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ANNEXURE C
GFSH-02

REPUBLIC OF SOUTH AFRICA

National Department of Housing

GEOTECHNICAL SITE INVESTIGATIONS FOR HOUSING DEVELOPMENTS

Project Linked Greenfield Subsidy Project Developments

Generic Specification GFSH-2
September 2002

PROJECT LINKED GREENFIELD SUBSIDY HOUSING PROJECTS	**Generic specification GFSH-2** (September 2002)	Geotechnical Site Investigations for Housing Developments

INTRODUCTION

The National Housing Code in Chapter 3 of Part 3 makes provision for the conducting of a geotechnical investigation in three phases, namely:

*The applicant for housing subsidies commissions the **preliminary investigation** when project descriptions are required. Such an investigation comprises the gathering of all known information relating to geotechnical conditions of the land and the interpretation of this information leading to a preliminary determination of the suitability of the land for a project-linked greenfield project development*

*The **Phase 1** investigation is commissioned by the developer (i.e. a municipality or a provincial housing department) when feasibility reports are required. Such an investigation comprises a stability investigation, if underlain by dolomites or undermined ground, or in undulating terrain where there is a potential for slope instability, and an investigation into the foundation characteristics of the near surface horizons in accordance with the NHBRC requirements for the enrolment of a project in the Warranty Scheme under the provisions of the Housing Consumer Protection Measures Act, 1998 (Act No, 95 of 1998) and the Joint Structural Division of the South African Institution of Civil Engineering and Institution of Structural Engineers' code of practice for foundations and superstructures for single storey residential buildings of masonry construction.*

*The **Phase 2** investigation is commissioned by the developer during the installation of township services. Such an investigation comprises observations, and in some instances, additional investigations, after the township has been pegged, to confirm the site class designations of individual erven in accordance with the NHBRC requirements for the enrolment of top structures in the Warranty Scheme under the provisions of the Housing Consumer Protection Measures Act, 1998 (Act No, 95 of 1998) and the Joint Structural Division of the South African Institution of Civil Engineering and Institution of Structural Engineers' code of practice for foundations and superstructures for single storey residential buildings of masonry construction.*

A critical outcome of the Phase 1 and Phase 2 investigations are the residential site class and dolomitic area designations in respect of the site and individual erven, respectively. The interpretation of these designations in accordance with the aforementioned code of practice may be summarized as follows:

RESIDENTIAL SITE CLASS DESIGNATIONS	TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	SINGLE STOREY MASONRY HOUSE CONSTRUCTION TYPE
R	Rocks	Stable	Normal
H	Clays, silty clays, clayey silts and sandy clays.	Expansive soils	Normal
H1			Modified normal / soil raft
H2			Stiffened or cellular raft / piled or split construction / soil raft
H3			Stiffened or cellular raft / piled construction / soil raft.
C	Silty sands, sands, sandy and gravely soils	Compressible and potentially collapsible soils	Normal
C1			Modified normal / compaction of in-situ soils below individual footings / deep strip foundations / soil raft.
C2			Stiffened strip footings, stiffened or cellular raft / deep strip foundations / compaction of in-situ soils below individual footings / piled or pier foundations / soil raft.
P	Contaminated soils, controlled fill, dolomitic areas, landslip, landfill, marshy areas, mine waste fill, mining subsidence, reclaimed areas, uncontrolled fill, very soft silts / silty clays.	Variable	Variable
S	Clayey silts, clayey sands of low plasticity, sands, sandy and gravely soils	Compressible soils	Normal
S1			Modified normal / compaction of in-situ soil below individual footings / deep strip foundations / soil raft.
S2			Stiffened strip footings, stiffened or cellular raft / deep strip foundations / compaction of in-situ soils below individual footings / piled or pier foundations / soil raft.

DOLOMITIC AREA DESIGNATION	DESCRIPTION	SINGLE STOREY MASONRY HOUSE CONSTRUCTION TYPE
D1	No site and service precautionary measures required	As for site class R, H – H3, C – C2 and S – S2
D2	General site and service precautionary measures required	As for site class R, H – H3, C – C2 and S – S2
D3	Precautionary measures in addition to D2 are required	Special foundations e.g. fill mattresses, rafts spanning near surface pinnacles.
D4	Unsuitable for housing developments	-

This generic specification was prepared by the Task Team: Implementation of National Housing Programmes to facilitate compliance with the requirements of Chapter 3 of Part 3 of the National Housing Code.

CONTENTS

1. SCOPE

This specification contains requirements applicable to three phases of Geotechnical Site Investigations in townships, which may be underlain by dolomites or undermined land, where unoccupied land or undeveloped parcels of land are to be utilised for housing development purposes.

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3. DEFINITIONS

Collapsible Soil: a soil with a collapsible soil structure (open textured with a low density) that, when subjected to a combination of an applied load and an increase in soil moisture content, will experience sudden or rapid settlement.

Competent Person (Geotechnics): a person registered as a professional engineer in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000) or a person who has a BSc degree, or higher, in geology or engineering geology and is registered in terms of Section 11 of the Natural Scientific Professions Act 1993 (Act No. 106 of 1993), who has the following experience in relation to the category of work contemplated:

- **Category of Work 1:** (preliminary Geotechnical Site Investigations in all areas and Phase 1 and Phase 2 Geotechnical Site Investigations of near surface soil horizons): not less than 1 200 hours per annum

experience over the last 6 years in Geotechnical Site Investigations in Southern Africa in partially saturated soils.

- **Category of Work 2:** (Geotechnical Site Investigations in undermined ground and or Contaminated Land): not less than 1200 hours per annum experience over the last 10 years in Geotechnical Site Investigations in Southern Africa in partially saturated soils.

- **Category of Work 3:** (Geotechnical Site Investigations in Dolomitic Areas): not less than 1200 hours per annum experience over the last 10 years in Geotechnical Site Investigations in Southern Africa with not less than 600 hours per annum experience over the last 4 years in Geotechnical Site Investigations involving areas underlain by dolomites and the investigation of sinkholes and dolines and the rehabilitation of sinkholes and dolines or an accumulative experience of 25 000 hours in Geotechnical Site Investigations in Southern Africa in partially saturated soils with not less than 3 500 hours experience in dolomitic related work.

Compressible Soil: soil that experiences gradual settlement as its volume decreases when subjected to an applied load.

Contaminated Land: any land in a condition, by reason of substances in, or under the land, which presents an unacceptable risk to the health and safety of occupants of housing units constructed on such land.

Council: the National Home Builders Registration Council.

Data: facts collected and assembled during the Geotechnical Site Investigation.

Development Risk: the likelihood and extent of loss of life, loss or damage to property or financial loss.

Differential Heave: the expected relative surface displacement between:

- the centre and edge of the mound formed by heave movements (doming/hogging), or
- the centre and edge of the dish formed by heave movements (edge heave or dishing/sagging) of the soil beneath a structure before allowances for heave suppression due to loading are made.

Differential Movement: Differential Heave or Differential Settlement.

Differential Settlement: the relative displacement (vertical) due to uneven settlement of different portions of a structure.

Dolomitic Areas: geographical areas underlain by dolomite or limestone rock directly or at shallow depth less than:

- 30 metres in areas underlain by limestone;
- 60 metres in areas underlain by dolomites where no de-watering has taken place and the local authority has jurisdiction, is monitoring and has control over the groundwater levels over the areas under consideration; or
- 100 metres in areas underlain by dolomites where de-watering has taken place or where the local authority has no jurisdiction or control over ground water levels.

Expansive Soil: a fine grained soil whose clay mineralogy is such that it changes in volume to varying degrees in response to changes in moisture content i.e., the soil may increase in volume (heave or swell) upon wetting and decrease in volume (shrink) upon drying out.

Factual Data: materials, statistics and properties that can be seen, measured or identified by means of accepted or standardized criteria, classifications and tests.

Founding Horizon: a stratum of soil that exhibits similar geotechnical and engineering properties and characteristics and supports a structure.

Foundation Indicator Tests: verification tests in the form of basic physical characteristics of disturbed samples.

Geotechnical: pertaining to the nature, condition and physical properties of the earth's crust (whether soil or rock and including water and gases therein) which affect its performance in civil engineering and building works.

Geotechnical Site Investigation: the process of evaluating the geotechnical character of a site in the context of existing or proposed works or land usage, which may include one or more of the following:

a) Evaluation of the geology and hydrogeology of the site.
b) Examination of existing geotechnical information pertaining to the site.
c) Excavating or boring in soil or rock.
d) In-situ assessment of geotechnical properties of materials.
e) Recovery of samples of soil or rock for examination, identification, recording, testing or display.
f) Testing of soil or rock samples to quantify properties relevant to the purpose of the investigation.
g) Evaluation of geotechnical properties of tested soils
h) Reporting of the results.

Hazard: inherently dangerous quality of a substance, procedure or an event.

Heave / Shrinkage : the anticipated (vertical) surface movement produced by an expansive soil horizon caused by seasonal cyclic fluctuation in moisture content within the horizon.

Identified Land Parcel: a tract of land, comprising one or more farm portions or erven registered in a Deeds Registry, identified for the purpose of housing development under the Subsidy Scheme.

Inherent Risk: the chance, in Dolomitic Areas, for a certain size sinkhole or doline to occur within the postulated scenario of land use and dewatering or non-dewatering situation.

Interpretative Data: information derived from Factual Data using accepted and proven techniques, or from reasonable judgment exercised in the assessment of geological conditions or processes evident at the site.

In-situ: in its original place.

Land Slip: The sudden movement of a soil/rock slope, or gradual creep of a slope (typically with both a vertical and horizontal movement component) over a period of time.

Opinion: conclusions or recommendations derived by the Competent Person (Geotechnics) from consideration of Factual and Interpretative Data, and from the exercise of judgment.

Risk Management Plan: a comprehensive programme of action to be implemented by a responsible group, who have a direct interest in the sustainability of a specific housing development that is in a Dolomitic Area which addresses all aspects of good governance on such land including storm water management, pro-active maintenance, monitoring and emergency reaction planning.

Settlement: The (vertical) movement within a structure due to the distribution or re-distribution of loading and stresses within the various elements of construction or the downward movement of a structure under applied load.

Site Class: areas which are designated as having common foundation and engineering characteristics

Soil Profile: a record of the vertical succession of the different soil (rock) horizons as they occur at any particular location on site.

Subsidence: The downward movement of a foundation caused by loss of support beneath the foundations.

Variability: the change in the properties or conditions of common materials or horizons in the soil profile with time or over short lateral and/or vertical distances.

4 OBJECTIVES

4.1 Objective of the preliminary Geotechnical Site Investigation

The objective of the preliminary Geotechnical Site Investigation is to make an initial determination for an Identified Land Parcel as to whether or not such land is:

a) fit for human settlements; and
b) suitable for project linked subsidy housing development.

Note: The preliminary Geotechnical Site Investigation is incorporated in the project descriptions that form part of the submission to a Provincial Government for the conditional approval of housing subsidies against the selected parcel of land.

4.2 Objective of the Phase 1 Geotechnical Site Investigation

The objective of a Phase 1 Geotechnical Site Investigation is, with respect to the identified parcel of land for which a Provincial Government has granted conditional approval of housing subsidies, to:

a) identify any potential Hazards;
b) define the ground conditions and provide Site Classifications including detailed soil profile and groundwater occurrences within the zone of influence of foundation work;
c) determine the suitability of Dolomitic Land for subsidy housing developments;
d) provide the geotechnical basis for safe and appropriate land use planning, infrastructure design, housing unit design, and the formulation of precautionary measures and risk management procedures;
e) broadly classify the land which is to be developed for subsidy housing in terms of the Council's residential Site Class designations;
f) designate Dolomitic Land in accordance with the Council's dolomitic area designations and to obtain the Council's in principle acceptance of such designations;
g) gather certain Factual Data which has a bearing on the determination of housing subsidy variations and the installation of township services; and
h) obtain necessary information for the Council's in principle approval for the enrolment of the project in terms of the Housing Consumers Protection Measures Act (Act 95 of 1998).

Note: The Phase 1 Geotechnical Site Investigation is undertaken after a Provincial Government has granted conditional approval of housing subsidies. The Report of the Phase 1 Geotechnical Site Investigation forms part of the feasibility study report which is required for the confirmation of housing subsidies.

4.3 Objective of the Phase 2 Geotechnical Site Investigation

The objective of a Phase 2 Geotechnical Site Investigation is, with respect to the Identified Land Parcel for which a Provincial Government has confirmed housing subsidies, to:

a) confirm and refine the residential Site Class designations in respect of each erf so that the necessary documentation required for the enrolment of individual houses with the Council can take place; and
b) confirm and refine, in sites with D2 and D3 dolomitic area designations, that the mandatory precautions have been observed.

Note: Work associated with Phase 2 can only be undertaken once the erven have been pegged. This phase of the Geotechnical Site Investigation must be co-ordinated with the installation of township services. The Phase 2 investigation in Dolomitic Areas is **essentially** a risk management and verification process.

5 REQUIREMENTS

5.1 General requirements

5.1.1 Geotechnical Site Investigations shall satisfy the objectives stated in section 4 for the particular investigation that is undertaken.

5.1.2 Geotechnical Site Investigations shall be undertaken under the direction of a Competent Person (Geotechnics), who has the necessary experience in relation to the Category of Work that is required. Such a person shall spend not less than 50% of the professional person-hours allocated to such investigation in the design of the investigation, the gathering of Data, the evaluation of Factual Data, the determination of Interpretative Data, and the drafting of reports and any interactions which may be required with the Council for Geoscience, the Government Mining Engineer and the Council.

5.1.3 The Competent Person (Geotechnics) shall formulate all Opinions.

5.1.4 The Competent Persons (Geotechnics) shall document and formulate all Opinions in such a manner that a peer review, if conducted on the same Data and Factual Data, will arrive at substantially similar Opinions.

5.1.5 Sites underlain by dolomites, which are recommended for housing developments shall have an Inherent Risk class, determined in accordance with Tables 1 and 2, of between 1 and 4.

5.1.6 Sites on former mine land shall have specific activities of ^{226}Ra, ^{228}Ra, ^{nat}Th and ^{nat}U of less than 200 becquerels / kilogram.

NOTE: Levels of specific and total activity of radioactive material and the radiation dose is governed by the provisions of the Nuclear Energy Act of 1993.

5.1.7 The Competent Person (Geotechnics) shall demonstrate in the case of Contaminated Land that the risk to the health and safety of occupants of subsidy housing is acceptable.

