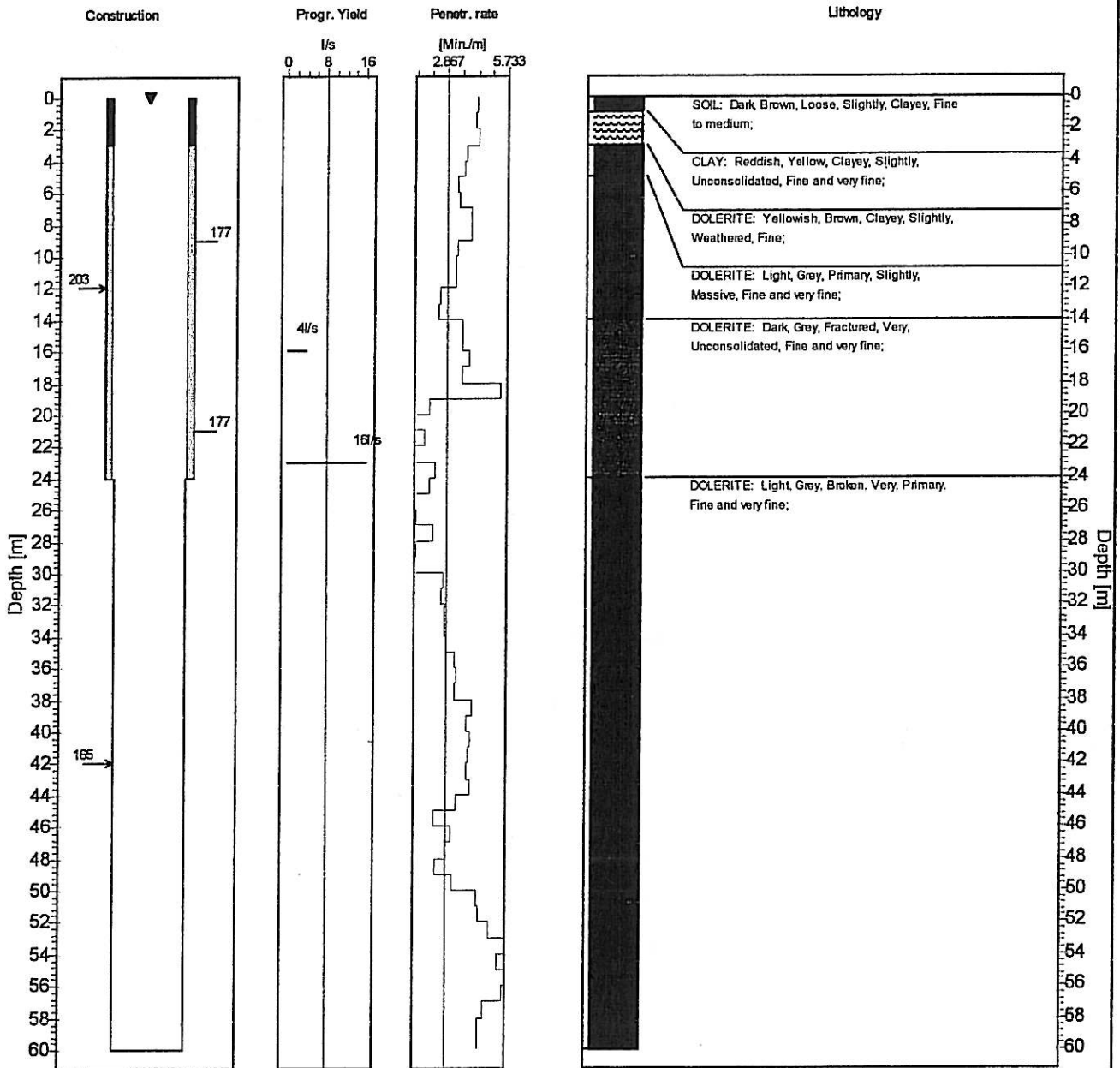
Drilling logs

BASIC SITE INFORMATION: Site Identifier: 3228ADV0017 Number: 110-0019 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KENTULI/AREA 4/DIS:/KENTANI

Longitude [°]: 28.3451642	Alt. No. 1:	Topo-set.: Valley	Depth [m]: 43.31
Latitude [°]: 32.4344444	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 358.00		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]		Sanitary seal
	Casing (plain /perforated, slotted)	← 152	Casing diameter [mm]		Drill cuttings
	Screen/ Mesh Screen	▼	Waterlevel measured: 20/05/03		
	Piezometer	0.50 →	Piezometer (Nr. & Diameter [mm])		



COMMENT:



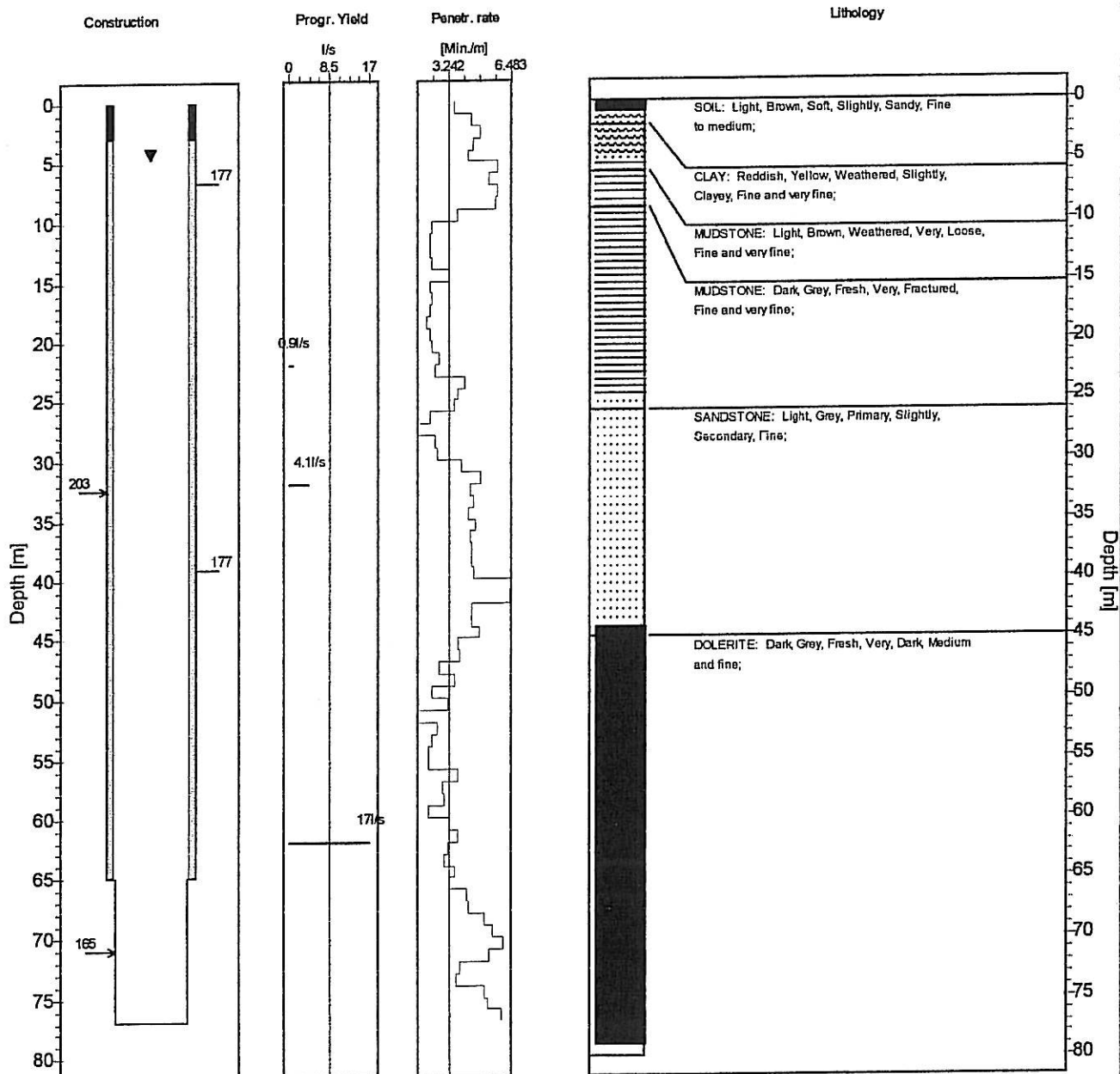
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BASIC SITE INFORMATION: Site Identifier: 3228CDV0001 Number: 110-0020 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: CENTULI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3515532	Alt. No. 1:	Topo-sel.: Flat surface, plain	Depth [m]: 77.10
Latitude [°]: 32.4248333	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 366.00		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

- Hole
- - - - Casing (plain/perforated, slotted)
- Screen/ Mesh Screen
- Piezometer
- 165 → Hole diameter [mm]
- ← 152 Casing diameter [mm]
- ▼ Water level measured: 10/05/03
- 0.50 → Piezometer (Nr. & Diameter [mm])
- Sanitary seal
- Gravel (> 2mm)



COMMENT:



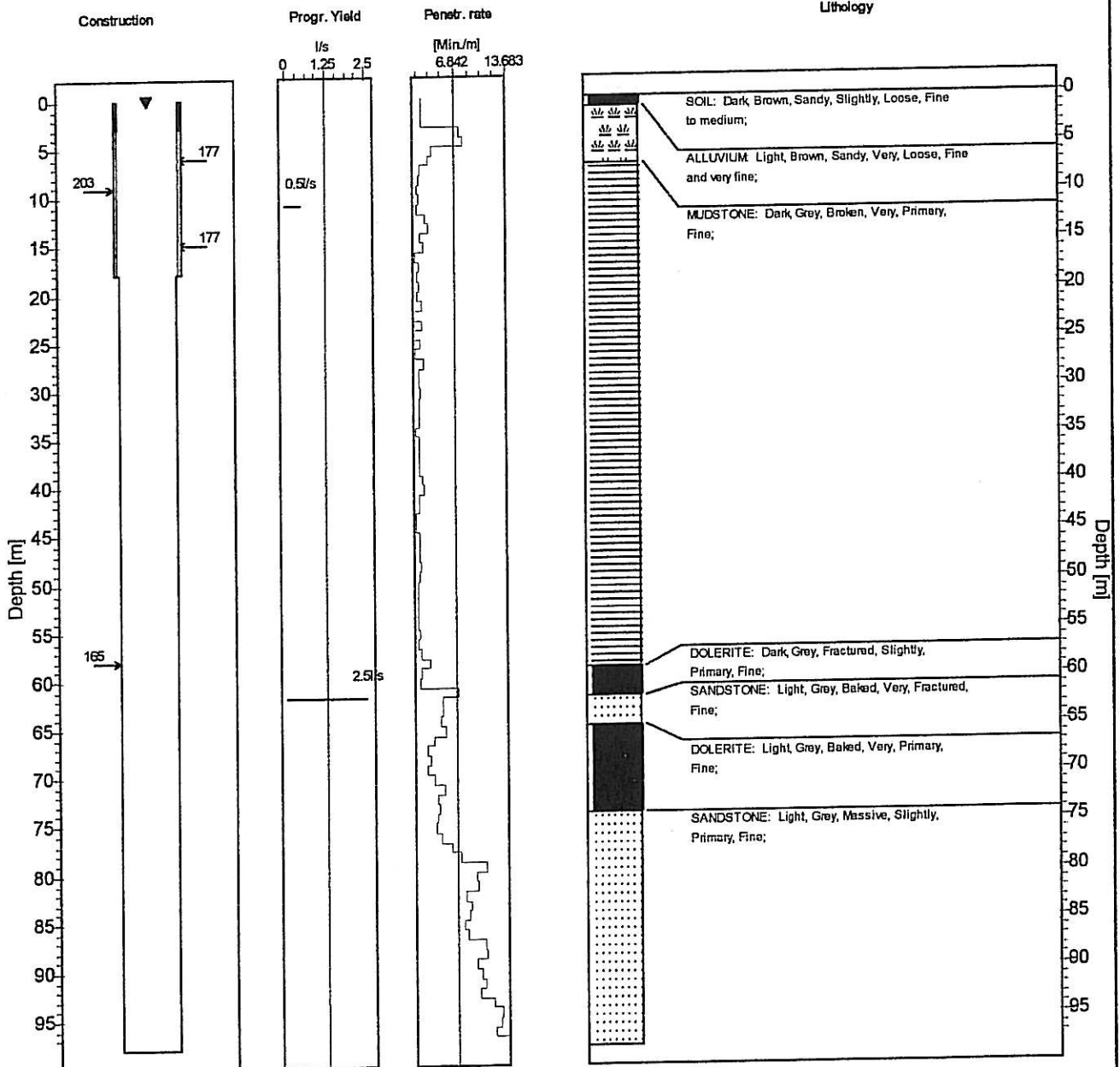
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BASIC SITE INFORMATION: Site Identifier: 3228ADV0018 Number: 110-0021 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: NQANDA/AREA4/DIS:/KENTANI

Longitude [°]: 28.3365252	Alt. No. 1:	Topo-set.: Flat surface, plain	Depth [m]: 55.73
Latitude [°]: 32.4332778	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.51
Altitude [m]: 358.00		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

- Hole
- - - Casing (plain/perforated, slotted)
- Screen/ Mesh Screen
- Piezometer
- 165 → Hole diameter [mm]
- ← 152 Casing diameter [mm]
- ▼ Waterlevel measured: 02/06/03
- 0:50 → Piezometer (Nr. & Diameter [mm])
- Sanitary seal
- Drill cuttings



COMMENT:



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Borehole Construction and Geological Log

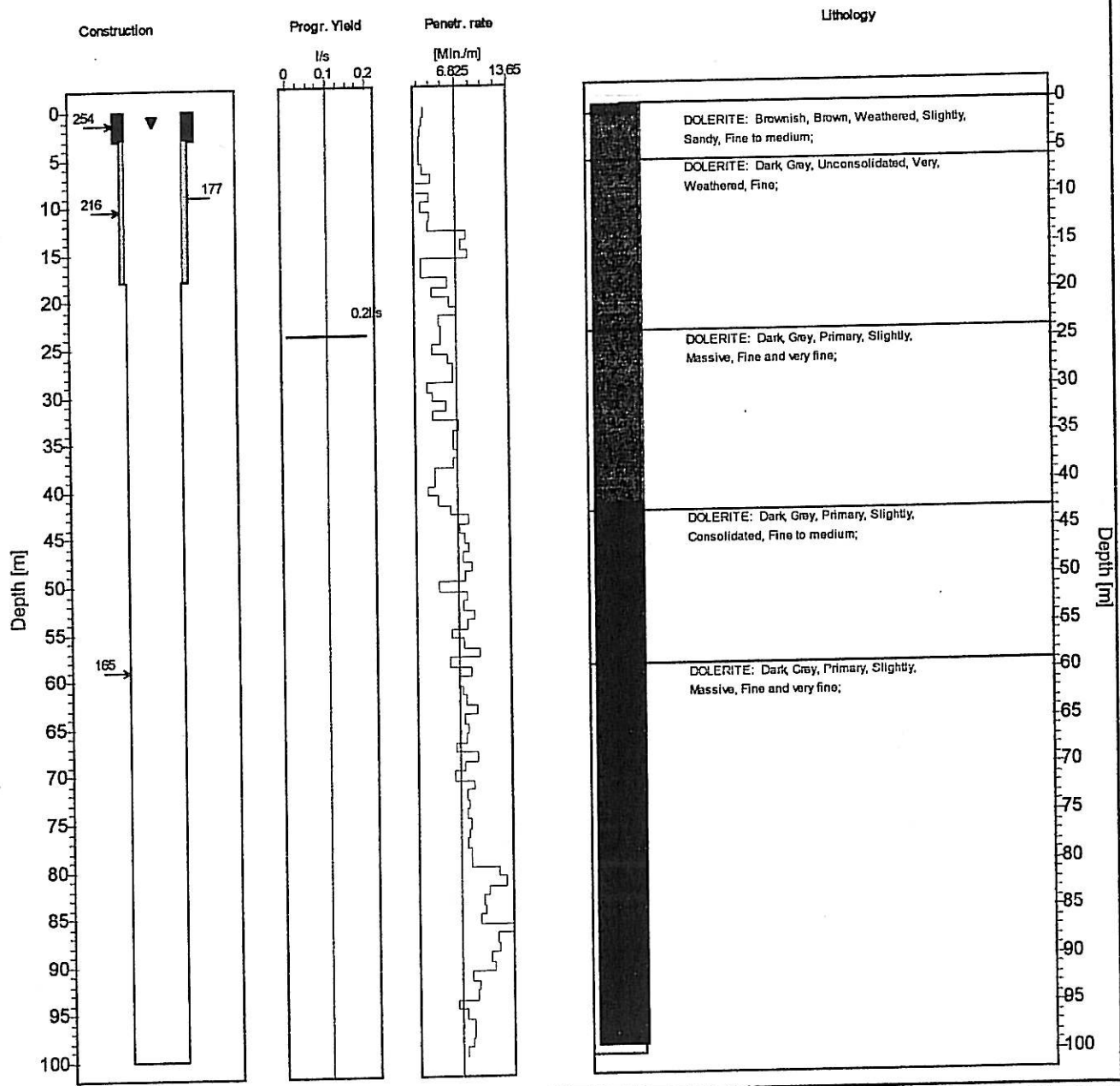
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0020 Number: 110-0023 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KWAQHITI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3704423	Alt. No. 1:	Topo-set.: Valley	Depth [m]: 97.73
Latitude [°]: 32.4059444	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 426.00		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

- Hole
 - Casing (plain/perforated, slotted)
 - Screen/ Mesh Screen
 - Piezometer
 - Hole diameter [mm]
 - Casing diameter [mm]
 - Piezometer (Nr. & Diameter [mm])
 - Sanitary seal
 - Drill cuttings
- Waterlevel measured: 27/05/03



COMMENT:



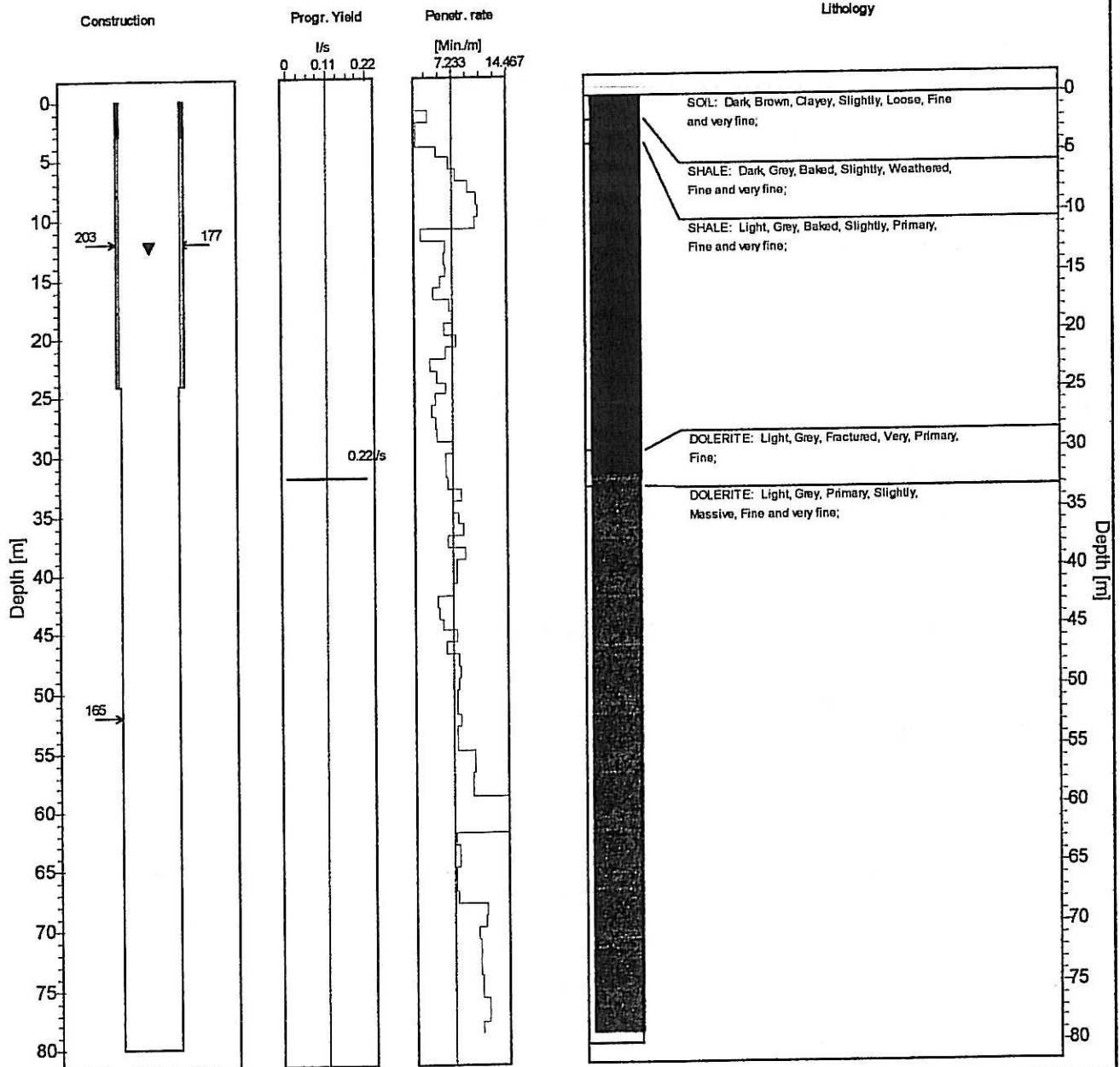
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BASIC SITE INFORMATION: Site Identifier: 3228ADV0021 Number: 110-0026 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: CENTULI/AREA2/DIS/KENTANI

Longitude [°]: 28.3673311	Alt. No. 1:	Topo-set: Flat surface, plain	Depth [m]: 80.93
Latitude [°]: 32.4185833	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 0.50		Site purp.: Production (water-supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. methr.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

- Hole
- - - Casing (plain/perforated, slotted)
- Screen/ Mesh Screen
- Piezometer
- 165 → Hole diameter [mm]
- ← 152 Casing diameter [mm]
- ▼ Waterlevel measured: 16/05/03
- 0.50 → Piezometer (Nr. & Diameter [mm])
- Sanitary seal
- Drill cuttings



COMMENT:



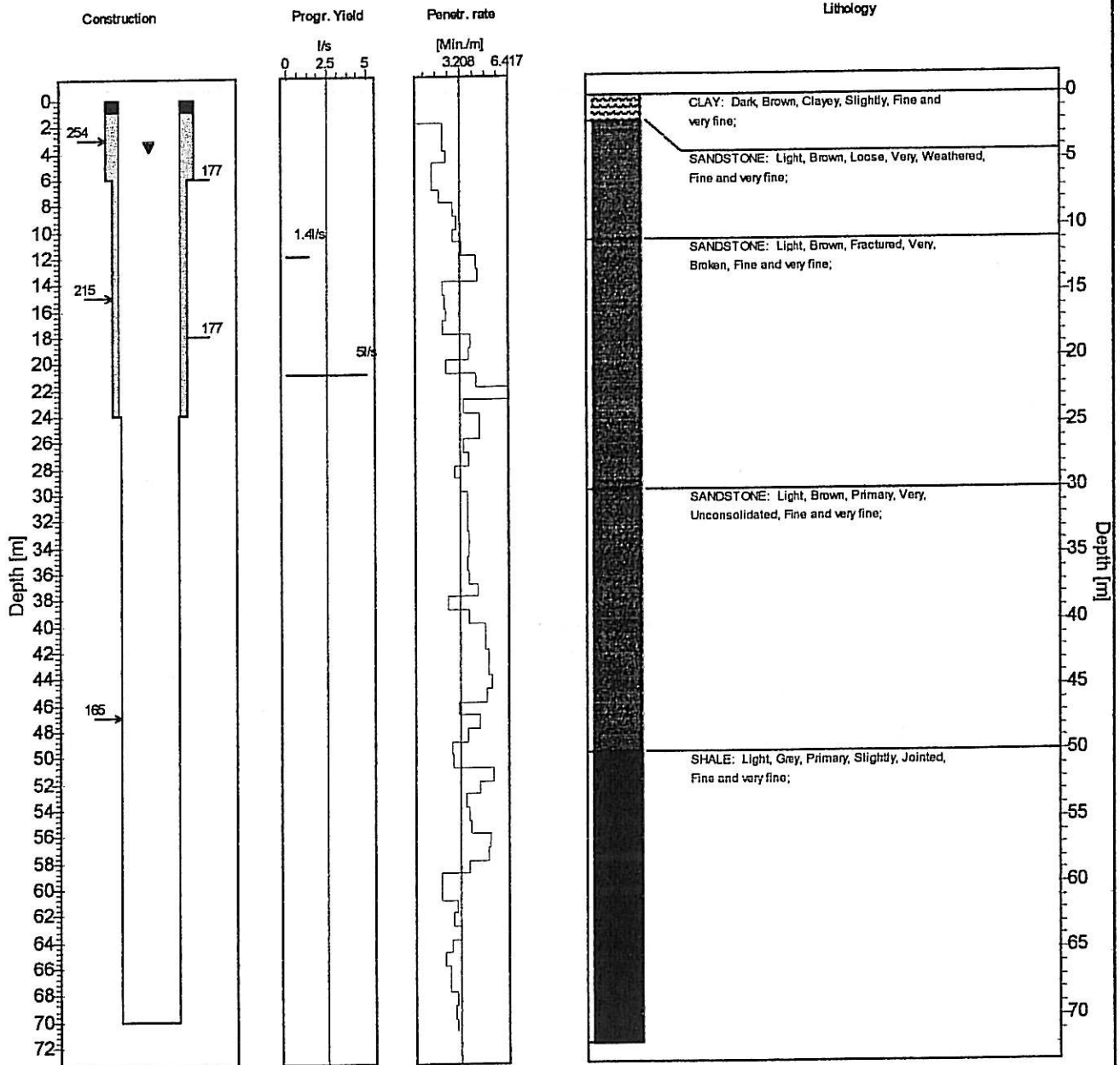
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BASIC SITE INFORMATION: Site Identifier: 3228CBV0025 Number: 110-0037 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KENTANE/DIS/AREA7

Longitude [°]: 28.4439152	Alt. No. 1:	Topo-set: Valley	Depth [m]: 70.01
Latitude [°]: 32.5468333	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.60
Altitude [m]:		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]		Sanitary seal
	Casing (plain/perforated, slotted)	← 152	Casing diameter [mm]		Drill cuttings
	Screen/ Mesh Screen	▼	Waterlevel measured: 30/05/03		
	Piezometer	0.50 →	Piezometer (Nr. & Diameter [mm])		



COMMENT:









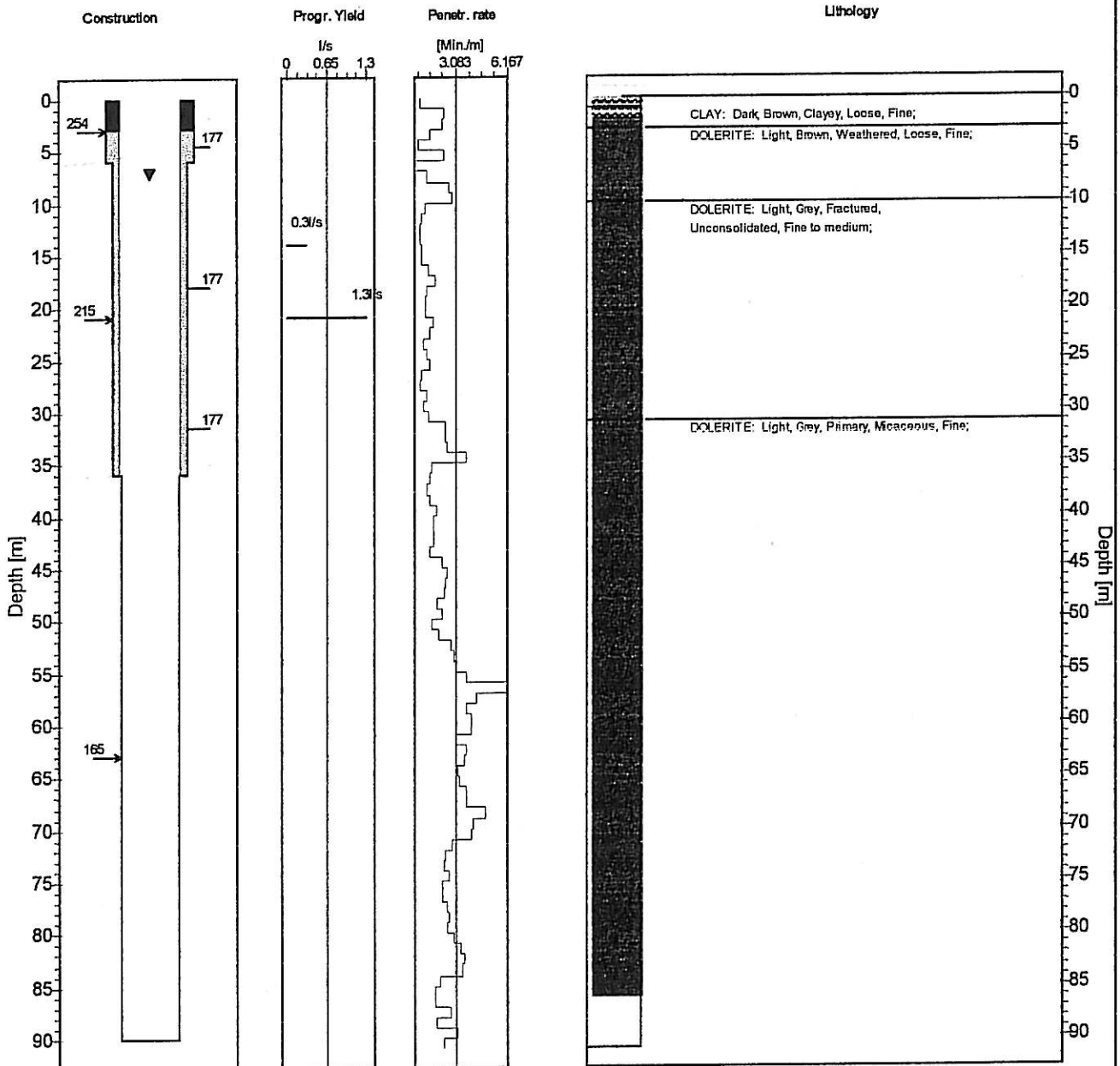
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BASIC SITE INFORMATION: Site Identifier: 3228ADV0016 Number: 110-0035 Site type: Borehole
 Distr./Farm No.: CENTANI Site Name/Descr.: KWAQITHI/CENTULI/DIS:/CENTANI

Longitude [°]: 28.3713034	Alt. No. 1:	Topo-set: Valley	Depth [m]: 88.96
Latitude [°]: 32.4130556	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 420.00		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]		Sanitary seal
	Casing (plain / perforated, slotted)	← 152	Casing diameter [mm]		Gravel (> 2mm)
	Screen/ Mesh Screen	▼	Water level measured: 25/05/03		
	Piezometer	0:50 →	Piezometer (Nr. & Diameter [mm])		



COMMENT:











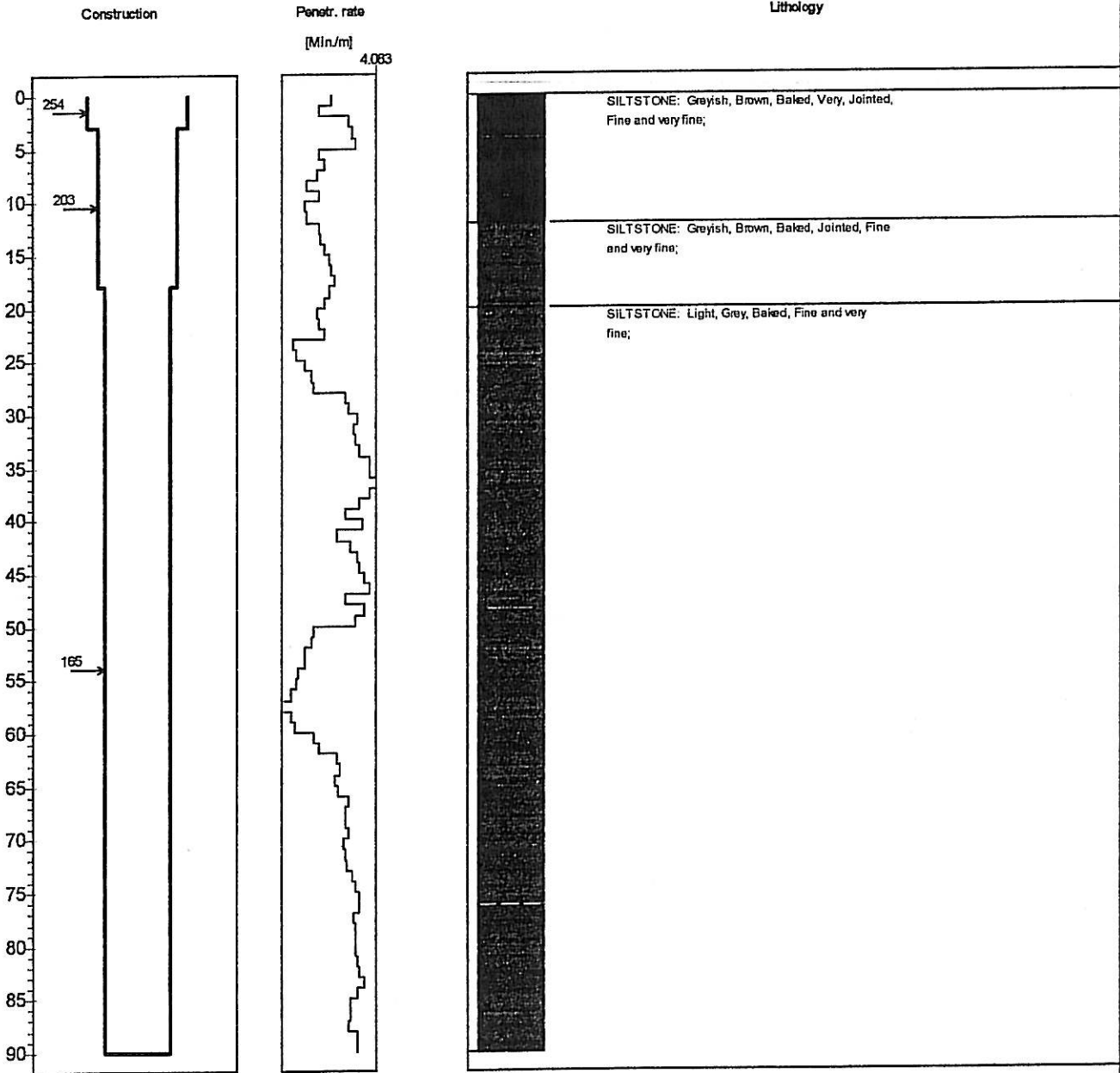
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BASIC SITE INFORMATION: Site Identifier: 3228CBV0028 Number: 110-0029 Site type: Borehole
 Distr./Farm No.: MAZEPPA Site Name/Descr.: KENTANI/DIS/JCINA

Longitude [°]: 28.5990550	Alt. No. 1:	Topo-set: Valley	Depth [m]: 65.00
Latitude [°]: 32.4783056	Alt. No. 2:	Site status: Destroyed	Collar h. [m]:
Altitude [m]:		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

- | | | | |
|---|--------------------------------------|---|----------------------------------|
|  | Hole |  | Hole diameter [mm] |
|  | Casing (plain / perforated, slotted) |  | Casing diameter [mm] |
|  | Screen/ Mesh Screen |  | Waterlevel with date meas. |
|  | Piezometer |  | Piezometer (Nr. & Diameter [mm]) |



COMMENT:



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Borehole Construction and Geological Log