Table 1: Inherent risk of doline and a specified-size sinkhole forming (Buttrick, Van Schalkwyk, Kleywegt and Watermeyer, 2001)

INHERENT RISK CLASS	SMALL SINKHOLE	MEDIUM SINKHOLE	LARGE SINKHOLE	VERY LARGE SINKHOLE	RISK OF DOLINE FORMATION #
SINKHOLE DIAMETER	**< 2m**	**2 – 5 m**	**5 – 15 m**	**> 15 m**	
Class 1	Low	Low	Low	Low	Low NDS or DS
Class 2	Medium	Low	Low	Low	Medium NDS
Class 3	Medium	Medium	Low	Low	Medium NDS
Class 4	Medium	Medium	Medium	Low	Medium NDS
Class 5	High	Low	Low	Low	High NDS
Class 6	High	High	Low	Low	High NDS
Class 7	High	High	High	Low	High NDS
Class 8	High	High	High	High	Low-High NDS or DS

NDS = Non Dewatering Scenario and DS = Dewatering Scenario

Table 2: Inherent risk characterisation and anticipated number of ground-movement events (Buttrick, Van Schalkwyk, Kleywegt and Watermeyer, 2001)

INHERENT RISK CHARACTERISATION	GROUND-MOVEMENT EVENTS PER ha IN A 20-YEAR PERIOD AFTER AN INITIAL 20-YEAR PERIOD (STATISTICS BASED ON INAPPROPRIATE AND POOR SERVICE DESIGN)
Low	$0 \leq 0,1$
Medium	$>0,1 \leq 1,0$
High	$> 1,0$

5.2 Preliminary Geotechnical Site Investigation

5.2.1 Minimum requirements

5.2.1.1 The Competent Person (Geotechnics) shall, as a minimum, in order to satisfy the objectives of the preliminary Geotechnical Site Investigation stated in 4.1:

a) approach the following organisations, as necessary, in order to gather data:
   - i) Mining Houses;
   - ii) the Council for Geoscience;
   - iii) the Deeds Office ;
   - iv) the Department of Land Affairs;
   - v) the Department of Water Affairs;
   - vi) the District Councils;
   - vii) the Government Mining Engineer;
   - viii) the Local Authority or regional databank of geotechnical data;
   - ix) the National Home Builders Registration Council;
   - x) the Surveyor General; and
   - xi) consultants;

b) gather and assimilate available data pertaining to the site from the following sources, as necessary:
   - i) orthophotographic coverage (Scale 1:10 000);
   - ii) aerial photographic coverage;
   - iii) geological data and mapping concerning the site and immediate environs;
   - iv) topographic maps;
   - v) geohydrological data (regional and local in the case of dolomitic areas);
   - vi) mining data;
   - vii) geotechnical reports from surrounding developments, infrastructure and the like;
   - viii) geotechnical problems previously recorded in the area e.g. sinkholes in Dolomitic Areas, seismic activity and the like;
   - ix) any available regional geophysical data, such as regional gravity surveys, aeromagnetic surveys and the like; and
   - x) seismological data.

c) review published geotechnical literature for the region;

d) make appropriate enquiry to the office of Government Mining Engineer in regard to any and all land rezoning applications where release of land is provided in areas of acknowledged mining work;

e) analyse data and identify and categorise terrain types in accordance with Table 3;

f) verify terrain types in the field and examine all visible data, including ground profile exposures, and the results, of large scale ground excavation and or alteration by means of borrow pits, quarrying, mining, construction and related remedial works and rehabilitation that can be viewed and reasonably annotated on orthophotos or aerial photographs;

g) indicate appropriate land uses;

h) comment on potential sources of construction materials; and

i) establish in principle whether the site is, or in future will be, influenced by underground or surface mining operations by making tentative enquiries to the Government Mining Engineer.

5.2.1.2 The Competent Person (Geotechnics) shall where the land ownership history includes a mining operator, provide a properly documented record or site plan in which the surface footprint of the mining or quarrying or material borrow area (opencast pit) or the (underground) mining plan is indicated on fully-coordinated drawings, based on the Government Mining Engineers records, on aerial photographs or ortho-mapping, as appropriate.

5.2.2 Reporting requirements

5.2.2.1 The Competent Person (Geotechnics) shall document and report all findings and Opinions in a written report using the following standard headings:

Executive summary
1 Introduction
2 Information
- 2.1 Description and list of the information assimilated and used in the study
- 2.2 General location and description of site
- 2.3 Evaluation procedures used in the investigations
- 2.4 Geology and geohydrology of the site

2.5 Geotechnical conditions and constraints
2.6 Terrain mapping units

3 Impact of the geotechnical character of the site on subsidy housing developments
3.1 Land usage
3.2 Installation of services
3.3 House construction
3.4 Housing subsidy variations

4 Conclusions and recommendations.

Table 3: Geotechnical Classification for Urban Development (after Partridge, Wood and Brink)

CONSTRAINT		Most favourable (1)	Intermediate (2)	Least favourable (3)
A	Collapsible Soil	Any collapsible horizon or consecutive horizons totaling a depth of less than 750mm in thickness*	Any collapsible horizon or consecutive horizons with a depth of more than 750mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5m below ground surface	Permanent or perched water table less than 1,5m below ground surface	Swamps and marshes
C	Active Soil	Low soil-heave potential anticipated*	Moderate soil heave potential anticipated	High soil-heave potential anticipated
D	Highly compressible soil	Low soil compressibility anticipated*	Moderate soil compressibility anticipated	High soil compressibility anticipated
E	Erodability of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of the total volume
G	Undermined ground	Undermining at a depth greater than 240m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 90-240 m below surface where stope closure has ceased	Mining within less than 90-240 m of surface or where total extraction mining has taken place
H	Stability: (Dolomite & Limestone)	Possibly stable. Areas of dolomite overlain by Karoo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated Inherent Risk Class I	Potentially characterised by instability. Anticipated Inherent Risk Classes 2 – 5.	Known sinkholes and dolines. Anticipated Inherent Risk Classes 6 –8.
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less than 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less than 2 degrees (all other regions)	More than 18 degrees (Natal and Western Cape) More than 12 degrees (all other regions)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100 cm/s² within 50 years	Mining-induced seismic activity more 100 cm/s²	Natural seismic activity more than 100 cm/s²
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a know drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

* These areas are designated as 1A, 1C, 1D, or 1F where localised occurrences of the constraint may arise.

Example: A sub-area designated as Zone 2BF would be an intermediate class with anticipated seepage and excavation problems. A sub-area designated as Zone 3B would be designated as least favourable and not recommended for development due to surface water inundation.

5.2.2.2 The report must:

a) include a discussion of the process followed to arrive at the Terrain Mapping Units as outlined and defined in Table 3;
b) include a locality plan of the site complete with site boundaries, co-ordinates and property descriptions;
c) indicate topographic and geological conditions clearly on appropriately co-ordinated and scaled maps with superimposed or overlaid property boundaries;
d) discuss ground conditions in terms of the presence of outcrop, and likely cover soils, the origin of which may be initially interpreted from maps, aerial photos, orthophotos, available information and observations from the walk-over survey or inspection;
e) provide a physical description of the surface soil condition, eg in alluvial floodplains, side gullies, undrained depressions or talus slopes, supported with photographic documentation of features of significance;

f) contain appropriate comments on the presence of prominent water-courses and preferred drainage routes;
g) present interpretations of groundwater seepage indications;
h) contain comments on the structural conditions of any buildings or improvements on the land as an indicator of the influence of ground conditions; and
i) include a drawing of the site showing terrain mapping units in accordance with the provisions of Table 3, complete with approximate co-ordinates.

5.2.2.3 The report and all drawings must also be available in an electronic format.

5.3. Phase 1 Geotechnical Site Investigations

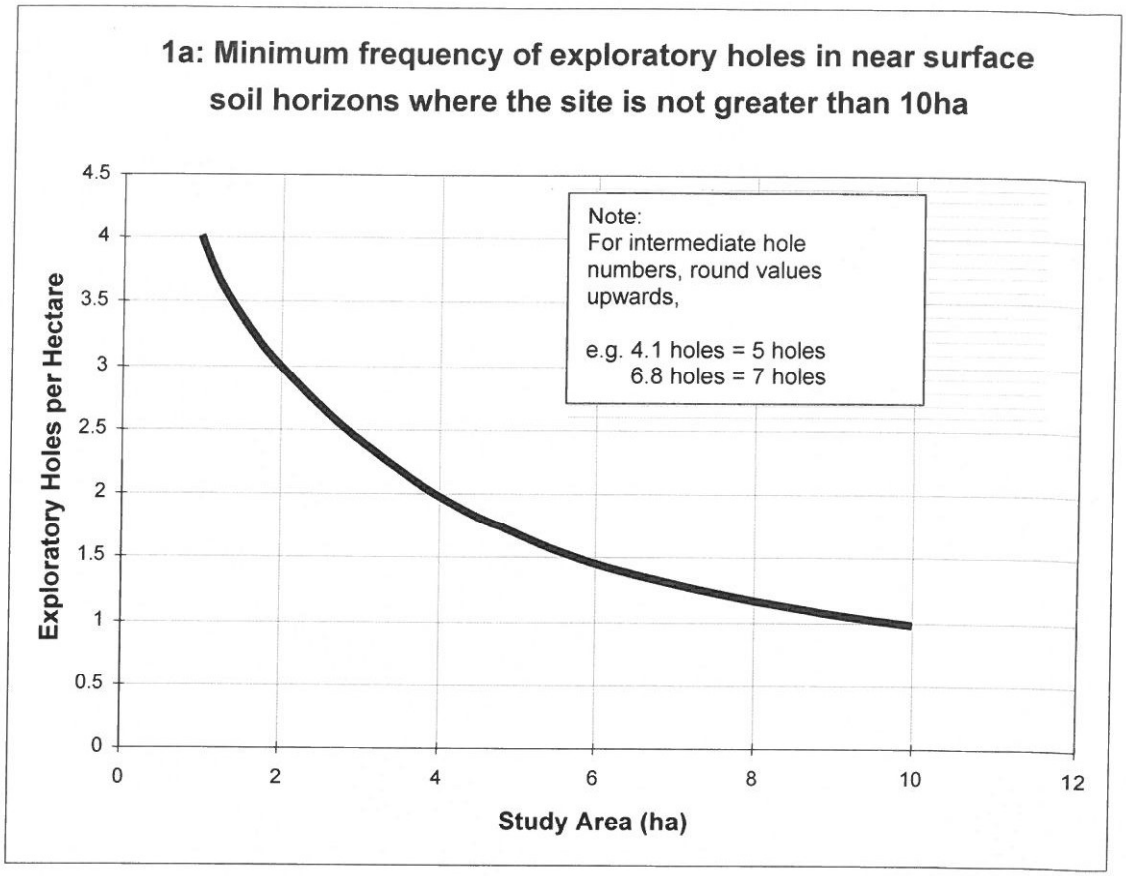
5.3.1 Requirements for near surface soil horizons investigations

5.3.1.1 Minimum requirements

The Competent Person (Geotechnics) shall, as a minimum, in order to satisfy the objectives of the Phase 1 Geotechnical Site Investigation in non-Dolomitic Land, or areas underlain by dolomites where the risk of sinkhole and doline formation is acceptable, as stated in 4.2:

a) conduct a detailed Geotechnical Site Investigation involving an in-situ evaluation of the ground profile to a minimum depth of 3,0 m or to the machine refusal depth at a frequency derived from Figures 1a and 1b, representative sampling, laboratory testing and the analysis of physical and (basic) chemical properties of all representative soil horizons which can be expected to influence improvements to the land relating to the subsidy housing development at the frequency derived from Table 4, including:
   i) foundations and structural nature of residential housing;
   ii) construction of roads (surfaced and gravel);
   iii) excavations for and construction of buried services including appropriate trench backfills;
   iv) landslip (slope instability); and
   v) present and past mining activities;
b) judge, in mine related land, the long-term prognosis for excessive settlement and particularly differential settlement which has the potential to give rise to unacceptable development due to factors such as:
   i) water-bearing service disruptions arising from loss of positive gradients, rupture due to ground settlement;
   ii) loss of positive stormwater run-off from zones of substantial settlement and resulting flooding, infiltration and exacerbated water-induced settlement;
   iii) loss of serviceability in structures due to rotation / tilt or settlement even where structural distress is controlled by adequate foundation stiffness; and
   iv) restrictions that will inevitably be placed on housing development to mitigate the negative impacts of the settlement process;
c) prepare a comprehensive geotechnical report which:
   i) provides the township description and defines the extent and boundaries of the township;
   ii) describes the local geology;
   iii) describes soil profile by Site Classification unit;
   iv) provides geotechnical interpretation of each soil profile unit;
   v) provides a provisional Site Classifications of the site in accordance with Table 5;
   vi) contains foundation recommendations by Site Classification unit;
   vii) contains earthworks (materials) and excavation classifications;
   viii) assesses the stability and related (geotechnical) parameters;
   ix) identifies conditions and constraints such as mining related problems, areas of outcrop, slope instability, contaminated land, unconsolidated fill etc; and
   x) provides information on the drainage of the site.

Note: The minimum extent of fieldwork and laboratory testing required is intended to give a minimum requirement of input data on the basis of which realistic engineering judgements may be made and site classification boundaries drawn, which provide the developer with a realistic sampling of the ground conditions. Clearly, where complex geological and topographic conditions exist eg in mine related land, uncontrolled fills (made up ground without controlled compaction), unstable slopes etc, or where the soils are highly Variable, supplementary work can be anticipated requiring additional input, deeper drilling or subsequent stages of investigation.



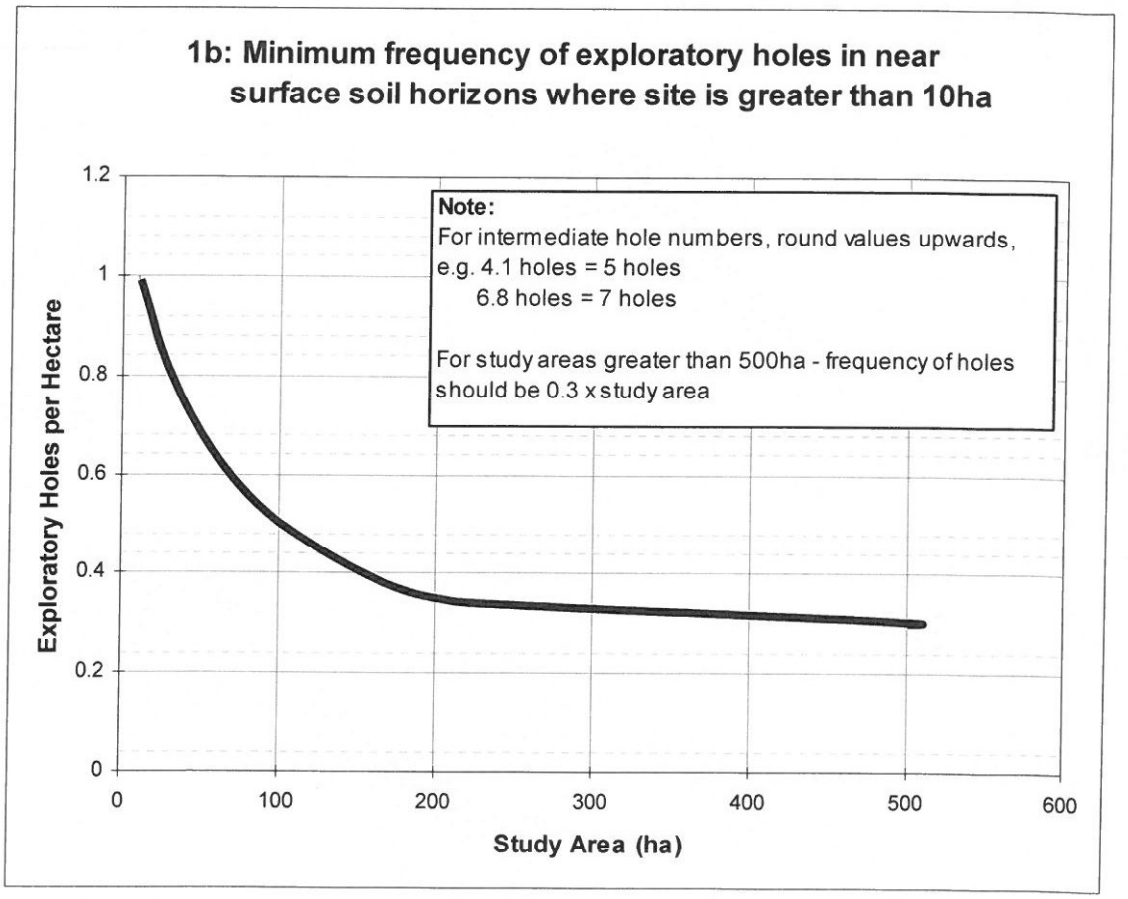


Figure 1: Minimum frequency of exploratory holes in near surface soil horizons

Table 4: Minimum Quantities of Laboratory Testing for Different Sizes of Study Areas

Study Area (ha)	Foundation Indicator / MC	Consolidometer/ Swell	Chemistry
<5	3	2	2
5 to 10	4	3	2
11 to 20	6	4	3
21 to 50	10	5	5
51 to 100	15	6	10
101 to 200	20	10	10
201 to 500	50	20	10

5.3.1.2 Field work requirements

5.3.1.2.1 Exploratory holes shall be set out using a hand held GPS, coordinated by survey or position using locally referenced landmarks or survey pegs.

5.3.1.2.2 Fieldwork shall consist of the excavation of the exploratory holes, in-situ profiling or sampling holes in a fashion appropriate to the ground conditions, groundwater, sampling requirement, personnel safety considerations and the like, using one or more of the following methods:

a) TLB or excavator pits or trenches;
b) penetrometer probes (continuous standard penetrometer test and / or dynamic probe super heavy penetrometer tests) with sample recovery;
c) large diameter (not less than 750mm) auger holes;
d) hand held DCP's supplemented by methods a) and c);
e) hand dug pits supplemented by other methods;
f) percussion drilling with sample recovery supplemented by other methods; and
g) rotary core drilling with sample recovery.

5.3.1.2.3 All In-situ Soil Profiling shall be in accordance with the provisions Jennings, Brink and Williams (1973) procedure and the Guidelines for Soil and Rock Logging. The Soil Profile shall record and be described in the following terms for each individual soil horizon exposed in the exploratory holes:

a) moisture;
b) colour;
c) consistency;
d) structure;
e) soil type;
f) origin; and
g) any other detail relevant to the engineering assessment of the in-situ soil conditions.

5.3.1.2.4 Zones of seepage and presence of water tables must be recorded, as well as the nature of the water table, ie perched or permanent.

5.3.1.2.5 The Competent Person (Geotechnics) shall take reasonable steps to ensure that all the provisions of the Code of Practice on the Safety of Men Working in Small Diameter Shafts and Test Pits for Civil Engineering Purposes are observed.

5.3.1.3 Laboratory testing requirements

The Competent Person (Geotechnics) shall arrange for the following laboratory test procedures to be undertaken by an accredited soil mechanics test laboratory on representative bulk, disturbed and / or undisturbed samples of all significant ground profile variants, in order to provide Interpretative Data for judging ground response to foundations, earthworks construction, excavation stability, chemical aggressiveness towards buried services and the like:

a) particle size distribution / grading;
b) Atterberg Limits;
c) Moisture content;
d) Compressibility / potential collapse;
e) Swell under load;
f) pH and conductivity;
g) Compaction (moisture : density relationship); and

h) CBR.

Table 5: Residential site class designations (After Watermeyer and Tromp (1992) and the Joint Structural Division)

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	< 7,5 7,5 – 15 15 – 30 > 30	50% 50% 50% 50%	H H1 H2 H3
Silty sands, sands, sandy and gravely soils	COMPRESSIBLE AND POTENTIALLY COLLAPSABLE SOILS	<5 5-10 >10	75% 75% 75%	C C1 C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravely soils	COMPRESSIBLE SOILS	<10 10-20 >20	50% 50% 50%	S S1 S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip, Landfill, Marshy areas Mine waste fill, mining subsidence Reclaimed areas, Uncontrolled fill, Very soft silts/silty clays	VARIABLE	VARIABLE		P

NOTE:

1) The classifications, C, H, R and S are not intended for dolomitic areas unless specific investigations are carried out to assess the stability (risk of sinkholes and doline formation) of the dolomites. Where the risk is found to be acceptable, the site shall be designated in accordance with note 10.
2) Site classes are based on the assumption that differential movements, experienced by single-storey residential structures, expressed as a percentage of the total soil movements are approximately equal to 50% for soils that exhibit expansive or compressive characteristics and 75% for soils that exhibit bath compressible and collapse characteristics. Where this assumption is incorrect or inappropriate, the total soil movements must be adjusted so that the resultant differential movement implied by the Table is equal to that which is expected in the field.
3) In some instances, it may be more appropriate to use a composite description to describe a site more fully e.g., C1/H2 or S1 and/or H2. Composite site classes may lead to higher differential movements and result in design solutions appropriate to a higher range of differential movement e.g., a Class R/S1 may be described as a Class S2 site. Alternatively, a further site investigation may be necessary as the final design solution may depend on the location of the housing unit on a particular site
4) Where it is not possible to provide a single site designation and a composite description is inappropriate, sites may be given multiple descriptions to indicate the range of possible conditions, e.g. H1-H2 or C1-C2.
5) Soft silts and clays usually exhibit high consolidation and low bearing characteristics. Structures founded on these horizons may experience high settlements and such sites should be designated as Class S1 or S2, as relevant and appropriate.
6) Sites containing contaminated soils include those associated with reclaimed mine land; land down slope of mine tailings and old land fills.
7) Where a site is classified as being P, full particulars relating to the founding conditions on the site must be provided.
8) Where sites are designated as being Class P; the reason for such classification shall be placed in brackets immediately after the suffix, i.e. P (contaminated soils). Under certain circumstances composite description may be appropriate.
9) Certain fills may contain contaminants, which present a health risk. The nature of such fills should be evaluated and should be clearly demarcated as such.
10) Dolomitic Areas should be designated as being Class P (Dolomites-D2/H2) or Class P (Limestones- D2/H2) where the first designation after dolomites / limestones is the designation obtained from Table 6 and the second designation is form Table 5.

5.3.1.4 Reporting requirements

5.3.1.4.1 The Competent Person (Geotechnics) shall document and report all findings and Opinions in a written report using the following standard headings:

Executive summary
1 Introduction and Terms of Reference
2 Information used in the study
3 Site Description
4 Nature of Investigation
5 Site Geology and Groundwater Conditions
5.1 General
5.2 Soil Profile
5.3 Water Table
6 Geotechnical Evaluation
6.1 Engineering and Material Characteristics

6.2 Slope Stability and Erosion
6.3 Excavation Classification with respect to Services
6.4 Impact of the Geotechnical Character of the Site on Subsidy Housing Developments
7 Site Classification
8 Foundation Recommendations and Solutions
9 Drainage
10 Special Precautionary Measures
11 Conclusions
Appendices

5.3.1.4.2 The report must:

a) describe and list the information assimilated and used in the study in Section 2 (Information used in the study);
b) provide particulars of site boundaries and a description of the property in Section 3 (Site Description);
c) describe the field investigation procedures used and laboratory tests undertaken in Section 4 (Nature of Investigation);
d) state engineering and material characteristics which will affect the development and construction including the identification of conditions and constraints such a mining related problems, areas of outcrop, slope instability, contaminated land, unconsolidated fill, etc in Subsection 6.1 (Engineering and Material Characteristics);
e) evaluate and establish the potential for lateral soil movement arising from surface erosion, soil creep, talus movement and slope instability in Subsection 6.2 (Slope Stability and Erosion);
f) establish, for the purposes of broadly estimating subsidy variations (see Annexure 1) the presence and extent of:
   i) permanent or perched water table less than 1,0 below ground surface;
   ii) permanent or perched water table less than 1,5 below ground surface;
   iii) the Unified Soil Classification of the uppermost soil horizon (0 to 750mm) where the average slope is steeper than or equal to 1:7,5; and
   iv) the presence of hard rock and / or boulder class excavation (see Annexure 2) in future service trenches up to a depth of 1,5 metres;
g) assess the suitability of the material in accordance with Annexure 2 in the upper 1,5 m of the site for excavation by hand in Subsection 6.3 (Excavation Classification with respect to Services);
h) discuss foundation recommendations in relation to Watermeyer and Tromp (1992) and the Joint Structural Division's Code of Practice) and provide geotechnical engineering data associated with the design of such foundations in Section 8 (Foundation Recommendations and Solutions) ;
i) discuss the effect of both surface water (flooding and ponding) and groundwater (marshy conditions, underground erosion, hydrostatic pressure and fluctuating water levels on the development and comment on whether or not the groundwater will be potentially harmful with respect to buried concrete and steel in Section 9 (Drainage);
j) contain all soil profiles and the results of laboratory and in situ field tests including penetrometer test results in an orderly manner in the Appendices;
k) include the following drawings:
   i) a locality plan of site;
   ii) a site plan showing positions of exploratory holes; and
   iii) a soil map defining approximate boundaries of areas with common Site Class designations.

5.3.1.4.3 The Competent Person (Geotechnics) shall, where the land ownership history includes a mining operator, provide in the report details of depths of shallowest mining, backfill method and materials, the Government Mining Engineer's requirements and / or conditions of future land use and / or development and any investigation studies required to proceed with housing development.

5.3.1.4.4 Drawings shall be to a common scale, legible and easily reviewed. All drawings shall be correctly referenced with a clear indication of co-ordinates.

5.3.1.4.5 The report and all drawings must also be available in an electronic format.

5.3.2 Requirements for stability investigations in Dolomitic Areas

5.3.2.1 Minimum requirements

The Competent Person (Geotechnics) shall, as a minimum in order to satisfy the general requirements for a Phase 1 Geotechnical Site Investigations in Dolomitic Areas as stated in 4.2:

a) map the basic geology and geomorphological features of the site as well as any sinkholes and dolines within or in close proximity to the site;
b) formulate an Opinion as to risk characterisation and land use of the site in terms of Table 1, using geophysics, the assessment of the morphology, subsurface profile from ground surface to dolomite bedrock and the geohydrological regime conditions and groundwater compartmentalization;
c) conduct a detailed Geotechnical Site Investigation comprising a gravity survey in accordance with the provisions of 5.3.2.2 and drilling in accordance with the provisions of 5.3.2.3 to a minimum depth of 6,0 into the bedrock at a frequency derived from Figures 2a and 2b;
d) prepare a comprehensive geotechnical report which:
   i) provides the township description and defines the extent and boundaries of the township;
   ii) establishes the geological changes over the site;
   iii) establishes the nature, fluctuations, compartmentalisation, and original ground water levels from geohydrological Data;
   iv) describes and interprets the local geology by Site Classification Unit;
   vi) provides appropriate land use proposals by Site Classification unit in accordance with Table 1;
   v) provides a Site Classifications of the site in accordance with Table 6;
   vi) contains recommendations for geotechnical and structural solutions in sites designated as D3 by Site Classification unit with reference to Wagener and Buttrick, Van Schalkwyk, Kleywegt and Watermeyer (2002);
   x) presents appropriate water precautionary measures;
   xi) identifies precautionary measures in addition to the mandatory measures contained in the Home Building Manual; and.
   xii) outlines an appropriate Risk Management Plan.

Note: Multiple remote sensing techniques in addition to the mandatory gravity survey may be required, depending on the geology , e.g. . electro magnetics to establish the contact between dolomite and conductive material such as Karoo shale.

Table 6: Dolomitic Area designations (After Joint Structural Division and Buttrick, Van Schalkwyk; Kleywegt and Watermeyer, 2001)

Dolomitic Area Class	Description
D1	No precautionary measures are required to permit the construction of housing units due to an adequate overburden thickness.
D2	The risk of sinkhole and doline formation is adjudged to be such that only general precautionary measures, which are intended to prevent the concentrated ingress of water into the ground, are required to permit the construction of housing units.
D3	The risk of sinkhole and doline formation is adjudged to be such that precautionary measures in addition to those pertaining to the prevention of concentrated ingress of water into the ground, are required to permit the construction of housing units.
D4	The risk of sinkhole and doline formation is such that precautionary measures cannot adequately reduce such risks to acceptable limits so as to permit the construction of housing units or the precautionary measures which are required are impracticable to implement.