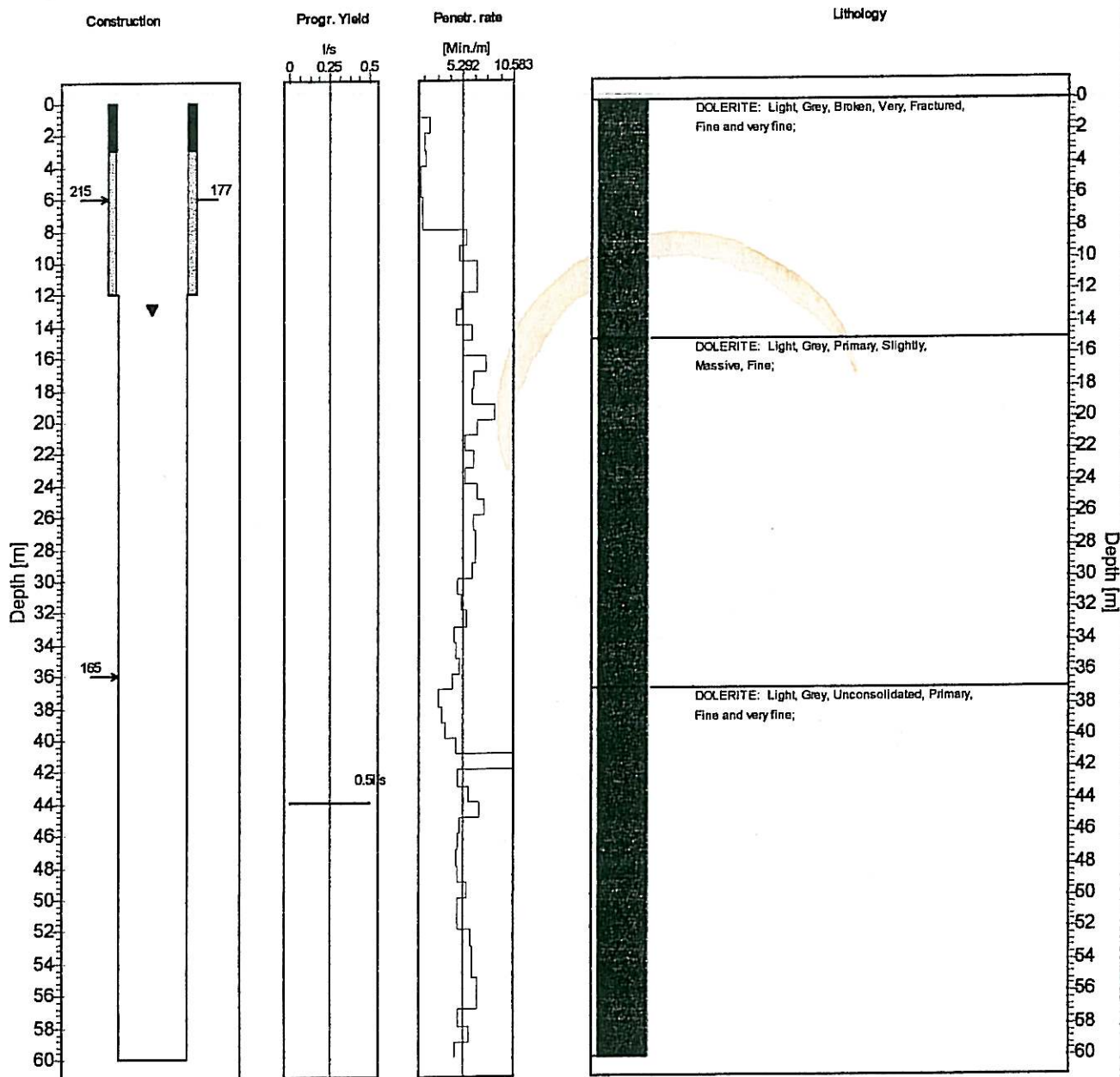
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CBV0030 Number: 110-0038 Site type: Borehole
 Distr./Farm No.: KENTANE Site Name/Descr.: KENTANI/DIS:/TAKAZI

Longitude [°]: 28.4084426	Alt. No. 1:	Topo-set.: In or along pan	Depth [m]: 59.49
Latitude [°]: 32.5417778	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.41
Altitude [m]:		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. Inst.: VSA

Construction and Geohydrological Legend

- Hole
- Casing (plain/perforated, slotted)
- Screen/ Mesh Screen
- Piezometer
- 165 → Hole diameter [mm]
- ← 152 Casing diameter [mm]
- ▼ Water level measured: 29/05/03
- 0.50 → Piezometer (Nr. & Diameter [mm])
- Sanitary seal
- ▨ Gravel (> 2mm)



COMMENT:


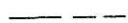

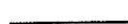


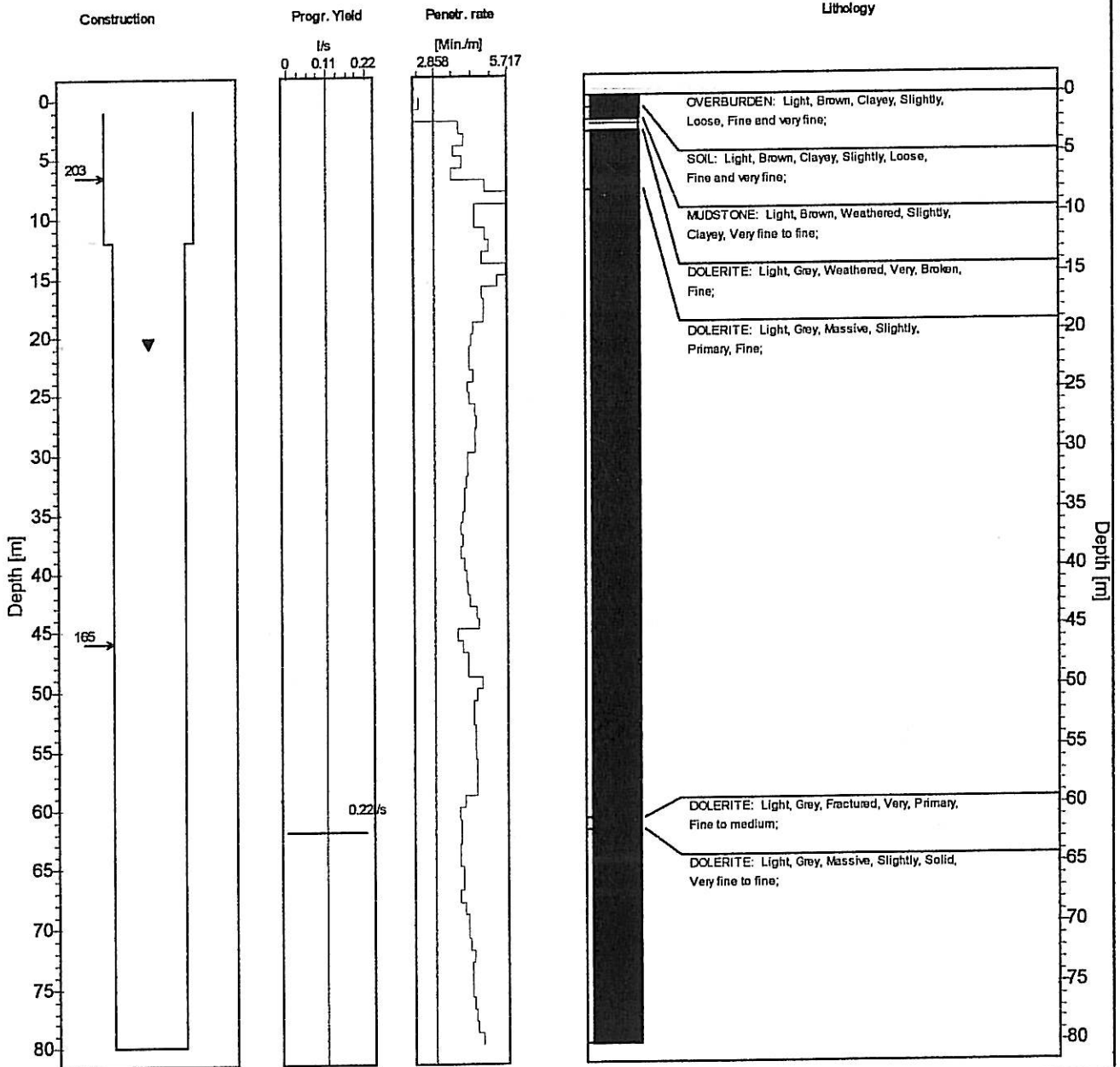
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BASIC SITE INFORMATION: Site Identifier: 3228BCV0052 Number: 110-0025 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KABAKAZI/AREA5/DIS:/KENTANI

Longitude [°]: 28.5358602	Alt. No. 1:	Topo-set.: Flat surface, plain	Depth [m]: 81.09
Latitude [°]: 32.4510000	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 258.00		Site purp.: Production (water-supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]
	Casing (plain / perforated, slotted)	← 152	Casing diameter [mm]
	Screen/ Mesh Screen	▼	Water level measured: 21/05/03
	Piezometer	0.50 →	Piezometer (Nr. & Diameter [mm])



COMMENT:











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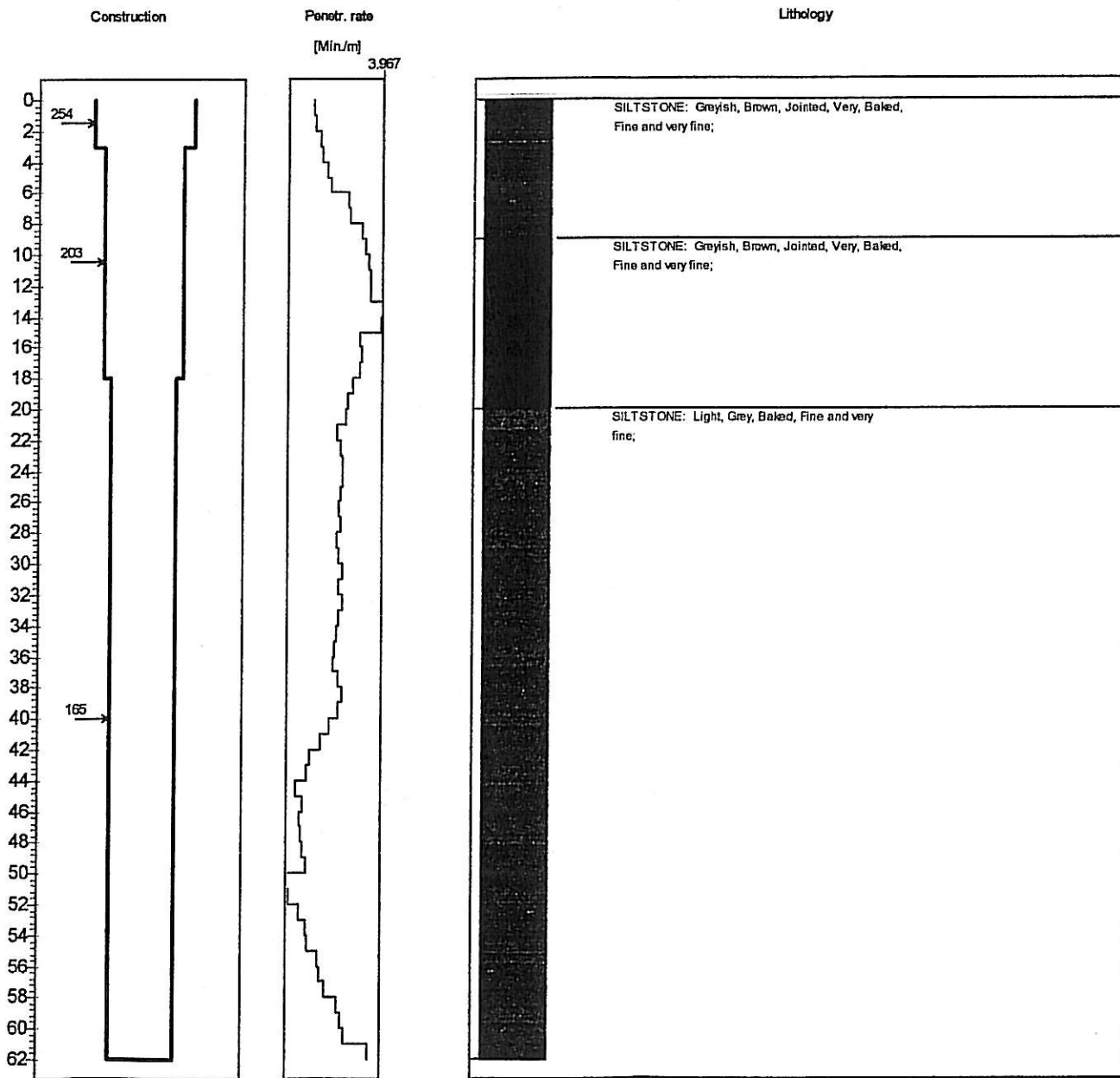
BASIC SITE INFORMATION: Site Identifier: 3228CBV0026 Number: 110-0027 Site type: Borehole

Distr./Farm No.: MAZEPPA Site Name/Descr.: KENTANI/DIS/JCINA

Longitude [°]: 28.5870549	Alt. No. 1:	Topo-set: Valley	Depth [m]: 62.00
Latitude [°]: 32.5866914	Alt. No. 2:	Site status: Destroyed	Collar h. [m]:
Altitude [m]:		Site purp.: Production (water-supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole		Hole diameter [mm]
	Casing (plain /perforated, slotted)		Casing diameter [mm]
	Screen/ Mesh Screen		Waterlevel with date meas.
	Piezometer		Piezometer (Nr. & Diameter [mm])



COMMENT:



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Borehole Construction and Geological Log

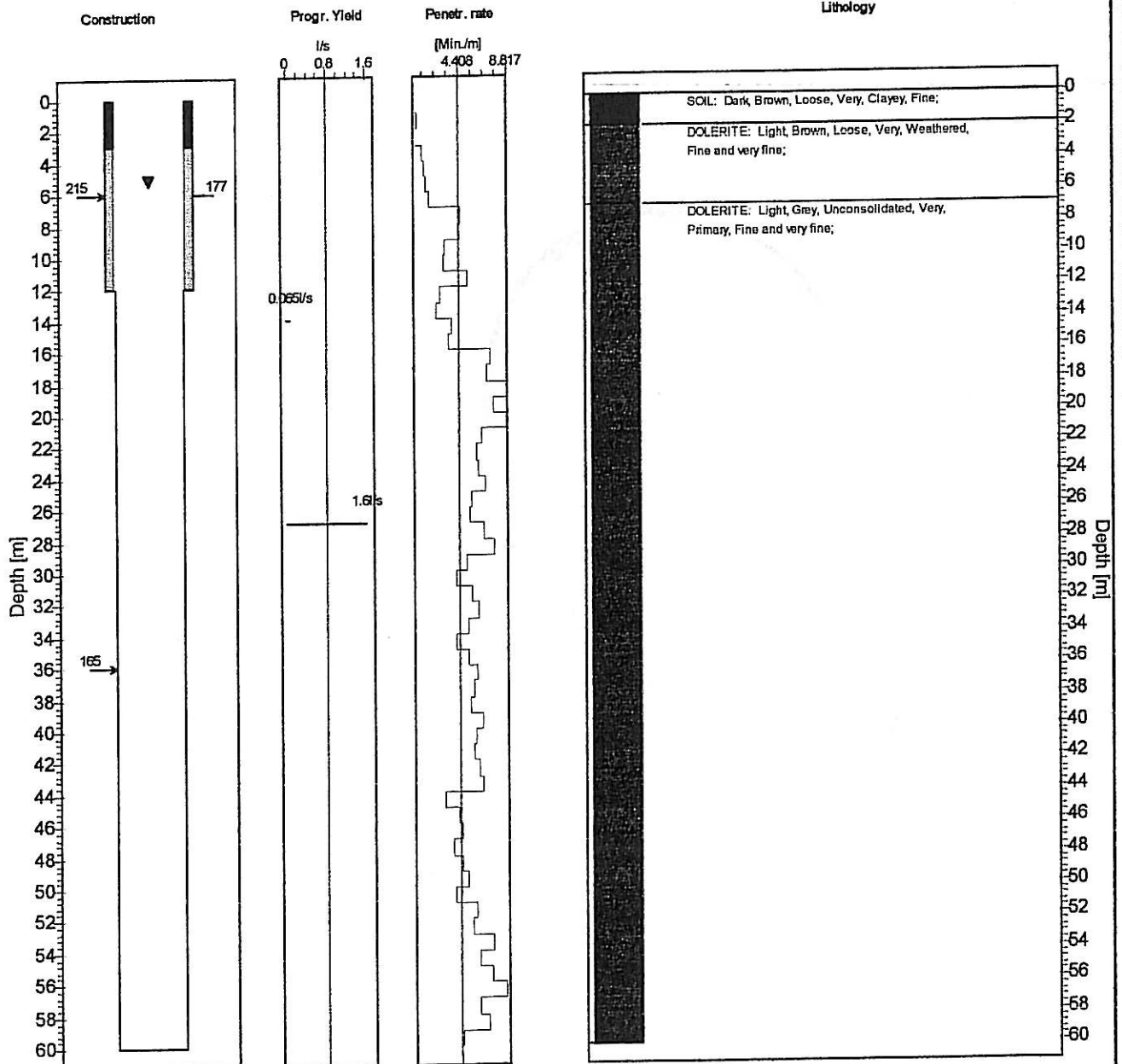
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0022 Number: 110-0039 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KENTANE/DIS:TAKAZI/AREA 7

Longitude [°]: 28.3363863	Alt. No. 1:	Topo-set: Valley	Depth [m]: 59.48
Latitude [°]: 32.4342778	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.37
Altitude [m]:		Site purp.: Production (water-supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole		Hole diameter [mm]		Sanitary seal
	Casing (plain/perforated, slotted)		Casing diameter [mm]		Drill cuttings
	Screen/ Mesh Screen		Water level measured: 31/05/03		
	Piezometer		Piezometer (Nr. & Diameter [mm])		



COMMENT:



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APPENDIX 5

Testing data

Borehole Construction and Geological Log

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228BCV0053 Number: 110-0028 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: GQUNQE/AREA5/DIS:/KENTANI

Longitude [°]: 28.5741660
 Latitude [°]: 32.4711944
 Altitude [m]: 214.00
 Coord. acc.: Accurate to within 100 units
 Coord. meth.: Global Positioning System

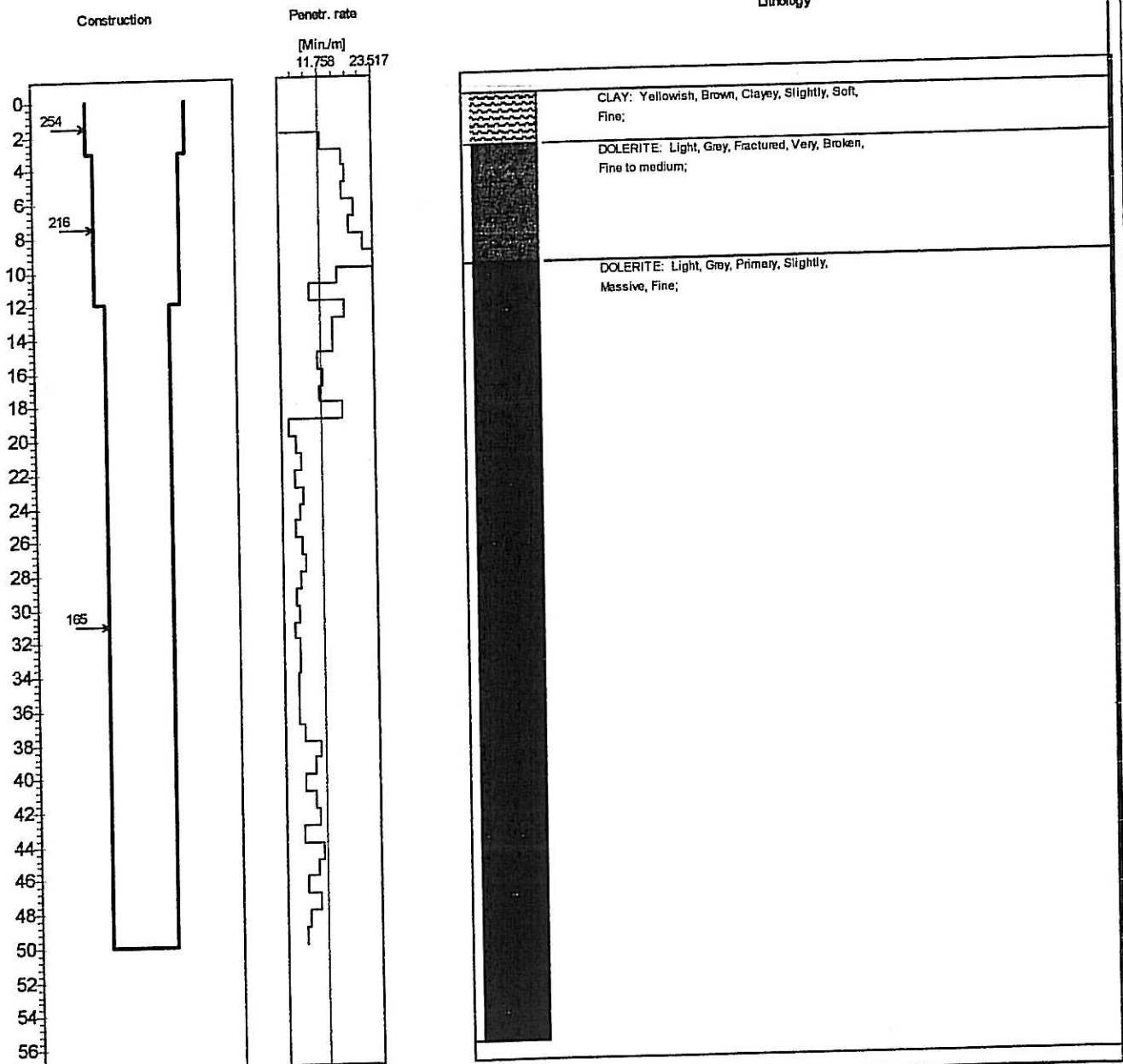
Alt. No. 1:
 Alt. No. 2:

Topo-set: Flat surface, plain
 Site status: Unused
 Site purp.: Production (water supply)
 Use applic.: Domestic - all purposes
 Equipment:

Depth [m]: 56.00
 Collar h. [m]:
 Drain. reg.:
 Diam. [mm]: 165
 Rep. inst.: VSA

Construction and Geohydrological Legend

- | | | | |
|--|------------------------------------|--------|----------------------------------|
| | Hole | 165 → | Hole diameter [mm] |
| | Casing (plain/perforated, slotted) | ← 152 | Casing diameter [mm] |
| | Screen/ Mesh Screen | ▼ | Water level with date meas. |
| | Piezometer | 0.50 → | Piezometer (Nr. & Diameter [mm]) |



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Borehole Construction and Geological Log

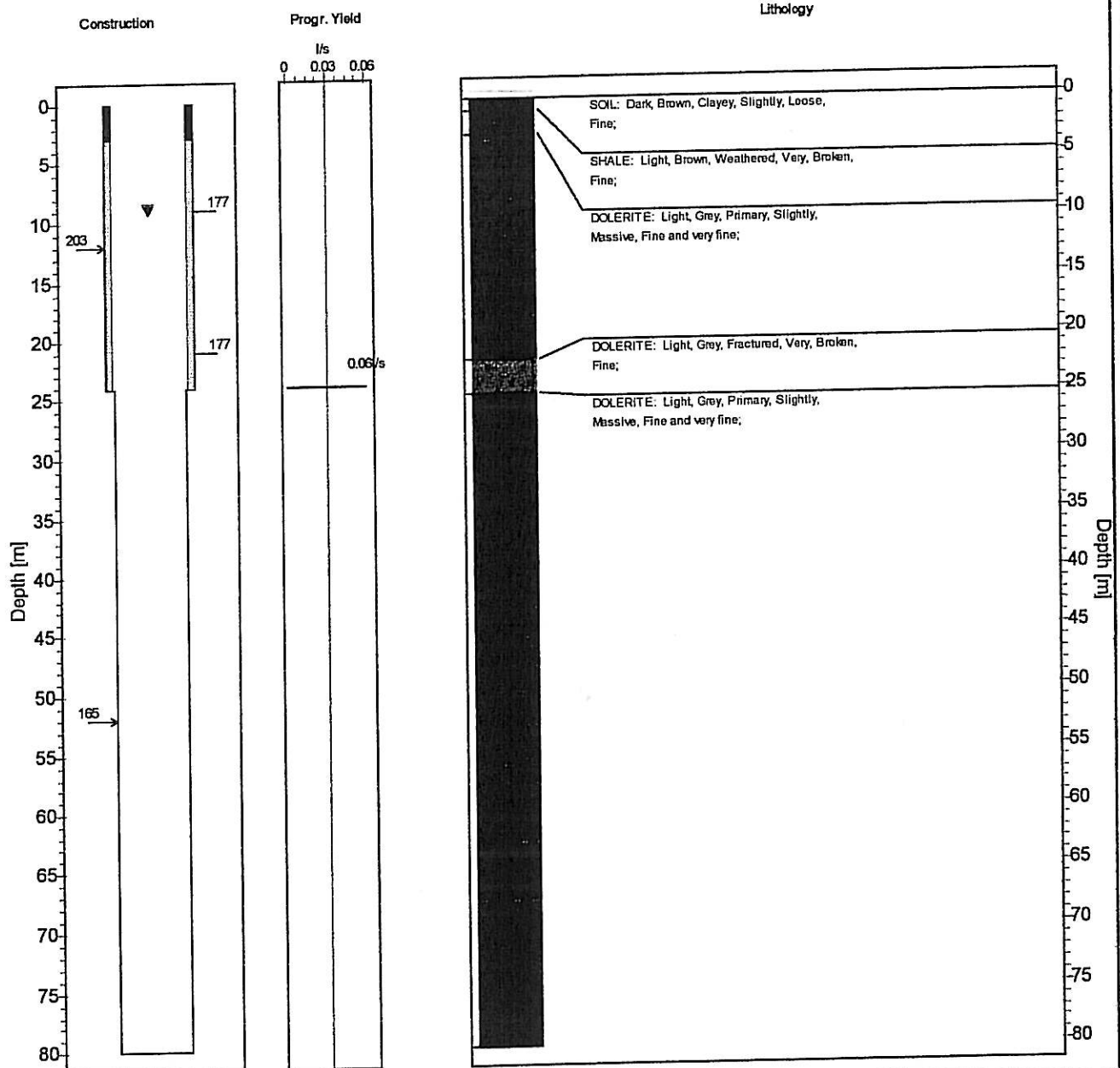
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228BCV0051 Number: 110-0024 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Descr.: KABAKAZI/AREAS/DIS/KENTANI

Longitude [°]: 28.5273046	Alt. No. 1:	Topo-set: Flat surface, plain	Depth [m]: 76.83
Latitude [°]: 32.4363889	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]: 298.00		Site-purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. Inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]		Sanitary seal
	Casing (plain/perforated, slotted)	← 152	Casing diameter [mm]		Gravel (> 2mm)
	Screen/ Mesh Screen	▼	Waterlevel measured: 24/05/03		
	Piezometer	0.50 →	Piezometer (Nr. & Diameter [mm])		



COMMENT:



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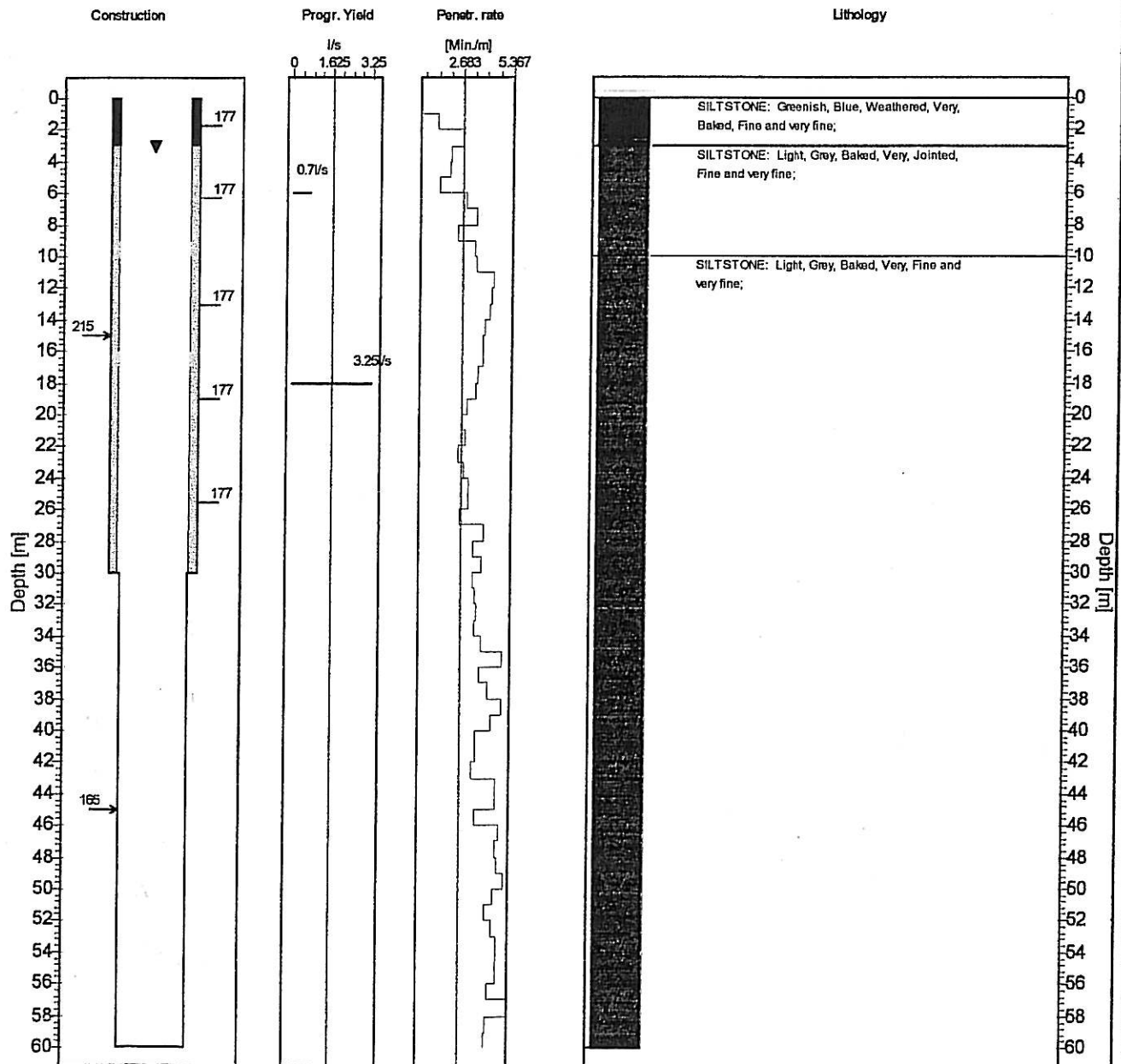
BASIC SITE INFORMATION: Site Identifier: 3228CBV0023 Number: 110-0036 Site type: Borehole

Distr./Farm No.: CENTANI Site Name/Descr.: AREA 7/DIS./KENTANI/E.CAPE

Longitude [°]: 28.4377762	Alt. No. 1:	Topo-set: Flat surface, plain	Depth [m]: 60.79
Latitude [°]: 32.5412500	Alt. No. 2:	Site status: Unused	Collar h. [m]: 0.50
Altitude [m]:		Site purp.: Production (water supply)	Drain. reg.:
Coord. acc.: Accurate to within 100 units		Use applic.: Domestic - all purposes	Diam. [mm]: 165
Coord. meth.: Global Positioning System		Equipment:	Rep. inst.: VSA

Construction and Geohydrological Legend

	Hole	165 →	Hole diameter [mm]		Sanitary seal
	Casing (plain/perforated, slotted)	← 152	Casing diameter [mm]		Gravel (> 2mm)
	Screen/ Mesh Screen	▼	Waterlevel measured: 26/05/03		
	Piezometer	0:50 →	Piezometer (Nr. & Diameter [mm])		



COMMENT:



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0021 Number: 110-0026 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: CENTULI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3673311	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 15.56
Latitude [°]: 32.4185833	Alt. No. 2:	Depth [m]: 80.93	WL status: Static
Altitude [m]: 0.50	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030516

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0026 Date sampled: 20030613 Depth sampl. [m]: 0 Comment:

Main Parameters:				Calculated Parameters:		Bacteriol. Parameters:		
pH:	8.43	Na:	95	Cl:	141	Langel.:	0.59	E.Coli:
EC: [mS/m]	73	K:	0.62	NO3 as N:	0.24	Aggr-Ind:	12.63	Faec. co: 0
TDS:	363	SI:		SO4:	2.9	Ion-bal:	-11.70	Total Co: 0
T. Alk.:	207	Al:		F:	0.17	CaCO3:	116.83	SPC:
Ca:	31	Fe:	0.546	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit				
Mg:	9.6	Mn:						

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield[l/s]	Method meas.	Aquifer type	Comment
32.00	32.00	0.22	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	24.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m³/d]	Storage	Comment
STEP TEST 1	20030516	60	68.00	0.23	16.45					
STEP TEST 2	20030516	60	68.00	0.40	21.90					
STEP TEST 3	20030516	60	68.00	0.80	35.60					
STEP TEST 4	20030516	23	68.00	1.51	65.61	15.56	76	180		
CONSTANT	20030516	720	68.00	0.29	30.11	9.03	70	720	1.1	0.00022

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	48.00	Hand	24	0.10	CLASS 1	27.11	38.00
Note:								
2	Hand pump	48.00	Hand	12	0.20	CLASS 1	27.11	38.00
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0016 Number: 110-0035 Site type: Borehole

Distr./Farm No.: CENTANI Site Name/Descr.: KWAQITHI/CENTULI/DIS/CENTANI

Longitude [°]: 28.3713034	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 7.14
Latitude [°]: 32.4130556	Alt. No. 2:	Depth [m]: 88.96	WL status: Static
Altitude [m]: 420.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030526

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]:
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0035	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:	
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:	
pH: 7.01	Na: 77	Cl: 158	Langel.: -0.43	E.Coli:
EC: [mS/m] 94	K: 2.1	NO3 as N: 0.04	Aggr-Ind: 11.65	Faec. co: 0
TDS: 469	Si:	SO4: 15	Ion-bal: -8.47	Total Co: 0
T. Alk.: 304	Al:	F: 0.43	CaCO3: 288.67	SPC:
Ca: 58	Fe: 15.011 ‡	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption		
Mg: 35	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit		
! Value exceeds recommended minimum limit Value exceeds minimum allowable limit				

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
14.00	14.00	0.30	Volumetric	Fractured	
21.00	21.00	1.30	Volumetric	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]:			Hor. Dist.	Vert. Dist.
						Length	Width			
0.00	9.00	177	Steel	4						
9.00	27.00	177	Steel	4						
27.00	36.00	177	Steel	4						

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030525	60	68.70	0.45	1.76						
STEP TEST 2	20030525	60	68.70	0.80	3.20						
STEP TEST 3	20030525	60	68.70	1.75	9.29						
STEP TEST 4	20030525	26	68.70	3.43	62.43	1.86	97	210			
CONSTANT	20030526	730	68.70	1.06	62.43	2.88	95	720			

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	24.00	Electric motor	24	0.40	CLASS 4	10.00	14.00

Note:

2	Mono-type pump	24.00	Electric motor	12	0.70	CLASS 4	10.00	14.00
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Note:



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/06/17

BASIC SITE INFORMATION: Site Identifier: 3228CBV0023 Number: 110-0036 Site type: Borehole

Distr./Farm No.: CENTANI Site Name/Descr.: AREA 7/DIS:/KENTANI/E.CAPE

Longitude [°]: 28.4377762	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 3.05
Latitude [°]: 32.5412500	Alt. No. 2:	Depth [m]: 60.79	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030527

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0036	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.06	Na: 89	Cl: 684 ‡	Langel.: -0.41
EC: [mS/m] 261	K: 1.5	NO3 as N: 2.4	Aggr-Ind: 11.75
TDS: 1.32	Si:	SO4: 33	Ion-bal: -41.39
T. Alk.: 357	Al:	F: 1.3	CaCO3: 371.67
Ca: 55	Fe: 0.315		SPC:
Mg: 57	Mn:		

Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield[l/s]	Method meas.	Aquifer type	Comment
6.00	6.00	0.70	Volumetric	Fractured	
18.00	18.00	3.25	Volumetric	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	3.50	177	Steel	4				
3.50	9.00	177	Steel	4				
10.00	16.00	177	Steel	4				
17.00	21.00	177	Steel	4				
21.00	30.00	177	Steel	4				

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	22.00	Electric motor	24	0.80	CLASS 3	6.75	12.00
Note:								
2	Mono-type pump	22.00	Electric motor	12	1.60	CLASS 3	6.75	12.00
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CBV0025 Number: 110-0037 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANE/DIS:AREA7

Longitude [°]: 28.4439152	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 3.57
Latitude [°]: 32.5468333	Alt. No. 2:	Depth [m]: 70.01	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.60	Date WL meas.: 20030531

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0037	Date sampled: 20030623	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.34	Na: 418 ±	Cl: 575	Langel.: -0.03
EC: [mS/m] 237	K: 2.6	NO3 as N: 0.01	Aggr-Ind: 12.15
TDS: 1190	Si:	SO4: 10	Ion-bal: 2.64
T. Alk.: 413	Al:	F: 1	CaCO3: 391.63
Ca: 63	Fe: 0.536	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 57	Mn:	† Value exceeds recommended maximum limit ± Value exceeds maximum allowable limit	
		! Value exceeds recommended minimum limit Value exceeds minimum allowable limit	

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
12.00	12.00	1.40	Notch (V- or U-notch)	Fractured	
21.00	21.00	5.00	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	12.00	177	Steel	4				
12.00	24.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] %	T [m ² /d]	Storage	Comment
STEP TEST 1	20030530	60	68.70	1.13	2.31				
STEP TEST 2	20030530	60	68.70	2.35	5.10				
STEP TEST 3	20030530	60	68.70	4.75	10.89				
STEP TEST 4	20030530	43	68.70	8.40	63.58	1.16 98	220		
CONSTANT	20030531	2880	68.70	2.61	11.16	0.89 92	2880	9.5	1.22E-5

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	27.60	Electric motor	24	1.30	CLASS 3	9.11	17.57
Note:								
2	Mono-type pump	27.60	Electric motor	12	2.70	CLASS 3	9.11	17.57
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CBV0030 Number: 110-0038 Site type: Borehole

Distr./Farm No.: KENTANE Site Name/Descr.: KENTANI/DIS:/TAKAZI

Longitude [°]: 28.4084426	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 12.95
Latitude [°]: 32.5417778	Alt. No. 2:	Depth [m]: 59.49	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.41	Date WL meas.: 20030529

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0038	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.92	Na: 197	Cl: 358	Langel.: 0.31
EC: [mS/m] 164	K: 3.8	NO3 as N: 0.02	Aggr-Ind: 12.44
TDS: 821	Si:	SO4: 28	Ion-bal: -5.21
T. Alk.: 293	Al:	F: 0.77	CaCO3: 313.81
Ca: 45	Fe: 1.063	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 49	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		‡ Value exceeds recommended minimum limit † Value exceeds minimum allowable limit	

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield[l/s]	Method meas.	Aquifer type	Comment
44.00	44.00	0.50	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]:	Hor. Dist.	Vert. Dist.
						Length	Width	
0.00	12.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m³/d]	Storage	Comment
STEP TEST 1	20030529	60	56.70	0.20	3.49						
STEP TEST 2	20030529	60	56.70	0.35	7.45						
STEP TEST 3	20030529	60	56.70	0.52	10.73						
STEP TEST 4	20030529	46	56.70	1.02	43.10	3.87	91	240			



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0022 Number: 110-0039 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANE/DIS:/TAKAZI/AREA 7

Longitude [°]: 28.3363863	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 6.84
Latitude [°]: 32.4342778	Alt. No. 2:	Depth [m]: 59.48	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.37	Date WL meas.: 20030531

EXISTING EQUIPMENT:

Pump: _____ Pulley Diam. [mm]: _____
 Type of Inst.: _____ Depth to Intk. [m]: _____
 Manufacturer: _____

Engine: _____ Power Rating [kW]: _____
 Manufacturer: _____ Pulley Diam. [mm]: _____
 Type of Power: _____

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0039	Date sampled: 20030623	Depth sampl. [m]: 0	Comment:	
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:	
pH: 7.22	Na: 364	Cl: 629 ‡	Langel.: -0.20	E.Coli:
EC: [mS/m] 231	K: 3.7	NO3 as N: 0.13	Aggr-Ind: 11.98	Faec. co: 47
TDS: 1160	Si:	SO4: 2.8	Ion-bal: -2.46	Total Co: 81
T. Alk.: 362	Al:	F: 0.87	CaCO3: 398.23	SPC:
Ca: 64	Fe: 0.524	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption		
Mg: 58	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit		
! Value exceeds recommended minimum limit Value exceeds minimum allowable limit				

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield[l/s]	Method meas.	Aquifer type	Comment
14.00	14.00	0.07	Notch (V- or U-notch)	Fractured	
27.00	27.00	1.60	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	12.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m²/d]	Storage	Comment
STEP TEST 1	20030531	60	56.70	0.22	2.23					
STEP TEST 2	20030531	60	56.70	0.40	4.04					
STEP TEST 3	20030531	60	56.70	0.98	20.03					
STEP TEST 4	20030531	60	56.70	2.09	52.83	1.78	97	210		
CONSTANT	20030531	1440	56.70	0.62	25.91	0.32	99	1440	2.3	3.13E-6

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	35.00	Hand	24	0.10	CLASS 3	10.23	25.00

Note:

2 Hand pump

35.00 Hand

12

0.30 CLASS 3

10.30

25.00

Note:



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APPENDIX 6B

EXISTING BOREHOLES

MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228CBV0022 Number: 110-0004 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANI/DIS:/DEBESE

Longitude [°]: 28.4480541	Alt. No. 1: G 42272	Diam. [mm]: 165	Water lev. [m]: 9.96
Latitude [°]: 32.5944722	Alt. No. 2:	Depth [m]: 84.60	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.12	Date WL meas.: 20030429

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]:
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: In use
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0004	Date sampled: 20030611	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.18	Na: 165	Cl: 181	Langel.: -0.60
EC: [mS/m] 115	K: 1.8	NO3 as N: 0.02	Aggr-Ind: 11.51
TDS: 577	Si:	SO4: 40	Ion-bal: -11.83
T. Alk.: 355	Al:	F: 0.78	CaCO3: 154.48
Ca: 24	Fe: 0.314	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 23	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		! Value exceeds recommended minimum limit Value exceeds minimum allowable limit	

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030428	60	74.40	2.00	2.02						
STEP TEST 2	20030428	60	74.40	4.15	3.36						
STEP TEST 3	20030428	60	74.40	6.03	4.54						
STEP TEST 4	20030428	60	74.40	8.31	7.59	2.32	69	240			
CONSTANT	20030429	1440	74.40	5.05	64.70	6.19	90	1440	10.5	0.00723	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	29.40	Electric motor	24	1.30	CLASS 3	12.00	19.35
Note:								
2	Mono-type pump	29.40	Electric motor	12	2.50	CLASS 3	12.00	19.35
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228CBV0029 Number: 110-0006 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANI/DIS:/MRAWUZELI

Longitude [°]: 28.2061623	Alt. No. 1: 42273	Diam. [mm]: 165	Water lev. [m]: 6.56
Latitude [°]: 32.4150000	Alt. No. 2:	Depth [m]: 57.42	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.38	Date WL meas.: 20030502

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0006	Date sampled: 20030609	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 6.9	Na: 43	Cl: 45	Langel.: -3.11
EC: [mS/m] 43	K: 0.69	NO3 as N: 0.76	Aggr-Ind: 8.77
TDS: 214	Si:	SO4: 3.6	Ion-bal: 46.82 ‡
T. Alk.: 1.36	Al:	F: 0.25	CaCO3: 104.25
Ca: 22	Fe: 0.157		
Mg: 12	Mn:		

Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030501	60	50.00	2.21	0.90						
STEP TEST 2	20030501	60	50.00	3.91	1.54						
STEP TEST 3	20030501	60	50.00	5.91	2.29						
STEP TEST 4	20030501	60	50.00	8.11	3.25						
STEP TEST 5	20030501	60	50.00	11.64	4.75	0.08	98	300			
CONSTANT	20030501	2880	50.00	4.93	3.04	0.08	97	1560	34.5	0.00419	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	20.50	Electric motor	24	3.70	CLASS 2	8.78	10.50
Note:								
2	Mono-type pump	20.50	Electric motor	12	7.40	CLASS 2	8.78	10.50
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228CBV0021 Number: T32908 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANI/DIS:/MAXHAMA

Longitude [°]: 28.3197195	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 0.76
Latitude [°]: 32.5814444	Alt. No. 2:	Depth [m]: 28.40	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.45	Date WL meas.: 20030426

EXISTING EQUIPMENT:

Pump:		USE APPLICATION:	
Type of Inst.:	Pulley Diam. [mm]:	Site Status:	Unused
Manufacturer:	Depth to Intk. [m]:	Purpose:	Production (water supply)
Engine:		Consumer:	Non-urban
Manufacturer:	Power Rating [kW]:	Application:	Domestic - all purposes
Type of Power:	Pulley Diam. [mm]:		

WATER CHEMISTRY:

Sample No.: T 32908	Date sampled: 20030609	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.18	Na: 28	Cl: 57	Langel.: -1.18
EC: [mS/m] 31	K: 0.38	NO3 as N: 0.64	Aggr-Ind: 10.76
TDS: 157	Si:	SO4: 2.9	Ion-bal: -8.90
T. Alk.: 85	Al:	F: 0.04	CaCO3: 81.52
Ca: 18	Fe: 0.0099	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 8.9	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		! Value exceeds recommended minimum limit † Value exceeds minimum allowable limit	

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m³/d]	Storage	Comment
STEP TEST 1	20030425	60	26.50	0.61	3.25					
STEP TEST 2	20030425	60	26.50	1.01	5.29					
STEP TEST 3	20030425	60	26.50	1.45	8.24					
STEP TEST 4	20030425	60	26.50	1.98	11.39	0.43	96	300		
CONSTANT	20030426	2880	26.50	1.99	17.60	0.47	97	2880	4.5	5.13E-5

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	22.00	Electric motor	24	0.50	CLASS 2	5.07	12.00
Note:								
2	Mono-type pump	22.00	Electric motor	12	1.00	CLASS 2	5.07	12.00
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228ADV0015 Number: T32927 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANI/DIS/TEKOKOMA

Longitude [°]: 28.2696910	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 5.25
Latitude [°]: 32.3441667	Alt. No. 2:	Depth [m]: 36.29	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.12	Date WL meas.: 20030505

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: In use
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: T32927	Date sampled: 20030609	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 6.92	Na: 39	Cl: 74	Langel.: -1.14
EC: [mS/m] 63	K: 0.42	NO3 as N: 7.3	Aggr-Ind: 10.84
TDS: 317	Si:	SO4: 6.9	Ion-bal: 4.45
T. Alk.: 102	Al:	F: 0.12	CaCO3: 176.93
Ca: 33	Fe: 0.15		
Mg: 23	Mn:		

Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030505	60	32.70	0.85	0.83					
STEP TEST 2	20030505	60	32.70	1.01	3.29					
STEP TEST 3	20030505	60	32.70	1.56	5.89					
STEP TEST 4	20030505	38	32.70	2.52	28.70	0.62	98	210		
CONSTANT	20030505	1440	32.70	1.16	8.16	0.67	92	1440	3.5	0.00022

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	21.60	Hand	24	0.40	CLASS 1	7.17	11.63
Note:								
2	Mono-type pump	21.60	Electric motor	12	0.80	CLASS 1	7.17	11.63
Note:								



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APPENDIX 7

Chemical analysis & Graphs

Chemical analyses of water

Borehole No.	110-0020						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	731.00	1	450	1000	2400	5000	3400
pH	7.27	0	6-9.5	6.5-8.5	4-4.5 or 10-10.5	4-7	<3 or >11
Turbidity (NTU)	2.60	2	0-10	100	20.00	50	50.00
EC (mS/m)	148.00	1	70	350	370	1000	520
Alkalinity	304.00						600
Total hardness (T.H.)	287.00	1	200	350	600	1000	300
Calcium (Ca)	49.00	0	80	100	300	500	400
Magnesium (Mg)	40.00	0	70	100	200	300	400
Sodium (Na)	167.00	1	100	300	400	1000	1000
Iron (Fe)	0.26	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	10.00	40
Nitrate (as N)	1.00	0	6	10	20	100	1200
Chloride (Cl)	162.00	1	100	200	600	1000	350
Fluoride (F)	0.44	0	0.70	1.00	1.50	3.00	1000
Sulphate (SO4)	2.90	0	200	300	600	1000	1000
Total coliforms (T.col)	3.00	1	0	10	10	100	100
Faecal coliforms (Fc)	0.00	-	0	10	100	100	500
Potassium (K)	1.70	0	25	50	100	100	20
Zinc (Zn)		-	3	10	10	100	2.00
Arsenic (As)		-	0.01	0.05	0.20	0.50	0.05
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	16.00
Copper (Cu)		-	1.00	1.00	2.00	5.00	

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/21

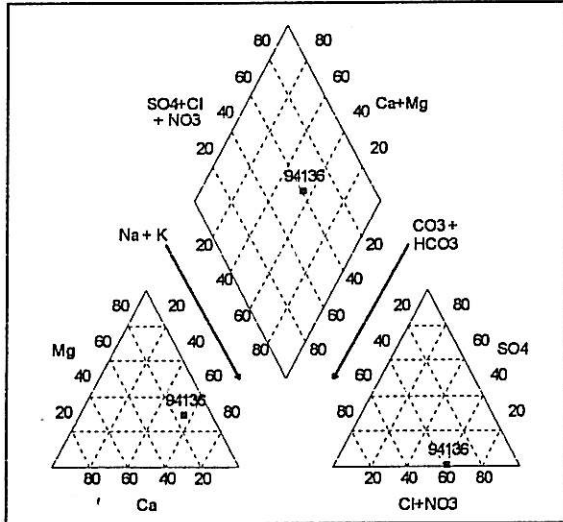
BASIC SITE INFORMATION: Site Identifier: 3228ADV0018 Number: 110-0021 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: NQANDA/AREA4/DIS:/KENTANI

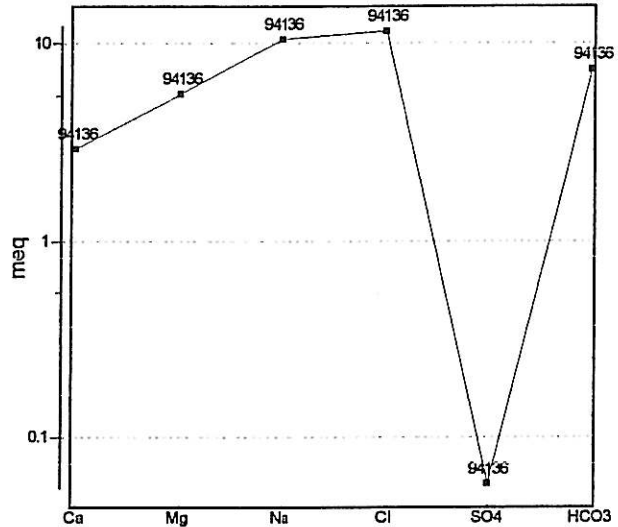
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3365252	Reg./BB.:	Topo-set.:	Flat surface, plain	Depth [m]:	55.73
Latitude [°]:	32.4332778	G-Nr.:	Site status:	Unused	Col. ht. [m]:	0.51
Altitude [m]:	358.00		Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94136	110-0021			20030623	0000		0	20030623	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94136	7.55	190	59	68	241	4.1		369		
Chem. ref. nr.	Si	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94136		410	2.8	0.01	0.6					0.407

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94136											0.03
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94136											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94136												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som. E.Coll	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94136	0	2					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94136					21	3.7					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94136	1233.70	1330.00	19.13	19.04	0.23	426.89	369.00	279.89	12.28	0.14	1.58	5.07

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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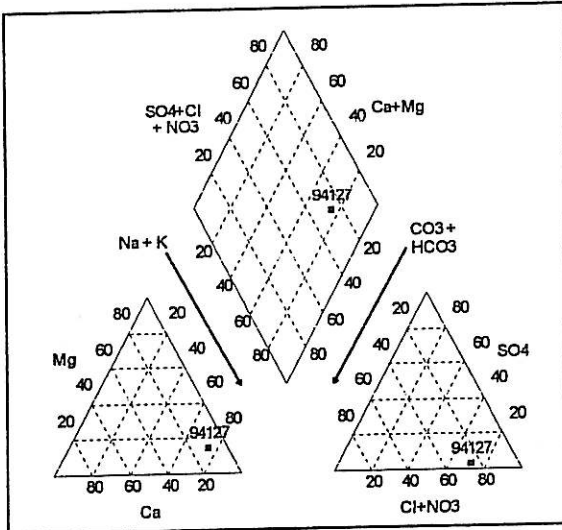
CHEMISTRY REPORT

Date compiled: 2003/07/21

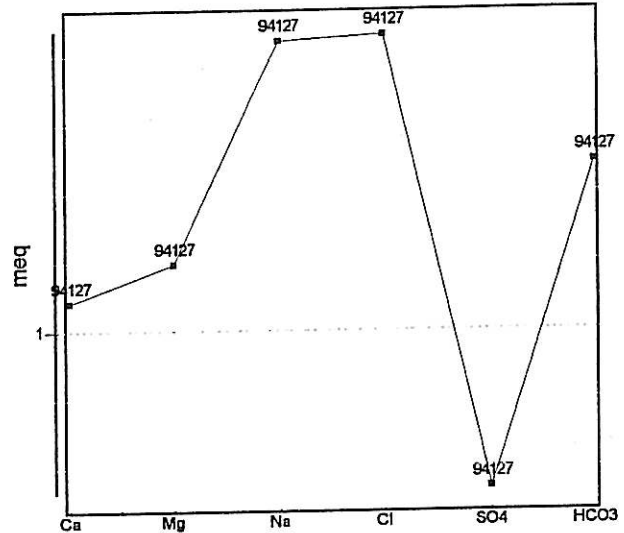
BASIC SITE INFORMATION: Site Identifier: 3228BCV0051 Number: 110-0024 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KABAKAZI/AREA5/DIS:/KENTANI
 Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.5273046	Reg./BB.:	Topo-set.:	Flat surface, plain	Depth [m]:	76.83
Latitude [°]:	32.4363889			Site status:	Unused	Col. ht. [m]:
Altitude [m]:	298.00	G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94127	110-0024			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94127	6.92	135	677	25	20	197	2.2	173		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94127		317	15	4	0.49					3.168

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94127											0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94127											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94127												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94127		470		220					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94127					21.1	25 ±					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94127	806.35	945.00	11.52	13.03	-6.14	144.63	144.63	82.32	10.95	-1.14	2.67	7.13

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.	110-0024						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	677.00	1	450	300	2400		3400
pH	6.92	0	6-9.5	5.5-7.0	4-4.5 or 10-10.5		<3 or >11
Turbidity (NTU)	25.00	3	0-10	100	20.00		50.00
EC (mS/m)	135.00	1	70	150	370		520
Alkalinity	173.00						
Total hardness (T.H.)	144.00	0	200	300	600		600
Calcium (Ca)	25.00	0	80	100	300		300
Magnesium (Mg)	20.00	0	70	100	200		400
Sodium (Na)	197.00	1	100	200	400		1000
Iron (Fe)	3.17	2	0.50	1.00	5.00		10.00
Manganese (Mn)		-	0-10	0-40	4.00		10.00
Nitrate (as N)	4.00	0	5	10	20		40
Chloride (Cl)	317.00	2	100	200	600		1200
Fluoride (F)	0.49	0	0.70	1.20	1.50		3.50
Sulphate (SO4)	15.00	0	200	400	600		1000
Total coliforms (T.col)	220.00	3	0	10	100		1000
Faecal coliforms (Fc)	470.00	4	0	10	10		100
Potassium (K)	2.20	0	25	50	100		500
Zinc (Zn)		-	3	10	10		20
Arsenic (As)		-	0.01	0.05	0.20		2.00
Cadmium (Cd)		-	0.00	0.01	0.02		0.05
Copper (Cu)		-	1.00	3.00	2.00		15.00

Class of water **4**

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/21

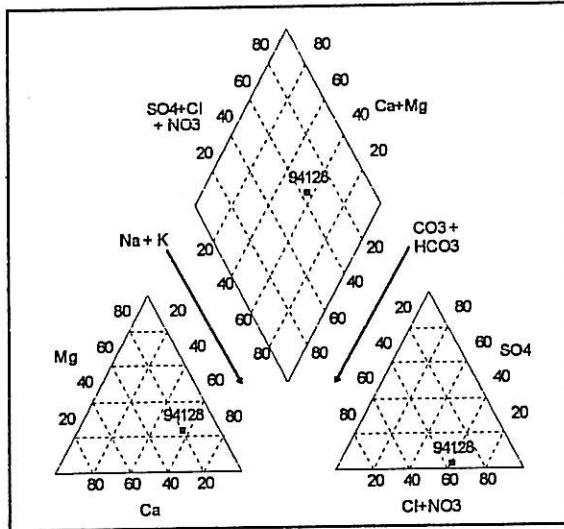
BASIC SITE INFORMATION: Site Identifier: 3228BCV0052 Number: 110-0025 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KABA KAZI/AREA5/DIS:/KENTANI

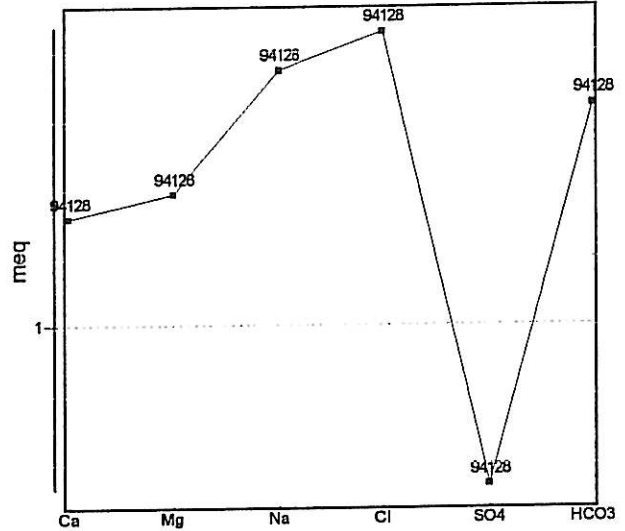
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.5358602	Reg./BB.:	Topo-set:	Flat surface, plain	Depth [m]:	81.09
Latitude [°]:	32.4510000		Site status:	Unused	Col. ht. [m]:	0.50
Altitude [m]:	258.00	G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94128	110-0025			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m								P. Alk.	T. Alk.	P. Acid.	M. Acid.
Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K					
94128	7.05	116	578	42	30	132	2.5		226		

Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94128		265	16	0.05	0.77					0.632

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94128											0.029

Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd
94128										

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94128												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coli	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94128		0		3					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94128					21	8.9					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94128	762.73	812.00	10.37	12.37	-8.81	228.18	226.00	123.48	11.42	-0.66	1.73	3.80

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 ! Value exceeds recommended minimum limit
 ; Value exceeds minimum allowable limit



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CHEMISTRY REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0020 Number: 110-0023 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KWAQHITI/AREA2/DIS:/KENTANI

Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

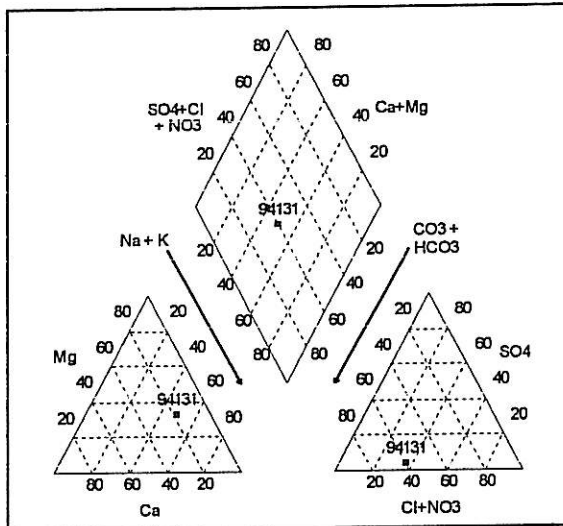
Longitude 28.3704423
 Latitude [°]: 32.4059444
 Altitude [m]: 426.00
 Coord. acc.: Accurate to within 100 units
 Coord. meth.: Global Positioning System

Reg./BB.:
 G-Nr.:

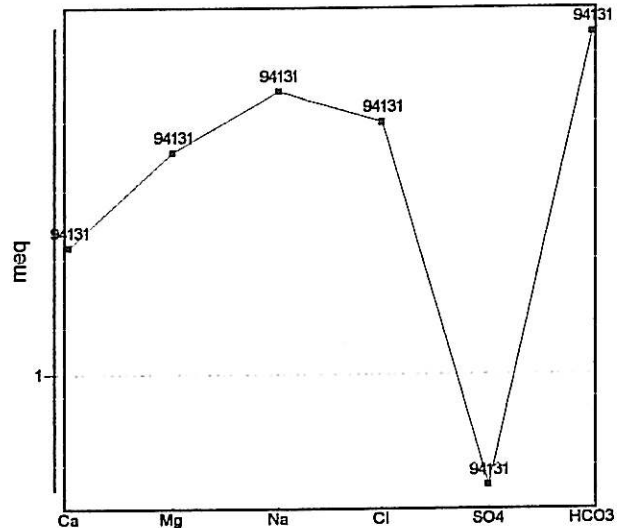
Topo-set.: Valley
 Site status: Unused
 Site purp.: Production (water supply)
 Use applic.: Domestic - all purposes
 Equipment:

Depth [m]: 97.73
 Col. ht. [m]: 0.50
 Drain. reg.:
 Diam. [mm]: 165
 Rep. inst.: VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date saml.	Time samp.	Time pump.	Depth saml. [m]	Date analysed	Laboratory
94131	110-0023			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94131	7.07	115	44	48	132	1.5		412		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94131		169	24	0.03	0.6					0.542

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	BI	Cu	Pb
94131											0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94131											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94131												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som.	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94131	0	0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94131		22.4	3.7					

CALCULATED PARAMETERS:

Chem. ref. nr.	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR		
94131	919.95	805.00	11.92	13.54	-6.35	307.20	307.20	197.57	11.73	-0.39	0.64	3.28

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.	110-0023						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	575.00	1	450	1000	2400	3000	3400
pH	7.07	0	6-8.5	6.5-8.5	4-4.5 or 10-10.5	3-3.5	<3 or >11
Turbidity (NTU)	3.70	2	0-10	10	20.00	30	50.00
EC (mS/m)	115.00	1	70	150	370	450	520
Alkalinity	412.00	-	-	-	-	-	600
Total hardness (T.H.)	308.00	2	200	300	600	750	900
Calcium (Ca)	44.00	0	80	100	300	350	400
Magnesium (Mg)	48.00	0	70	100	200	250	300
Sodium (Na)	132.00	1	100	200	400	500	1000
Iron (Fe)	0.54	1	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)	-	-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	0.03	0	5	10	20	20	40
Chloride (Cl)	169.00	1	100	200	600	750	1200
Fluoride (F)	0.60	0	0.70	1.00	1.50	1.50	3.50
Sulphate (SO4)	24.00	0	200	400	600	1000	1000
Total coliforms (T.col)	0.00	-	0	10	10	100	100
Faecal coliforms (Fc)	0.00	-	0	1	10	100	500
Potassium (K)	1.50	0	25	50	100	100	20
Zinc (Zn)	-	-	3	5	10	10	20
Arsenic (As)	-	-	0.01	0.05	0.20	0.20	0.05
Cadmium (Cd)	-	-	0.00	0.01	0.02	0.02	0.05
Copper (Cu)	-	-	1.00	1.00	2.00	2.00	16.00

Class of water 2

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0017 Number: 110-0019 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTULI/AREA 4/DIS:/KENTANI

Longitude [°]: 28.3451642	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 0
Latitude [°]: 32.4344444	Alt. No. 2:	Depth [m]: 43.31	WL status: Static
Altitude [m]: 358.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030521

EXISTING EQUIPMENT:

Pump:		Pulley Diam. [mm]:
Type of Inst.:		Depth to Intk. [m]:
Engine:		Power Rating [kW]
Manufacturer:		Pulley Diam. [mm]:
Type of Power:		

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0019	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.26	Na: 121	Cl: 200	Langel.: -0.40
EC: [mS/m] 108	K: 1.7	NO3 as N: 0.01	Aggr-Ind: 11.69
TDS: 539	Si: 15	SO4: 15	Ion-bal: -9.95
T. Alk.: 274	Al: 0.275	F: 0.61	CaCO3: 204.24
Ca: 39	Fe: 0.275		
Mg: 26	Mn:		

Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
16.00	16.00	4.00	Notch (V- or U-notch)	Fractured	
23.00	23.00	16.00	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	Depth to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	18.00	177	Steel	4				
18.00	24.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] % [min]	T [m³/d]	Storage	Comment
STEP TEST 1	20030520	60	39.68	4.20	0.52				
STEP TEST 2	20030520	60	39.68	8.63	1.32				
STEP TEST 3	20030520	60	39.68	12.35	2.68				
STEP TEST 4	20030520	60	39.68	24.32	6.29	1.52 76 240			
CONSTANT	20030521	4320	39.68	15.17	10.77	1.89 82 4320	54.9	0.00188	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	24.00	Electric motor	24	6.30	CLASS 2	4.43	15.00

Note:

2	Mono-type pump	24.00	Electric motor	12	12.50	CLASS 2	4.43	15.00
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Note:



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Chemical analyses of water

Borehole No.		110-0025					
Project		Kentani					
District		Kentani					
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	578.00	1	450	600	2400		3400
pH	7.05	0	5-9.5	7-8.5 or 9-10	4-4.5 or 10-10.5		<3 or >11
Turbidity (NTU)	8.90	2	0-10	10	20.00		50.00
EC (mS/m)	116.00	1	70	100	370		620
Alkalinity	226.00						600
Total hardness (T.H.)	229.00	1	200	300	600		300
Calcium (Ca)	42.00	0	80	100	300		400
Magnesium (Mg)	30.00	0	70	100	200		400
Sodium (Na)	132.00	1	100	200	400		1000
Iron (Fe)	0.83	1	0.50	1.00	5.00		10.00
Manganese (Mn)		-	0.10	0.40	4.00		10.00
Nitrate (as N)	0.05	0	5	10	20		40
Chloride (Cl)	265.00	2	100	200	600		1200
Fluoride (F)	0.77	1	0.70	1.40	1.50		3.50
Sulphate (SO4)	16.00	0	200	200	600		1000
Total coliforms (T.col)	3.00	1	0	10	100		100
Faecal coliforms (Fc)	0.00	-	0	10	100		500
Potassium (K)	2.50	0	25	50	10		25
Zinc (Zn)		-	2	10	10		20
Arsenic (As)		-	0.01	0.05	0.20		0.05
Cadmium (Cd)		-	0.00	0.01	0.02		0.05
Copper (Cu)		-	1.00	1.00	2.00		15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CDV0001 Number: 110-0020 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: CENTULI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3515532	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 4.24
Latitude [°]: 32.4248333	Alt. No. 2:	Depth [m]: 77.10	WL status: Static
Altitude [m]: 366.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030510

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0020	Date sampled: 20030613	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.27	Na: 167	Cl: 162	Langel.: -0.25
EC: [mS/m] 146	K: 1.7	NO3 as N: 1	Aggr-Ind: 11.84
TDS: 731	Si: 2.8	SO4: 2.8	Ion-bal: 9.40 †
T. Alk.: 304	Al: 0.44	F: 0.44	CaCO3: 286.77
Ca: 49	Fe: 0.264	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 40	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		! Value exceeds recommended minimum limit † Value exceeds minimum allowable limit	

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
22.00	22.00	0.90	Notch (V- or U-notch)	Fractured	
32.00	32.00	4.10	Notch (V- or U-notch)	Fractured	
62.00	62.00	17.00	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	13.40	177	Steel	4				
13.40	65.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery %	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030510	60	57.68	5.28	2.70					
STEP TEST 2	20030510	60	57.68	12.69	7.56					
STEP TEST 3	20030510	60	57.68	18.05	12.62					
STEP TEST 4	20030510	60	57.68	22.52	19.44	0.58	97	180		
CONSTANT	20030510	4320	57.68	13.04	13.18	2.23	83	4560	47.7	0.00956

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	26.00	Electric motor	24	10.10	CLASS 2	10.00	16.00
Note:								
2	Mono-type pump	26.00	Electric motor	12	20.20	CLASS 2	10.00	16.00
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228CBU1273 Number: T32913 Site type: Borehole

Distr./Farm No.: QOLORA Site Name/Descr.: KENTANI/DIS/NOTSHIVGETHAFINI

Longitude [°]: 28.3964981	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 36.74
Latitude [°]: 32.5925556	Alt. No. 2:	Depth [m]: 80.60	WL status: Static
Altitude [m]: 225.00	Rep. inst.: VSA	Col. ht. [m]: 0.22	Date WL meas.: 20030429

EXISTING EQUIPMENT:

Pump: _____ Pulley Diam. [mm]: _____
 Type of Inst.: _____ Depth to Intk. [m]: _____
 Manufacturer: _____

Engine: _____ Power Rating [kW] _____
 Manufacturer: _____ Pulley Diam. [mm]: _____
 Type of Power: _____

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: T32913	Date sampled: 20030609	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.22	Na: 260	Cl: 558	Langel.: -0.76
EC: [mS/m] 192	K: 1.5	NO3 as N: 0.01	Aggr-Ind: 11.38
TDS: 965	Si: _____	SO4: 15	Ion-bal: -6.16
T. Alk.: 164	Al: _____	F: 0.79	CaCO3: 288.86
Ca: 35	Fe: 1.37	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 49	Mn: _____	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		! Value exceeds recommended minimum limit Value exceeds minimum allowable limit	

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030429	60	62.80	0.45	1.75						
STEP TEST 2	20030429	60	62.80	1.01	5.94						
STEP TEST 3	20030429	63	62.80	1.50	26.09	1.24	95	180			
CONSTANT	20030429	1440	62.80	0.60	9.56	2.00	79	1440	1.8	4.94E-5	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	52.00	Hand	24	0.20	CLASS 2	40.00	42.00
Note:								
2	Hand pump	52.00	Hand	12	0.40	CLASS 2	40.00	42.00
Note:								



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CHEMISTRY REPORT

Date compiled: 2003/07/21

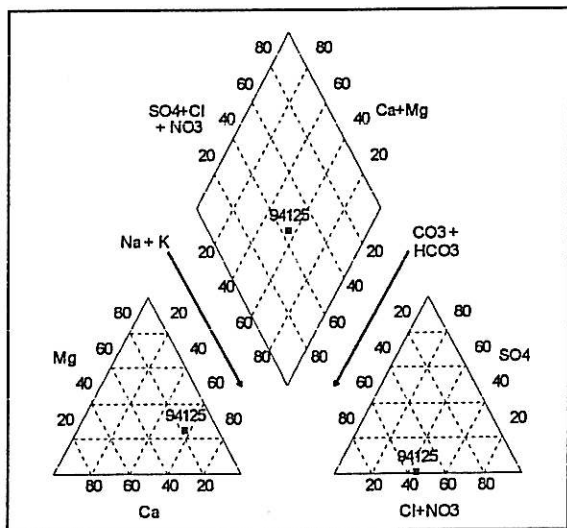
BASIC SITE INFORMATION: Site Identifier: 3228CDV0001 Number: 110-0020 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: CENTULI/AREA2/DIS:/KENTANI

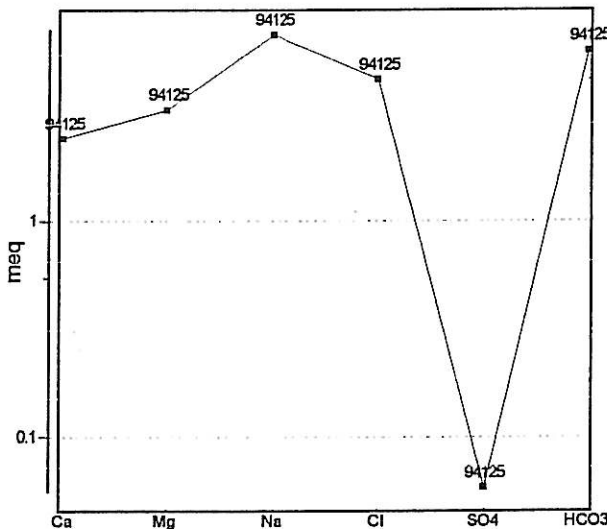
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3515532	Reg./BB.:	Topo-set:	Flat surface, plain	Depth [m]:	77.10
Latitude [°]:	32.4248333		Site status:	Unused	Col. ht. [m]:	0.50
Altitude [m]:	366.00	G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94125	110-0020			20030613	0000		0	20030613	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acld.	M. Acld.
94125	7.27	146	731	49	40	167	1.7	304		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94125		162	2.8	1	0.44					0.264

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	BI	Cu	Pb
94125											0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94125											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94125												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som.	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94125							

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94125		21.2	2.6					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94125	796.13	1022.00	13.04	10.80	9.40	286.77	286.77	164.64	11.84	-0.25	0.76	4.29

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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CHEMISTRY REPORT

Date compiled: 2003/07/21

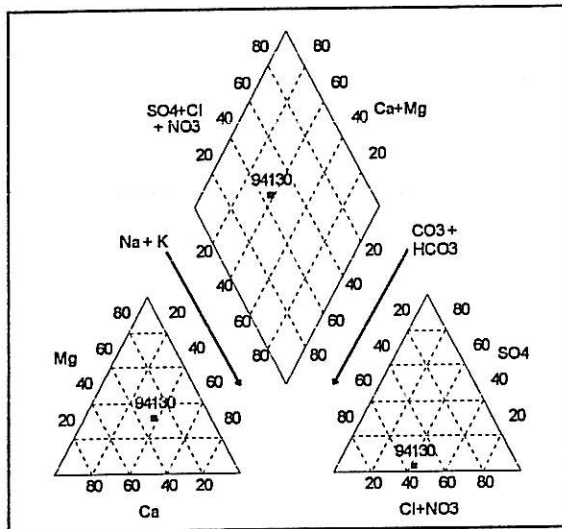
BASIC SITE INFORMATION: Site Identifier: 3228ADV0016 Number: 110-0035 Site type: Borehole

Distr./Farm No.: CENTANI Site Name/Des.: KWAQITHI/CENTULI/DIS:/CENTANI

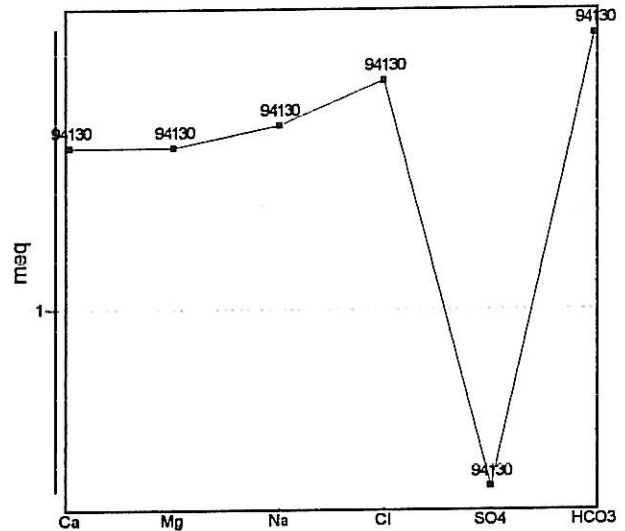
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3713034	Reg./BB.:	Topo-set:	Valley	Depth [m]:	88.96
Latitude [°]:	32.4130556		Site status:	Unused	Col. ht. [m]:	0.50
Altitude [m]:	420.00	G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94130	110-0035			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94130	7.01	94	469	58	35	77	2.1	304		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94130		158	15	0.04	0.43					15.011 ‡