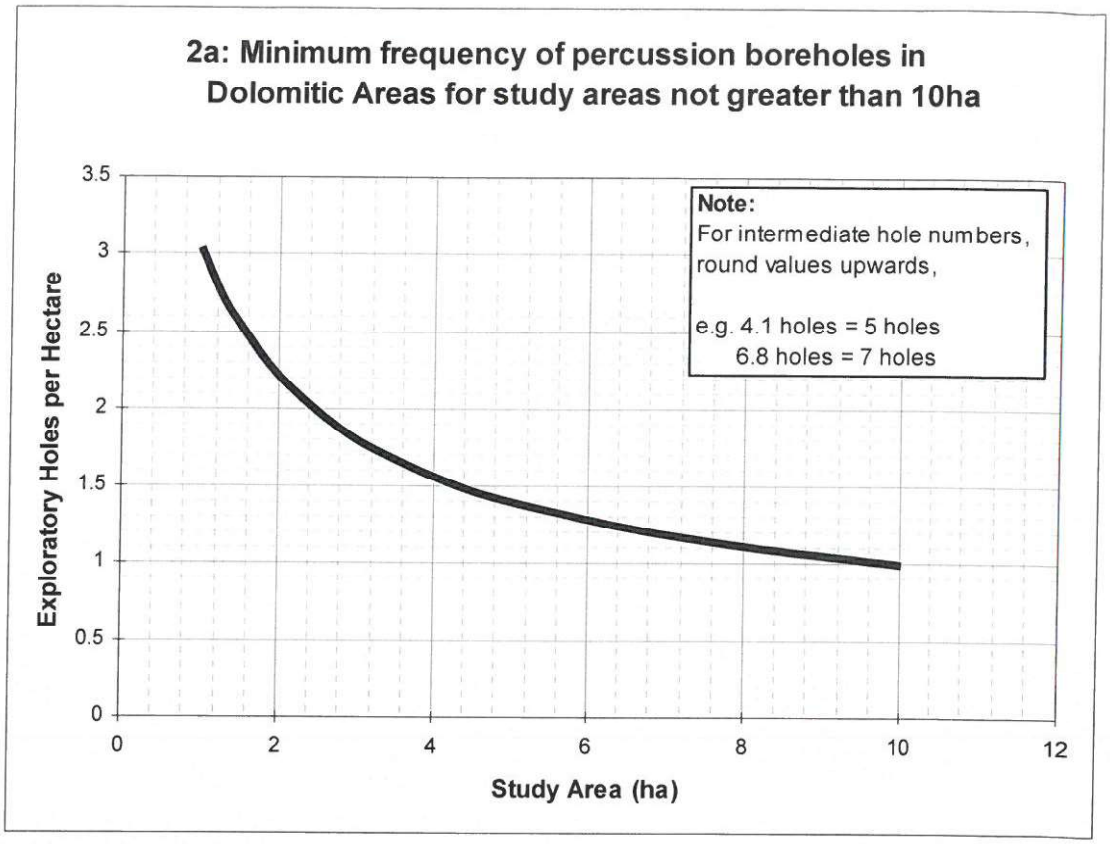
5.3.2.2 Gravity survey requirements

5.3.2.2.1 The gravity survey shall be undertaken by a suitably qualified geophysicist, with at least 3 years total working experience in dolomite environments of South Africa. Observations may be undertaken by a suitably qualified and experienced geotechnician under the direction of an experienced geophysicist.

5.3.2.2.2 The grid spacing for gravity surveys shall not exceed the lesser of 30 metres and the anticipated thickness of the overburden above the dolomites or limestones.

5.3.2.2.3 Five to ten percent of observations shall be repeated for control purposes.

5.3.2.2.4 A residual gravity map shall be produced and utilised to determine initial borehole positions. After an initial phase of drilling, a provisional residual gravity map shall be produced. The final residual gravity map shall only be produced after drilling is completed.



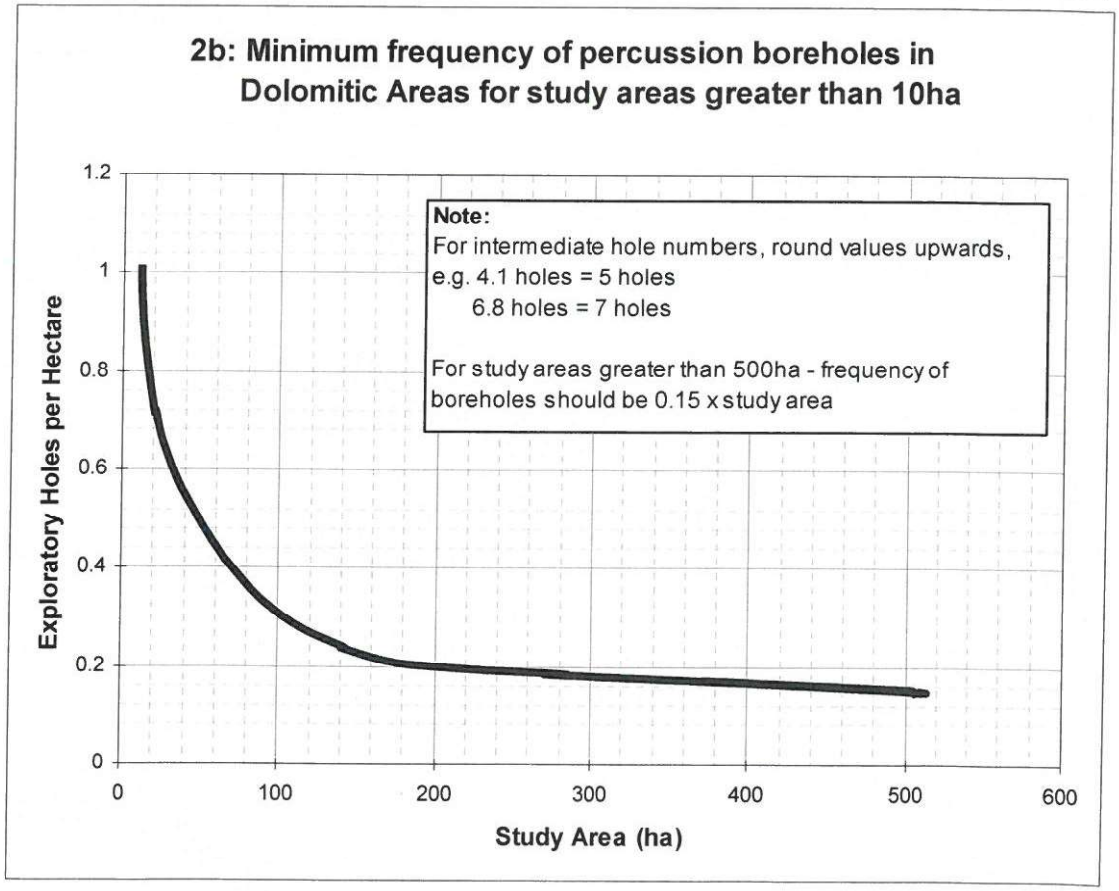


Figure 2: Minimum frequency of percussion boreholes in Dolomitic Areas

5.3.2.2.5 The accuracy of reduced observations on a relative basis shall be at least 0,01 mgal or better.

5.3.2.2.6 Contour intervals of not more than 0.1 milligals are to be used.

5.3.2.2.7 A geophysical report shall be produced describing the work procedures, interpretation and conclusions of the survey.

5.3.2.3 Drilling work requirements

5.3.2.3.1 Rotary percussion boreholes shall be drilled on the site utilising geophysical data to select the positions. Retrieve samples for every 1m drilled shall be retrieved.

5.3.2.3.2 Boreholes shall be drilled at least 6m into solid dolomite or limestone bedrock.

5.3.2.4.3 Drilling equipment shall comprise of the following mobile units:

a) Compressor unit with measured and calibrated constant air delivery rating at 750 cfm and 16 Bar minimum.

b) Pneumatic percussion drilling rig with 165mm nominal diameter button bit capable of drilling in all soil and rock types.

5.3.2.3.4 The following minimum information shall be recorded on the Drilling Sheet during the drilling of each borehole:

a) Driller/drilling contractor;
b) Date of drilling borehole;
c) Drilling rig;
d) Compressor type, capacity and delivery;
e) Hammer size;
f) Depth intervals for sampling (1m);
g) Penetration times;
h) Formation e.g. cavity, very soft, soft, reasonably hard, hard, solid;
i) Hammer tempo e.g. highly irregular, irregular, regular;
j) Air loss e.g. none, partial, total;
k) Moisture condition e.g. water intercepted, wet, moist, dry;
l) Borehole ravelling/collapsing;
m) Water or foam added;
n) Casing used;
o) Sample retrieval e.g. good, medium, poor, none; and
p) Other remarks or comments.

5.3.2.3.5 The depth range of use of water or foam to enhance sample recovery shall be clearly indicated on the drillers field report.

5.3.2.3.6 Boreholes shall be backfilled with soil, recovered from drilling, suitably moistened to form a flowing slurry. The borehole shall be capped using a 400mm x 400mm x 150mm 15MPa wood floated concrete cap with 100mm concrete down the hole. The borehole number, drilling date and direction of inclination shall be marked in the wet concrete.

5.3.2.4 Requirements for descriptions of borehole chip sample

5.3.2.4.1 The method of borehole chip sample description shall be in accordance with the published recommendations of the South African Institution of Engineering and environmental Geologists.

5.3.2.4.2 Descriptions of borehole chip samples recovered shall include the following:

a) Soil component:
   i) Colour
   ii) Soil type
b) Rock component:
   i) Chip shape e.g. angular, sub angular, sub rounded, rounded, etc.
   ii) Colour
   iii) Weathering described in terms of unweathered, slightly, medium, highly and completely weathered.
   iv) Rock type.

5.3.2.4.3 The major portion of the sample is to be described first followed by the description of the sub-ordinate material. Subordinate portions are to be described using descriptions outlined below:

i) Trace.
ii) Minor.
iii) Abundant.
iv) Equal amounts.

5.3.2.4.4 The name of the driller, date of drilling, date of logging, loggers name, compressor capacity and delivery, drill rig type, hammer size, penetration times, level at which water is struck, groundwater rest level, ground elevation and co-ordinates shall be recoded on the profile sheet together with any problematic conditions such as air loss, sample loss and cavitation.

5.3.2.5 Requirements for gathering of geohydrological Data

5.3.2.5.1 The available geohydrological data shall be obtained from the Department of Water Affairs.

5.3.2.5.2 Where groundwater is encountered in a borehole, the level shall be established at least 24 hours after completion of the borehole. Two readings shall be taken within a week thereafter.

5.3.2.6 Requirements for the determination of Hazard and Risk Zones

Hazard, Inherent Risk and Development Risk shall be determined in accordance with the procedure outlined by Buttrick, Van Schalkwyk, Kleywegt and Watermeyer (2001) as summarized in Annexure 3.

5.3.2.7 Reporting requirements

5.3.2.7.1 The Competent Person (Geotechnics) shall document and report all findings and Opinions in a written report using the following standard headings:

Executive summary
1 Introduction and Terms of Reference
2 Information used in the study
3 Site Description
4 Nature of Investigation
5 Site Geology and Groundwater Conditions
5.1 General
5.2 Profile
5.3 Ground water levels
6 Stability Evaluation
6.1 Dolomite stability characterisation
6.2 Characterisation procedure.
6.3 Stability characterisation of the site.
7 Conclusions and Recommendations
7.1 Summary of Risk Zonation
7.2 Appropriate land use recommendations
7.3 Water and foundation precautionary measures
7.4 Development densities and types
7.4 Dolomite Area Designations for each Inherent Risk Zone.
7.5 Specific founding measures in D3 areas.
7.7 Outline of the preliminary Risk Management Plan.
Appendices

5.3.2.7.2 The report must:

a) describe and list the information assimilated and used in the study in Section 2 (Information used in the study);
b) provide particulars of site boundaries and a description of the property in Section 3 (Site Description);
c) describe the field investigation procedures used and laboratory tests undertaken in Section 4 (Nature of Investigation);
d) discuss the geology and geohydrology in both the regional and site specific context in Section 5 (Site Geology and Groundwater Conditions);

e) explain and motive the risk characterisation of the site in Section 6 (Stability Evaluation);
f) specify water precautionary and special founding measures for each risk zone in Subsection 7.3 (Water and foundation precautionary measures);
g) assess the impact of the Site Classes on subsidy housing developments;
h) discuss foundation recommendations in D3 zones in relation to Wagener (1985) and Buttrick, van Schalkwyk, Kleywegt and Watermeyer (2002) and provide geotechnical engineering data associated with the design of such foundations in Subsection 7.5 (Specific founding measures in D3 areas);
i) contain all Data from the gravity survey, boreholes and the results of laboratory and in situ field tests in an orderly manner in the Appendices;
j) include the following drawings:
   i) Locality plan of site.
   iii) Site plan showing positions of boreholes and gravity contours.
   iii) Zone map defining approximate boundaries of areas with common Site Class designations.

5.3.2.7.3 Drawings shall be to a common and appropriate scale, legible and easily reviewed. All drawings shall be correctly referenced with a clear indication of co-ordinates.

5.3.2.7.4 The report and all drawings must also be available in an electronic format.

5.4 Phase 2 Geotechnical Site Investigations

5.4.1 Requirements for Non-Dolomitic Areas

5.4.1.1 Minimum requirements

The Competent Person (Geotechnics) shall, as a minimum in order to satisfy the general requirements for a Phase 2 Geotechnical Site Investigations non-Dolomitic Areas as stated in 4.3:

a) established formal profiling procedures with the person responsible for the installation of township services so that the available trenching is optionally utilized within the construction framework and programme for profiling purposes;
b) co-ordinate activities associated with the profiling procedures;
c) observe and record soil profiles in exposed services trenches at not more than 100m intervals or wherever soil type changes occur;
d) undertake where justified supplementary Geotechnical Site Investigations;
e) arrange for undisturbed samples to be taken for a set of Foundation Indicator Tests at a frequency of not more than one set for every five points profiled; and
f) record data on field sheets and the points in the trenches which were profiled on a site layout plan.

5.4.1.2 Reporting

5.4.1.2.1 The Competent Person (Geotechnics) shall prepare a brief report as an addendum to the Phase 1 report which shall contain:

a) a drawing indicating the location of the points profiled in the service trenches;
b) records of all profiles and tests; and
c) a marked up township layout drawing which confirms the Site Classes of each individual erf

5.4.1.2.2 The report and all drawings must also be available in an electronic format.

5.4.2 Requirements for Dolomitic Areas

5.4.2.1 Minimum requirements

The Competent Person (Geotechnics) shall satisfy the requirements of 5.4.1 and, as a minimum in order to satisfy the general requirements for a Phase 2 Geotechnical Site Investigations Dolomitic Areas as stated in 4.3:

a) interact with the town planners, civil engineers and the developer concerning appropriate planning, design of infrastructure and housing units;
b) develop a Risk Management Plan specific to the development (refer to Annexure 3);
c) establish formal inspection procedures with the person responsible for the installation of township services so that the available trenching is optimally utilized within the construction framework and programme for inspection purposes;

d) co-ordinate activities associated with the inspection procedures;
e) inspect the service trenches to verify the Phase 1 stability zonation and to check for paleofeatures;
f) investigate potential paleosinkhole structures wherever they are exposed; and
g) undertake where justified supplementary Geotechnical Site Investigations.