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94130											0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94130											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94130												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94130		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94130					21	28 ‡					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94130	729.22	658.00	9.18	10.87	-8.47	288.67	288.67	144.06	11.65	-0.43	0.78	1.97

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228CBV0020 Number: T32909 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KENTANI/DIS:/KOMKHULU

Longitude [°]: 28.3029415	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 1.53
Latitude [°]: 32.5794722	Alt. No. 2:	Depth [m]: 28.01	WL status: Static
Altitude [m]:	Rep. inst.: VSA	Col. ht. [m]: 0.24	Date WL meas.: 20030427

EXISTING EQUIPMENT:

Pump:	
Type of Inst.:	Pulley Diam. [mm]:
Manufacturer:	Depth to Intk. [m]:
Engine:	
Manufacturer:	Power Rating [kW]
Type of Power:	Pulley Diam. [mm]:

USE APPLICATION:

Site Status: Unused
Purpose: Production (water supply)
Consumer: Non-urban
Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: T32909	Date sampled: 20030609	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 6.99	Na: 44	Cl: 95	Langel.: -1.33
EC: [mS/m] 50	K: 0.49	NO3 as N: 8.7	Aggr-Ind: 10.66
TDS: 250	Si:	SO4: 2.8	Ion-bal: -7.30
T. Alk.: 81	Al:	F: 0.14	CaCO3: 119.08
Ca: 23	Fe: 0.618	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit	
Mg: 15	Mn:	E.Coli:	Faec. co: 13
		Total Co:	29
		SPC:	

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m]	%	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030426	60	26.50	0.23	2.65						
STEP TEST 2	20030426	60	26.50	0.41	3.48						
STEP TEST 3	20030426	60	26.50	0.57	5.60						
STEP TEST 4	20030426	60	26.50	0.80	11.37						
STEP TEST 5	20030426	60	26.50	1.23	25.75	0.15	99	360			
CONSTANT	20030427	1440	26.50	0.52	5.64	0.22	96	1440	16.5	1.7E-13	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	18.00	Hand	24	0.40	CLASS 3	5.42	8.00
Note:								
2	Mono-type pump	18.00	Electric motor	12	0.70	CLASS 3	5.42	8.00
Note:								



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CHEMISTRY REPORT

Date compiled: 2003/07/21

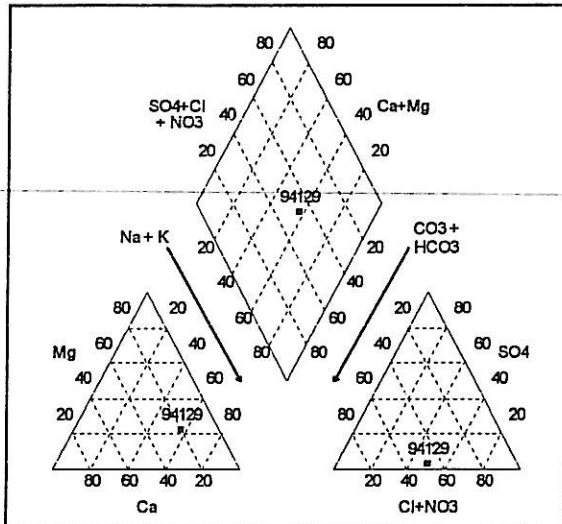
BASIC SITE INFORMATION: Site Identifier: 3228ADV0017 Number: 110-0019 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTULI/AREA 4/DIS:/KENTANI

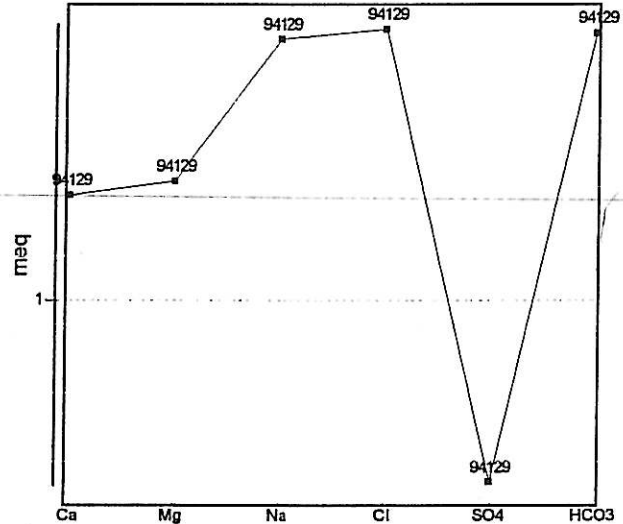
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3451642	Reg./BB.:	Topo-set:	Valley	Depth [m]:	43.31
Latitude [°]:	32.4344444	G-Nr.:	Site status:	Unused	Col. ht. [m]:	0.50
Altitude [m]:	358.00		Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date saml.	Time samp.	Time pump.	Depth saml. [m]	Date analysed	Laboratory
94129	110-0019			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94129	7.26	108	539	39	26	121	1.7	274		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94129		200	15	0.01	0.61					0.275

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94129											0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94129											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94129												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94129		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	MBAS	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94129						20.9	7					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94129	735.55	756.00	9.39	11.47	-9.95	204.24	204.24	107.02	11.69	-0.40	1.09	3.68

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

110-0019

Borehole No.	Kentani					
Project	Kentani					
District	Kentani					
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 4
TDS	539.00	1	450	1000	2400	<3 or >11
pH	7.26	0	5-9.5	6.5-9.5	4-4.5 or 10-10.5	50.00
Turbidity (NTU)	7.00	2	0-10	10	20.00	620
EC (mS/m)	108.00	1	70	150	370	600
Alkalinity	274.00					600
Total hardness (T.H.)	204.00	1	200	300	600	300
Calcium (Ca)	39.00	0	80	150	300	400
Magnesium (Mg)	26.00	0	70	100	200	1000
Sodium (Na)	121.00	1	100	200	400	10.00
Iron (Fe)	0.28	0	0.50	1.00	5.00	10.00
Manganese (Mn)		-	0.10	0.20	4.00	40
Nitrate (as N)	0.02	0	5	10	20	1200
Chloride (Cl)	200.00	2	100	200	600	3.50
Fluoride (F)	0.81	0	0.70	1.00	1.50	1000
Sulphate (SO4)	15.00	0	200	400	600	1000
Total coliforms (T.col)	0.00	-	0	10	100	100
Faecal coliforms (Fc)	0.00	-	0	10	100	500
Potassium (K)	1.70	0	25	50	10	20
Zinc (Zn)		-	3	15	0.20	2.00
Arsenic (As)		-	0.01	0.05	0.02	0.05
Cadmium (Cd)		-	0.00	0.01		15.00
Copper (Cu)		-	1.00	1.00	2.00	

Class of water 2

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

Chemical analyses of water

110-0021

Borehole No.	Kentani						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	952.00	1	450	1000	2400	4000	3400
pH	7.55	0	5-9.5	4.5-10.5	4-4.5 or 10-10.5	3-3.5 or 11-11.5	3 or >11
Turbidity (NTU)	3.70	2	0.10	1.00	20.00	50.00	50.00
EC (mS/m)	190.00	2	70	150	370	500	520
Alkalinity	369.00						
Total hardness (T.H.)	427.00	2	200	300	600	800	800
Calcium (Ca)	59.00	0	80	150	300	400	400
Magnesium (Mg)	68.00	0	70	100	200	300	400
Sodium (Na)	241.00	2	100	200	400	600	1000
Iron (Fe)	0.41	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)	-	-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	0.01	0	6	15	20	40	40
Chloride (Cl)	410.00	2	100	500	600	1200	1200
Fluoride (F)	0.80	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	2.80	0	200	400	600	1000	1000
Total coliforms (T.col)	2.00	1	0	10	100	100	100
Faecal coliforms (Fc)	0.00	-	0	10	100	500	500
Potassium (K)	4.10	0	25	50	100	200	200
Zinc (Zn)	-	-	3	10	10	20	20
Arsenic (As)	-	-	0.01	0.15	0.20	2.00	2.00
Cadmium (Cd)	-	-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)	-	-	1.00	1.00	2.00	15.00	15.00

Class of water 2

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

Chemical analyses of water

110-0036

Borehole No.	Kentani						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	1320.00	2	450	1000	2400	4000	3400
pH	7.06	0	5-9.5	5-9.5	4-10.5	4-10.5	3-11
Turbidity (NTU)	1.50	2	0-10	10	20.00	50	50.00
EC (mS/m)	261.00	2	70	150	370	500	520
Alkalinity	367.00	-	-	-	-	-	-
Total hardness (T.H.)	372.00	2	200	300	600	800	600
Calcium (Ca)	55.00	0	80	100	200	300	400
Magnesium (Mg)	57.00	0	70	100	200	300	400
Sodium (Na)	89.00	0	100	200	400	1000	1000
Iron (Fe)	0.32	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)	-	-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	2.40	0	5	10	20	40	40
Chloride (Cl)	684.00	3	100	250	600	1200	1200
Fluoride (F)	1.30	2	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	33.00	0	200	400	600	1000	1000
Total coliforms (T.col)	0.00	-	0	10	100	100	100
Faecal coliforms (Fc)	0.00	-	0	10	100	100	100
Potassium (K)	1.50	0	25	10	10	20	20
Zinc (Zn)	-	-	3	0.01	0.20	2.00	2.00
Arsenic (As)	-	-	0.01	0.01	0.02	0.05	0.05
Cadmium (Cd)	-	-	0.00	0.00	0.02	15.00	15.00
Copper (Cu)	-	-	1.00	0.00	2.00	-	-

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

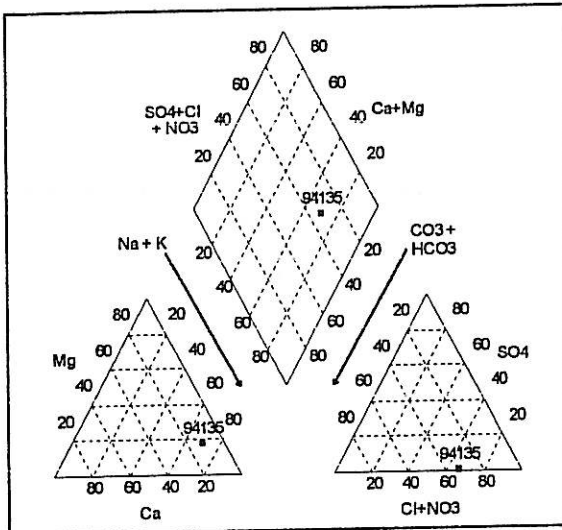
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CBV0025 Number: 110-0037 Site type: Borehole

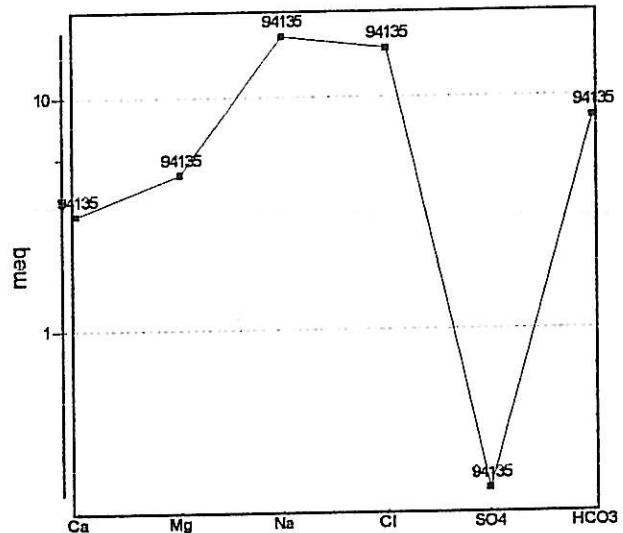
Distr./Farm No.: KENTANI Site Name/Des.: KENTANE/DIS:/AREA7
 Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.4439152	Reg./BB.:	Topo-set:	Valley	Depth [m]:	70.01
Latitude [°]:	32.5468333			Site status:		Unused
Altitude [m]:		G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94135	110-0037			20030623	0000		0	20030623	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94135	7.34	237	63	57	418 ‡	2.6		413		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94135		575	10	0.01	1					0.536

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	BI	Cu	Pb
94135											0.03
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94135											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94135												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coli	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94135		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	MBAS	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94135						20.9	5.2					

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 | Value exceeds recommended minimum limit
 | Value exceeds minimum allowable limit



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CHEMISTRY REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0022 Number: 110-0039 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANE/DIS:/TAKAZI/AREA 7

Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude 28.3363863

Latitude [°]: 32.4342778

Altitude [m]:

Coord. acc.: Accurate to within 100 units

Coord. meth.: Global Positioning System

Reg./BB.:

G-Nr.:

Topo-set: Valley

Site status: Unused

Site purp.: Production (water supply)

Use applic.: Domestic - all purposes

Equipment:

Depth [m]: 59.48

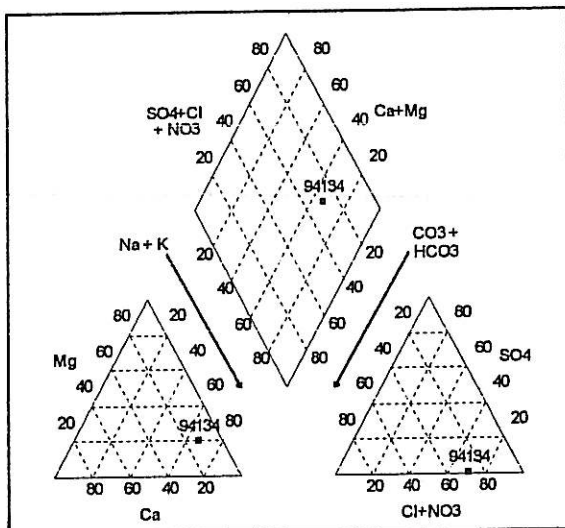
Col. ht. [m]: 0.37

Drain. reg.:

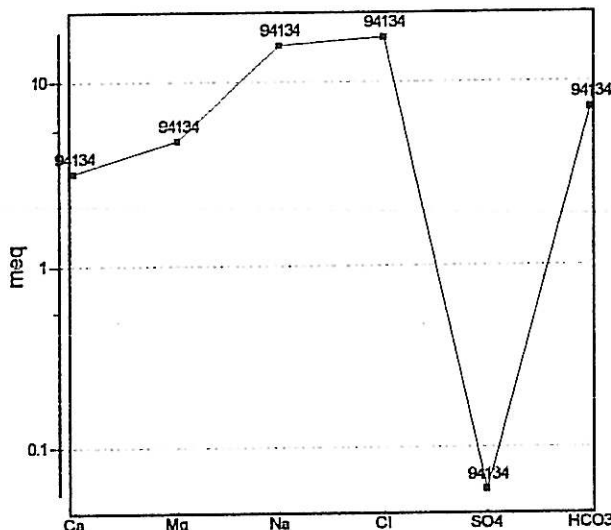
Diam. [mm]: 165

Rep. inst.: VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94134	110-0039			20030623	0000		0	20030623	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94134	7.22	231	1160	64	58	364	3.7	362		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94134		629 ‡	2.8	0.13	0.87					0.524

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94134											0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94134											

ORGANIC PARAMETERS:

Chem. ref. nr.	GOD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94134												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som.	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94134	E.Coll	Faec. co	Col				
94134		47		81			

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94134	Colour	Odour	Taste	MBAS				
94134				21.2	4.9			

CALCULATED PARAMETERS:

Chem. ref. nr.	Cations sum	Anions sum	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR		
94134	1562.69	1617.00	23.89	25.10	-2.46	398.23	362.00	238.73	11.98	-0.20	2.46	7.93

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 ! Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.		110-0039				
Project		Kentani				
District		Kentani				
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 4
TDS	1160.00	2	450	400	2400	3400
pH	7.22	0	5-9.5	5-9	4-4.5 or 10-10.5	<3 or >11
Turbidity (NTU)	4.90	2	0.10	1.0	20.00	50.00
EC (mS/m)	231.00	2	70	150	370	520
Alkalinity	362.00	2	200	300	600	600
Total hardness (T.H.)	399.00	0	80	100	300	300
Calcium (Ca)	64.00	0	70	100	200	200
Magnesium (Mg)	58.00	0	100	200	400	400
Sodium (Na)	364.00	2	0.50	1.0	5.00	10.00
Iron (Fe)	0.52	1	0.10	1.0	4.00	10.00
Manganese (Mn)	0.13	0	5	10	20	40
Nitrate (as N)	629.00	3	100	300	600	1200
Chloride (Cl)	0.87	1	0.70	1.0	1.50	3.50
Fluoride (F)	2.80	0	200	300	600	1000
Sulphate (SO4)	81.00	2	0.2	0.5	1.00	2.00
Total coliforms (T.col)	47.00	3	0	10	100	1000
Faecal coliforms (Fc)	3.70	0	25	50	100	1000
Potassium (K)	-	-	0.01	1.0	10	100
Zinc (Zn)	-	-	0.00	0.02	0.20	2.00
Arsenic (As)	-	-	1.00	5.00	2.00	0.05
Cadmium (Cd)	-	-	-	-	-	15.00
Copper (Cu)	-	-	-	-	-	-

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.
Class 0	<p>Drinking health : No effects, suitable for many generations.</p> <p>Drinking Aesthetic : Waters is pleasing.</p> <p>Food preparation : No effects.</p> <p>Bathing : No effects.</p> <p>Laundry : No effects.</p>
Class 1	<p>Drinking health : Suitable for lifetime use. Rare instances of sub-clinical effects.</p> <p>Drinking Aesthetic : Some aesthetic effects may be apparent.</p> <p>Food preparation : Suitable for lifetime use.</p> <p>Bathing : Minor effects on bathing or on bath fixtures.</p> <p>Laundry : Minor effects on laundry or on fixtures.</p>
Class 2	<p>Drinking health : May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups.</p> <p>Drinking Aesthetic : Some effects possible after lifetime use</p> <p>Food preparation : Poor taste and appearance are noticeable.</p> <p>Bathing : May be used without health or aesthetic effects by the majority persons</p> <p>Laundry : Slight effects on bathing or on bath fixtures.</p>
Class 3	<p>Drinking health : Slight effects on bathing or on bath fixtures.</p> <p>Drinking Aesthetic : Poses a risk of chronic health effects, especially in babies, children and the elderly.</p> <p>Food preparation : Bad taste and appearance may lead to rejection of the water.</p> <p>Bathing : Poses a risk of chronic health effects, especially in children and elderly</p> <p>Laundry : Significant effects on bathing or on bath fixtures.</p>
Class 4	<p>Drinking health : Significant effects on laundry or on fixtures.</p> <p>Drinking Aesthetic : Severe acute health effects, even with short-term use.</p> <p>Food preparation : Taste and appearance will lead to rejection of the water.</p> <p>Bathing : Severe acute health effects, even with short-term use.</p> <p>Laundry : Serious effects on bathing or on bath fixtures.</p>

Comments

MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0018 Number: 110-0021 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: NQANDA/AREA4/DIS:/KENTANI

Longitude [°]: 28.3365252	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]:
Latitude [°]: 32.4332778	Alt. No. 2:	Depth [m]: 55.73	WL status: Static
Altitude [m]: 358.00	Rep. inst.: VSA	Col. ht. [m]: 0.51	Date WL meas.: 20030602

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0021	Date sampled: 20030623	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.55	Na: 241	Cl: 410	Langel.: 0.14
EC: [mS/m] 190	K: 4.1	NO3 as N: 0.01	Aggr-Ind: 12.28
TDS: 952	Si: 2.8	SO4: 2.8	Ion-bal: 0.23
T. Alk.: 369	Al: 0.6	F: 0.6	CaCO3: 426.89
Ca: 59	Fe: 0.407	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 68	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		Value exceeds recommended minimum limit Value exceeds minimum allowable limit	

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
11.00	11.00	0.50	Notch (V- or U-notch)	Fractured	
62.00	62.00	2.50	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	12.00	177	Steel	4				
12.00	18.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m²/d]	Storage	Comment
STEP TEST 1	20030602	60	16.00	0.73	4.45					
STEP TEST 2	20030602	60	16.00	1.51	14.82					
STEP TEST 3	20030602	10	16.00	2.45	18.09	0 100	10			
CONSTANT	20030602	1440	16.00	0.71	6.71	0 100	7	2.6	8.85E-6	



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CHEMISTRY REPORT

Date compiled: 2003/06/24

BASIC SITE INFORMATION: Site Identifier: 3228CBV0030 Number: 110-0038 Site type: Borehole

Distr./Farm No.: KENTANE Site Name/Des.: KENTANI/DIS:/TAKAZI

Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude 28.4084426

Latitude [°]: 32.5417778

Altitude [m]:

Coord. acc.: Accurate to within 100 units

Coord. meth.: Global Positioning System

Reg./BB.:

G-Nr.:

Topo-set.: In or along pan

Site status: Unused

Site purp.: Production (water supply)

Use applic.: Domestic - all purposes

Equipment:

Depth [m]: 59.49

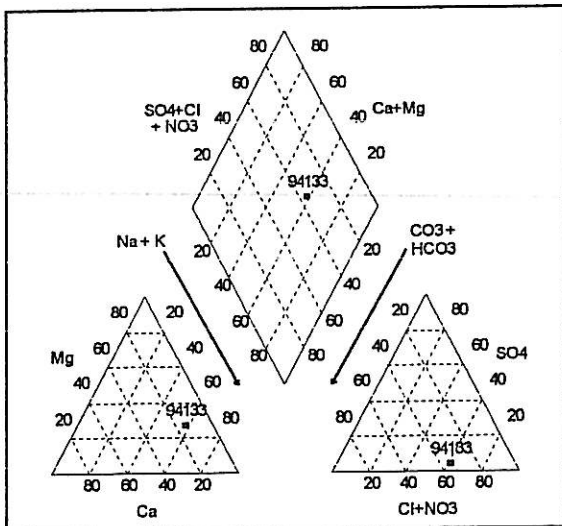
Col. ht. [m]: 0.41

Drain. reg.:

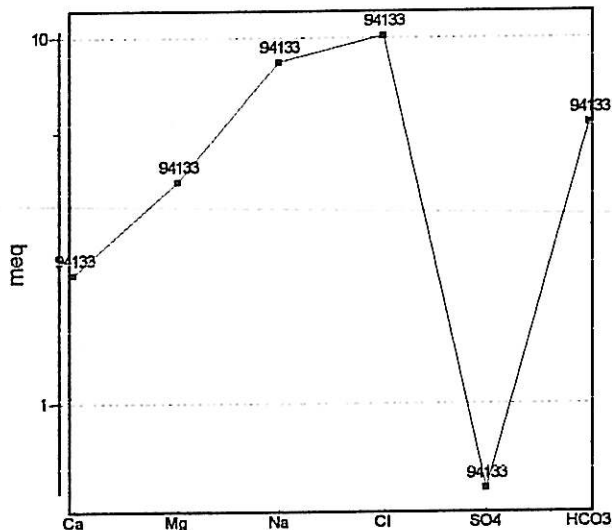
Diam. [mm]: 165

Rep. inst.: VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94133	110-0038			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94133	7.92	164	821	45	49	197	3.8	293		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94133		358	28	0.02	0.77					1.063

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94133											0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94133											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94133												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som.	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94133	0	4					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	MBAS	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94133						22.2	8.2					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94133	1037.81	1148.00	14.94	16.58	-5.21	313.81	293.00	201.68	12.44	0.31	1.82	4.84

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.	110-0038						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	821.00	1	450	1000	2400		3400
pH	7.92	0	5-9.5	6.5-8.5	4-4.5 or 10-10.5		3.0-11
Turbidity (NTU)	8.20	2	0-10	10-20	20.00		50.00
EC (mS/m)	164.00	2	70	150	370		520
Alkalinity	293.00						
Total hardness (T.H.)	314.00	2	200	300	600		600
Calcium (Ca)	45.00	0	80	150	300		300
Magnesium (Mg)	49.00	0	70	100	200		400
Sodium (Na)	197.00	1	100	200	400		1000
Iron (Fe)	1.06	2	0.50	1.00	5.00		10.00
Manganese (Mn)		-	0.10	0.30	4.00		10.00
Nitrate (as N)	0.02	0	5	10	20		40
Chloride (Cl)	358.00	2	100	200	600		1200
Fluoride (F)	0.77	1	0.70	1.40	1.50		3.50
Sulphate (SO4)	28.00	0	200	400	600		1000
Total coliforms (T.col)	4.00	1	0	10	100		1000
Faecal coliforms (Fc)	0.00	-	0	10	100		500
Potassium (K)	3.80	0	20	100	10		20
Zinc (Zn)		-	5	10	0.20		2.00
Arsenic (As)		-	0.01	0.05	0.02		0.05
Cadmium (Cd)		-	0.00	0.00	0.02		15.00
Copper (Cu)		-	1.00	1.00	2.00		

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

Chemical analyses of water

110-0037

Borehole No.	Kentani						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	1190.00	2	450	1000	2400	4000	3400
pH	7.34	0	5-9.5	5.5-8.5	4.5-10	4-10.5	<3 or >11
Turbidity (NTU)	5.20	2	0-10	10	20.00	30	50.00
EC (mS/m)	237.00	2	70	150	370	500	520
Alkalinity	413.00	-	-	-	-	-	-
Total hardness (T.H.)	392.00	2	200	300	600	800	600
Calcium (Ca)	63.00	0	80	100	300	400	400
Magnesium (Mg)	57.00	0	70	80	200	300	400
Sodium (Na)	418.00	3	100	200	400	500	1000
Iron (Fe)	0.54	1	0.50	0.50	5.00	10.00	10.00
Manganese (Mn)	-	-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	0.01	0	5	10	20	30	1200
Chloride (Cl)	575.00	2	100	200	600	1000	350
Fluoride (F)	1.00	2	0.70	1.00	1.50	2.00	1000
Sulphate (SO4)	10.00	0	200	400	600	1000	1600
Total coliforms (T.col)	0.00	-	0	10	10	10	100
Faecal coliforms (Fc)	0.00	-	0	10	10	10	500
Potassium (K)	2.60	0	25	50	100	200	20
Zinc (Zn)	-	-	5	10	0.20	0.20	2.00
Arsenic (As)	-	-	0.01	0.05	0.02	0.02	0.05
Cadmium (Cd)	-	-	0.00	0.00	0.02	0.02	15.00
Copper (Cu)	-	-	1.00	2.00	2.00	2.00	-

Class of water **3**

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0021 Number: 110-0026 Site type: Borehole

Distr./Farm No.: KENTANI

Site Name/Des.: CENTULI/AREA2/DIS:/KENTANI

Region Type: Transitional Local Council

Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude 28.3673311

Reg./BB.:

Topo-set.: Flat surface, plain

Depth [m]: 80.93

Latitude [°]: 32.4185833

G-Nr.:

Site status: Unused

Col. ht. [m]: 0.50

Altitude [m]: 0.50

Site purp.: Production (water supply)

Drain. reg.:

Coord. acc.: Accurate to within 100 units

Use applic.: Domestic - all purposes

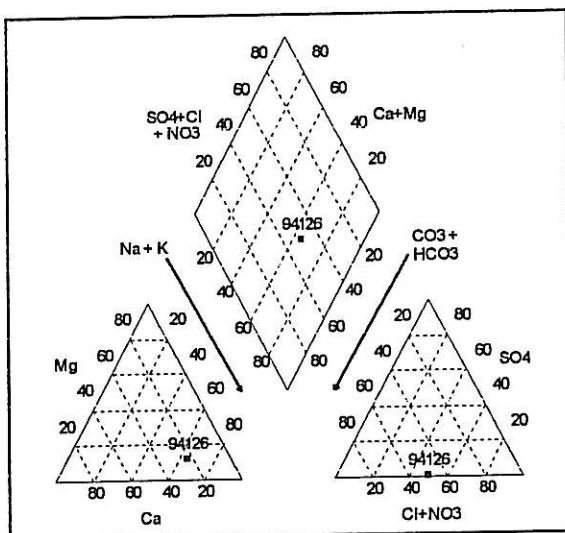
Diam. [mm]: 165

Coord. meth.: Global Positioning System

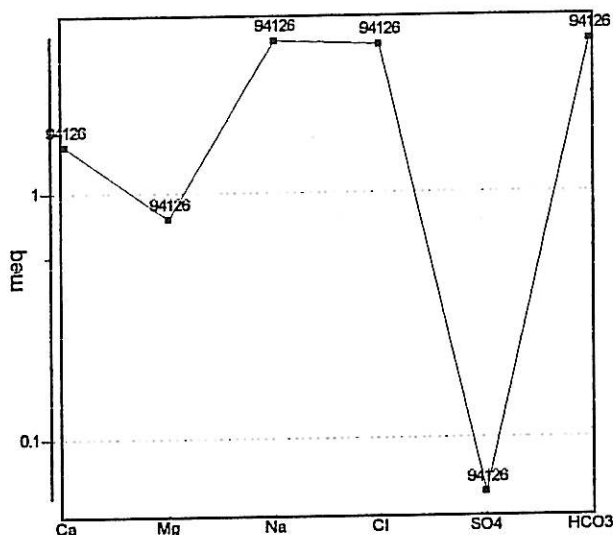
Equipment:

Rep. inst.: VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94126	110-0026			20030613	0000		0	20030613	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94126	8.43	73	31	9.6	95	0.62		207		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94126		141	2.9	0.24	0.17					0.546

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94126											0.182 ±

Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd
94126										

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94126												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coli	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94126		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94126					21.7	2.6					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94126	532.14	511.00	6.48	8.20	-11.70	116.83	116.83	39.51	12.63	0.59	0.98	3.82

Bact. param. In counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

110-0026

Borehole No.	Kentani						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	363.00	0	450	1000	2400		3400
pH	8.43	0	5-9.5	5-9.5	4-4.5 or 10-10.5		<3 or >11
Turbidity (NTU)	0.29	1	0-10	100	20.00		50.00
EC (mS/m)	73.00	1	70	150	370		520
Alkalinity	207.00						
Total hardness (T.H.)	117.00	0	200	300	600		600
Calcium (Ca)	31.00	0	80	150	300		300
Magnesium (Mg)	9.60	0	70	100	200		400
Sodium (Na)	95.00	0	100	200	400		1000
Iron (Fe)	0.55	1	0.50	1.00	5.00		10.00
Manganese (Mn)		-	0.10	0.40	4.00		10.00
Nitrate (as N)	0.24	0	6	10	20		30
Chloride (Cl)	141.00	1	100	200	600		1200
Fluoride (F)	0.17	0	0.70	1.00	1.50		3.50
Sulphate (SO4)	2.90	0	200	400	600		1000
Total coliforms (T.col)	0.00	-	0	100	100		100
Faecal coliforms (Fc)	0.00	-	0	100	100		500
Potassium (K)	0.62	0	25	50	100		200
Zinc (Zn)		-	3	10	10		20
Arsenic (As)		-	0.01	0.05	0.20		0.05
Cadmium (Cd)		-	0.00	0.01	0.02		0.05
Copper (Cu)		-	1.00	1.00	2.00		15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
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Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

Chemical analyses of water

Borehole No.	110-0035						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	469.00	1	450	1000	2400		3400
pH	7.01	0	5-9.5	6.5-9.0	4-4.5 or 10-10.5		<3 or >11
Turbidity (NTU)	28.00	3	0-10	100	20.00		50.00
EC (mS/m)	94.00	1	70	150	370		520
Alkalinity	304.00						
Total hardness (T.H.)	289.00	1	200	300	600		600
Calcium (Ca)	58.00	0	80	100	300		300
Magnesium (Mg)	35.00	0	70	100	200		400
Sodium (Na)	77.00	0	100	200	400		1000
Iron (Fe)	15.01	4	0.50	1.00	5.00		10.00
Manganese (Mn)		-	0.10	0.40	4.00		10.00
Nitrate (as N)	0.04	0	5	15	20		40
Chloride (Cl)	158.00	1	100	200	600		1200
Fluoride (F)	0.43	0	0.70	1.00	1.50		3.50
Sulphate (SO4)	15.00	0	200	400	600		1000
Total coliforms (T.col)	0.00	-	0	10	10		100
Faecal coliforms (Fc)	0.00	-	0	10	100		500
Potassium (K)	2.10	0	25	50	100		20
Zinc (Zn)		-	3	10	10		2.00
Arsenic (As)		-	0.01	0.05	0.20		0.05
Cadmium (Cd)		-	0.00	0.01	0.02		1.00
Copper (Cu)		-	1.00	3.00	2.00		15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

Class 0	Ideal water quality-suitable for lifetime use.
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Comments

CHEMISTRY REPORT

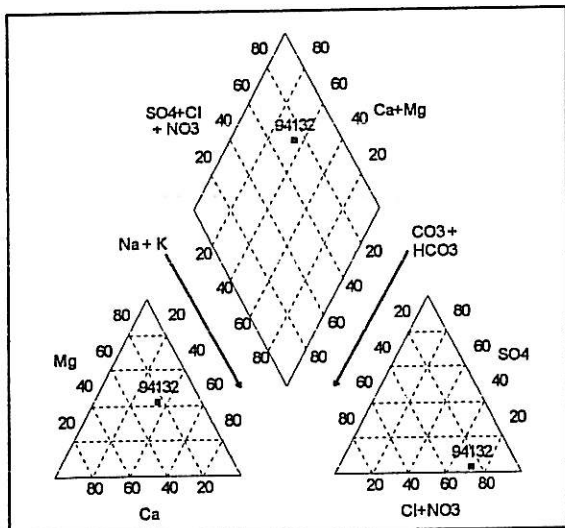
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228CBV0023 Number: 110-0036 Site type: Borehole

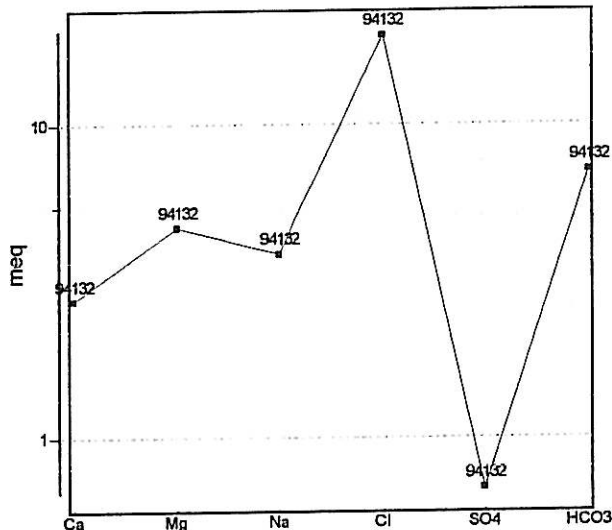
Distr./Farm No.: CENTANI Site Name/Des.: AREA 7/DIS:/KENTANI/E.CAPE
 Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.4377762	Reg./BB.:	Topo-set:	Flat surface, plain	Depth [m]:	60.79
Latitude [°]:	32.5412500	G-Nr.:	Site status:	Unused	Col. ht. [m]:	0.50
Altitude [m]:			Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94132	110-0036			20030617	0000		0	20030617	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94132	7.06	261	1.32	55	57	89	1.5	357		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94132		684 ‡	33	2.4	1.3					0.315

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94132											0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94132											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94132												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94132		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94132					22.3	1.5					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94132	1364.86	1827.00	11.34	27.36	-41.39	371.67	357.00	234.61	11.75	-0.41	2.80	2.01

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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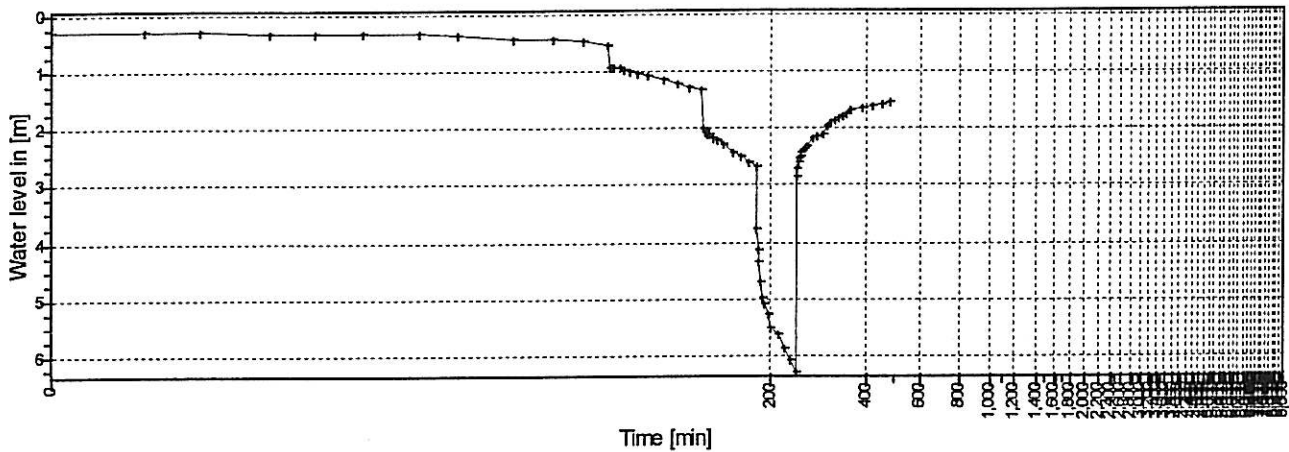
PUMPING TEST REPORT

Date compiled: 2003/07/19

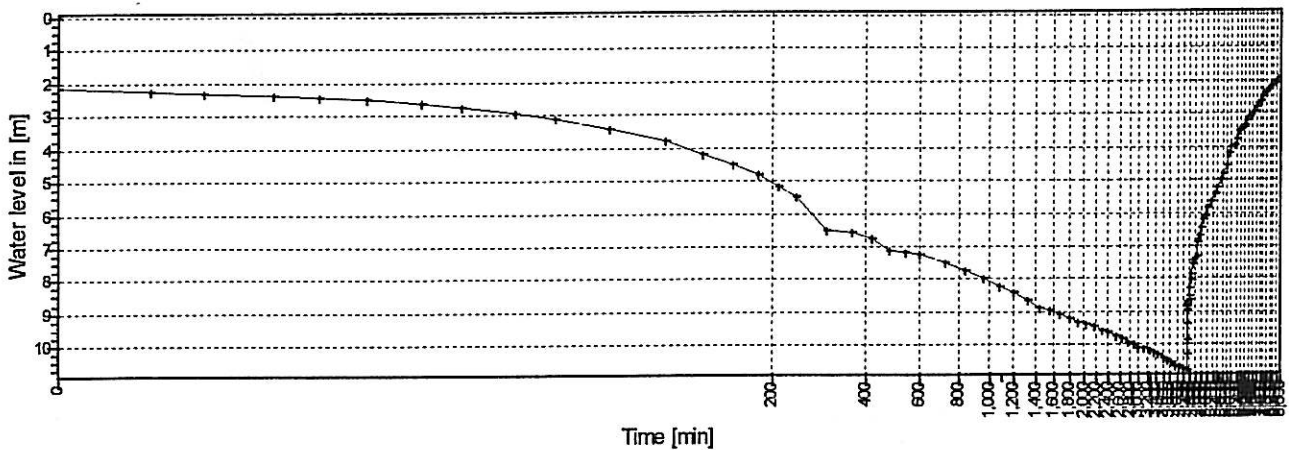
BASIC SITE INFORMATION: Site Identifier: 3228ADV0017 Number: 110-0019 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTULI/AREA 4/DIS:/KENTANI

Longitude [°]: 28.3451642	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 0
Latitude [°]: 32.4344444	Alt. No. 2:	Depth [m]: 43.31	Piezometer: 0
Altitude [m]: 358.00	Rep. inst.: VSA	Col. ht. [mm]: 0.50	Date WL meas.: 20030521

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. Inst.	Meth. tested		Time	Time			
VSA	Step test	39.68	20030520 1420	20030520 2220			
VSA	Constant rate test	39.68	20030521 0700	20030527 0700			

TESTING DETAILS:		Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	1420	60	39.68	4.20	0.52						8.08
STEP TEST 2	1520	60	39.68	8.63	1.32						6.54
STEP TEST 3	1620	60	39.68	12.35	2.68						4.61
STEP TEST 4	1720	60	39.68	24.32	6.29	1.52	76	240			3.87
CONSTANT	0700	4320	39.68	15.17	10.77	1.89	82	4320	54.9	0.00188	1.41



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228CDV0001 Number: 110-0020

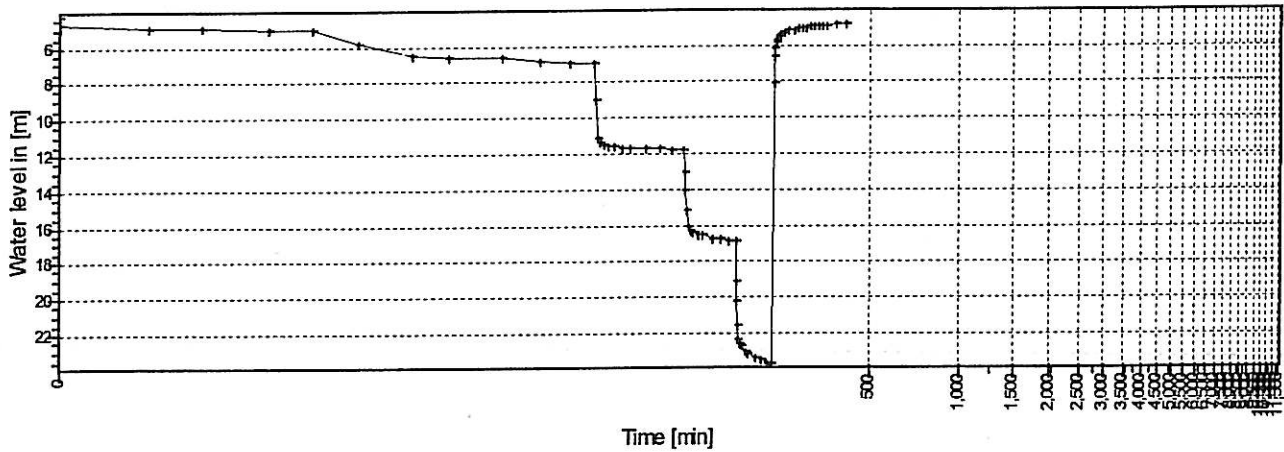
Site type: Borehole

Distr./Farm No.: KENTANI

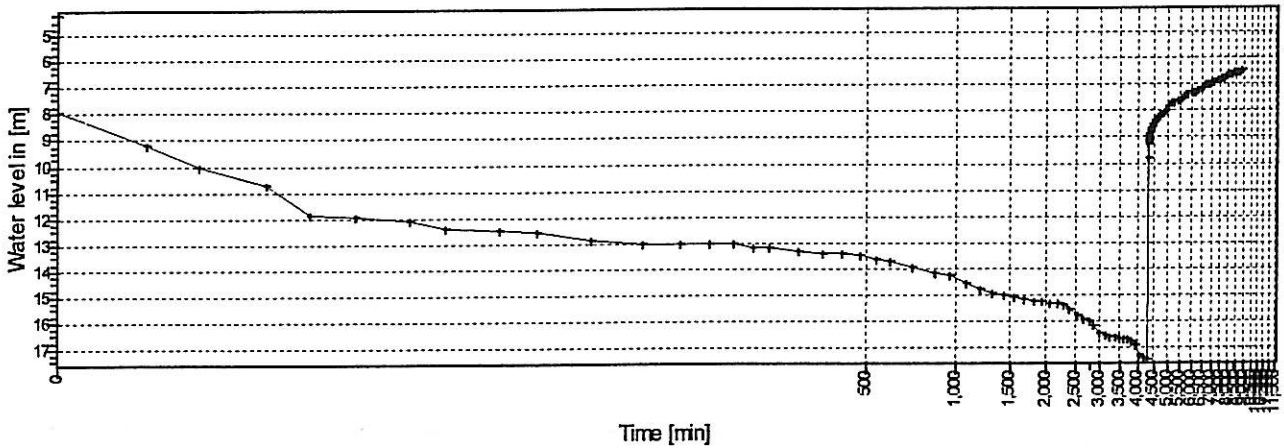
Site Name/Des.: CENTULI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3515532	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 4.24
Latitude [°]: 32.4248333	Alt. No. 2:	Depth [m]: 77.10	Piezometer: 0
Altitude [m]: 366.00	Rep. inst.: VSA	Col. ht. [mm]: 0.50	Date WL meas.: 20030510

Multirate Test



Constant Rate Test



PUMPING TEST:

Rep. Inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
VSA	Step test	57.68	20030510	0750	20030510	1450			
VSA	Constant rate test	57.68	20030510	1520	20030518	1720			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	0750	60	57.68	5.28	2.70							1.96
STEP TEST 2	0850	60	57.68	12.69	7.56							1.68
STEP TEST 3	0950	60	57.68	18.05	12.62							1.43
STEP TEST 4	1050	60	57.68	22.52	19.44	0.58	97	180				1.16
CONSTANT	1520	4320	57.68	13.04	13.18	2.23	83	4560	47.7		0.00956	0.99



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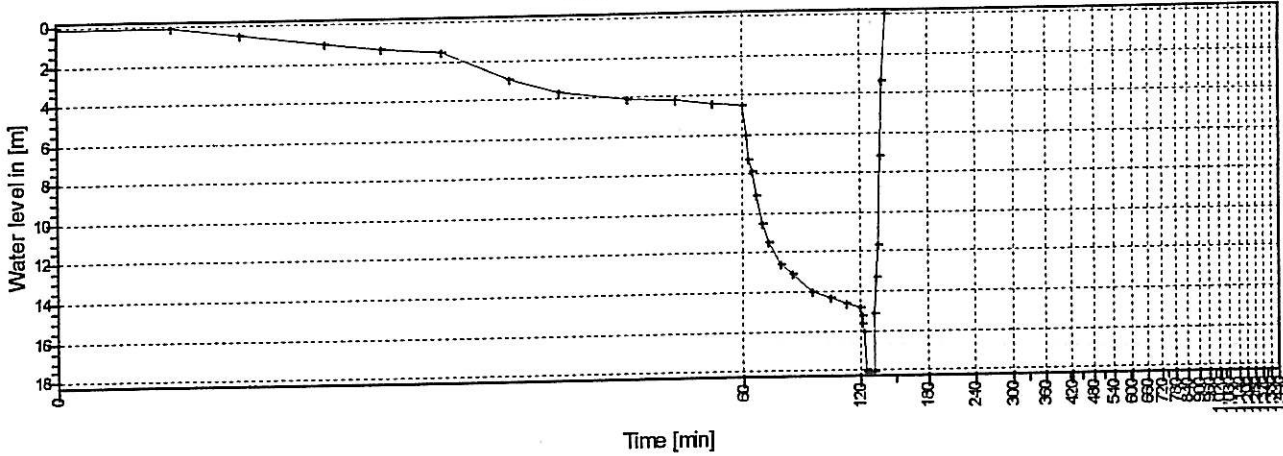
PUMPING TEST REPORT

Date compiled: 2003/07/21

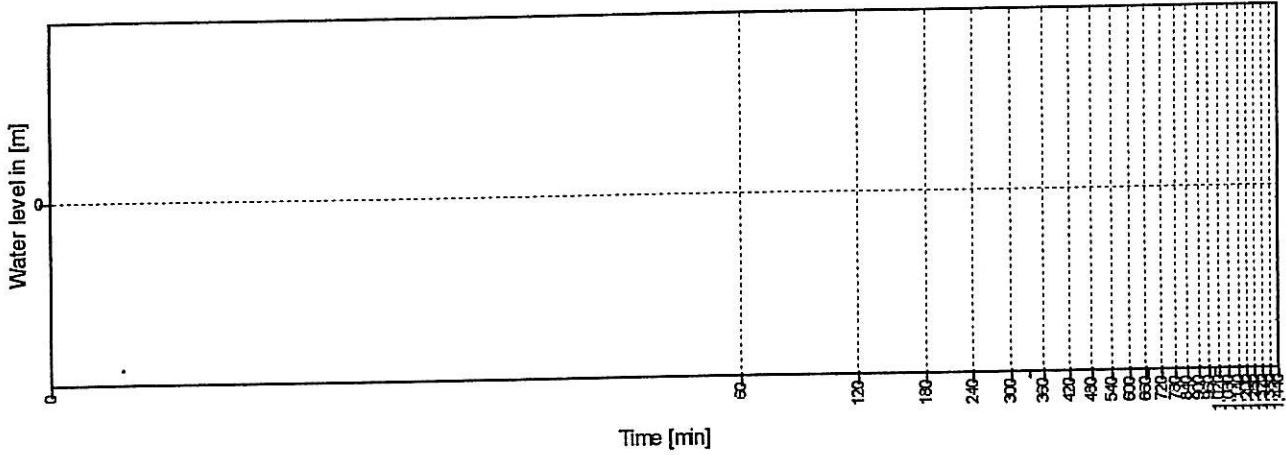
BASIC SITE INFORMATION: Site Identifier: 3228ADV0018 Number: 110-0021 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: NQANDA/AREA4/DIS:/KENTANI

Longitude [°]: 28.3365252	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]:
Latitude [°]: 32.4332778	Alt. No. 2:	Depth [m]: 55.73	Piezometer: 0
Altitude [m]: 358.00	Rep. inst.: VSA	Col. ht. [mm]: 0.51	Date WL meas.: 20060602

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmls. [m ³ /d]	Rec. abs. [l/s]
Rep. Inst.	Meth. tested		Time	Time	Storativ.	
VSA	Step test	16.00	20030602 0820	20030602 1040		
VSA	Constant rate test	16.00	20060602 1110	20030603 1117		

TESTING DETAILS:	Description	Time start.	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [%]	Rec. Dur. [min]	Trans. [m ³ /d]	Perm. [m/d]	Storat.	Q/st
	STEP TEST 1	0820	60	16.00	0.73	4.45						0.16
	STEP TEST 2	0920	60	16.00	1.51	14.82						0.10
	STEP TEST 3	1020	10	16.00	2.45	18.09	0 100	10				0.14
	CONSTANT	1110	1440	16.00	0.71	6.71	0 100	7	2.6		8.85E-6	0.11



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PUMPING TEST REPORT

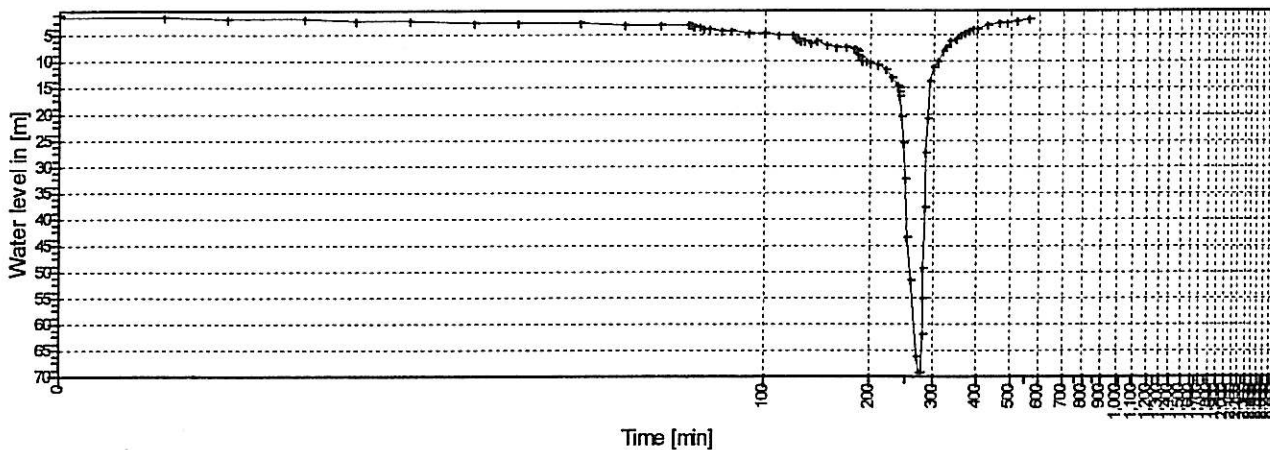
Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0020 Number: 110-0023 Site type: Borehole

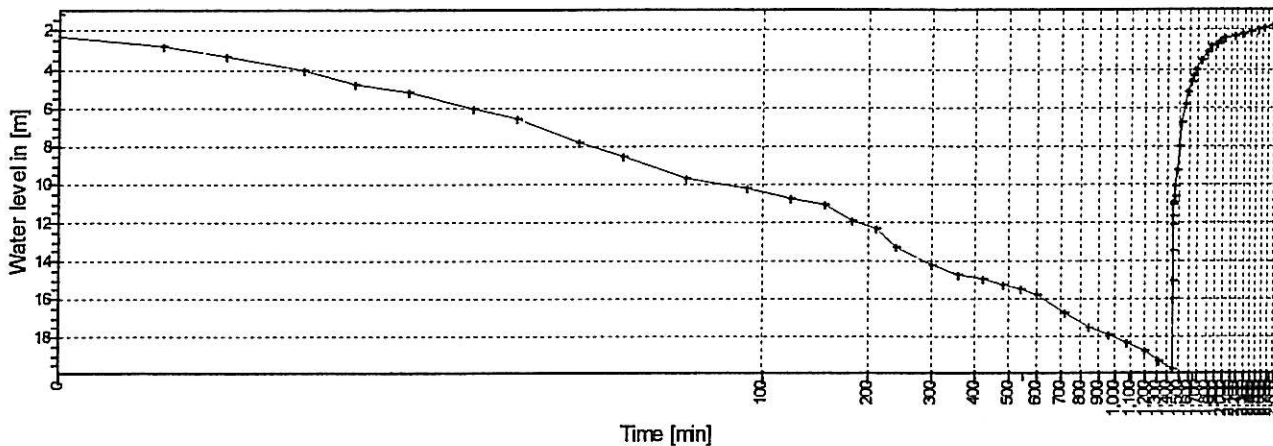
Distr./Farm No.: KENTANI Site Name/Des.: KWAQHITI/AREA2/DIS:/KENTANI

Longitude [°]: 28.3704423	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 1.12
Latitude [°]: 32.4059444	Alt. No. 2:	Depth [m]: 97.73	Piezometer: 0
Altitude [m]: 426.00	Rep. inst.: VSA	Col. ht. [mm]: 0.50	Date WL meas.: 20030528

Multirate Test



Constant Rate Test



PUMPING TEST:

Rep. inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [Vs]
VSA	Step test	68.70	20030527	1400	20030527	2320			
VSA	Constant rate test	68.70	20030528	0700	20030530	0700			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to Intk. [m]	Disch. rate [Vs]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1400	60	68.70	0.23	1.95							0.12
STEP TEST 2	1500	60	68.70	0.40	3.89							0.10
STEP TEST 3	1600	60	68.70	0.66	6.43							0.10
STEP TEST 4	1700	60	68.70	1.26	13.63							0.09
STEP TEST 5	1800	40	68.70	2.32	68.26	0.87	99	280				0.03
CONSTANT	0700	1440	68.70	0.94	18.51	0.56	97	1440	3.4		7.7E-6	0.05



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228BCV0051 Number: 110-0024

Site type: Borehole

Distr./Farm No.: KENTANI

Site Name/Des.: KABA KAZI/AREA5/DIS:/KENTANI

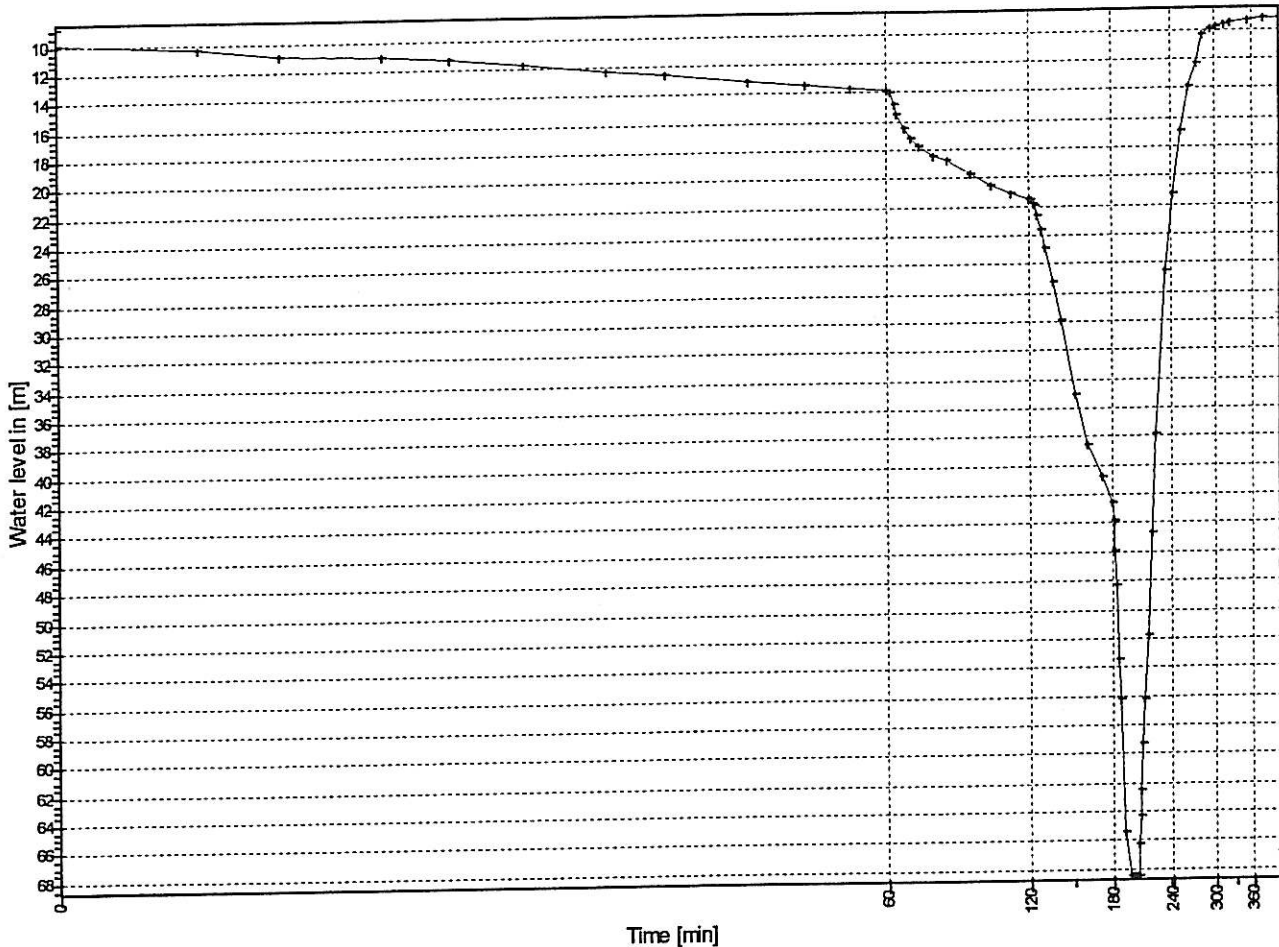
Longitude [°]: 28.5273046
 Latitude [°]: 32.4363889
 Altitude [m]: 298.00

Alt. No. 1:
 Alt. No. 2:
 Rep. inst.: VSA

Diam. [mm]: 165
 Depth [m]: 76.83
 Col. ht. [mm]: 0.50

Water lev. [m]: 8.78
 Piezometer: 0
 Date WL meas.: 20030524

Multirate Test



PUMPING TEST:

Rep. inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transms. [m ³ /d]	Storativ.	Rec. abs. [l/s]
VSA	Step test	68.70	20030524	1150	20030524	1843			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ³ /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1150	60	68.70	0.20	4.97							0.04
STEP TEST 2	1250	60	68.70	0.38	12.66							0.03
STEP TEST 3	1350	60	68.70	0.61	33.71							0.02
STEP TEST 4	1450	23	68.70	1.14	59.70	0.44	99	210				0.02



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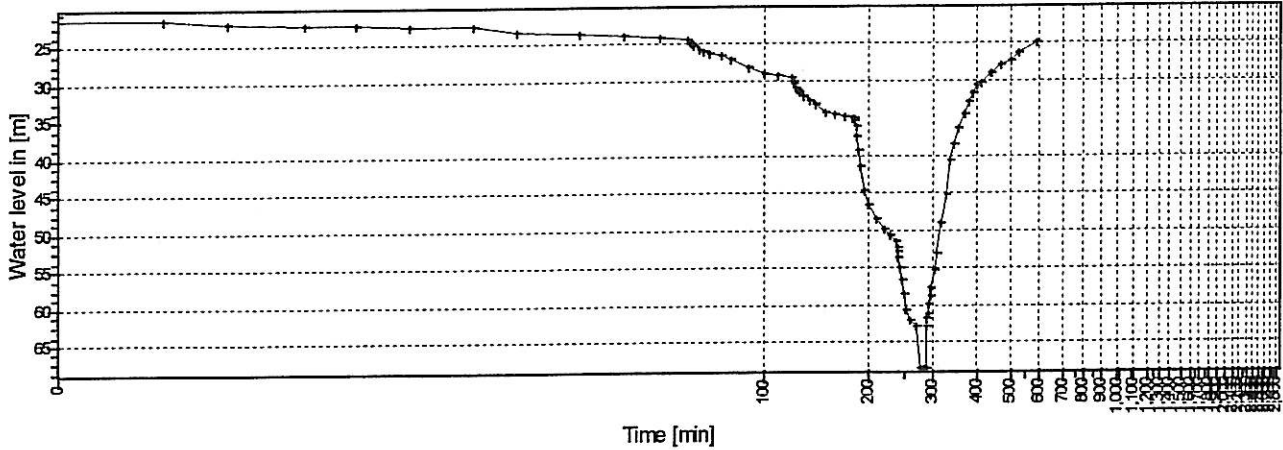
PUMPING TEST REPORT

Date compiled: 2003/07/21

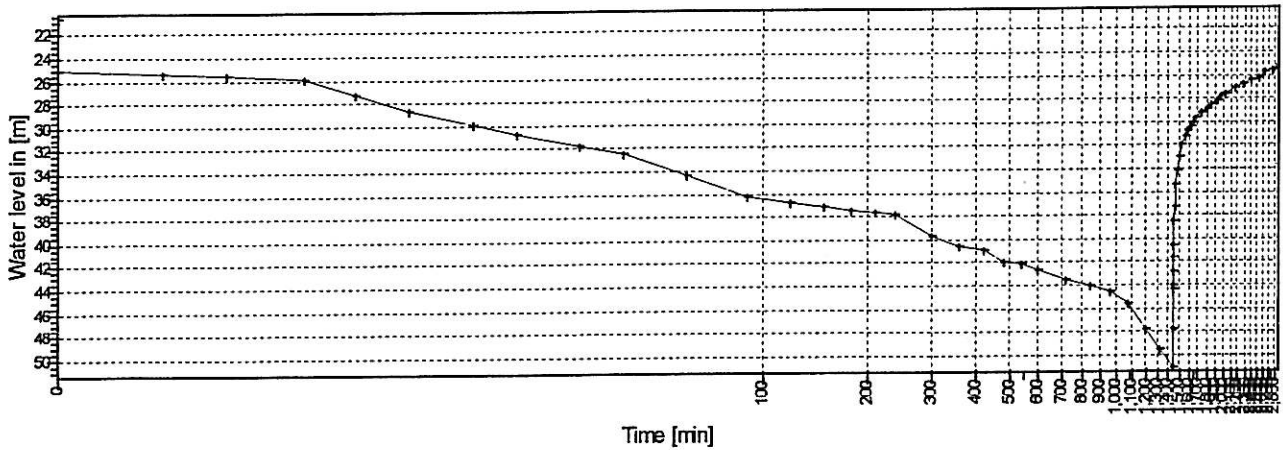
BASIC SITE INFORMATION: Site Identifier: 3228BCV0052 Number: 110-0025 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KABAKAZI/AREA5/DIS:/KENTANI

Longitude [°]: 28.5358602	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 20.55
Latitude [°]: 32.4510000	Alt. No. 2:	Depth [m]: 81.09	Piezometer: 0
Altitude [m]: 258.00	Rep. inst.: VSA	Col. ht. [mm]: 0.50	Date WL meas.: 20030522

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested		Time	Time			
VSA	Step test	68.30	20030521 1500	20030522 0049			
VSA	Constant rate test	68.30	20030522 0700	20030524 0700			

TESTING DETAILS:		Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	1500	60	68.30	0.22	3.69						0.06
STEP TEST 2	1600	60	68.30	0.41	8.89						0.05
STEP TEST 3	1700	60	68.30	0.62	14.25						0.04
STEP TEST 4	1800	60	68.30	1.22	30.88						0.04
STEP TEST 5	1900	49	68.30	1.84	47.98	4.40	91	300			0.04
CONSTANT	0700	1440	68.30	0.52	30.50	4.69	85	1440			0.02



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228ADV0021 Number: 110-0026

Site type: Borehole

Distr./Farm No.: KENTANI

Site Name/Des.: CENTULI/AREA2/DIS:/KENTANI

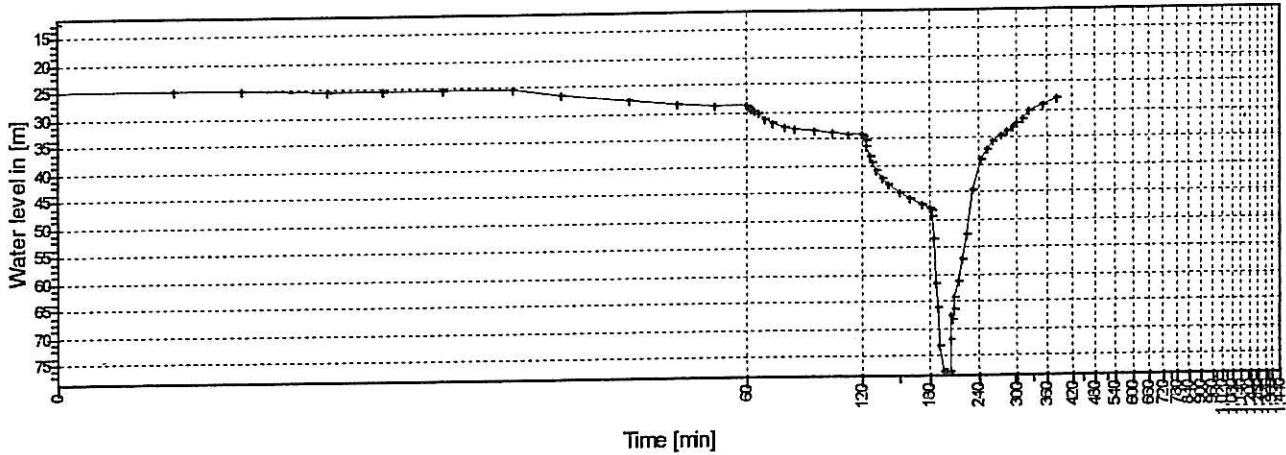
Longitude [°]: 28.3673311
 Latitude [°]: 32.4185833
 Altitude [m]: 0.50

Alt. No. 1:
 Alt. No. 2:
 Rep. inst.: VSA

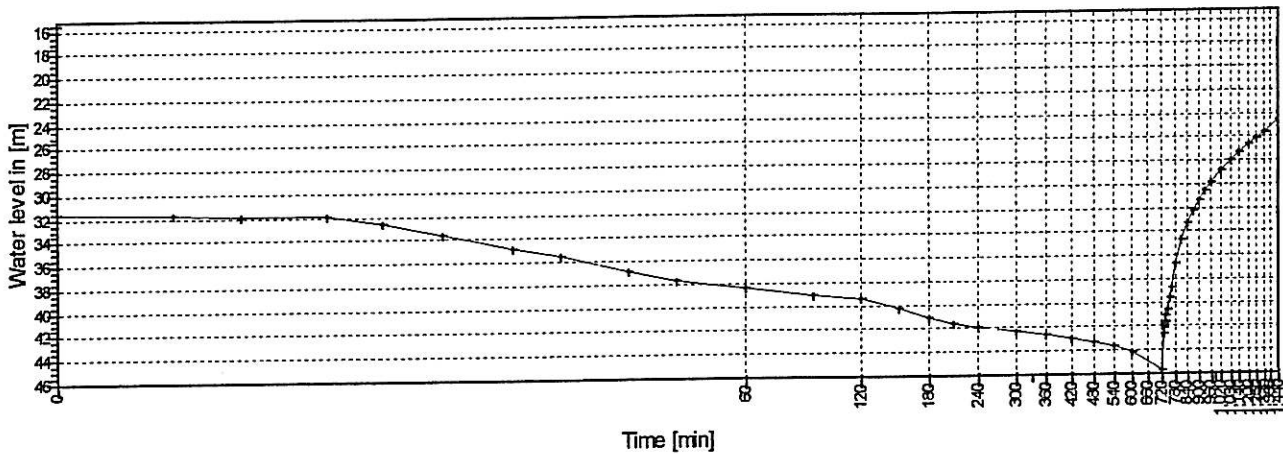
Diam. [mm]: 165
 Depth [m]: 80.93
 Col. ht. [mm]: 0.50

Water lev. [m]: 15.56
 Piezometer: 0
 Date WL meas.: 20030516

Multirate Test



Constant Rate Test



PUMPING TEST:

Rep. Inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transms. [m ² /d]	Stora ^{iv} .	Rec. abs. [l/s]
VSA	Step test	68.00	20030516	1100	20030516	1723			
VSA	Constant rate test	68.00	20030516	1800	20030517	1800			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1100	60	68.00	0.23	16.45							0.01
STEP TEST 2	1200	60	68.00	0.40	21.90							0.02
STEP TEST 3	1300	60	68.00	0.80	35.60							0.02
STEP TEST 4	1400	23	68.00	1.51	65.61	15.56	76	180				0.02
CONSTANT	1800	720	68.00	0.29	30.11	9.03	70	720	1.1		0.00022	0.01



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228ADV0016 Number: 110-0035

Site type: Borehole

Distr./Farm No.: CENTANI

Site Name/Des.: KWAQITHI/CENTULI/DIS:/CENTANI

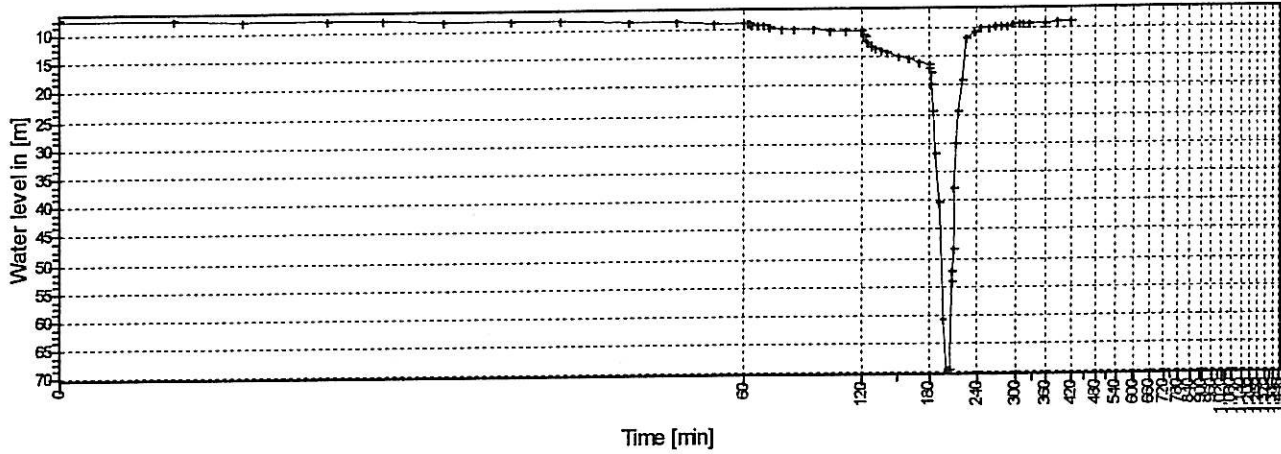
Longitude [°]: 28.3713034
 Latitude [°]: 32.4130556
 Altitude [m]: 420.00

Alt. No. 1:
 Alt. No. 2:
 Rep. inst.: VSA

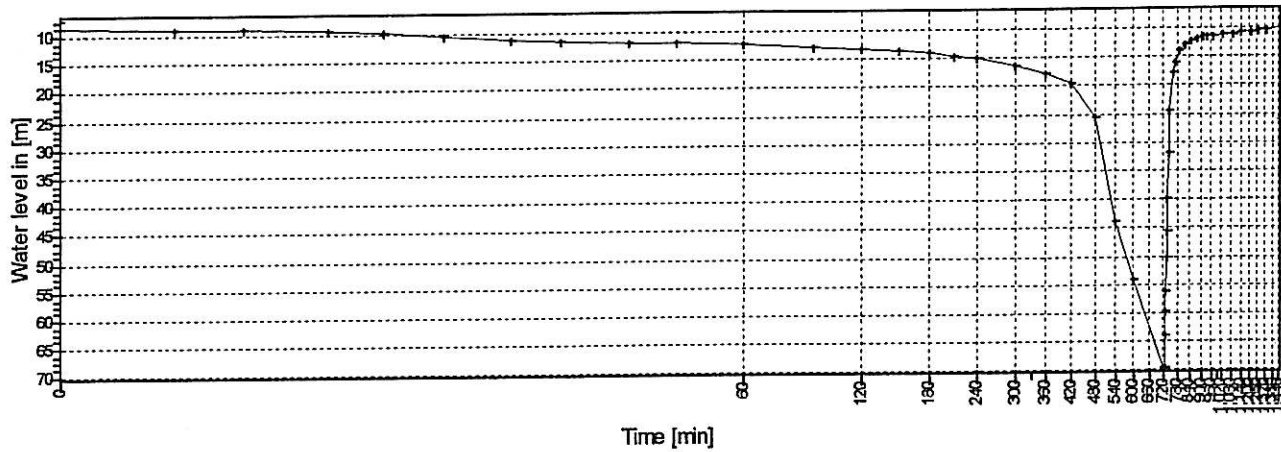
Diam. [mm]: 165
 Depth [m]: 88.96
 Col. ht. [mm]: 0.50