5.4.2.2 Reporting requirements

5.4.2.2.1 The Competent Person (Geotechnics) shall prepare a brief report as an addendum to the Phase 1 report which shall contain:

a) a drawing indicating the location of the points profiled in the service trenches;
b) records of all profiles and tests; and
c) a township layout drawing which confirms the Site Classes of each individual erf;

5.4.2.2.2 The report and all drawings must also be available in an electronic format.

Annexure 1: Schedule of generic subsidy variations for site and founding conditions

CATEGORY OF SUBSIDY VARIATION	VERIFICATION CRITERIA	FACTORS TO CONSIDER IN ESTABLISHING QUANTUM OF SUBSDIY VARIATION
II: SITE CONDITIONS		
1 Seepage / ground water		
1.1 Category 1	Permanent or perched water table less than 1,0 m below ground surface.	Subsurface drainage / improved damproofing measures to houses; service trenches to be dewatered during construction.
1.2 Category 2	Permanent or perched water table less than 1,5 m below ground surface.	Service trenches to be dewatered during construction.
2 Erodability of soil	Uppermost soil horizon (0 to 750mm) over erf is classified in terms of the Unified Soil Classification as SP, SM, CL or CH and average slope of erf measured in any direction is steeper than or equal to 1:7,5.	Provision of retaining wall and earthworks required to reduce slopes.
3 Difficulty of servicing of land due to slopes		
3.1 Type 1 site	Average slope measured along a 100 metre line in any direction from any of the boundaries of the erf is flatter than 1:100.	Difficulties associated the provision of waterborne sanitation and the drainage of sites/ provision of pump stations.
3.2 Type 2 site	Average slope measured across the erf in any direction exceeds 1:20 but is flatter than or equal to 1:10.	Terracing for houses/ additional masonry units in foundation walls required.
3.3 Type 3 site	Average slope measured across the erf in any direction exceeds 1:10 but is flatter than or equal to 1:7,5.	Terracing for houses required. Additional earthworks to roads and storm water control measures
3.4 Type 4 site	Average slope measured across the erf in any direction exceeds 1:7,5 but is flatter than or equal to 1:5.	Terracing for houses required. Additional earthworks to roads and storm water control measures.
3.5 Type 5 site	Average slope measured across the erf in any direction exceeds 1:5.	Terracing for houses required. Additional earthworks to roads and storm water control measures.
4 Difficulty of excavation		
4.1 Type 1 condition	Average slope measured across the erf in any direction is flatter than or equal to 1:10 and between 10 and 40% of material to a depth of 1,5 metres below pre-development level is classified as hard rock excavation.	Additional cost of trench excavation.
4.2 Type 2 condition	Average slope measured across the erf in any direction is flatter than or equal to 1:10 and in excess of 40% of material to a depth of 1,5 metres below pre-development level is classified as hard rock excavation.	Additional cost of trench excavation.
4.3 Type 3 condition	Average slope measured across the erf in any direction is steeper than 1:10 and the material to a depth of 1,5 metres below pre-development level is classified as Boulder Class B excavation.	Additional cost of trench excavation. Additional cost of road excavation.
4.4 Type 4 condition	Average slope measured across the erf in any direction is steeper than 1:10 and the material to a depth of 1,5 metres below pre-development level is classified as Boulder Class A or Hard Rock excavation.	Additional cost of trench excavation. Additional cost of road excavation.
5 Precautionary measures in sites underlain by dolomites/ limestones	Class P(dolomites/limestones- D2/D3) site class designation in accordance with 2.5 and 2.8 of Part 1 of Section 2 of the NHBRC Home Building Manual.	The design and construction of township services will need to be in accordance with 2.8.3 of Part 1 of Section 2 of the NHBRC Home Building Manual.

CATEGORY OF SUBSIDY VARIATION	VERIFICATION CRITERIA	FACTORS TO CONSIDER IN ESTABLISHING QUANTUM OF SUBSDIY VARIATION
III: FOUNDING CONDITIONS#		
1 Expansive soils		
1.1 Class H1		
1.2 Class H2		
1.3 Class H3		
2 Compressible and potentially collapsible soil	Site class designations classified in accordance with 2.5 of Part 1 Section 2 of the NHBRC Home Building Manual	Masonry houses will require foundation design, building procedures and precautionary measures to be in accordance with Tables 5, 6 and 7 of Part 1 Section 2 of the NHBRC Home Building Manual
2.1 Class C1		
2.2 Class C2		
3 Compressible soils		
3.1 Class S1		
3.2 Class S2		
4 Variable		
4.1 Class P (Dolomites /Limestones– D2)	Class P site class designation in accordance with 2.5 and 2.8 of Part 1 of Section 2 of the NHBRC Home Building Manual.	Houses will require precautionary measures in accordance with NHBRC requirements.
4.2 Class P (Dolomites / Limestones– D3		
4.3 Class P (Mining subsidence)	Class P site class designation in accordance with 2.5 of Part 1 of Section 2 of the NHBRC Home Building Manual.	Precautionary measures will need to be in accordance with specialist literature.

Sites designated as Class P (contaminated), Class P (controlled fills), Class P (marshy areas), Class P (mine waste fill), Class P (uncontrolled fill), Class P (landfill) and Class P (landslip), Class P (reclaimed areas) and Class P (very soft silts / silty clays) are not generally considered appropriate for development in the subsidy scheme.

Annexure 2: Earthworks classifications for service trenches

Earthworks for service trenches are classified in terms of Tables 2.1 and 2.2.

Table 2.1: Classification of material for machine excavation (SANS 1200 D)

CLASSIFICATION	DESCRIPTION
Restricted excavation	
Soft	Material which can be efficient removed by a back-acting excavator of fly wheel power >0,10 kW for each mm of tined bucket width.
Intermediate	Material which can be removed by a back-acting excavator having a fly wheel power > 0,10kW for each mm of tined-bucket width or with the use of pneumatic tools before removal by a machine capable of removing soft material.
Hard Rock	Material that cannot be removed without blasting or wedging and splitting.
Non-restricted excavation	
Soft	Material which can be efficiently removed or loaded, without prior ripping, by any of the following plant: a bulldozer or a track type front end loader having an approximate mass of 22 tonne and a fly wheel power of 145 kW. a tractor-scraper unit having an approximate mass of 28 tonne and fly wheel power of 245 kW, pushed during loading by a bulldozer equivalent to that described above.
Intermediate	Material which can be efficiently ripped by a bulldozer having an approximate mass of 35 tonne and a fly wheel power of 220 kW.
Hard Rock	Material that cannot be efficiently ripped by a bulldozer having an approximate mass of 35 tonne and a fly wheel power of 220 kW.
Boulder class A	Material containing more than 40% by volume of boulders of size between 0,03 m^3 and 20m^3, in a matrix of soft material or smaller boulders.
Boulder class B	Material containing 40% or less by volume of boulders of size between 0,03 m^3 and 20m^3, in a matrix of soft material or smaller boulders.

Table 2.2 Classification for material for hand excavation (Watermeyer, RB. Mobilising the Private Sector to Engage in Labour Based Infrastructure Works: A South African Perspective. Sixth Regional Seminar for Labour-Based Practitioners. Ministry of Works, Transport and Communications in collaboration with ILO/ASIST, Jinja, Uganda, October, 1997.)

Criteria for classifying material as soft excavation Class A *		
Dynamic cone penetrometer - minimum number of blows required to penetrate 100 mm	Granular materials	Cohesive materials
	7-15 +	6 to 8 +
Consistency	Dense - high resistance to penetration by the point of a geological pick; several blows required for removal of material.	Stiff / Very stiff Stiff - can be indented by thumb-nail; slight indentation produced by pushing geological pick point into soil; cannot be moulded by fingers. Very stiff - indented by thumb-nail with difficulty; slight penetration of point produced by blow of geological pick.

* Soft excavation Class A is material which, using a pick or equivalent hand swing tool, can only be excavated with difficulty.

\+ Only applicable to materials comprising not more than 10% gravel (Particles having dimensions ; 2.5 mm) of size less than 10 mm and materials containing no isolated small boulders.

Annexure 3: Summary of Buttrick, Van Schalkwyk, Kleywegt and Watermeyer's Method for dolomite land hazard and risk assessment in South Africa

Using the geomorphological, geological, borehole, gravity and geohydrological information, the site shall be zoned in terms of eight Inherent Risk Classes and four Development Risk Categories as described in Tables 3.1 and 3.2.

Inherent Risk Classes are to be determined through the evaluation of the following parameters using the borehole information:

- Receptacle development
- Mobilisation agencies
- Potential development space
- Nature of the blanketing layer
- Bedrock morphology

The procedural guidelines for site characterization are as follows:

Step 1: Undertake preliminary zoning of the site into morphological units using geophysical tools (particularly gravity surveys), remote sensing techniques and field information (geological and topographic mapping). These zones are areas that are anticipated to have similar subsurface geological conditions (rock types, depth to bedrock, extent of weathering, residual materials etc).

Step 2: Boreholes are drilled to investigate the preliminary zones. The stability characterisation procedures are as described / briefly outlined above. The method requires hypothesising the probable impact of a development on the dolomite environment. The potential stability of the land is reviewed in the context of both a dewatering or non-dewatering scenario. Factors to be evaluated are mobilising agencies, receptacle development, potential development space, natural blanketing layer, mobilisation potential of the blanketing layer and bedrock morphology.

Step 3: The individual borehole characterisations and all available information is integrated. The spatial representation of the individual boreholes is decided on. It is essential that the lateral continuity of the conditions represented by individual boreholes is established. Borehole information represents point data and geological conditions vary between boreholes. The use of the geological mapping, gravity survey data and the borehole information will prove invaluable in the process of refining zonal boundaries. Particular subsurface conditions will provide the risk characterisation of a zone. The subsurface conditions represented by the various boreholes are used in conjunction with geophysical, karst and bedrock morphology and geohydrology to determine the boundaries of areas of similar geotechnical characteristics and to develop a 'composite' Inherent Risk characterisation for each particular zone.

Step 4: The finalised risk zonation of the site must be described in terms of the eight Inherent Risk Classes (as outlined in Table 3.1).

Step 5: The appropriate development types are to be selected for each zone and suitable precautionary and remedial measures provided. The particular type of development selected determines the Development Risk, indicating long term safety.

Dolomite Area "D" Designation is to be assigned to each Inherent Risk Class on the site. These "D" designations and related typical precautionary measures are outlined below.

General

1. The site and surrounding area shall be shaped to permit the ready drainage of surface water and to prevent ponding.
   Drainage ports should be incorporated in boundary walls particularly at the lowest point of the site, to permit the passage of surface runoff.
2. Natural ponds and water courses located within 10m of any structure shall be rendered impervious.
3. Sanitation systems shall not incorporate soak aways.
4. Backwash and other water from swimming pools, shall be discharged into either the storm water or drainage systems as required by the local authority.
   The dolomitic stability over the route of any bulk water bearing service should be evaluated.

Table 3.1: Characterisation: Inherent Risk of doline and a specified-size sinkhole forming.

Inherent Risk Class	*Small sinkhole*	*Medium sinkhole*	*Large sinkhole*	*Very large sinkhole*	*Risk of doline formation*	*Recommended type of development in order to maintain acceptable Development Risk.*
Sinkhole diameter	**< 2m**	**2 – 5m**	**5 – 15m**	**> 15m**		
Class 1	Low	Low	Low	Low	Low # NDS or DS	Residential, light industrial and commercial development provided that appropriate water precautionary measures are applied. Other factors affecting economic viability such as excavatability, problem soils, etc. must be evaluated.
Class 2	Medium	Low	Low	Low	Medium #NDS	Residential development with remedial water precautionary measures. No site and service schemes. May consider for commercial or light industrial development
Class 3	Medium	Medium	Low	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and service schemes. May consider for commercial or light (dry) industrial development with appropriate precautionary measures.
Class 4	Medium	Medium	Medium	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and service schemes. May utilise for commercial or light (dry) industrial development with appropriate stringent precautionary measures.
Class 5	High	Medium	Low	Low	High #NDS	These areas are usually not recommended for residential development but under certain circumstances selected residential development (including lower-density residential development, multi-storied complexes, etc.), may be considered, commercial and light industrial development. The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground are required to permit the construction of housing units.
Class 6	High	High	Medium	Low	High #NDS	These areas are usually not recommended for residential development but under certain circumstances highrise structures or gentleman's estates (stands 4 000m^2 with 500m^2 proven suitable for placing a house) may be considered, commercial or light industrial development. Expensive foundation designs may be necessary. Sealing of surfaces, earth mattresses, water in sleeves or in ducts, etc.
Class 7	High	High	High	Low	High #NDS	No residential development. Special types of commercial or light industrial (dry) development only (eg. bus or trucking depots, coalyards, parking areas). All surfaces sealed. Suitable for parkland.
Class 8	High	High	High	High	Low-High *NDS or DS	No development, nature reserves or parkland.

* = Number of anticipated events per hectare over a period of 20 years with poor design & management
\# = Non Dewatering Scenario and Dewatering Scenario

Table 3.2: Dolomitic Area Designations

Dolomitic Area Class	Description	Typical Foundation Solutions (Masonry Structures)
D1	**No precautionary measures** are required to permit the construction of housing units due to an adequate overburden thickness.	Foundations in accordance with the Joint Structural Division's Code of Practice (1995)
D2	The risk of sinkhole and doline formation is adjudged to be such that only **general precautionary measures**, which are intended to prevent the concentrated ingress of water into the ground, are required to permit the construction of housing units.	Foundations in accordance with Joint Structural Division's Code of Practice (1995).
D3	The risk of sinkhole and doline formation is adjudged to be such that precautionary measures in **addition** to those pertaining to the prevention of concentrated ingress of water into the ground, are required to permit the construction of housing units.	Possible solutions where sinkholes occur include the provision of: • reinforced concrete grids incorporating floor spanning between exposed pinnacles (Wagener, 1985) • mattresses of improved material (Wagener, 1985) • raft foundations to allow occupants to escape and limit damage in the event of a sinkhole occurring (JSD 2000) Possible solutions where dolines are expected include split construction and raft construction in accordance with the Joint Structural Divisions Code of Practice (1995).
D4	The risk of sinkhole and doline formation is such that precautionary measures cannot adequately reduce such risks to acceptable limits so as to permit the construction of housing units or the precautionary measures which are required are impracticable to implement.	-

Township services

5. Underground services shall be designed and constructed so as to minimise maintenance requirements and any potential leakage points in wet services and shall, as far as possible, be designed to avoid possible disturbance of the underground environment.
6. The relevant provision of SANS 1200 DB, L, LB, LC, LD and LE shall be observed in the installation of all underground services.
7. The backfilling to service trenches and other excavations shall, except in rock, not be more permeable than the surrounding material.
8. The stormwater drainage and sewerage system shall incorporate measures to ensure watertightness of conduits and other compartments. Whenever possible, storm water should be channeled in lined, surface canals.
   Concrete non-pressure pipes should be of the spigot and socket type with rubber ring seals. Joints in box culverts, channels, etc. should be sealed.
9. Storm water drainage conduits shall be constructed at gradients, which will not permit the deposition of silt, or sand, of the type present in the catchment area.
10. Water mains shall be laid only in road reserves.
11. Water piping materials shall be one or more of the following:
    pipes of 75mm and larger diameter:
    high impact PVC pipes with vitaulic joints.
    steel pipes with internal and external corrosion protection or other flexible (as defined in SANS 10102 Part 1) water pipes with flexible, self anchoring connections.
    pipes having a diameter of less than 75mm:
    PE-63 or PE-80 piping in accordance with the provisions of SANS 4427 ISO 4427 polypropylene piping
    The piping used in mains and communication pipes should be flexible, joints should be minimal in number and, be of the flexible, self anchoring type, i.e. not reliant on thrust blocks or friction for their anchorage.
12. Provision for future connections shall be made in order to minimise the cutting into pipes to provide such connections.
13. Provision shall be made in all water bearing pipelines to accommodate any potential differential movements without causing the pipeline or joints to leak.
14. Road surfaces shall be located sufficiently low so as to permit the drainage of erven onto them.
15. Roadways, which have a gradient of less than 1:80, shall be surfaced/sealed.

16. Where un-surfaced roads are the sole storm water system in a township, the roadways, which act as major storm water collectors, shall be surfaced.
17. The velocity of the 1 in 20 year storm water, flowing along un-surfaced roadways shall not exceed 1,5 m/s.

Plumbing

18. Water pipe entries into the buildings shall be in accordance with Figure 3.1.
19. All sewer and water pipes and fittings shall be provided with flexible, watertight joints.
20. No plumbing and drainage pipes shall be placed under floor slabs, as far as is practicable.
21. The fall of the trenches shall be away from the buildings.
22. Pipes through walls shall be sleeved to permit relative movement.
23. WC pans shall be provided with a flexible connection at the junction with the outlet pipe.
24. The selection of piping material shall take cognisance of corrosion (both external and internal).
25. Water pipes shall have a minimum cover of 500mm.
26. Wherever practical, service trenches shall not be excavated along the length of housing units within the first 3,0m beyond the perimeter of such units.

Site precautions

27. Down pipes, if provided, shall discharge into concrete line drainage channels, which discharge the water at least 1,5m away from buildings.
28. Where guttering is not provided, a 1,5m wide impervious apron slab shall be provided.
29. The ground immediately against the buildings shall be shaped to fall in excess of 75mm over the first 1,5m beyond the perimeter of the building, from where it shall drain freely away from housing units. Apron slabs, where provided shall have the same fall.

The matters to be considered when establishing and maintaining a Risk Management Plan include:

1 New Townships

1.1 Bulk and internal services in new townships must be installed in accordance with the aforementioned precautionary measures and any additional provisions provided in the geotechnical report.

1.2 A register of townships in areas designated as being D1, D2, D3 and D4 (Risk Classes 1 to 8) should be opened. Specified precautionary measures should be entered into the register where they differ from the aforementioned precautionary measures.

1.3 The local authority must ensure that bulk services are upgraded appropriately in relation to increasing residential densification.

2. Raising awareness

2.1. A map of all known dolomite areas within the local authorities area of jurisdiction should be prepared and maintained. This map should provide a composite stability zonation based on the Dolomite Area Designations and the related Dolomite Risk Class e.g. D2 (Risk Class 1) and D3 (Risk Class 4). The Dolomite Area Designation will be of immediate importance to civil engineers involved in service design and maintenance, whereas the Dolomite Risk Class will be of value to the dolomite risk specialists from a development perspective.

2.2 The sections / departments of local authorities responsible for the maintenance of the water, sewer and electrical reticulation and bulk services as well as the building control section should be issued with maps showing the D2, D3 and D4 (Risk Classes 1 to 8) areas and must be informed of the potential risks and maintenance requirements for services in these areas.

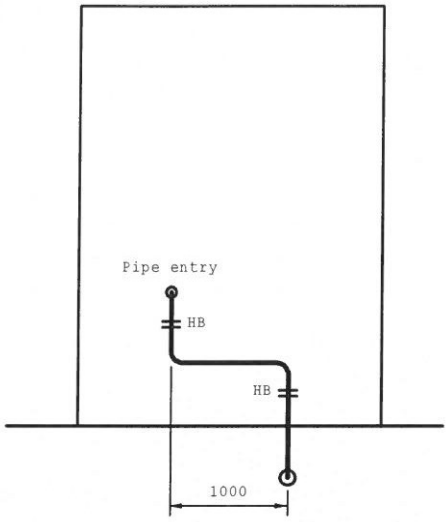
2.3 Councillors whose wards fall within D1, D2, D3 and D4 (Dolomite Risk Class 1 to 8) areas, as well as leaders of community structures and organisations whose constituents reside in D2 (Classes 1 to 4) and D3 (Classes 3 to 5) areas should be informed of the potential risks and maintenance requirements for services in these areas and the necessity to report any leakage / blockages / ponding of water in these areas to designated Council officials.

2.4 Officials who receive and log reports from the public on disruptions in services etc. must be provided with contingency plans including maps showing D2 (Classes 1 to 5), D3 (Classes 3 to 5) and D4 (Classes 6 to 8) areas and must be briefed on the implications of leaks and the like in these areas. Special reporting procedures must be established to ensure that maintenance teams are promptly advised of leaks and the like in areas designated as being D2, D3 and D4.

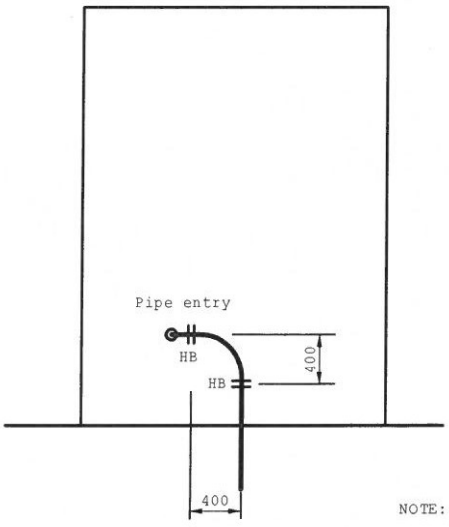
2.5 The local authority should inform residents in areas designated D2 (Classes 1 to 5) and D3 (Classes 3 to 5), every two years in a written communication, of the risks and their responsibilities which will include:

* Prompt reporting of leaks and any subsidence.

* Refraining from making illegal connections and proceeding with the erection of new buildings on properties and the installation of swimming pools without permission.



RIGID / SEMI FLEXIBLE PIPE



FLEXIBLE PIPING

NOTE:

HB - Holderbats.

Clamp type holderbat not to be fully tightened to allow for movement.

Figure 3.1
Water pipe entry points

* Ensure that water does not dam up on their properties.

3. Maintenance of services

3.1 A pro-active maintenance strategy for water bearing infrastructure should be developed. This can be readily done by superimposing the waterbearing infrastructure on the stability risk zonation map described in Section 2.1 above. Priority in terms of vigilance, general maintenance, repair of leaks and expenditure of funds for upgrading or service replacement can be assigned on the basis of risk exposure. In this manner a prioritised, co-ordinated and pro-active strategy for maintenance and review of waterbearing infrastructure can be developed by the local authority.

3.2 Areas designated as being D2, D3 and D4 (Dolomite Risk Classes 1 to 8) must receive priority in the repair of leaks arising from the sewer and water reticulation.

3.3 Sewer mains in areas designated as D2, D3 or D4 (Dolomite Risk Classes 1 to 8) should be checked for water tightness by means of an air test at intervals not exceeding two years and repairs undertaken where necessary.

3.4 The stormwater systems in areas designated as being D2, D3 or D4 (Risk Classes 1 to 8) should be inspected for blockages and leaks at intervals not exceeding one year and repairs / cleaning undertaken where required.

3.5 All bulk services which are located in areas designated as being D2, D3 and D4 should be inspected for water tightness / blockages at intervals not exceeding one year and cleared/repaired where required.

3.6 Priority should be given to the upgrading of services in areas designated as being D2, D3 and D4 in order to minimise sewer overflows, ponding of water, bursts, water losses, etc.

4. Management of improvements to properties

4.1 Building control officers must in areas designated as being D2 and D3, enforce any restriction regarding swimming pools and must ensure that alterations and additions are in accordance with the NHBRC requirements.

4.2 Building control officers should once every two years visually inspect properties in areas designated as being D2 and D3 to ensure that water is not damming up on properties.

4.3 Building control officers must not permit any densification of properties in areas designated as being D1, D2 or D3 unless it is confirmed by a competent person that such densification does not change the area designation.

5. Measures to prevent land invasion

The local authority must put in place a policy and measures to preclude land invasions and to act positively where such invasions have occurred.

6. Ground water control measures

Artificially induced fluctuations in the dolomite ground water level, particularly where shallow, may trigger sinkhole or doline formation. Consequently, it is essential that local authorities liaise with the Department of Water Affairs and set up appropriate groundwater monitoring procedures. Depending on the Dolomite Risk Class and Dolomite Area Designation (e.g. D4 or Class 7 and 8) of an area, in certain sensitive groundwater compartments, an outright ban on the sinking of abstraction boreholes may be required.

7. Emergency reaction plan in the event of a sinkhole or doline occurring.

The local authority should set in place an emergency reaction plan to be followed in the event of a sinkhole or doline occurring in their area of jurisdiction. Managers of emergency services should be provided with the dolomitic zone designation and risk map and briefed on the implications thereof. It is essential that these managers and emergency services personnel fully understand what a sinkhole is, possible stages of development and how large an area to evacuate around a potential event.

8. Data base of ground subsidence events and structural damage.

The local authority should establish a data base of ground subsidence events and reported structural damage. Detailed records of this nature are useful in developing a clear perspective of the stability situation in a township, highlight areas of weakness and assists in the installation and management of a pro-active maintenance strategy.

NOTE: *The policy should not cause residents to be concerned to live in dolomitic areas. It is perfectly safe to do so provided that certain precautionary measures are observed.*

PART C 4:
SITE INFORMATION

DEPARTMENT OF CO-OPERATIVE GOVERNANCE, HUMAN SETTLEMENTS AND TRADITIONAL AFFAIRS OF THE NORTHERN CAPE

TENDER NO. NC/04/2022

JTG 5 INDIVIDUALS: THE CONSTRUCTION OF 5 BNG HOUSES THROUGHOUT THE JTG DISTRICT

C 4: SITE INFORMATION

C 4.1 SCOPE

The documentation included describes the site as at the time of tender to enable the Tenderer to price his tender and to decide upon his method of working and programming.

Work will be executed in a residential area and the Contractor will take all necessary steps to ensure the safety of people, animals and/or property.

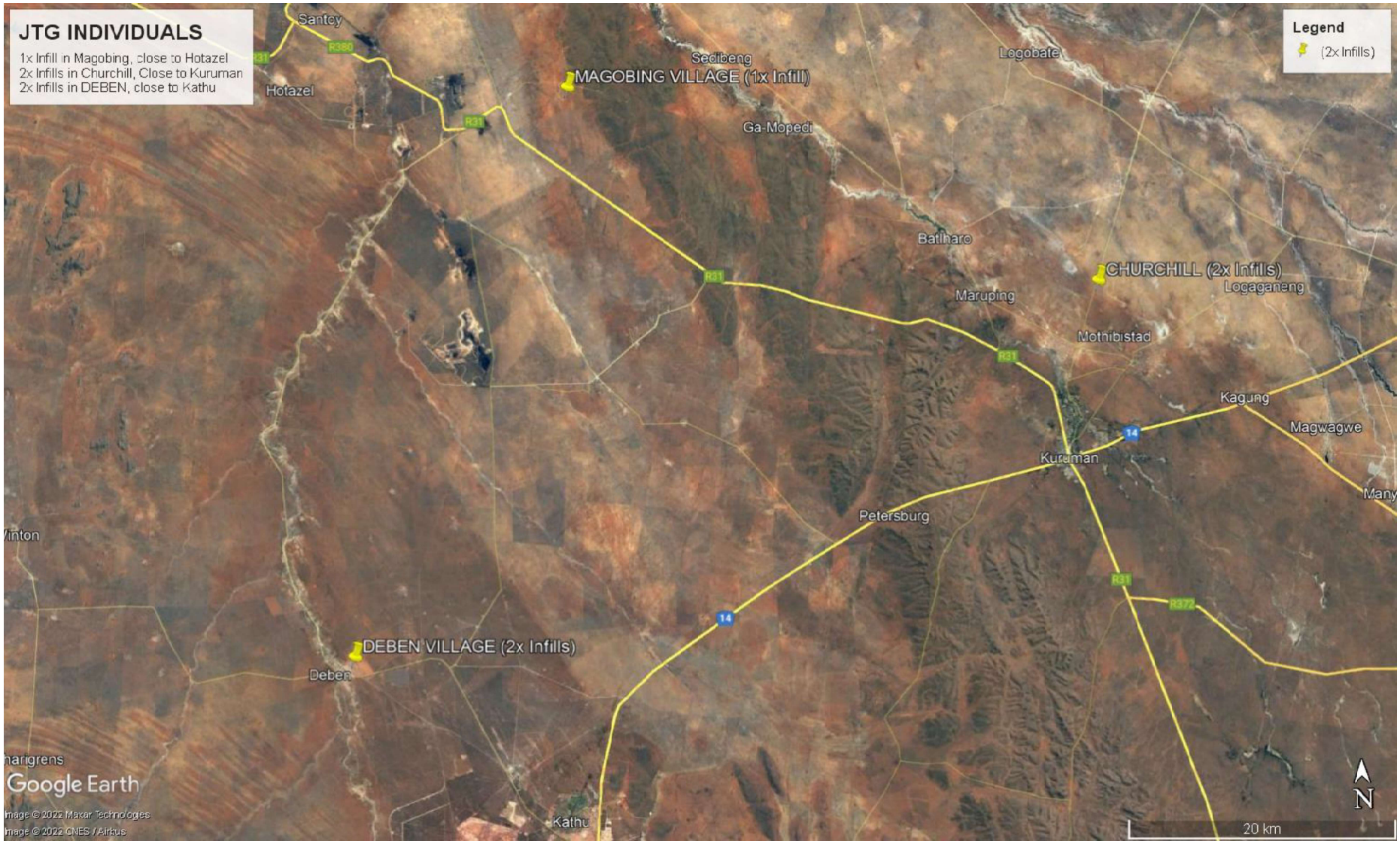
C 4.2 SUBSOIL INVESTIGATIONS, BOREHOLE RECORDS AND TEST RESULTS

The material on site varies.(But Rock and Hard excavation is expected)

Trail holes were excavated. See C 3.1.3.

C 4.3 INFORMATION ABOUT PIPED AND OTHER SERVICES BELOW THE SURFACE OF THE SITE FOR CONTRACTS INVOLVING GROUND WORKS, AND ABOUT HOOK-UP AND BOUNDARY DETAILS FOR CONTRACTS WITH PLANT INTERFACES, IN ADDITION TO ANYTHING ABOUT THE PHYSICAL SITE WHICH IMPACTS UPON THE CONTRACT

All existing services that could be indicated by the Employer are shown on the Drawings. The Contractor will however investigate on site with the Engineer to identify any existing services that are not indicated on the Drawings before any work commences in an area.