Water lev. [m]: 7.14
 Piezometer: 0
 Date WL meas.: 20030526

Multirate Test



Constant Rate Test



PUMPING TEST:

Rep. Inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
VSA	Step test	68.70	20030525	1240	20030525	1936			
VSA	Constant rate test	68.70	20030526	0700	20030527	0710			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1240	60	68.70	0.45	1.76							0.26
STEP TEST 2	1340	60	68.70	0.80	3.20							0.25
STEP TEST 3	1440	60	68.70	1.75	9.29							0.19
STEP TEST 4	1540	26	68.70	3.43	62.43	1.86	97	210				0.05
CONSTANT	0700	730	68.70	1.06	62.43	2.88	95	720				0.02



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228CBV0023 Number: 110-0036

Site type: Borehole

Distr./Farm No.: CENTANI

Site Name/Des.: AREA 7/DIS:/KENTANI/E.CAPE

Longitude [°]: 28.4377762

Alt. No. 1:

Diam. [mm]: 165

Water lev. [m]: 3.05

Latitude [°]: 32.5412500

Alt. No. 2:

Depth [m]: 60.79

Piezometer: 0

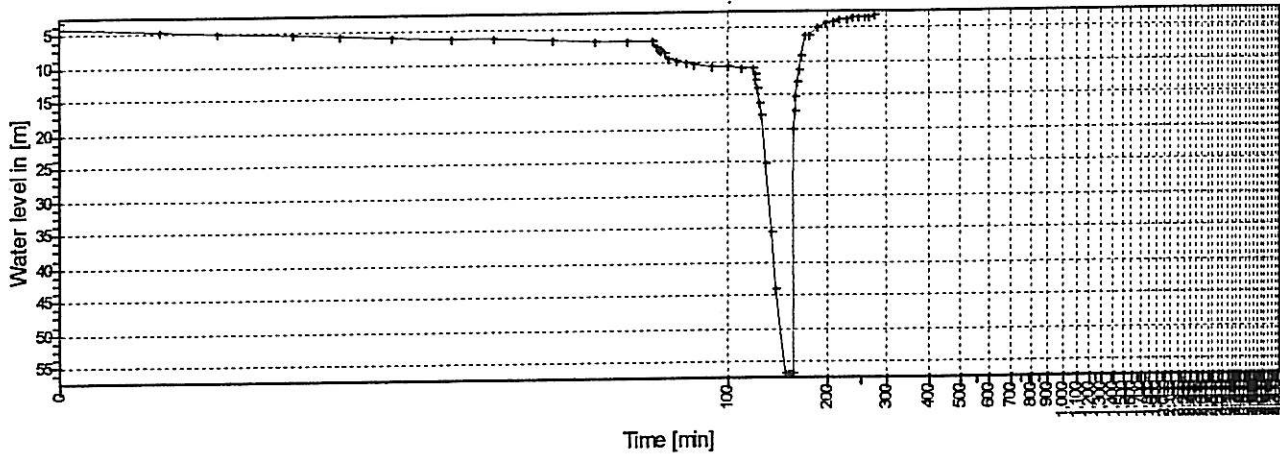
Altitude [m]:

Rep. inst.: VSA

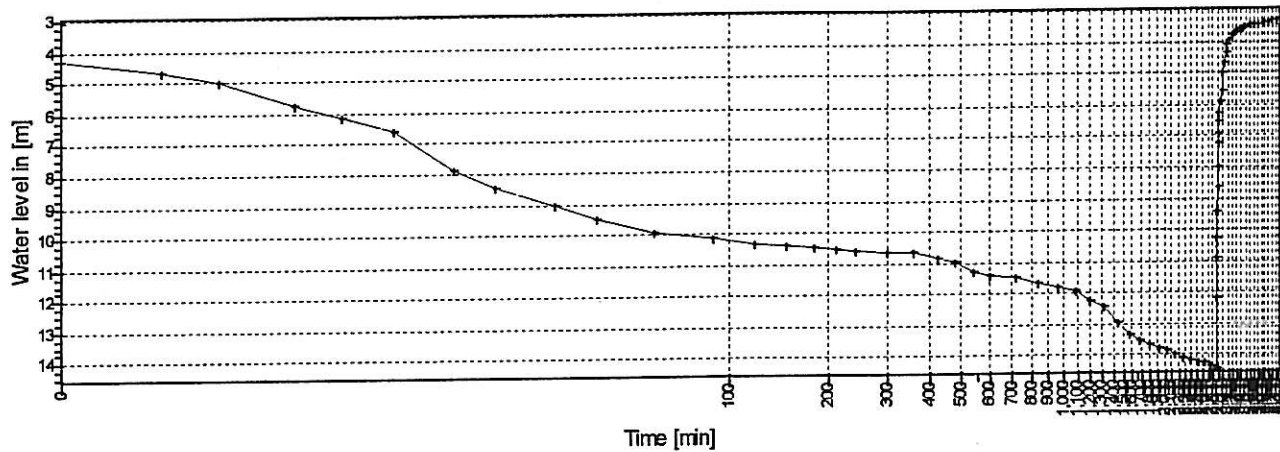
Col. ht. [mm]: 0.50

Date WL meas.: 20030527

Multirate Test



Constant Rate Test



PUMPING TEST:

Rep. inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transms. [m ³ /d]	Storativ.	Rec. abs. [l/s]
VSA	Step test	57.68	20030526	1530	20030526	2007			
VSA	Constant rate test	57.68	20030527	0730	20030530	0930			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ³ /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1530	60	57.68	1.54	3.69							0.42
STEP TEST 2	1630	60	57.68	3.02	7.91							0.38
STEP TEST 3	1730	37	57.68	6.00	53.68	0.10	100	120				0.11
CONSTANT	1317	37	57.68	2.52	11.38	0.22	98	1560	8.8		4.5E-5	0.22



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PUMPING TEST REPORT**BASIC SITE INFORMATION:**

Site Identifier: 3228CBV0025 Number: 110-0037

Site type: Borehole

Distr./Farm No.: KENTANI

Site Name/Des.: KENTANE/DIS:/AREAT

Longitude [°]: 28.4439152

Alt. No. 1:

Diam. [mm]: 165

Water lev. [m]: 3.57

Latitude [°]: 32.5468333

Alt. No. 2:

Depth [m]: 70.01

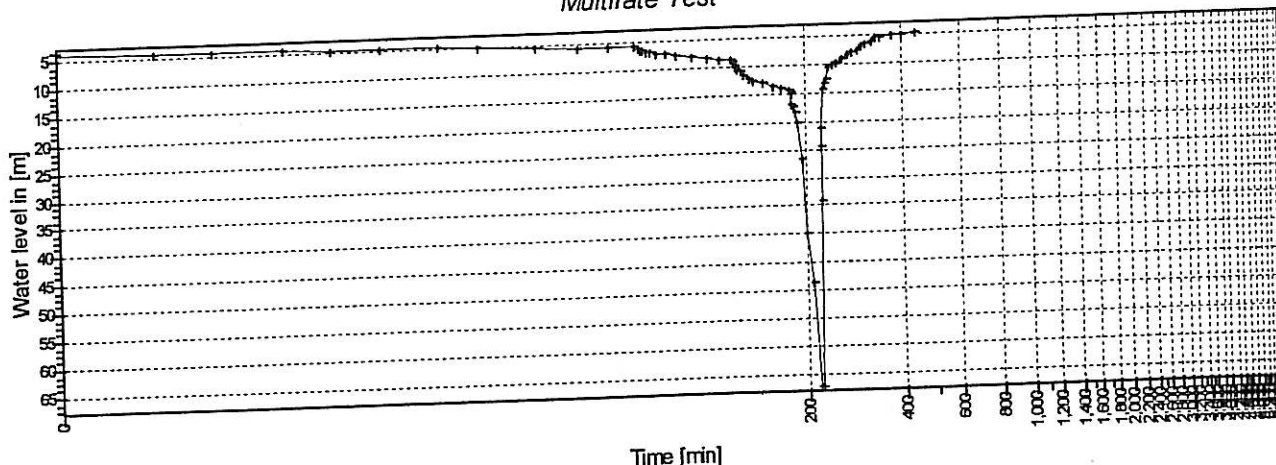
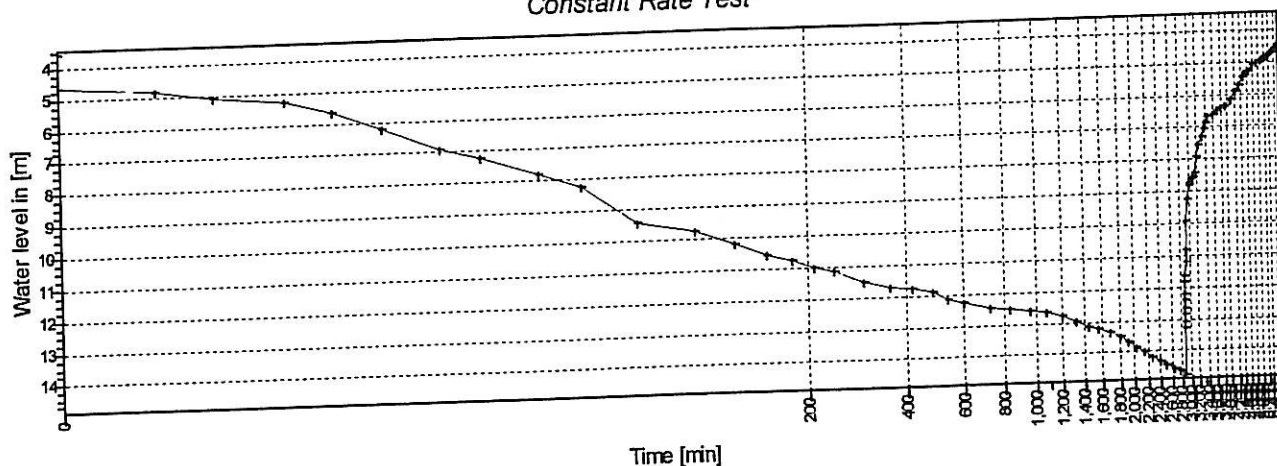
Piezometer: 0

Altitude [m]:

Rep. inst.: VSA

Col. ht. [mm]: 0.60

Date WL meas.: 20030531

Multirate Test**Constant Rate Test**

PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested		Time	Time			
VSA	Step test	68.70	20030530 1430	20030530 2153			
VSA	Constant rate test	68.70	20030531 0800	20030604 0800			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	1430	60	68.70	1.13	2.31						0.49
STEP TEST 2	1530	60	68.70	2.35	5.10						0.46
STEP TEST 3	1630	60	68.70	4.75	10.89						0.44
STEP TEST 4	1730	43	68.70	8.40	63.58	1.16	98	220			0.13
CONSTANT	0800	2880	68.70	2.61	11.16	0.89	92	2880	9.5	1.22E-5	0.23



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228CBV0030 Number: 110-0038

Site type: Borehole

Distr./Farm No.: KENTANE

Site Name/Des.: KENTANI/DIS:/TAKAZI

Longitude [°]: 28.4084426

Alt. No. 1:

Diam. [mm]: 165

Water lev. [m]: 12.95

Latitude [°]: 32.5417778

Alt. No. 2:

Depth [m]: 59.49

Piezometer: 0

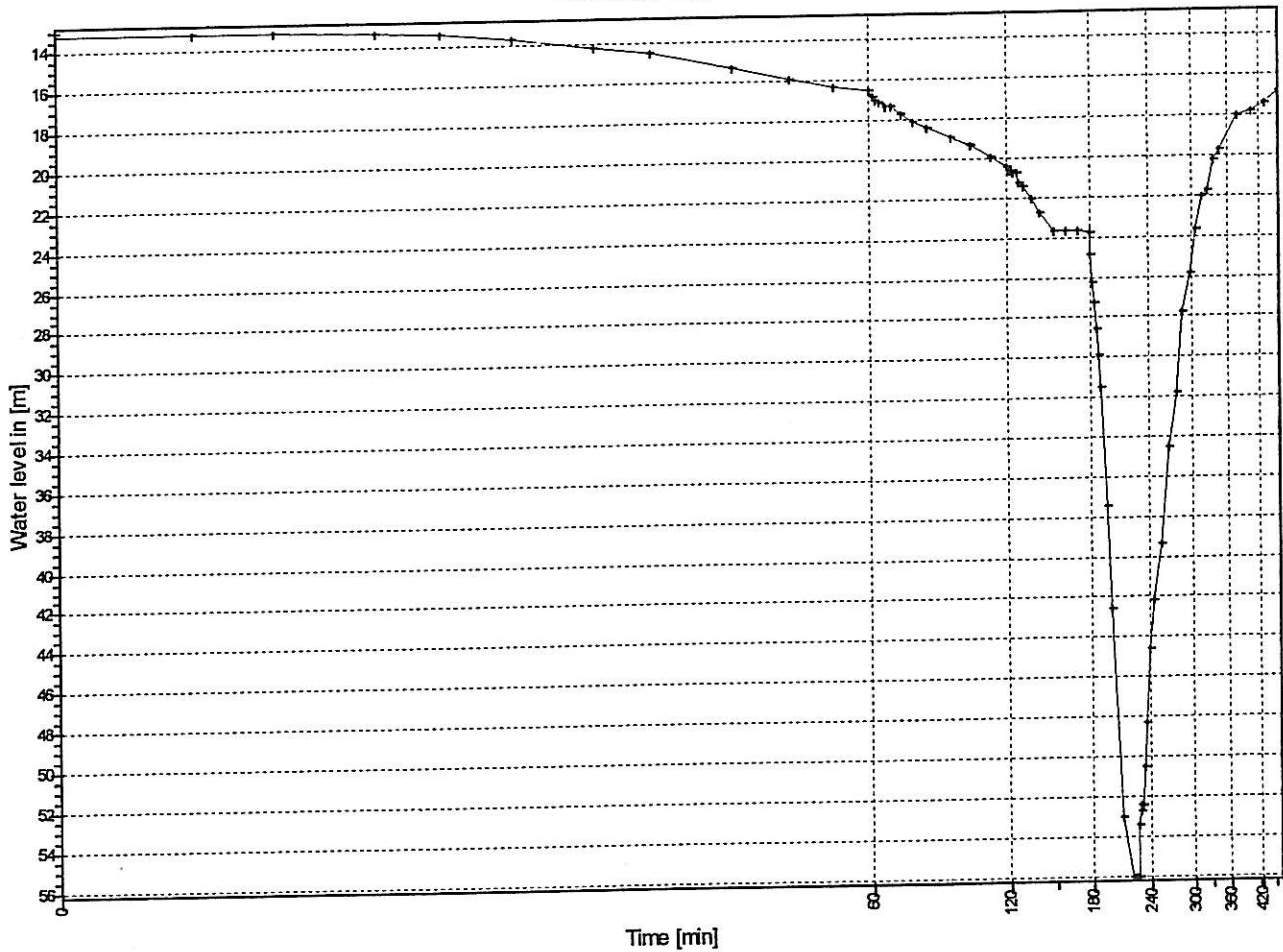
Altitude [m]:

Rep. inst.: VSA

Col. ht. [mm]: 0.41

Date WL meas.: 20030529

Multirate Test



PUMPING TEST:

Rep. Inst.	Meth. tested	Depth to Intake [m]	Starting Date	Time	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
VSA	Step test	56.70	20030529	1620	20030530	0006			

TESTING DETAILS:

Description	Time start	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
STEP TEST 1	1620	60	56.70	0.20	3.49							0.06
STEP TEST 2	1720	60	56.70	0.35	7.45							0.05
STEP TEST 3	1820	60	56.70	0.52	10.73							0.05
STEP TEST 4	1920	46	56.70	1.02	43.10	3.87	91	240				0.02



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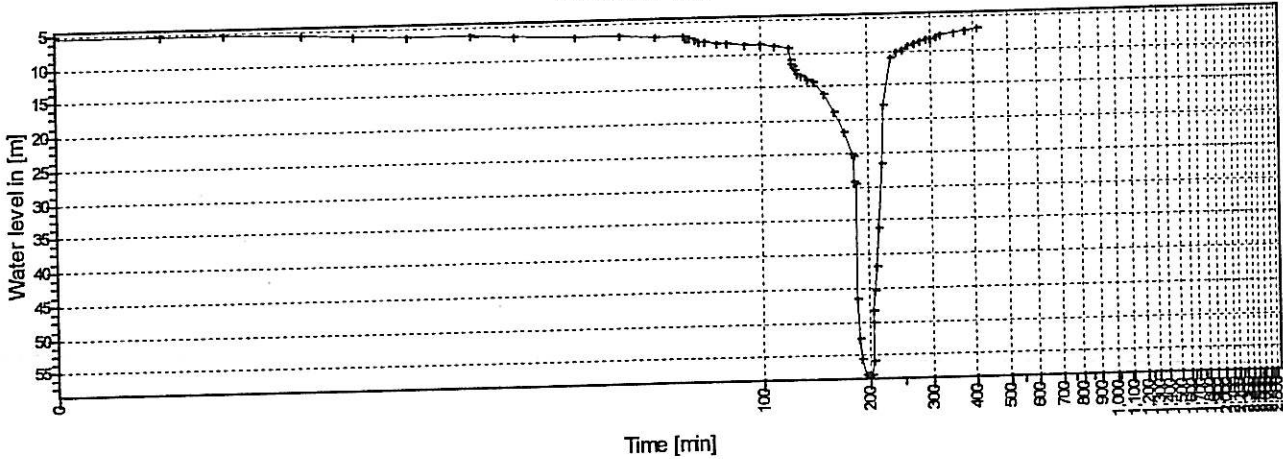
PUMPING TEST REPORT

Date compiled: 2003/07/21

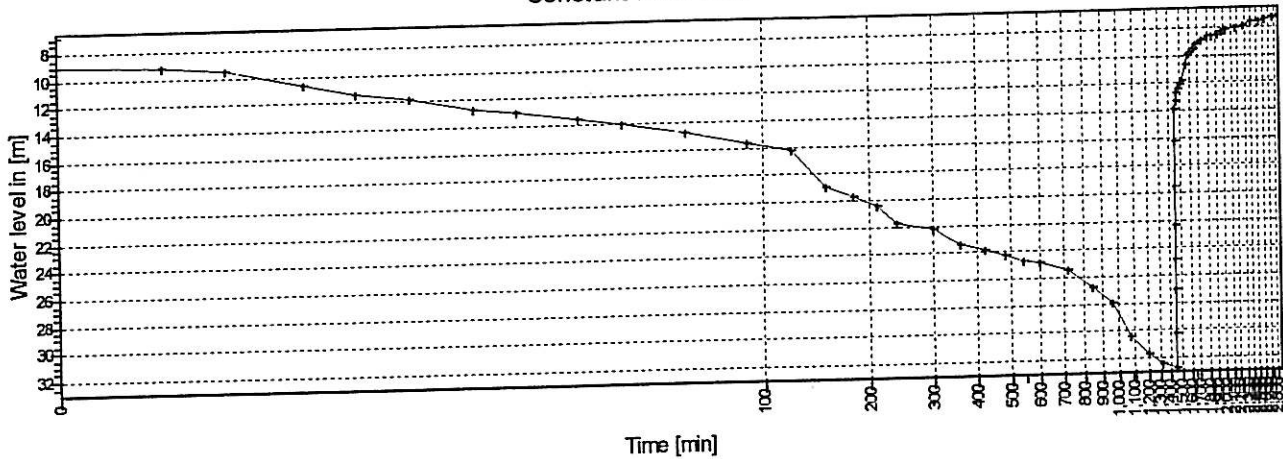
BASIC SITE INFORMATION: Site Identifier: 3228ADV0022 Number: 110-0039 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTANE/DIS./TAKAZI/AREA 7

Longitude [°]: 28.3363863	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 6.84
Latitude [°]: 32.4342778	Alt. No. 2:	Depth [m]: 59.48	Piezometer: 0
Altitude [m]:	Rep. inst.: VSA	Col. ht. [mm]: 0.37	Date WL meas.: 20030531

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested		Time	Time			
VSA	Step test	59.70	20030531 1010	20030531 1702			
VSA	Constant rate test	56.70	20030531 1703	20030602 1703			

TESTING DETAILS:	Description	Time start.	Durat. [min]	Depth to intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
	STEP TEST 1	1010	60	56.70	0.22	2.23							0.10
	STEP TEST 2	1110	60	56.70	0.40	4.04							0.10
	STEP TEST 3	1210	60	56.70	0.98	20.03							0.05
	STEP TEST 4	1310	60	56.70	2.09	52.83	1.78	97	210				0.04
	CONSTANT	1703	1440	56.70	0.62	25.91	0.32	99	1440	2.3		3.13E-6	0.02



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APPENDIX 5B
EXISTING BOREHOLES

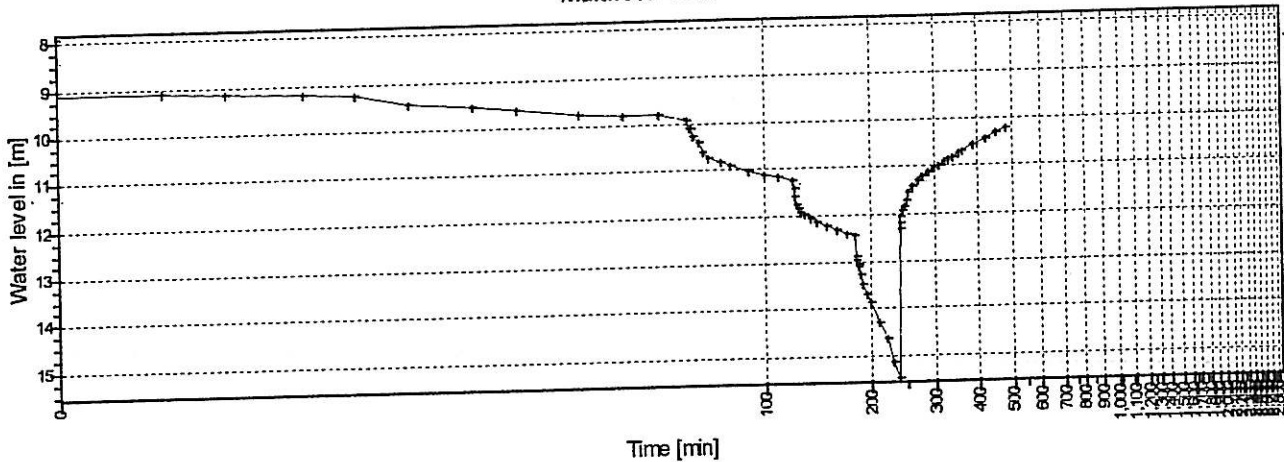
PUMPING TEST REPORT

Date compiled: 2003/07/21

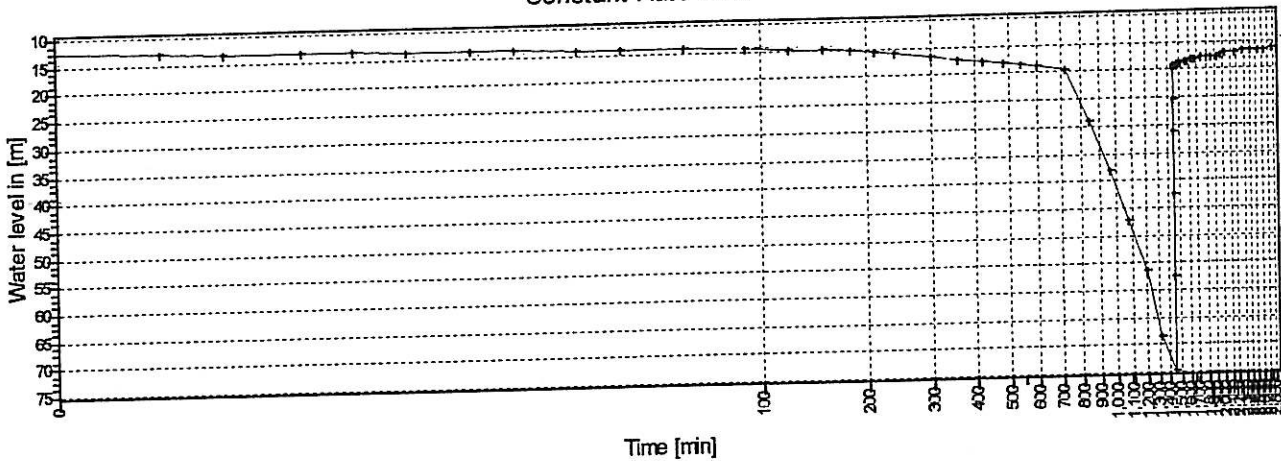
BASIC SITE INFORMATION: Site Identifier: 3228CBV0022 Number: 110-0004 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/DEBESE

Longitude [°]: 28.4480541	Alt. No. 1: G 42272	Diam. [mm]: 165	Water lev. [m]: 9.96
Latitude [°]: 32.5944722	Alt. No. 2:	Depth [m]: 84.60	Piezometer: 0
Altitude [m]:	Rep. inst.: VSA-	Col. ht. [mm]: 0.12	Date-WL meas.: 20030429-

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Math. tested		Time	Time			
VSA	Step test	74.70	20030428 1505	20030428 2305			
VSA	Constant rate test	74.70	20030429 0630	20030501 0630			

TESTING DETAILS:	Description	Time start	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [%]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
	STEP TEST 1	1505	60	74.40	2.00	2.02						0.99
	STEP TEST 2	1605	60	74.40	4.15	3.36						1.24
	STEP TEST 3	1705	60	74.40	6.03	4.54						1.33
	STEP TEST 4	1805	60	74.40	8.31	7.59	2.32	69	240			1.09
	CONSTANT	0630	1440	74.40	5.05	64.70	6.19	90	1440	10.5	0.00723	0.06



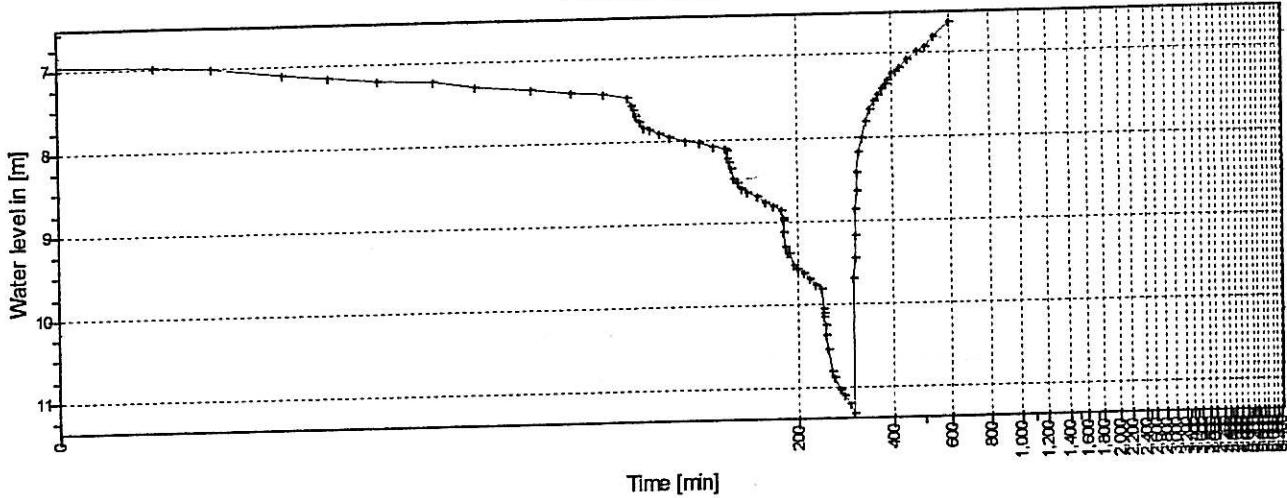
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PUMPING TEST REPORT

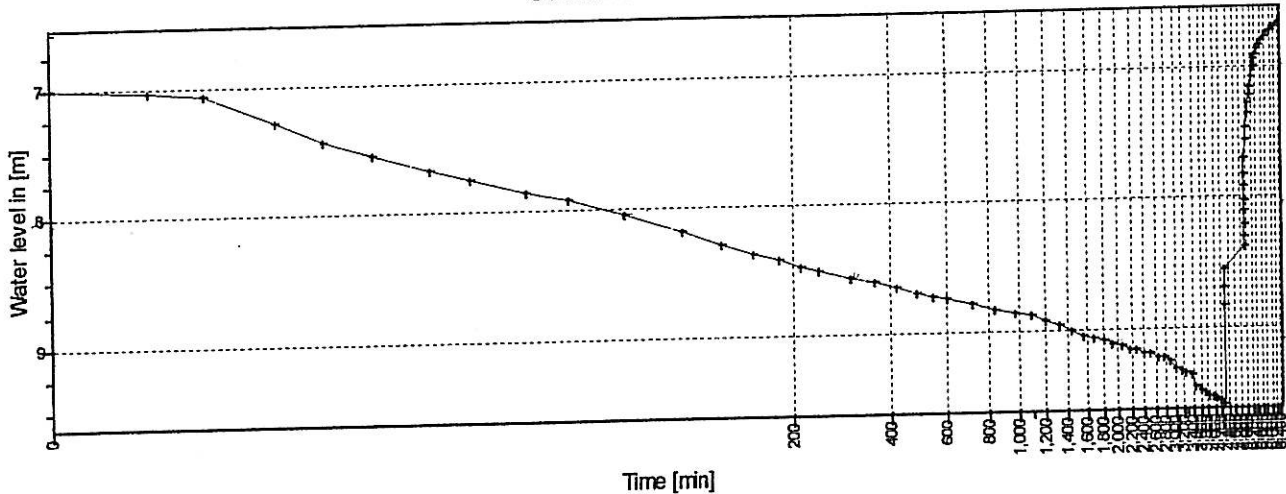
Date compiled: 2003/07/21

BASIC SITE INFORMATION:		Site Identifier: 3228CBV0029	Number: 110-0006	Site type: Borehole
Distr./Farm No.:	KENTANI	Site Name/Des.: KENTANI/DIS:/MRAWUZELI		
Longitude [°]:	28.2061623	Alt. No. 1:	42273	Diam. [mm]: 165
Latitude [°]:	32.4150000	Alt. No. 2:		Depth [m]: 57.42
Altitude [m]:		Rep. inst:	VSA	Col. ht. [mm]: 0.38
				Water lev. [m]: 6.56
				Piezometer: 0
				Date-WL meas.: 20030502

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to Intake [m]	Starting Date	Time	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. Inst.	Meth. tested								
VSA	Step test	50.00	20030501	1350	20030501	2350			
VSA	Constant rate test	50.00	20030502	0740	20030506	1940			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.											
STEP TEST 1	1350	60	50.00	2.21	0.90							2.46
STEP TEST 2	1450	60	50.00	3.91	1.54							2.54
STEP TEST 3	1550	60	50.00	5.91	2.29							2.58
STEP TEST 4	1650	60	50.00	8.11	3.25							2.50
STEP TEST 5	1750	60	50.00	11.64	4.75	0.08	98	300				2.45



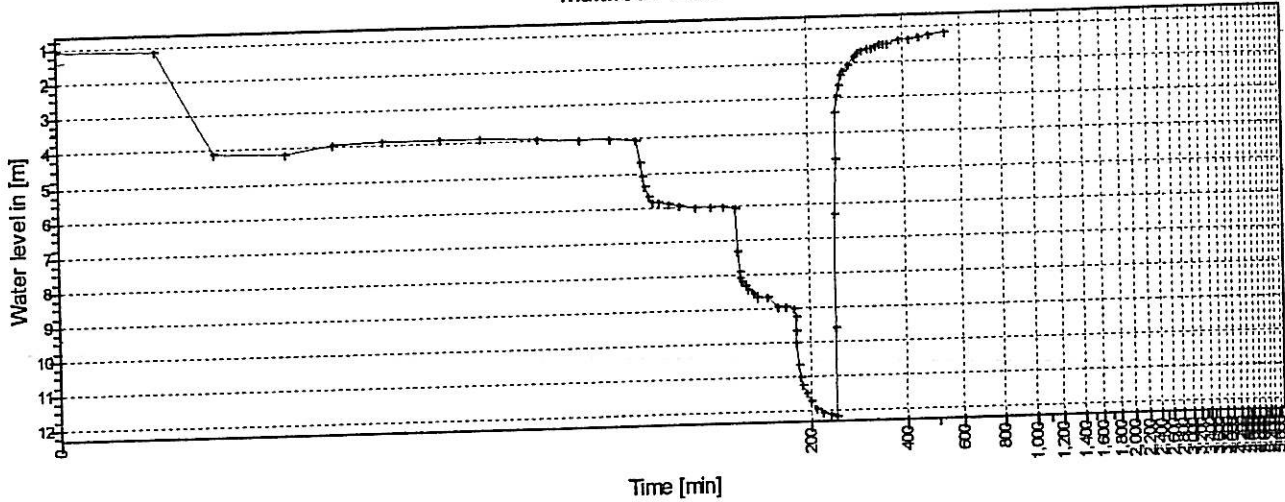
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PUMPING TEST REPORT

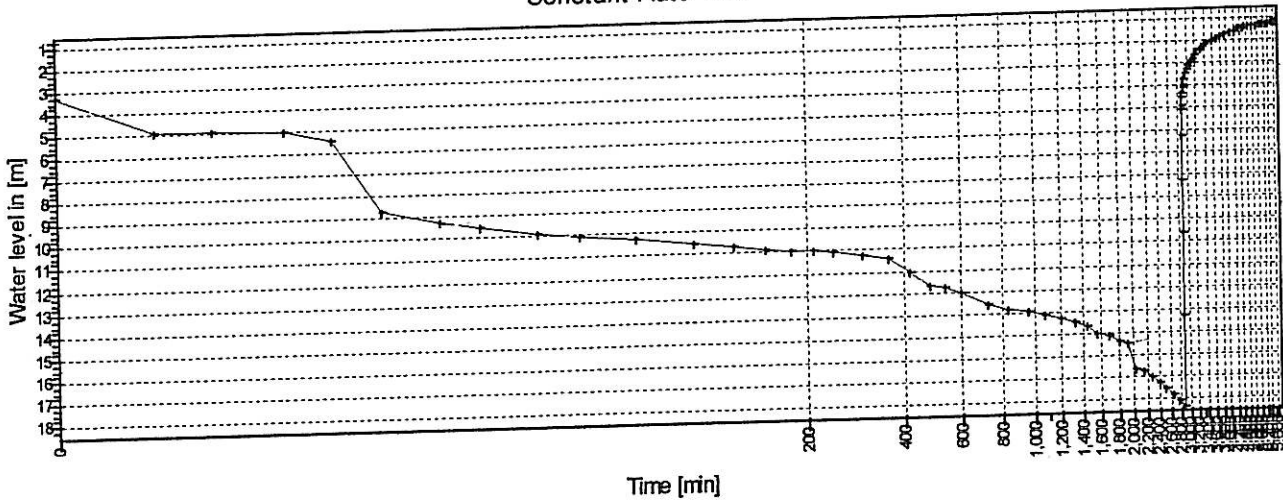
Date compiled: 2003/07/21

BASIC SITE INFORMATION:		Site Identifier: 3228CBV0021	Number: T32908	Site type: Borehole
Distr./Farm No.:	KENTANI	Site Name/Des.: KENTANI/DIS/MAXHAMA		
Longitude [°]:	28.3197195	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 0.76
Latitude [°]:	32.5814444	Alt. No. 2:	Depth [m]: 28.40	Piezometer: 0
Altitude [m]:		Rep. inst.: VSA	Col. ht. [mm]: 0.45	Date WL meas.: 20030426

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to Intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested		Time	Time			
VSA	Step test	26.50	20030425 1130	20030425 2030			
VSA	Constant rate test	26.50	20030426 0630	20030430 0630			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. %	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.											
STEP TEST 1	1130	60	26.50	0.61	3.25							0.19
STEP TEST 2	1230	60	26.50	1.01	5.29							0.19
STEP TEST 3	1330	60	26.50	1.45	8.24							0.18
STEP TEST 4	1430	60	26.50	1.98	11.39	0.43	96	300				0.17
CONSTANT	0630	2880	26.50	1.99	17.60	0.47	97	2880	4.5		5.13E-5	0.11