JTG INDIVIDUALS
1x Infill in Magobing, close to Hotazel
2x Infills in Churchill, Close to Kuruman
2x Infills in DEBEN, close to Kathu
Legend
(2x Infills)
Santoy
Hotazel
Sedibeng
MAGOBING VILLAGE (1x Infill)
Ga-Mopedi
Legobate
Batlharo
CHURCHILL (2x Infills)
Logaganeng
Maruping
Mothibistad
Kagung
Magwagwe
Kuruman
Petersburg
DEBEN VILLAGE (2x Infills)
Deben
Kathu
R31
R380
R372
14
Google Earth
20 km
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VOLUME 2

DRAWINGS

4.7 Sewage lifts

Where a building is at such a level in relation to the nearest connecting sewer that a drainage installation serving such building cannot discharge into such connecting sewer by gravitation, a suitable appliance, so designed and located as not to be offensive or to be injurious or dangerous to health, shall be installed. Where required by the local authority, standby facilities, for the purpose of raising sewage to a level that will enable it to gravitate to such connecting sewer, shall also be provided.

NOTE The owner of the building is responsible for ensuring that the drainage discharges into the connecting sewer. The owner is also responsible for the operation and maintenance of such arrangements.

4.8 Conservancy tanks, septic tanks and french drains

4.8.1 Conservancy tanks shall, subject to the clearing services provided by the local authority in question,

a) have a capacity as prescribed by such local authority,

b) be constructed with a means of access for cleaning, and

c) be provided with a means for clearing as prescribed by such local authority.

4.8.2 A conservancy tank or septic tank to be used on a site for the reception of sewage shall

a) be so designed and constructed that it will be impervious to liquid,

b) be so sited

1) that there will be a ready means of access for the clearing of such tank,

2) that it is not less than 2,0 m from the property boundary, or another structure,

c) be so designed and sited that it is not likely to become a source of nuisance or a danger to health or the structural integrity of adjacent buildings,

d) satisfy one of the following criteria:

1) it shall be the subject of an Agrément certificate and be used within the scope, conditions and limitations prescribed in the certificate;

2) it shall be rationally designed by a competent person (sanitation);

3) it shall be designed and constructed in accordance with standard drawings issued by a local authority; or

4) it shall be in accordance with the requirements of 4.8.3, 4.8.5, or 4.8.6, as relevant, and

e) be vented at the building.

NOTE 1 The siting of conservancy tanks should be approved by the local authority. Generally tanks should be located near driveways to facilitate cleaning by a vacuum tanker.

NOTE 2 The function of the septic tank is to condition raw sewage, which has a clogging effect on soil, thereby reducing the effective absorption capacity of the subsoil. When the raw sewage enters the tank some of the suspended solids settle to the bottom of the tank and some collect at the surface, with the result that three distinct layers are formed in the tank: a layer of sludge at the bottom, a floating layer of scum on the top

and a relatively clear liquid layer in between. The organic solids and dissolved material in the sewage are attacked by bacteria so that the volume of scum and sludge is reduced by liquification and gasification. The only function of the final disposal system is to get rid of the effluent from the septic tank in a safe and inoffensive way.

NOTE 3 Septic tanks and conservancy tanks should be constructed to prevent contamination of water supplies by leakage or spillage. Accordingly, such tanks should be impermeable to their contents and to sub-soil water.

NOTE 4 The vents should extend above the eaves level of the building.

4.8.3 Masonry conservancy tanks shall be constructed in accordance with the details shown in figures 1 and 2 provided that they are constructed above the water table in accordance with the requirements of SANS 2001-CC1 or SANS 2001-CC2, SANS 2001-CM1 and SANS 2001-EM1, and shall comply with the following:

a) solid and hollow concrete and calcium silicate masonry units shall have a nominal compressive strength of not less than 10,5 MPa and 7,0 MPa, respectively;

b) burnt clay masonry units shall have a nominal compressive strength of not less than 14,0 MPa and a water absorption of not more than 12 %;

c) the accuracy of the setting out shall be achieved by positive control measures;

d) excavations shall be deepened locally, where necessary, to remove soft spots;

e) hard spots, wherever practicable, shall be removed;

f) excessive excavations shall be avoided;

g) excavations shall be kept free of surface water;

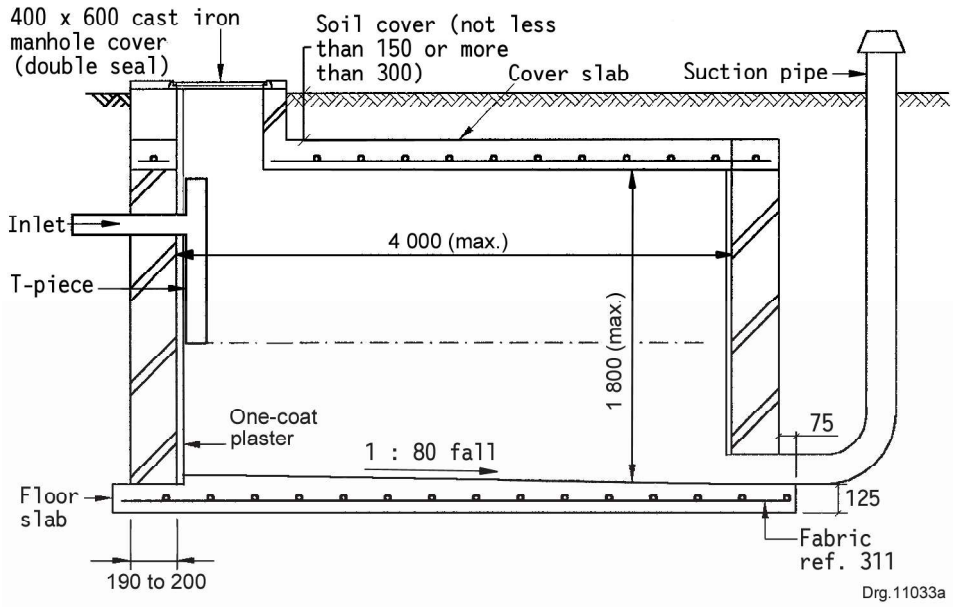
h) where the bottom of the excavation has dried out excessively due to exposure or it has softened due to rain or ground water, the excavation shall be rebottomed before concreting;

i) backfill, that complies with the requirements of SANS 1200 DB, shall be maintained before compaction, so that a small quantity squeezed in the hand is firm, but does not show signs of moisture;

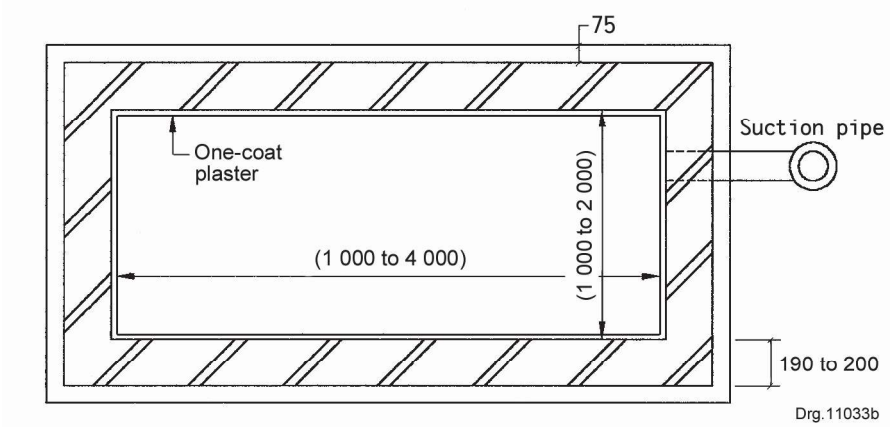
j) fill shall be placed in uncompacted layers that do not exceed 100 mm in respect of hand compaction, and 150 mm in respect of compaction by mechanical means; and

k) each uncompacted layer shall be well compacted before additional fill material is added.

Dimensions in millimetres



a) Section through conservancy tank



b) Plan of conservancy tank

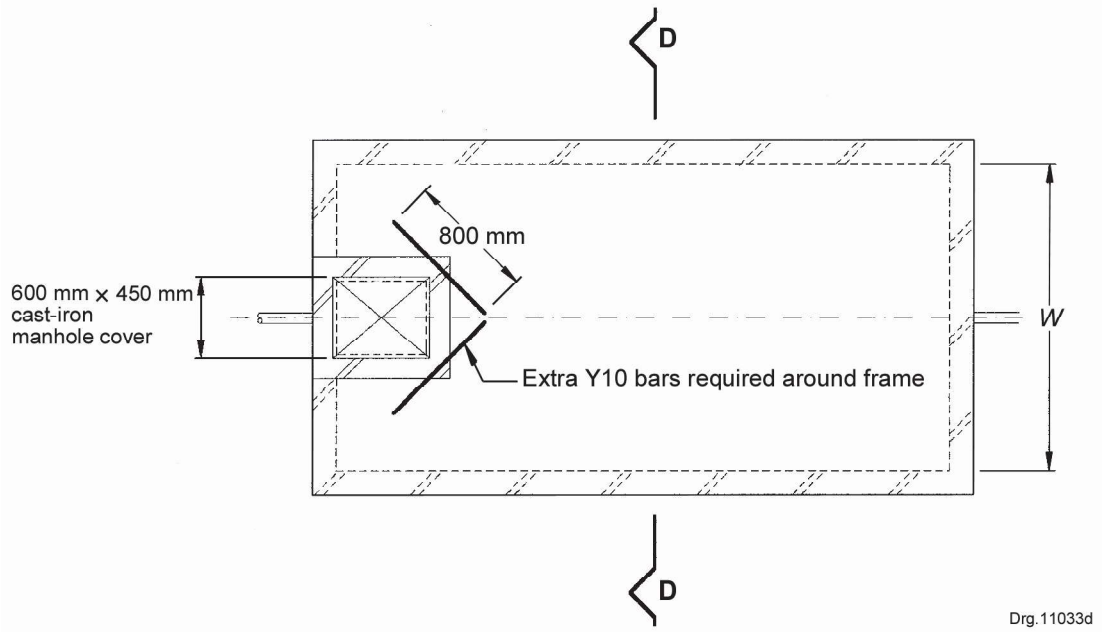
The suction pipe and coupling details shall be in accordance with local authority requirements.

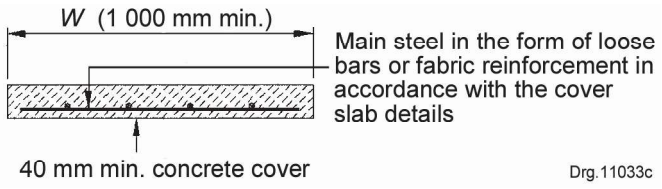
Hollow units shall be filled with grade 10 infill concrete.

A competent person shall provide construction details for tanks founded below perched or permanent water tables.

NOTE See figure 2 for cover slab details.

Figure 1 — Masonry construction details for conservancy tanks





Section D – D
(Through cover slab of septic tank)

Cover slab details

W	Slab thickness	Reinforcement		Fabric reinforcement
m	mm	Short span (main)	Long span (distribution)	(see SANS 1024)
≥ 1,0 but ≤ 1,7	125	Y10 bars at 250 mm centres	Y10 bars at 300 mm centres	Ref. 359
> 1,7 but ≤ 2,0	125	Y12 bars at 250 mm centres	Y12 bars at 300 mm centres	Ref. 617
W = internal width of conservancy tank				
NOTE The slab design is for a maximum of 300 mm soil cover.				

Figure 2 — Reinforced concrete cover slab details for conservancy tanks

DEPARTMENT OF CO-OPERATIVE GOVERNANCE, HUMAN SETTLEMENTS AND TRADITIONAL AFFAIRS OF THE NORTHERN CAPE

TENDER NO. NC/04/2022

JTG 5 INDIVIDUALS: THE CONSTRUCTION OF 3 BNG HOUSES IN JOE MOROLONG MUNICIPALITY AND 2 BNG HOUSES IN GAMAGARA MUNICIPALITY

DRAWINGS NOTES

The client accepts the fact that the contractor is a Professional builder and a master of his trade. It is accepted that he has visited the site and has familiarized himself with the local conditions before his tender was submitted, to eliminate any possible chance that a misunderstanding might arise at a later stage due to his limited knowledge of the site.

All work to be carried out strictly in accordance with the local authority building regulations and by-laws.

All materials to be SABS approved (stamped). Proof of which to be supplied (official certification) on request when applicable.

Workmanship to comply with the relevant National Building Regulations and Building Standards Act (Act 103 of 1977 as amended) and the NHBRC home building Manual.

Foundations to be inspected and approved by the engineer before concrete is poured. This also applies to services in the ground.

Wall plate inspection and timber truss fixing to be approved before walls are plastered.

Trade names specified are purely to indicate the quality and standard required. These can be substituted with any product matching the quality subject to the engineer's approval.

The contractor must check all the measurements and levels indicated on the drawings on site prior to the work commencing.

The setting out of the building work remains the sole responsibility of the contractor.

Do not scale the drawing. If uncertain about any of the dimensions, contact the Engineer.

Report any discrepancies between the drawings and/or contract documentation to the Engineer prior to the commencement of the work.

All the materials used must be of the best quality obtainable. The work must be done by skilled artisans and carried out in such a way as to ensure the highest quality workmanship obtainable in the local industry. The standard must at least be acceptable to members of the BIA and the M.B.A. Work not complying with afore said will be condemned and redone at the contractor's expense.

All the materials, fittings and equipment used on the project must be applied/installed strictly according to the manufacturer's specifications and guidelines.

Great care must be taken when installing the damp proof courses to ensure that no damaged material is used. All joints to have 150mm overlaps and to be taped.

It is important to note that the safety of any material brought onto the site and paid for by the client remains the responsibility of the Contractor even though ownership has been transferred to the Client.

All materials on site must be stored properly to minimize any damage that might occur. Planning the work sequence is of the utmost importance when ordering materials to ensure that they are not stored for too long a period.

Plastered wall surfaces must be given sufficient time to dry out before any paintwork commences.

The contractor must insist that all site instructions be noted in writing in the site instruction book to avoid any later disputes.

Contractor must familiarize himself with the 'Occupational Health and Safety act no. 85 of i993' and fully comply with the contents thereof. The safety of the public, visitors and of the workers on site is of the utmost importance and remains his sole responsibility for the duration of the contract.

The site must be kept clean at all times and builders rubble removed from time to time Temporary toilet facilities must be provided by the contractor for the workers and kept clean at all times.

Contractor must not deviate from the plans and must notify the Engineer of any problems immediately as they arise.