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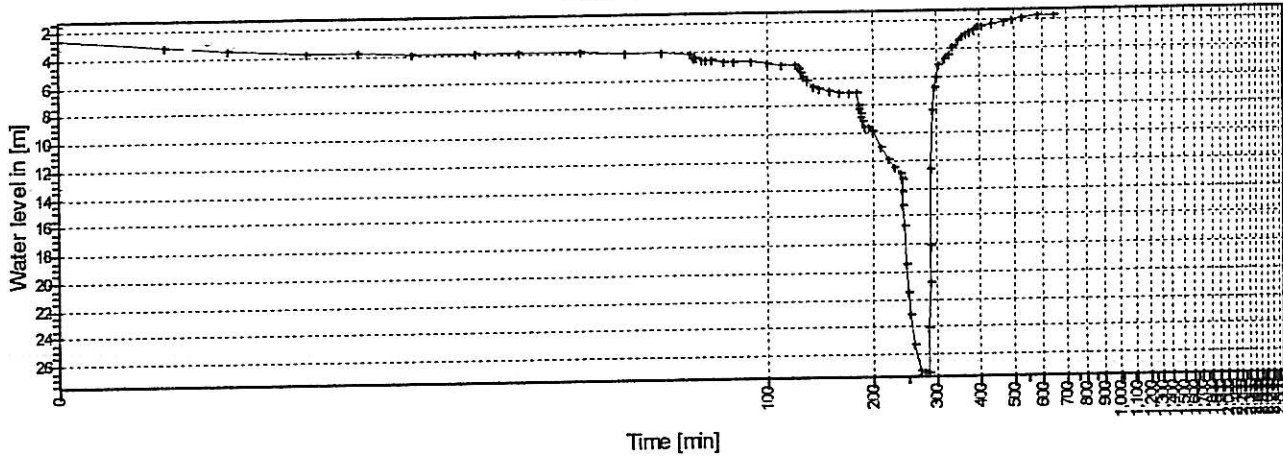
PUMPING TEST REPORT

Date compiled: 2003/07/21

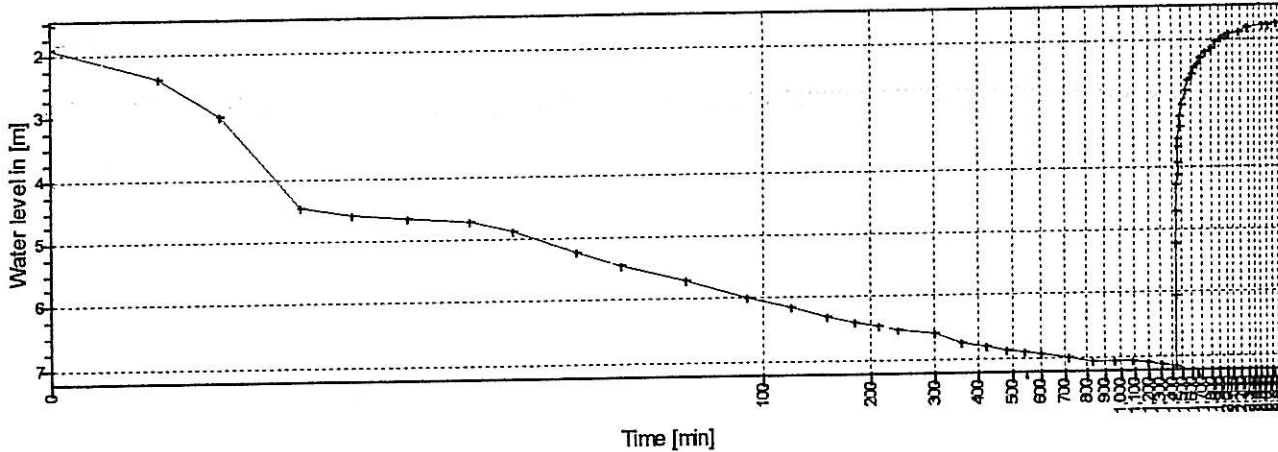
BASIC SITE INFORMATION: Site Identifier: 3228CBV0020 Number: T32909 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/KOMKHULU

Longitude [°]: 28.3029415	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 1.53
Latitude [°]: 32.5794722	Alt. No. 2:	Depth [m]: 28.01	Piezometer: 0
Altitude [m]:	Rep. inst.: VSA	Col. ht. [mm]: 0.24	Date-WL meas.: 20030427

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. Inst.	Meth. tested							
VSA	Step test	26.50	20030426	20030426	1310 2356			
VSA	Constant rate test	26.50	20030427	20030429	0620 0620			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.											
STEP TEST 1	1310	60	26.50	0.23	2.65							0.09
STEP TEST 2	1410	60	26.50	0.41	3.48							0.12
STEP TEST 3	1510	60	26.50	0.57	5.60							0.10
STEP TEST 4	1610	60	26.50	0.80	11.37							0.07
STEP TEST 5	1710	60	26.50	1.23	25.75	0.15	99	360				0.05
CONSTANT	0620	1440	26.50	0.52	5.64	0.22	96	1440	16.5		1.7E-13	0.09



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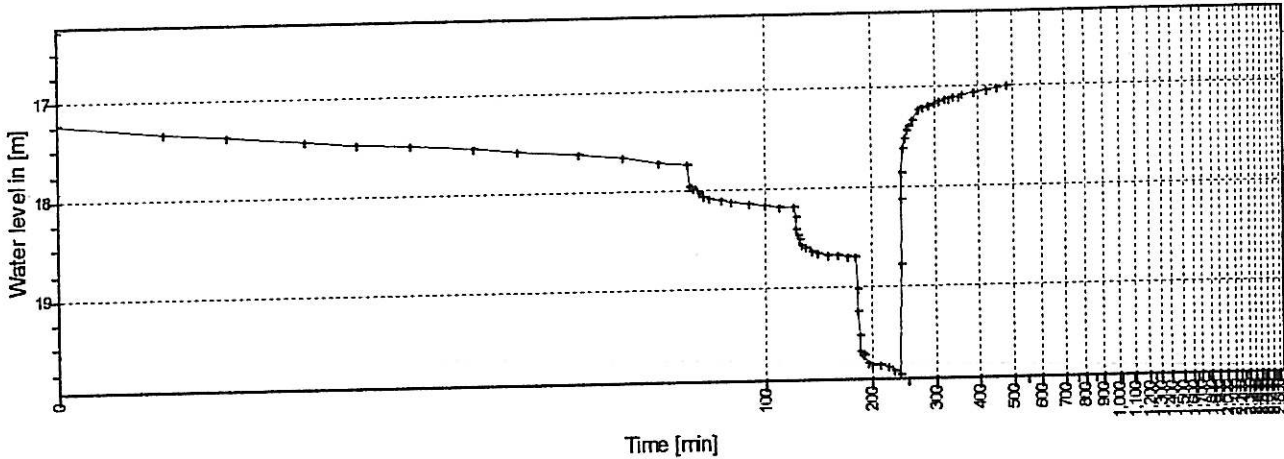
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Date compiled: 2003/07/21

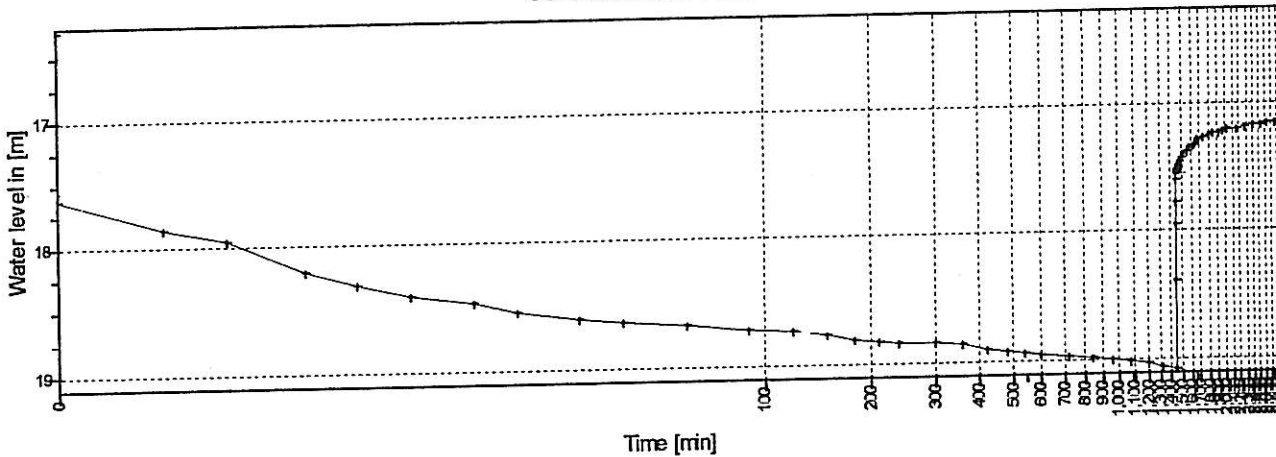
BASIC SITE INFORMATION: Site Identifier: 3228CBV0019 Number: T32910 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/MNYAMA

Longitude [°]: 28.2521630	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 16.29
Latitude [°]: 32.5012500	Alt. No. 2:	Depth [m]: 23.45	Piezometer: 0
Altitude [m]:	Rep. inst.: VSA	Col. ht: [mm]: 0.36	Date WL meas.: 20030426

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. Inst.	Meth. tested		Time	Time			
VSA	Step test	20.83	20030425 1150	20030425 1950			
VSA	Constant rate test	20.83	20030426 0630	20030428 0630			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	1150	60	23.48	0.15	1.45						0.10
STEP TEST 2	1250	60	23.48	0.25	1.90						0.13
STEP TEST 3	1350	60	23.48	0.42	2.41						0.17
STEP TEST 4	1450	60	23.48	0.62	3.60	0.72	80	240			0.17
CONSTANT	0630	1440	23.48	0.40	2.79	0.85	70	1440	1.5	0.0306	0.14



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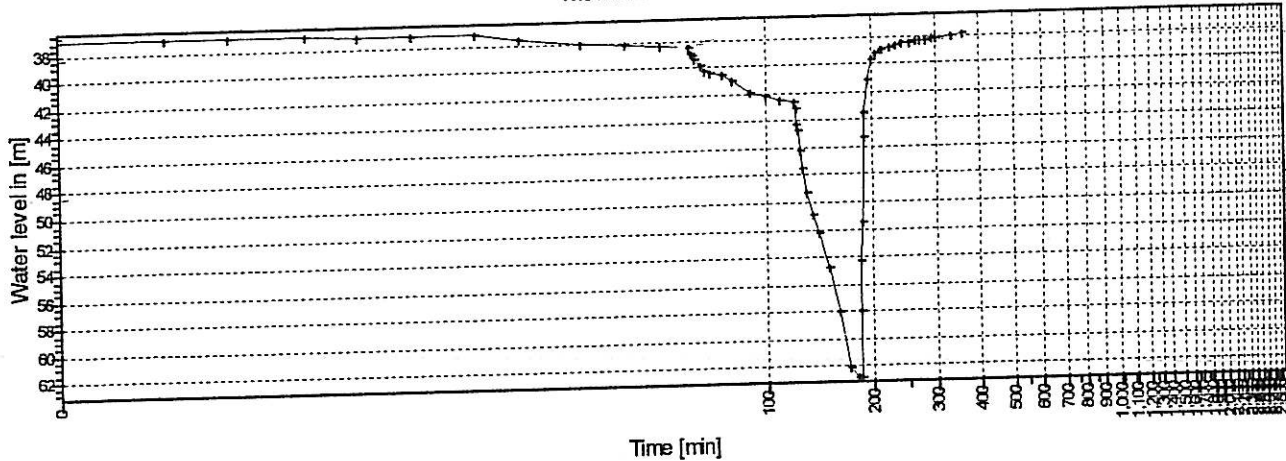
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Date compiled: 2003/07/21

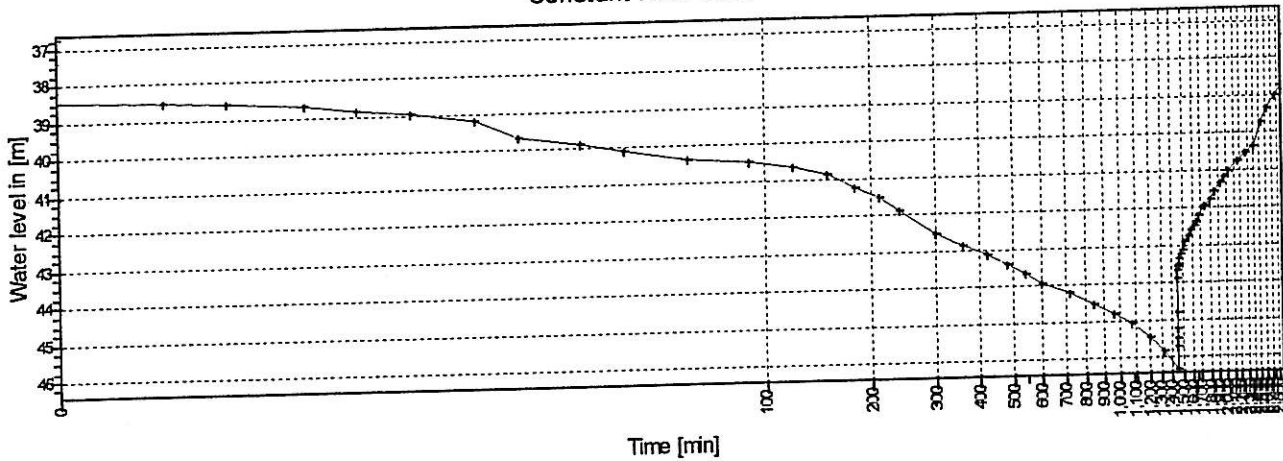
BASIC SITE INFORMATION: Site Identifier: 3228CBU1273 Number: T32913 Site type: Borehole
 Distr./Farm No.: QOLORA Site Name/Des.: KENTANI/DIS:/NOTSHIVGETHAFINI

Longitude [°]: 28.3964981	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 36.74
Latitude [°]: 32.5925556	Alt. No. 2:	Depth [m]: 80.60	Piezometer: 0
Altitude [m]: 225.00	Rep. inst.: VSA	Col. ht. [mm]: 0.22	Date WL meas.: 20030429

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Time	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested							
VSA	Step test	62.83	20030429	20030429	0630 1233			
VSA	Constant rate test	62.83	20030429	20030501	1300 1300			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [%]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.										
STEP TEST 1	0630	60	62.80	0.45	1.75						0.26
STEP TEST 2	0730	60	62.80	1.01	5.94						0.17
STEP TEST 3	0830	63	62.80	1.50	26.09	1.24	95	180			0.06
CONSTANT	1300	1440	62.80	0.60	9.56	2.00	79	1440	1.8	4.94E-5	0.06



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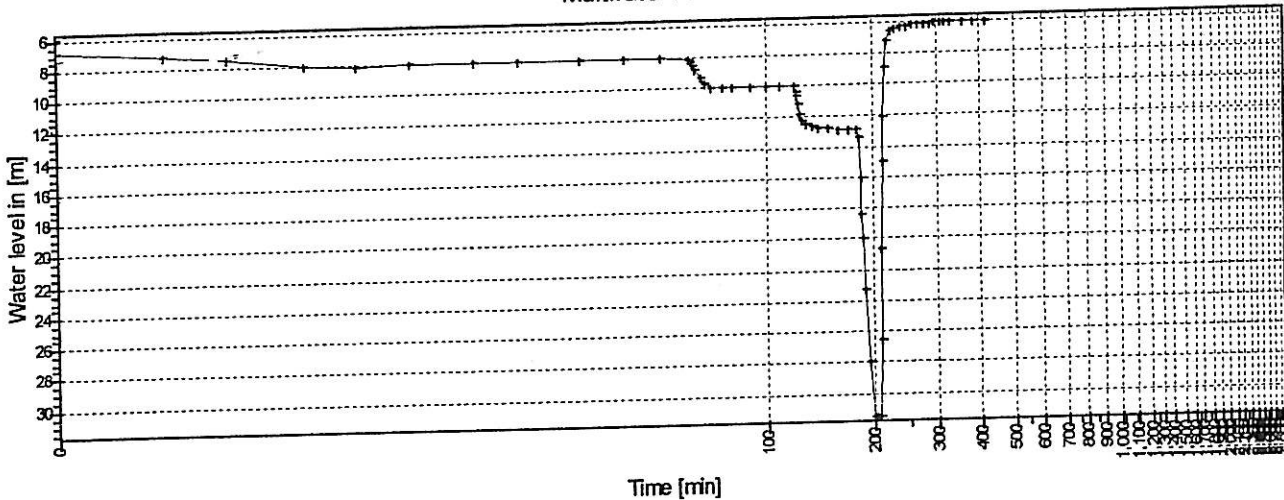
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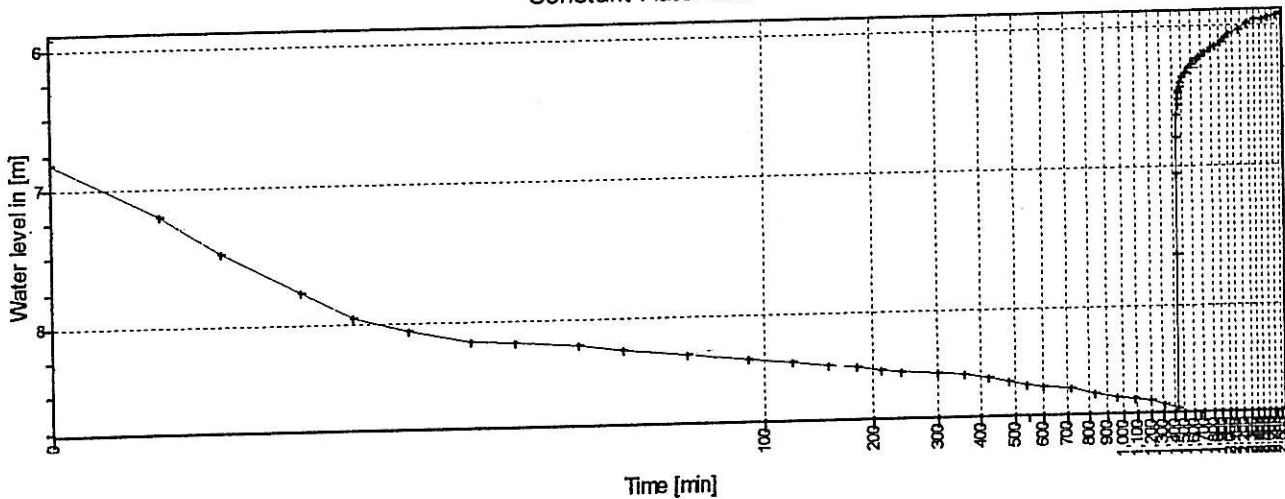
BASIC SITE INFORMATION: Site Identifier: 3228CBU1275 Number: T32916 Site type: Borehole
 Distr./Farm No.: QOLORA Site Name/Des.: QOLORA KWANONTSINGA - A/DIS:/CENTANI

Longitude [°]: 28.3527198	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 5.91
Latitude [°]: 32.6072222	Alt. No. 2:	Depth [m]: 34.75	Piezometer: 0
Altitude [m]: 200.00	Rep. inst.: VSA	Col. ht. [mm]: 0.20	Date-WL meas.: 20030430

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. inst.	Meth. tested		Time	Time			
VSA	Step test	32.70	20030430 0630	20030430 1328			
VSA	Constant rate test	32.70	20030430 1700	20030502 1700			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	0630	60	32.70	0.52	2.17						0.24
STEP TEST 2	0730	60	32.70	1.01	4.12						0.25
STEP TEST 3	0830	60	32.70	1.50	6.92						0.22
STEP TEST 4	0930	28	32.70	2.07	25.57	0.08	100	210			0.08
CONSTANT	1700	1440	32.70	0.61	2.84	0	100	1440	2.2	0.0005	0.21



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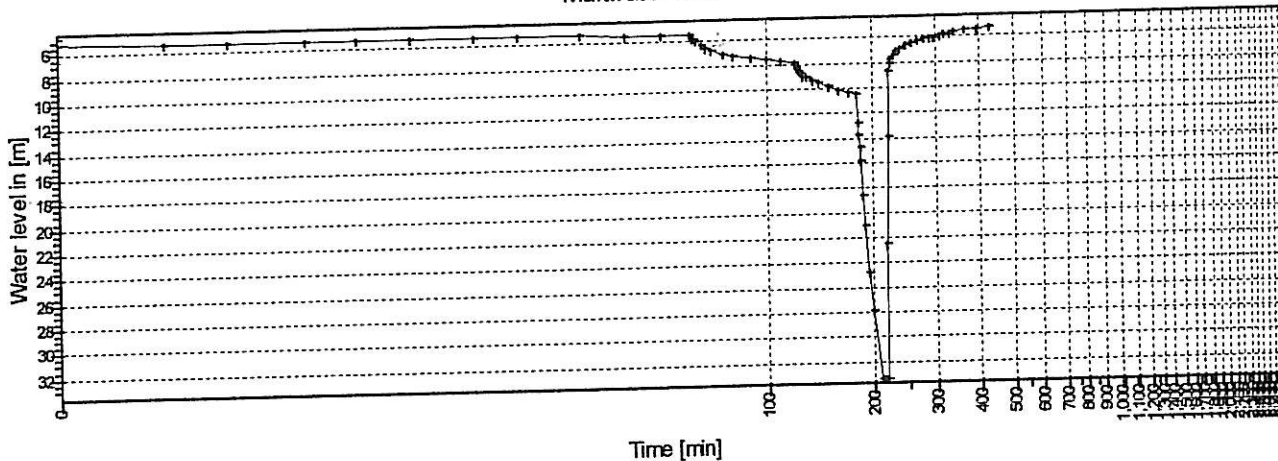
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Date compiled: 2003/07/21

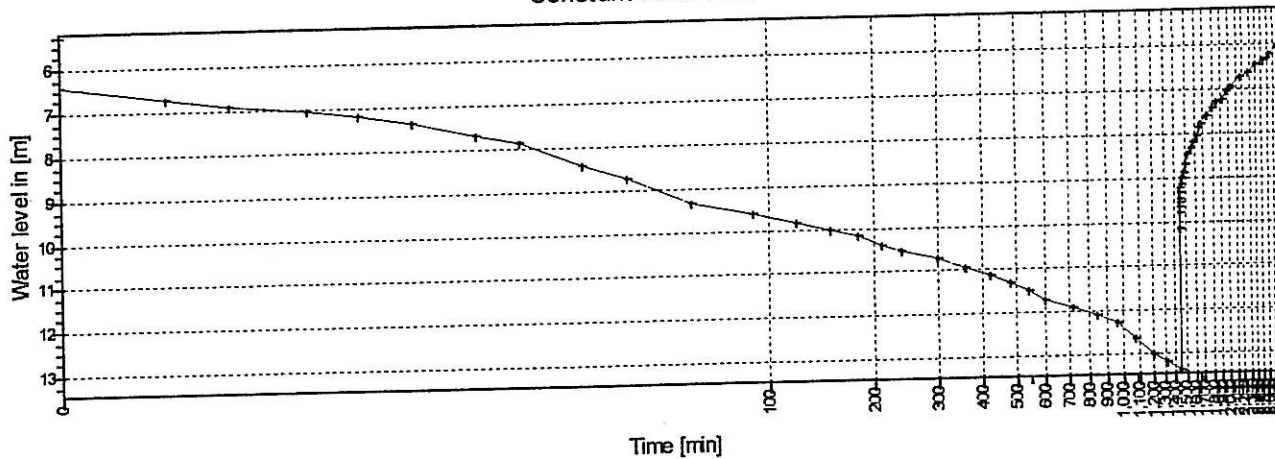
BASIC SITE INFORMATION: Site Identifier: 3228ADV0015 Number: T32927 Site type: Borehole
 Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/TEKOKOMA

Longitude [°]: 28.2696910	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 5.25
Latitude [°]: 32.3441667	Alt. No. 2:	Depth [m]: 36.29	Piezometer: 0
Altitude [m]:	Rep. inst.: VSA	Col. ht. [mm]: 0.12	Date WL meas.: 20030505

Multirate Test



Constant Rate Test



PUMPING TEST:		Depth to intake [m]	Starting Date	Ending Date	Transmis. [m ² /d]	Storativ.	Rec. abs. [l/s]
Rep. Inst.	Meth. tested		Time	Time			
VSA	Step test	32.70	20030505 0640	20030505 1348			
VSA	Constant rate test	32.70	20030505 1350	20030507 1350			
VSA	Constant rate test	32.70	20030506 1350	20030507 1350			
VSA	Constant rate test	32.70	20030506 1350	20030507 1350			

TESTING DETAILS:		Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
Description	Time start.					%					
STEP TEST 1	0640	60	32.70	0.85	0.83						1.02
STEP TEST 2	0740	60	32.70	1.01	3.29						0.31
STEP TEST 3	0840	60	32.70	1.56	5.89						0.26
STEP TEST 4	0940	38	32.70	2.52	28.70	0.62	98	210			0.09
CONSTANT	1310	1440	32.70	1.16	8.16	0.67	92	1440	3.5	0.00022	0.14



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PUMPING TEST REPORT

Date compiled: 2003/07/21

BASIC SITE INFORMATION:

Site Identifier: 3228ADU1285 Number: T32928

Site type: Borehole

Distr./Farm No.: KENTANI

Site Name/Des.: KENTANI/DIS:/TEKOKONA

Longitude [°]: 28.2774967

Alt. No. 1:

Diam. [mm]: 165

Water lev. [m]: 2.20

Latitude [°]: 32.3447778

Alt. No. 2:

Depth [m]: 16.29

Piezometer: 0

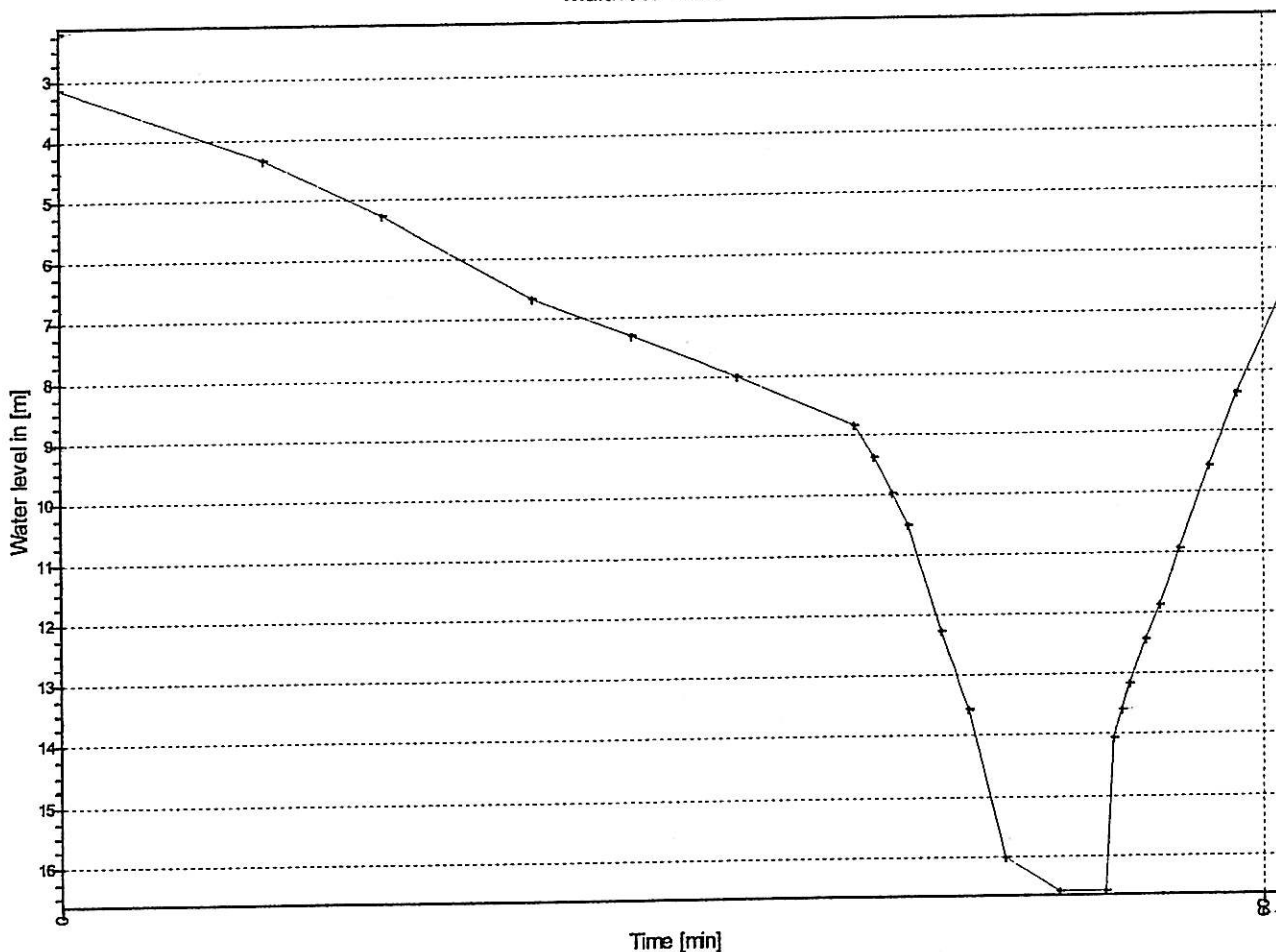
Altitude [m]: 0

Rep. inst.: VSA

Col. ht. [mm]: 0.00

Date WL meas.: 20030502

Multirate Test



PUMPING TEST:

Rep. inst.	Meth. tested	Depth to intake [m]	Starting Date	Time	Ending Date	Time	Transms. [m ² /d]	Storativ.	Rec. abs. [l/s]
VSA	Calibration test	14.70	20030502	1605	20030502	1710			

TESTING DETAILS:

Description	Time start.	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recov. [m]	%	Rec. Dur. [min]	Trans. [m ² /d]	Perm. [m/d]	Storat.	Q/st
CALIBRATION	1605	35	14.70	0.40	14.38	4.36	70	30				0.03



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APPENDIX 6

Management Recommendation

MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228BCV0051 Number: 110-0024 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KABAKAZI/AREA5/DIS:/KENTANI

Longitude [°]: 28.5273046	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 8.78
Latitude [°]: 32.4363889	Alt. No. 2:	Depth [m]: 76.83	WL status: Static
Altitude [m]: 298.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030524

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0024	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 6.92	Na: 197	Cl: 317	Langel.: -1.14
EC: [mS/m] 135	K: 2.2	NO3 as N: 4	Aggr-Ind: 10.95
TDS: 677	Si:	SO4: 15	Ion-bal: -6.14
T. Alk.: 173	Al:	F: 0.49	CaCO3: 144.63
Ca: 25	Fe: 3.168	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 20	Mn:	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit	
		Value exceeds recommended minimum limit Value exceeds minimum allowable limit	

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield[l/s]	Method meas.	Aquifer type	Comment
24.00	24.00	0.06	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
18.00	24.00	177	Steel	4				
0.00	18.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to intk. [m]	Disch. rate[l/s]	Drawd. [m]	Recovery [m] %	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030524	60	68.70	0.20	4.97					
STEP TEST 2	20030524	60	68.70	0.38	12.66					
STEP TEST 3	20030524	60	68.70	0.61	33.71					
STEP TEST 4	20030524	23	68.70	1.14	59.70	0.44	99	210		



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228BCV0052 Number: 110-0025 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KABAKAZI/AREA5/DIS:/KENTANI

Longitude [°]: 28.5358602	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 20.55
Latitude [°]: 32.4510000	Alt. No. 2:	Depth [m]: 81.09	WL status: Static
Altitude [m]: 258.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030522

EXISTING EQUIPMENT:

Pump: _____	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine: _____	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0025	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.05	Na: 132	Cl: 265	Langel.: -0.66
EC: [mS/m] 116	K: 2.5	NO3 as N: 0.05	Aggr-Ind: 11.42
TDS: 578	Si: _____	SO4: 16	Ion-bal: -8.81
T. Alk.: 226	Al: _____	F: 0.77	CaCO3: 228.18
Ca: 42	Fe: 0.832	Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption	
Mg: 30	Mn: _____	† Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit	
			E.Coli: _____
			Faec. co: 0
			Total Co: 3
			SPC: _____

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
62.00	62.00	0.22	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	12.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery %	[min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030521	60	68.30	0.22	3.69					
STEP TEST 2	20030521	60	68.30	0.41	8.89					
STEP TEST 3	20030521	60	68.30	0.62	14.25					
STEP TEST 4	20030521	60	68.30	1.22	30.88					
STEP TEST 5	20030521	49	68.30	1.84	47.98	4.40	91	300		
CONSTANT	20030522	1440	68.30	0.52	30.50	4.69	85	1440		

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Hand pump	53.00	Hand	24	0.10	CLASS 2	28.65	43.00
Note:								
2	Hand pump	53.00	Hand	12	0.30	CLASS 2	28.65	43.00
Note:								



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MANAGEMENT RECOMMENDATIONS

Date compiled: 2003/07/21

BASIC SITE INFORMATION: Site Identifier: 3228ADV0020 Number: 110-0023 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Descr.: KWAQHITI/AREA2/DIS:KENTANI

Longitude [°]: 28.3704423	Alt. No. 1:	Diam. [mm]: 165	Water lev. [m]: 1.12
Latitude [°]: 32.4059444	Alt. No. 2:	Depth [m]: 97.73	WL status: Static
Altitude [m]: 426.00	Rep. inst.: VSA	Col. ht. [m]: 0.50	Date WL meas.: 20030528

EXISTING EQUIPMENT:

Pump:	Pulley Diam. [mm]:
Type of Inst.:	Depth to Intk. [m]:
Manufacturer:	
Engine:	Power Rating [kW]
Manufacturer:	Pulley Diam. [mm]:
Type of Power:	

USE APPLICATION:

Site Status: Unused
 Purpose: Production (water supply)
 Consumer: Non-urban
 Application: Domestic - all purposes

WATER CHEMISTRY:

Sample No.: 110-0023	Date sampled: 20030617	Depth sampl. [m]: 0	Comment:
Main Parameters:		Calculated Parameters:	Bacteriol. Parameters:
pH: 7.07	Na: 132	Cl: 169	Langel.: -0.39
EC: [mS/m] 115	K: 1.5	NO3 as N: 0.03	Aggr-Ind: 11.73
TDS: 575	Si:	SO4: 24	Ion-bal: -6.35
T. Alk.: 412	Al:	F: 0.6	CaCO3: 307.20
Ca: 44	Fe: 0.542		SPC:
Mg: 48	Mn:		

Concentrations in [mg/l]; Bact. param. in counts/100ml; Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit ‡ Value exceeds minimum allowable limit

AQUIFER INFORMATION:

Depth to Top [m]	Depth to Bot. [m]	Yield [l/s]	Method meas.	Aquifer type	Comment
24.00	24.00	0.20	Notch (V- or U-notch)	Fractured	

CASING DETAILS:

Depth to Top [m]	Depth to Bot. [m]	Diam. [mm]	Material	Thickn. [mm]	Type of openings	Openings [mm]: Length Width	Hor. Dist.	Vert. Dist.
0.00	18.00	177	Steel	4				

TESTING DETAILS:

Description	Date	Durat. [min]	Depth to Intk. [m]	Disch. rate [l/s]	Drawd. [m]	Recovery [m] % [min]	T [m ² /d]	Storage	Comment
STEP TEST 1	20030527	60	68.70	0.23	1.95				
STEP TEST 2	20030527	60	68.70	0.40	3.89				
STEP TEST 3	20030527	60	68.70	0.66	6.43				
STEP TEST 4	20030527	60	68.70	1.26	13.63				
STEP TEST 5	20030527	40	68.70	2.32	68.26	0.87 99 280			
CONSTANT	20030528	1440	68.70	0.94	18.51	0.56 97 1440	3.4	7.7E-6	

RECOMMENDATIONS:

Prior.	Rec. equipm.	Depth to Intk. [m]	Type of power	Duty cyc. [hrs]	Disch. rate [l/s]	Water quality	Dyn. water level [m]	Crit. water level [m]
1	Mono-type pump	25.10	Electric motor	24	0.40	CLASS 2	9.40	15.12
Note:								
2	Mono-type pump	25.10	Electric motor	12	0.80	CLASS 2	9.40	15.12
Note:								



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APPENDIX 7B
EXISTING BOREHOLES

CHEMISTRY REPORT

Date compiled: 2003/07/22

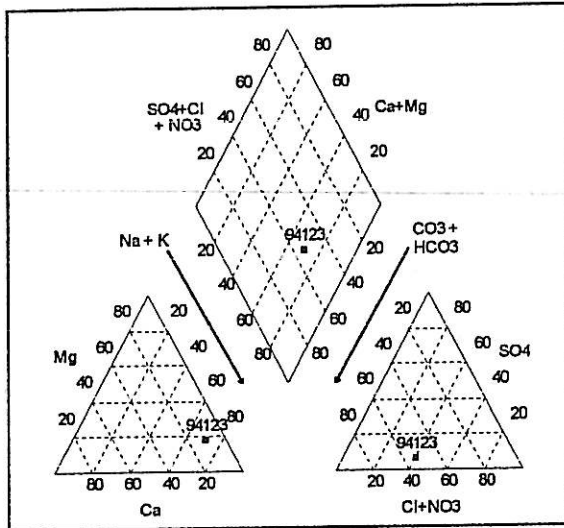
BASIC SITE INFORMATION: Site Identifier: 3228CBV0022 Number: 110-0004 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS/DEBESE

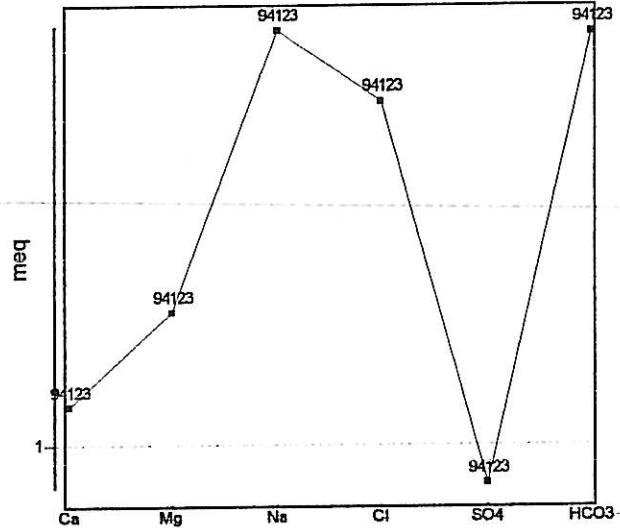
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.4480541	Reg./BB.:		Topo-set.:	Hillside (slope)	Depth [m]:	84.60
Latitude [°]:	32.5944722	G-Nr.:	G 42272	Site status:	In use	Col. ht. [m]:	0.12
Altitude [m]:				Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units			Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System			Equipment:	Mono-type pump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94123	110-0004			20030611	0000		0	20030611	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94123	7.18	115	577	24	23	165	1.8	355		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94123		181	40	0.02	0.78					0.314

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94123	0.01										0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94123											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94123												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94123		61		93					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94123					19.7	1.4					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94123	866.66	805.00	10.31	13.08	-11.83	154.48	154.48	94.67	11.51	-0.60	0.84	5.77

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.:		110-0004					
Project:		Kentani					
District:		Kentani					
Constituent (mg/l):	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	577.00	1	450	1000	2400	3000	3400
pH	7.18	0	5-9.5	4.5-6.5	4-4.5 or 10-10.5	3-10	<3 or >11
Turbidity (NTU)	1.40	2	0-10	100	20.00	50.00	50.00
EC (mS/m)	115.00	1	70	150	370	520	520
Alkalinity	355.00						
Total hardness (T.H.)	155.00	0	200	300	600	600	600
Calcium (Ca)	24.00	0	80	150	300	300	300
Magnesium (Mg)	23.00	0	70	100	200	400	400
Sodium (Na)	165.00	1	100	200	400	1000	1000
Iron (Fe)	0.31	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.30	4.00	10.00	10.00
Nitrate (as N)	0.01	0	6	10	20	40	40
Chloride (Cl)	181.00	1	100	200	600	1200	1200
Fluoride (F)	0.78	1	0.70	1.00	1.50	3.50	3.50
Sulphate (SO ₄)	40.00	0	200	300	600	1000	1000
Total coliforms (T.col)	93.00	2	0	10	100	1000	1000
Faecal coliforms (Fc)	61.00	3	0	1	10	100	100
Potassium (K)	1.80	0	25	50	100	500	500
Zinc (Zn)		-	3	5	10	200	20
Arsenic (As)		-	0.01	0.05	0.20	2.00	2.00
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	3.00	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO₃)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages. but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

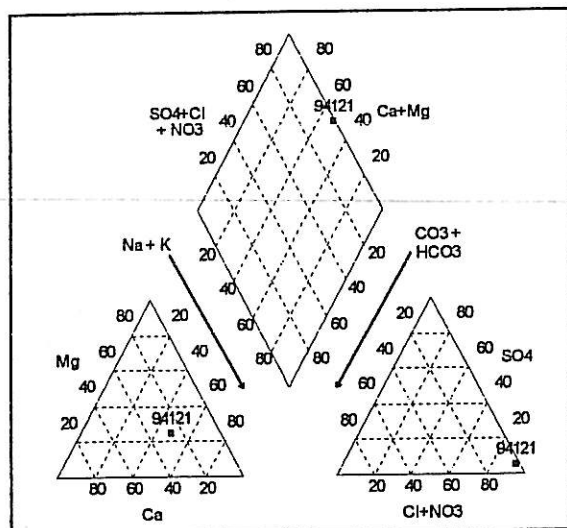
BASIC SITE INFORMATION: Site Identifier: 3228CBV0029 Number: 110-0006 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/MRAWUZELI

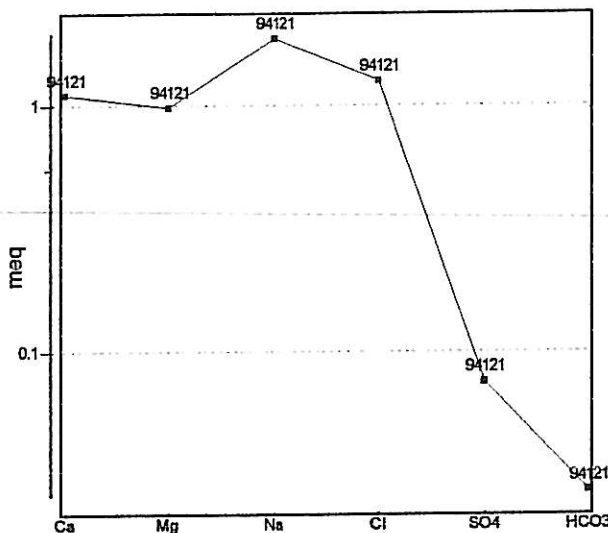
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.2061623	Reg./BB.:	Topo-set:	Valley	Depth [m]:	57.42	
Latitude [°]:	32.4150000	G-Nr.:	42273	Site status:	Unused	Col. ht. [m]:	0.38
Altitude [m]:			Site purp.:	Production (water supply)	Drain. reg.:		
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165	
Coord. meth.:	Global Positioning System		Equipment:		Rep. inst.:	VSA	

Piper Diagram



Schoeller Diagram



Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94121	110-0006			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m								P. Alk.	T. Alk.	P. Acid.	M. Acid.
Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K					
94121	6.9	43	214	22	12	43	0.69		1.36		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe	
94121		45	3.6	0.76	0.25					0.157	

ADDITIONAL PARAMETERS:											
Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94121	0.0009										0.029

Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd
94121										

ORGANIC PARAMETERS:												
Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94121												

BACTERIOLOGICAL PARAMETERS:										
Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO	
94121		2		2						

PHYSICAL PROPERTIES AND ISOTOPES:											
Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94121					24.8	0.99					

CALCULATED PARAMETERS:												
Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94121	129.58	301.00	3.97	1.44	46.82	104.25	1.36	49.39	8.77	-3.11	49.43	1.83

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.	110-0006						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	214.00	0	450	1000	2400	3400	3400
pH	6.90	0	5-9.5	4.5-6.0 or 9.5-10	4-4.5 or 10-10.5	3-3.5 or 10.5-11	3 or >11
Turbidity (NTU)	0.99	1	0.10	1.00	20.00	50.00	50.00
EC (mS/m)	43.00	0	70	150	370	1150	520
Alkalinity	139.00						
Total hardness (T.H.)	104.00	0	200	300	600	600	600
Calcium (Ca)	22.00	0	80	150	300	300	300
Magnesium (Mg)	12.00	0	70	100	200	400	400
Sodium (Na)	43.00	0	100	200	400	1000	1000
Iron (Fe)	0.16	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	0.76	0	6	10	20	40	40
Chloride (Cl)	45.00	0	100	200	600	1200	1200
Fluoride (F)	0.25	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	3.60	0	200	400	600	1000	1000
Total coliforms (T.col)	2.00	1	0	10	10	100	100
Faecal coliforms (Fc)	2.00	2	0	10	100	500	500
Potassium (K)	0.69	0	25	50	10	20	20
Zinc (Zn)		-	3	5	10	20	20
Arsenic (As)		-	0.01	0.05	0.20	1.00	0.05
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	1.00	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

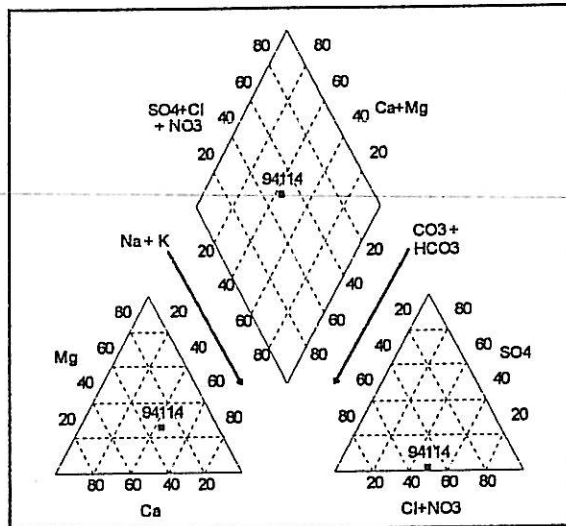
BASIC SITE INFORMATION: Site Identifier: 3228CBV0021 Number: T32908 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS/MAXHAMA

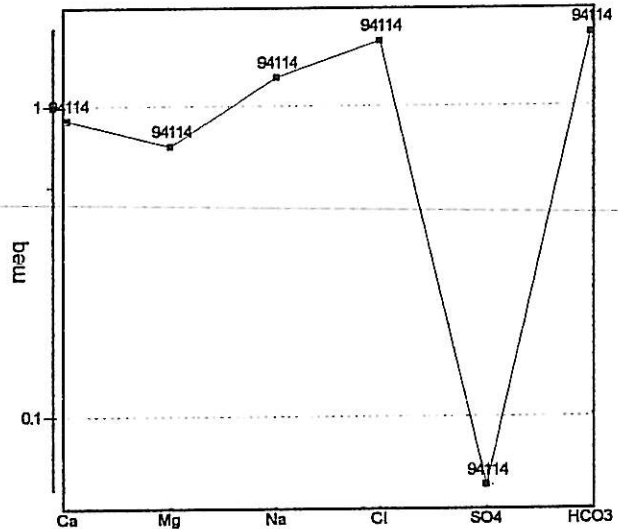
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3197195	Reg./BB.:	Topo-set.:	Hillside (slope)	Depth [m]:	28.40
Latitude [°]:	32.5814444	G-Nr.:	Site status:	Unused	Col. ht. [m]:	0.45
Altitude [m]:			Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Windpump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date samp.	Time samp.	Time pump.	Depth samp. [m]	Date analysed	Laboratory
94114	T 32908			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94114	7.18	31	157	18	8.9	28	0.38	85		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94114		57	2.9	0.64	0.04					0.0099

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94114	0.01										0.03
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94114											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94114												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	Som.	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94114	7	13					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94114		19.7	0.22					

CALCULATED PARAMETERS:

Chem. ref. nr.	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94114	219.56	217.00	2.86	3.42	-8.90	81.52	36.63	10.76	-1.18	0.98

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.	T32908						
Project	Kentane						
District	E Cape						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	157.00	0	450	1000	2400	10000	34000
pH	7.18	0	6-9,5	4,5-9 or 9,5-10	4-4,5 or 10-10,5	4-11 or 11	<3 or >11
Turbidity (NTU)	0.22	1	0-10	100	20.00	50.00	50.00
EC (mS/m)	31.00	0	70	150	370	1000	520
Alkalinity	85.00						
Total hardness (T.H.)	82.00	0	200	300	600	800	600
Calcium (Ca)	18.00	0	80	150	300	800	300
Magnesium (Mg)	8.90	0	70	100	200	400	400
Sodium (Na)	28.00	0	100	200	400	1000	1000
Iron (Fe)	0.10	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	0.64	0	6	10	20	40	40
Chloride (Cl)	57.00	0	100	200	600	200	1200
Fluoride (F)	0.04	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	2.90	0	200	400	600	1000	1000
Total coliforms (T.col)	13.00	2	0	10	100	100	100
Faecal coliforms (Fc)	7.00	2	0	1	10	100	100
Potassium (K)	0.38	0	25	50	100	500	500
Zinc (Zn)		-	3		10		20
Arsenic (As)		-	0.01	0.05	0.20	0.50	2.00
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	3.00	2.00	1.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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.
	Poor water quality-unsuitable for use without treatment. Chronic effects may occur.
Class 4	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

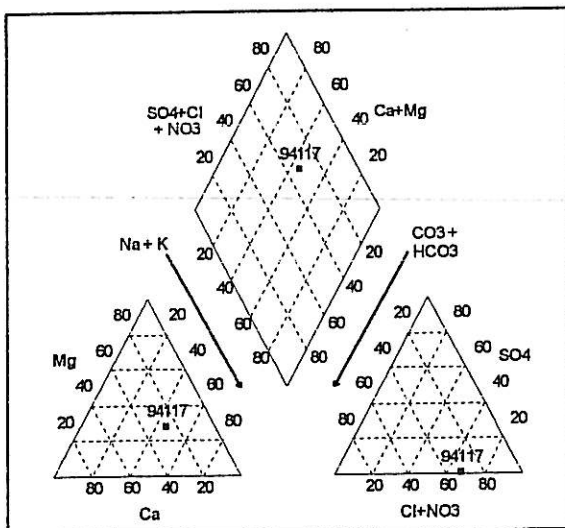
BASIC SITE INFORMATION: Site Identifier: 3228CBV0020 Number: T32909 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS:/KOMKHULU

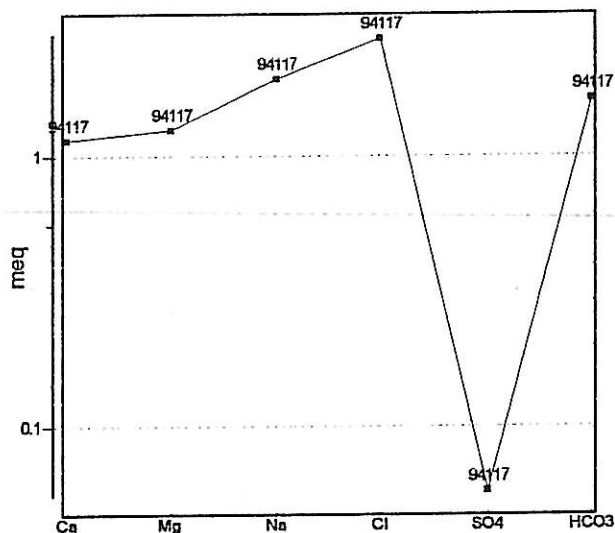
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3029415	Reg./BB.:	Topo-set:	Hillside (slope)	Depth [m]:	28.01
Latitude [°]:	32.5794722		Site status:	Unused	Col. ht. [m]:	0.24
Altitude [m]:		G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Windpump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94117	T32909			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94117	6.99	50	23	15	44	0.49		81		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94117		95	2.8	8.7	0.14					0.618

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94117	0.01										0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94117											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94117												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94117		13		29					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	MBAS	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94117						19.8	0.3					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94117	316.17	350.00	4.31	4.99	-7.30	119.08	81.00	61.74	10.66	-1.33	1.69	1.75

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

			T 32909				
Borehole No.			Kentani				
Project			Kentani				
District			Kentani				
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	250.00	0	450	1000	2400	3400	3400
pH	6.99	0	5-9.5	4.5-9.5	4-4.5 or 10-10.5	3-10	<3 or >11
Turbidity (NTU)	0.30	1	0.10	1.00	20.00	50.00	50.00
EC (mS/m)	50.00	0	70	150	370	520	520
Alkalinity	81.00						
Total hardness (T.H.)	119.00	0	200	300	600	600	600
Calcium (Ca)	23.00	0	80	150	300	400	400
Magnesium (Mg)	15.00	0	70	100	200	400	1000
Sodium (Na)	44.00	0	100	200	400	1000	1000
Iron (Fe)	0.62	1	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	8.70	1	6	10	20	40	40
Chloride (Cl)	95.00	0	100	200	600	1200	1200
Fluoride (F)	0.14	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	2.80	0	200	400	600	1000	1000
Total coliforms (T.col)	29.00	2	0	10	100	1000	1000
Faecal coliforms (Fc)	13.00	3	0	1	10	500	500
Potassium (K)	0.49	0	25	50	100	200	200
Zinc (Zn)		-	3	5	10	20	20
Arsenic (As)		-	0.01	0.05	0.20	1.00	2.00
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	1.30	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

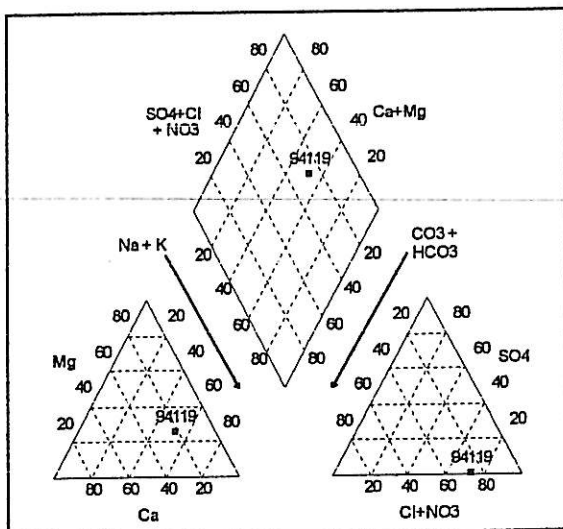
BASIC SITE INFORMATION: Site Identifier: 3228CBV0019 Number: T32910 Site type: Borehole

Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS/MNYAMA

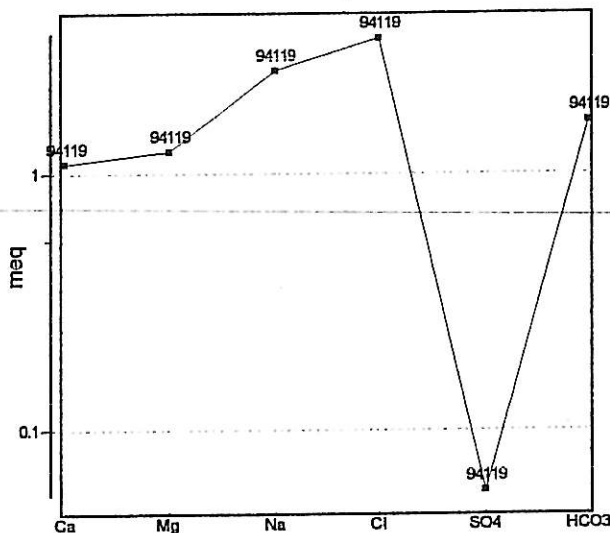
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.2521630	Reg./BB.:	Topo-set:	Hillside (slope)	Depth [m]:	23.45
Latitude [°]:	32.5012500		Site status:	Unused	Col. ht. [m]:	0.36
Altitude [m]:		G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Windpump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94119	T32910			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94119	6.63	59	297	22	15	58	0.93	80		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94119		120	2.8	12	0.21					0.1

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94119	0.01										0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94119											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94119												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94119		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94119					19.8	0.41					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94119	367.55	413.00	4.88	5.91	-9.57	116.58	80.00	61.74	10.27	-1.73	2.15	2.34

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

T 32910

Borehole No.	Kentani						
Project	Kentani						
District	Kentani						
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	297.00	0	450	1000	2400	3400	3400
pH	6.63	0	5-9.5	5-9.5	4-4.5 or 10-10.5	5-6.5	5-6.5
Turbidity (NTU)	0.41	1	0-10	5	20.00	50.00	50.00
EC (mS/m)	59.00	0	70	150	370	520	520
Alkalinity	80.00						
Total hardness (T.H.)	117.00	0	200	300	600	600	600
Calcium (Ca)	22.00	0	80	150	300	300	300
Magnesium (Mg)	15.00	0	70	100	200	200	200
Sodium (Na)	58.00	0	100	200	400	1000	1000
Iron (Fe)	0.09	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	10.00	10.00
Nitrate (as N)	12.00	2	6	10	20	40	40
Chloride (Cl)	120.00	1	100	200	600	2000	1200
Fluoride (F)	0.21	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	2.90	0	200	400	600	1000	1000
Total coliforms (T.col)	0.00	-	0	10	100	1000	1000
Faecal coliforms (Fc)	0.00	-	0	10	100	500	500
Potassium (K)	0.93	0	25	50	100	1500	20
Zinc (Zn)		-	3	5	10	200	2.00
Arsenic (As)		-	0.01	0.05	0.20	0.05	0.05
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	1.00	2.00	15.00	15.00

Class of water **2**

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

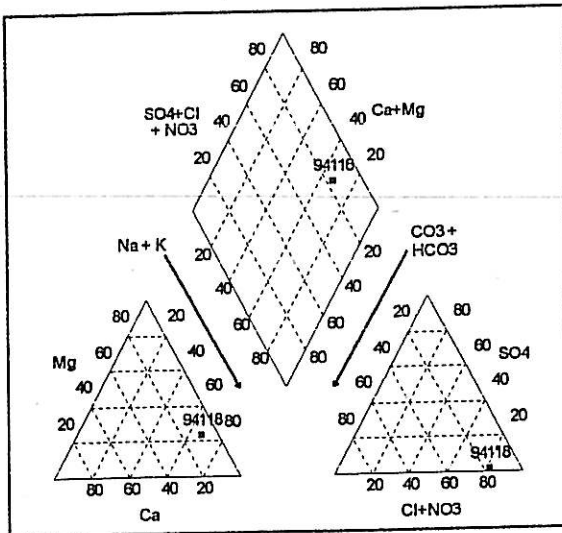
BASIC SITE INFORMATION: Site Identifier: 3228CBU1273 Number: T32913 Site type: Borehole

Distr./Farm No.: QOLORA Site Name/Des.: KENTANI/DIS:/NOTSHIVGETHAFINI

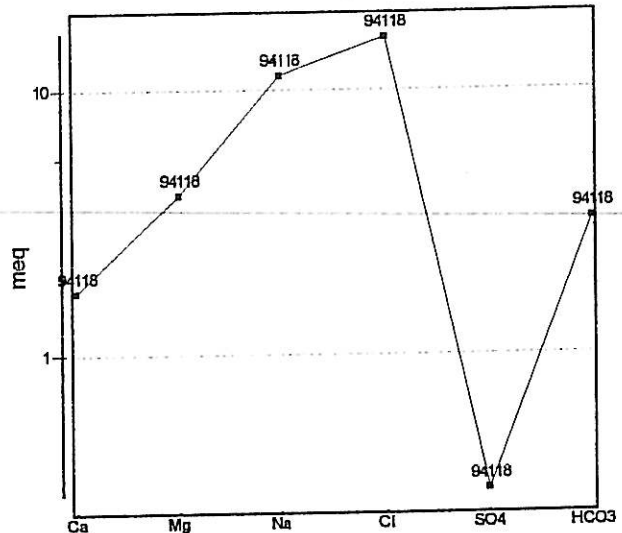
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3964981	Reg./BB.:	Topo-set.:	Depth [m]:	80.60	
Latitude [°]:	32.5925556			Site status:	Unused	Col. ht. [m]:
Altitude [m]:	225.00	G-Nr.:	Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Windpump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94118	T32913			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94118	7.22	192	35	49	260	1.5		164		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94118		558	15	0.01	0.79					1.37

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94118	164 ‡										0.029
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94118											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94118												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coli	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94118		0		15					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	MBAS	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94118						19.8	16					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94118	1118.52	1344.00	17.13	19.38	-6.16	288.86	164.00	201.68	11.38	-0.76	4.89	6.65

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

T 32913

Borehole No.		Kentani					
Project		Kentani					
District		Kentani					
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	965.00	1	450	1000	2400	3400	3400
pH	7.22	0	5-9.5	4.5-9.5	4-4.5 or 10-10.5	<3 or >11	<3 or >11
Turbidity (NTU)	16.00	2	0-10	10	20.00	50.00	50.00
EC (mS/m)	192.00	2	70	150	370	520	520
Alkalinity	164.00						
Total hardness (T.H.)	289.00	1	200	300	600	600	600
Calcium (Ca)	35.00	0	80	150	300	400	400
Magnesium (Mg)	49.00	0	70	100	200	400	400
Sodium (Na)	260.00	2	100	200	400	1000	1000
Iron (Fe)	1.37	2	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.10	4.00	10.00	10.00
Nitrate (as N)	0.01	0	6	10	20	40	40
Chloride (Cl)	558.00	2	100	200	600	1200	1200
Fluoride (F)	0.00	-	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	15.00	0	200	400	600	1000	1000
Total coliforms (T.col)	15.00	2	0	10	10	100	100
Faecal coliforms (Fc)	0.00	-	0	10	10	500	500
Potassium (K)	1.50	0	25	50	100	1500	1500
Zinc (Zn)		-	3	5	10	20	20
Arsenic (As)		-	0.01	0.05	0.20	0.05	0.05
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	300	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures. Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use. Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures.

Comments

CHEMISTRY REPORT

Date compiled: 2003/07/22

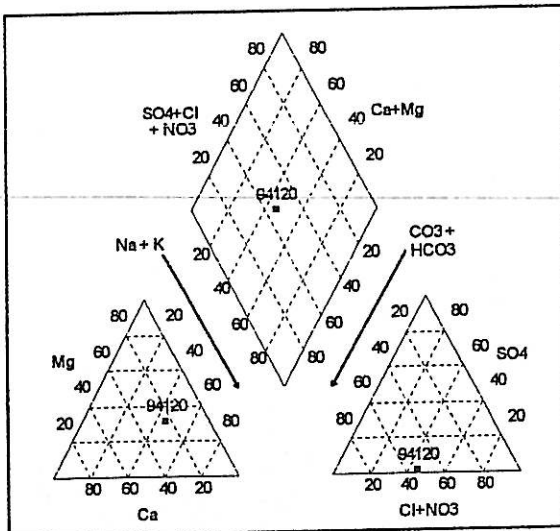
BASIC SITE INFORMATION: Site Identifier: 3228CBU1275 Number: T32916 Site type: Borehole

Distr./Farm No.: QOLORA Site Name/Des.: QOLORA KWANONTSINGA - A/DIS:/CENTANI

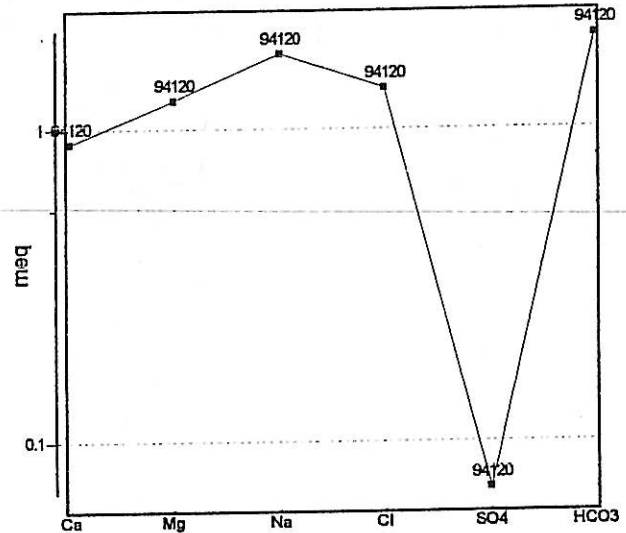
Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.3527198	Reg./BB.:	Topo-set:	Valley	Depth [m]:	34.75
Latitude [°]:	32.6072222		G-Nr.:	Site status:	Unused	Col. ht. [m]:
Altitude [m]:	200.00		Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Windpump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date sampl.	Time samp.	Time pump.	Depth sampl. [m]	Date analysed	Laboratory
94120	T32916			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m

Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K	P. Alk.	T. Alk.	P. Acid.	M. Acid.
94120	6.77	45	228	18	15	40	0.27	99		
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe
94120		46	3.4	3.5	0.11					0.1

ADDITIONAL PARAMETERS:

Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94120	0.009										0.0289
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94120											

ORGANIC PARAMETERS:

Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94120												

BACTERIOLOGICAL PARAMETERS:

Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO
94120		0		0					

PHYSICAL PROPERTIES AND ISOTOPES:

Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94120					25.3 †	0.36					

CALCULATED PARAMETERS:

Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94120	258.94	315.00	3.88	3.66	2.90	106.61	99.00	61.74	10.42	-1.54	0.72	1.69

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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CHEMISTRY REPORT

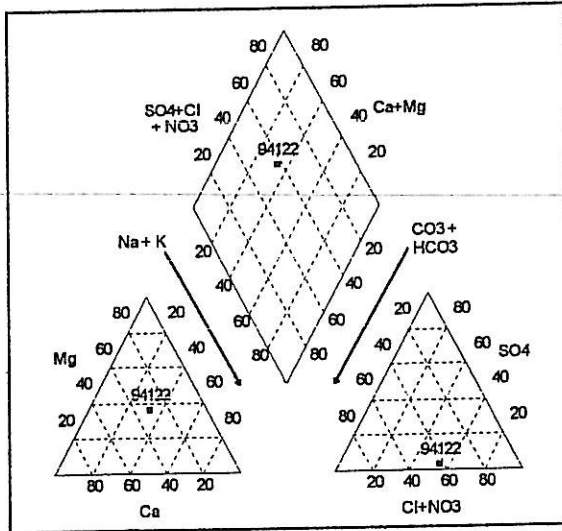
Date compiled: 2003/07/22

BASIC SITE INFORMATION: Site Identifier: 3228ADV0015 Number: T32927 Site type: Borehole

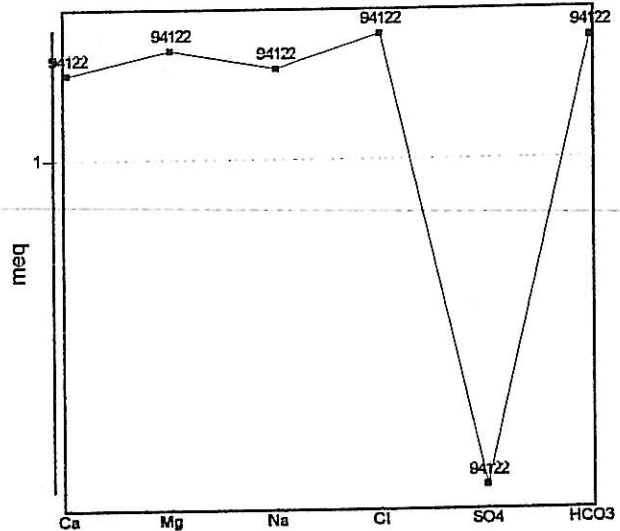
Distr./Farm No.: KENTANI Site Name/Des.: KENTANI/DIS/TEKOKOMA
 Region Type: Transitional Local Council Region Descr.: AMATOLE DISTRICT MUNICIPALITY

Longitude	28.2696910	Reg./BB.:	Topo-set.:	Hillside (slope)	Depth [m]:	36.29
Latitude [°]:	32.3441667		G-Nr.:	Site status:	In use	Col. ht. [m]:
Altitude [m]:			Site purp.:	Production (water supply)	Drain. reg.:	
Coord. acc.:	Accurate to within 100 units		Use applic.:	Domestic - all purposes	Diam. [mm]:	165
Coord. meth.:	Global Positioning System		Equipment:	Mono-type pump	Rep. inst.:	VSA

Piper Diagram



Schoeller Diagram



SAMPLE INFORMATION:

Chem. ref.	Sample	Meth. sampled	Sample Type	Date samp.	Time samp.	Time pump.	Depth [m]	Date analyzed	Laboratory
94122	T32927			20030609	0000		0	20030609	

MAIN PARAMETERS: EC mS/m										P. Alk.	T. Alk.	P. Acid.	M. Acid.	
Chem. ref. nr.	pH	TDS	Ca	Mg	Na	K								
94122	6.92	63	317	33	23	39	0.42	102						
Chem. ref. nr.	SI	Cl	SO4	NO3 as N	F	CO3	HCO3	Al	Mn	Fe				
94122		74	6.9	7.3	0.12							0.15		

ADDITIONAL PARAMETERS:											
Chem. ref. nr.	NH4 as N	NO2 as N	PO4	S	CN	B	As	Sb	Bi	Cu	Pb
94122	0.01										0.028
Chem. ref. nr.	Zn	Cr	Ni	Ti	Hg	Mo	Co	Ba	Sr	Cd	
94122											

ORGANIC PARAMETERS:												
Chem. ref. nr.	COD	Cl2	DOC	TOC	DO	BOD	H2S	Phenols	Tot.	Oil	Soap	Kjeld-N
94122												

BACTERIOLOGICAL PARAMETERS:											
Chem. ref. nr.	E.Coll	Faec. co	Som. Col	Total Co	Faec. St	SPC	Prot. Pa	Ent. Vir	TVO		
94122		0		0							

PHYSICAL PROPERTIES AND ISOTOPES:											
Chem. ref. nr.	Colour	Odour	Taste	S. Grav.	Temp.	Turb.	Susp. So	C14	H2	H3	O18
94122					21	0.51					

CALCULATED PARAMETERS:												
Chem. ref. nr.	sum TDS	TDS-EC*7	Cations	Anions	Ion-bal	CaCO3	Ca Hard.	Mg Hard.	Aggr-Ind	Langel.	CRT	SAR
94122	331.12	441.00	5.25	4.80	4.45	176.93	102.00	94.67	10.84	-1.14	1.09	1.28

Bact. param. in counts/100ml
 Chemistry Standard: SABS for human consumption
 † Value exceeds recommended maximum limit
 ‡ Value exceeds maximum allowable limit
 † Value exceeds recommended minimum limit
 ‡ Value exceeds minimum allowable limit



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Chemical analyses of water

Borehole No.		T 32927					
Project		Kentani					
District		Kentani					
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	317.00	0	450	1000	2400	3000	3400
pH	6.92	0	5-9.5	4.5-9.5	4-4.5 or 10-10.5	3-6 or 10-14	<3 or >11
Turbidity (NTU)	0.51	1	0-10	100	370	520	520
EC (mS/m)	63.00	0	70	150	370	520	520
Alkalinity	102.00						
Total hardness (T.H.)	177.00	0	200	300	600	600	600
Calcium (Ca)	0.01	0	80	150	300	300	300
Magnesium (Mg)	23.00	0	70	100	200	400	400
Sodium (Na)	39.00	0	100	200	400	1000	1000
Iron (Fe)	0.15	0	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.30	4.00	10.00	10.00
Nitrate (as N)	7.30	1	8	10	20	40	40
Chloride (Cl)	74.00	0	100	200	600	1200	1200
Fluoride (F)	0.12	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	6.90	0	200	400	600	1000	1000
Total coliforms (T.col)	0.00	-	0	10	100	1000	1000
Faecal coliforms (Fc)	0.00	-	0	10	100	500	500
Potassium (K)	0.42	0	25	50	100	500	500
Zinc (Zn)		-	3	5	10	20	20
Arsenic (As)		-	0.01	0.05	0.20	2.00	2.00
Cadmium (Cd)		-	0.00	0.01	0.02	0.05	0.05
Copper (Cu)		-	1.00	30	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

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	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing. No effects. No effects. No effects.
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
Class 4	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Severe acute health effects, even with short-term use Taste and appearance will lead to rejection of the water. Severe acute health effects, even with short-term use. Serious effects on bathing or on bath fixtures. Serious effects on bathing or on bath fixtures

Comments

Chemical analyses of water

Borehole No.:		T 32928					
Project:		Kentani					
District:		Kentani					
Constituent (mg/l)	Tested	Class	Class 0	Class 1	Class 2	Class 3	Class 4
TDS	208.00	0	450	1000	2400	3400	3400
pH	7.19	0	5-9.5	4.5-10.5	4-4.5 or 10-10.5	3-3.5 or 11-11.5	<3 or >11
Turbidity (NTU)	27.00	3	0-10	100	20.00	50.00	50.00
EC (mS/m)	42.00	0	70	150	370	520	520
Alkalinity	188.00						
Total hardness (T.H.)	122.00	0	200	300	600	600	600
Calcium (Ca)	24.00	0	80	150	300	300	300
Magnesium (Mg)	15.00	0	70	100	200	400	400
Sodium (Na)	30.00	0	100	200	400	1000	1000
Iron (Fe)	8.10	3	0.50	1.00	5.00	10.00	10.00
Manganese (Mn)		-	0.10	0.40	4.00	70.00	10.00
Nitrate (as N)	13.00	2	6	10	20	40	40
Chloride (Cl)	44.00	0	100	200	600	1200	1200
Fluoride (F)	0.03	0	0.70	1.00	1.50	3.50	3.50
Sulphate (SO4)	2.90	0	200	400	600	1000	1000
Total coliforms (T.col)	440.00	3	0	10	100	1000	1000
Faecal coliforms (Fc)	270.00	4	0	1	10	100	100
Potassium (K)	0.45	0	25	50	100	2500	500
Zinc (Zn)		-	3	5	10	20	20
Arsenic (As)		-	0.01	0.05	0.20	0.05	0.05
Cadmium (Cd)		-	0.00	0.01	0.02	0.01	0.05
Copper (Cu)		-	1.00	1.30	2.00	15.00	15.00

Class of water

Nitrate (as N)*4.42 = Nitrate (as NO3)

Class 0	Ideal water quality-suitable for lifetime use.
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Class 0	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	No effects, suitable for many generations. Waters is pleasing No effects. No effects. No effects
Class 1	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Suitable for lifetime use. Rare instances of sub-clinical effects. Some aesthetic effects may be apparent. Suitable for lifetime use. Minor effects on bathing or on bathing or on bath fixtures Minor effects on laundry or on fixtures.
Class 2	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	May be used without health effects by majority of individuals of all ages, but may cause effects in some individuals in sensitive groups. Some effects possible after lifetime use Poor taste and appearance are noticeable. May be used without health or aesthetic effects by the majority persons Slight effects on bathing or on bath fixtures. Slight effects on bathing or on bath fixtures.
Class 3	Drinking health : Drinking Aesthetic : Food preparation : Bathing : Laundry :	Poses a risk of chronic health effects, especially in babies, children and the elderly. Bad taste and appearance may lead to rejection of the water. Poses a risk of chronic health effects, especially in children and elderly Significant effects on bathing or on bath fixtures. Significant effects on laundry or on fixtures.
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Comments