This is to certify that I / we ……

of (Tenderer) ……

……

of (Address) ……

……

……

Telephone Number ……

Fax Number ……

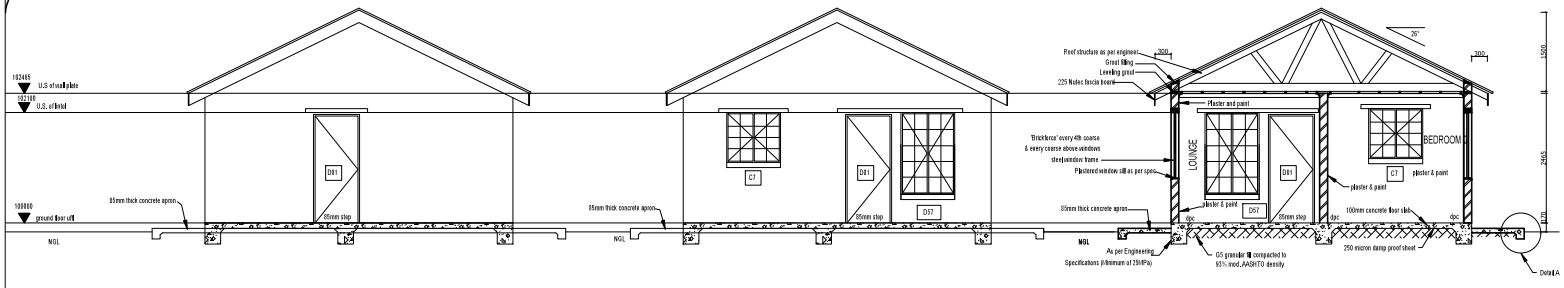
on (Date) ……

have examined the drawing notes and its surroundings for which I/we am/are submitting this tender and have, so far as is practicable, familiarized myself/ourselves with all the information, risks, contingencies and other circumstances which may influence or affect my/our tender.

SIGNED ON BEHALF OF THE TENDERER: ……

SIGNED ON BEHALF OF THE CONSULTANT: ……

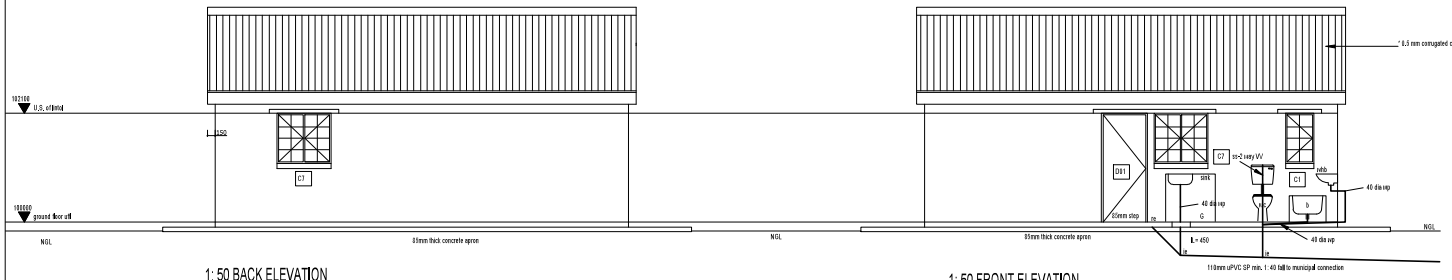
DATE: ……



1: 50 SIDE ELEVATION

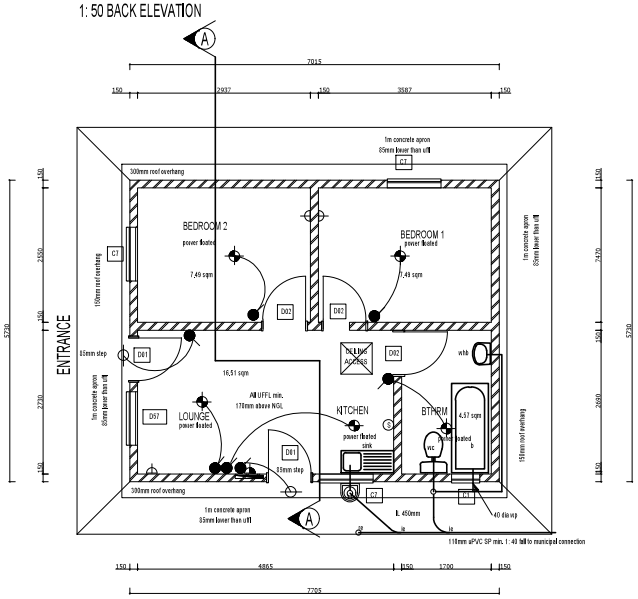
1: 50 SIDE ELEVATION

1: 50 SECTION A - A

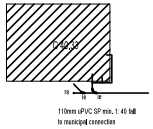


1: 50 BACK ELEVATION

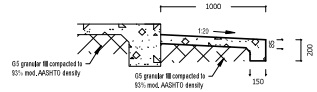
1: 50 FRONT ELEVATION



1: 50 GROUND FLOOR PLAN



1: 200 SITE PLAN



DETAIL A

1: 50 WINDOW SCHEDULE

C1	C7	D57
0,90 sqm	6,97 sqm	1,97 sqm
4mm Obscured Glass	4mm Glass	4mm Glass
Fixed with Putty	Fixed with Putty	Fixed with Putty

TYPOLOGY C 40.19 sqm MAXI BRICK

Climate Zone = 1
Minimum Required R-Value = 3,5 sqm K/W
Direction of Heat Flow = UP
The following roof assembly calculation options all comply with 4.4.5 of SANS 10400-XA

OPTIONS AS INDICATED ON THE DRAWINGS

Outdoor Air Film = 0.03
Concrete Roof Tiles = 0,00
Roof Air Space = 0,18
135mm Aerolite Fibre Insulation = 3,38
6,4mm Gypsum Ceiling Board = 0,06
Indoor Air Film (still air) = 0,11
= 3,75 sqm K/W

Therefore Roof Assembly complies with SANS 4.4.5.1
Total R-value is above 3,7 Table 7

DOOR SPECIFICATION

D01 EXTERNAL DOORS: weatherboards to be fitted to all external doors

2032x813x44mm Meranti FL & B Flush door fixed to 150mm exterior wall with 1,2mmGalvabar frame and Union 3 Inner Mortice lockset

D02 INTERIOR DOORS:

2032X813X44mm Masonite Hollow Core Door with 1,2mm steel door frame fitted to 150mm internal wall and Union 2 Inner Mortice lockset

FENESTRATION COMPLIANCE

40,33 sqm NET FLOOR AREA
6,05 sqm Allowable Fenestration Area (15% of 40,33 sqm)
5,03 sqm Actual Fenestration area

DRAINAGE

SS SUBSTACK = 2 WAY VV B BATH
VV VENT VALVE WC WATER CLOSET
G GULLEY
IE INSPECTION EYE L INVERT LEVEL
RE ROODING EYE

ELECTRICAL LEGEND

- WALL MOUNTED LIGHT POINT
- CEILING MOUNTED LIGHT POINT
- SINGLE WALL PLUG (0,3m above u/fl to inside)
- SINGLE WALL PLUG (1,1m above u/fl to inside)
- RECESSED DISTRIBUTION BOARD WITH LID
- light switch @ 1m above u/fl
- S stove point

LEGEND

- 150 mm MAXI BRICK
- SEWER PIPE LINE
- GREY WATER PIPE LINE
- HOT WATER PIPING INSTALLED TO WALLS ONLY
- FUTURE SWH - Solar Water Heater

AREA SCHEDULE

TOTAL STAND AREA 000 sqm
NEW HOUSE AREA 40,19 sqm

COVERAGE 00%
FAR: 00

NOTES:

All building materials to be SABS approved (stamped where applicable)
All workmanship to be carried out in accordance with National Building Regulations and Building Standards Act (Act 103 of 1977, as amended) and the NHBRC Home Building Manual. In case of uncertainty National Building Regulations and the NHBRC Home Building Manual should take precedence. All foundation inspection requests to be accompanied by the Engineer's certificate. Truss inspection to be done on un-plastered walls.

CONSTRUCTION SPECIFICATIONS:

FOUNDATIONS
* Foundations as per Contractor's engineer's design - to be approved by the Client's engineer and NHBRC.
* The land around the individual structures shall be shaped to avoid ponding of surface water and drainage precautionary measures such as flexible wet services pipe shall be provided. Floor must be at least 150mm from the natural ground level.

WALLS
* Intersection of internal and external walls must be done accordingly with hoop iron, 'Brickforce' must be place on every layer above window/door level.
* Internal walls to have 12mm 1:6 cement plaster with 1 x plaster primer, and 2 x 'Plascon' pure acrylic emulsion paint.
* External walls to have 12mm 1:6 cement plaster with 1 x plaster primer, and 2 x Exterior 'Plascon' pure acrylic emulsion paint.

DOORS & WINDOWS
* 2,0mm steel cottage section windows and 1,2mm thick steel doorframes with fixing lugs neatly built into brickwork. Windows to have standard fittings.
* Semi-face brick window sills inclusive of dpc. High bedded Class II mortar and pointed at all exposed joints.
* Install precast lintels over all window and door openings.
* Exterior 2032 x 813 x 44mm 'Ab door complete with 70mm weather board and 'Union' 34lever lock set. Painted internal 2032 x 813 x 44mm hollow core doors (commercial veneer) to be fitted with 'Union' 34lever lock set.
* Floor to have 20mm threshold below external door.

PLUMBING
* All plumbing to be carried out by a plumber registered with the local council/authorities.
* Build in 1700mm acrylic bath side wall and sand bed complete with 15mm chromium plated hot and cold taps, 40mm bath outlet and removable fibre cement inspection panel.
* Fit one 'Vast AquasaveSlimline' code 750152 wc complete with 6 litre cistern, fitments, toilet seat and flush pipe.
* Provide and fit a 'Franke Trendline 711' - 1200 x 535mm code 311850 stainless steel single bowl sink unit OSA with 1 x chromium plated bib tap, 38mm chromed waste outlet and 40mmm pvc trap,on one pair 'Falcon' code 313852 brackets.
* Hot and cold water polycop lines to be neatly chased into walls to all sanitary fittings. Hot water to be blanked off at future geyser position.
* Install angle valves and a stop cock where applicable.

DRAINAGE
* Provide 1 x 15mm chromed threaded bib tap over a gully at the kitchen.
* Provide a 100mm vent valve at the head of the 100mm soil line.
* Waste water pipe system to have 50mm vent valve at highest point.
* Provide a marked rodding eye at the head of the soil drain and at a change of direction. All pipe connection on soil drain to have inspection eyes.

ELECTRICAL
* The Electrical Installation must be done by a person registered as an Electrical Contractor in terms of the Occupational Health and Safety Act of 1993–'Electrical Installation Regulations', as well as be registered with the local council/authorities.

FINISHES
* 'Plascon' or else 'Dulux' paint products to take preference.
* Floors to be power-floated to a smooth and level finish and kept damp for a period, as per engineer's requirements, before any brickwork commences.
* Steel window and door frames to have 1 x coat red oxide factory coated primer, 1 x universal undercoat and 2 x 'PlasconVelvaglo' finishing coats.
* External timber door well sanded and cleaned, apply 1 coat mahogany wood stain and 2 coats external polyurethane varnish.
* Internal doors: sand surfaces smooth and clean, apply 1 x coat timber primer (pink) and 1 x universal undercoat and 2 coats 'PlasconVelvaglo' finishing coats.
* Window panes to be fitted with correctly prepared putty and only painted when surface is firm and dry - not to be left unpainted for too long, paint as per window frames.

ROOF
* Engineer's designed and certified pre-fabricated timber roof trusses @ 26 degrees bedded in dagha.
* Truss design to allow for future geyser placing..
* 0,5 mm corrugated chromadek roof dadding color sandstone beige beklige installed according to manufacturer's specification.
* Intersection of internal & external walls must be done with hoop iron not 'Brickforce'.
* Trusses tied down with 2 x 2,4mm wire, the wire must be wrapped around and tied on top spacing according to Engineer's specifications, No use of dowels.
* Fit 225 x 10mm 'Nutec' fibre cement tiles to truss end with 50 x 5mm counter sunk steel wood screws. Prime screw heads and apply paint with 1x plaster primer, and 2x Dulux roof paint

CEILING
* 6,4mm gypsum ceiling with 50x8mm cover strips on 38x38mm brandering @450mm centres one direction, with standard 70mm coved gypsum cornice fixed with 'Crestestone' OSA paste. Apply acrylic filler where needed and 2x white commercial PVA paint.
* 130 mm mineral fibreglass blanket above ceiling insulation.

STORMWATER
* 1000 x 85mm in-situ concrete apron with positive fall away from walls. Provide 10mm expansion joints @ approx. 2500mm distances. See engineer's specifications.

PROJECT: The Construction of BNG Houses - CoGHSTA Northern Cape
TITLE: 40m² BNG HOUSE: PLANS, SECTIONS AND ELEVATIONS

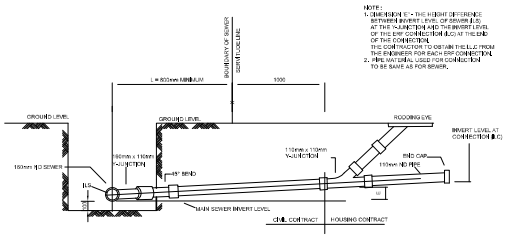
COGHSTA
Department: Cooperative Governance, Human Settlements and Traditional Affairs
NORTHERN CAPE PROVINCE

V3 CONSULTING ENGINEERS

DRAWING NUMBER		SCALE	REV. NO
1660043 - C40		AS SHOWN	00
CHECKED	PLACE	CLIENT	TYPE

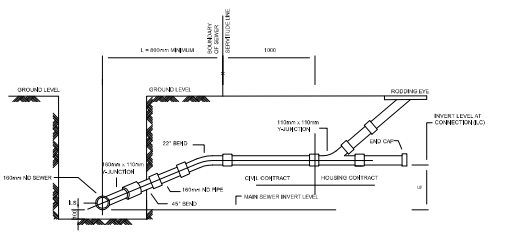
VERY IMPORTANT NOTES:

* The client accepts the fact that the contractor is a Professional builder and a master of his trade, it is accepted that he has visited the site and has familiarized himself with the local conditions before his tender was submitted, to eliminate any possible chance that a misunderstanding might arise at a later stage due to his limited knowledge of the site.
* All work to be carried out strictly in accordance with the local authority building regulations and by-laws.
* All materials to be SABS approved (stamped). Proof of which to be supplied (official certification) on request when applicable.
* Workmanship to comply with the relevant National Building Regulations and Building Standards Act (Act 103 of 1977 as amended) and the NHBRC home building Manual.
* Foundations to be inspected and approved by the engineer before concrete is poured. This also applies to services in the ground.
* Wall plate inspection and timber truss fixing to be approved before walls are plastered.
* Trade names specified are purely to indicate the quality and standard required. These can be substituted with any product matching the quality subject to the engineer's approval.
* The contractor must check all the measurements and levels indicated on the drawings on site prior to the work commencing.
* The setting out of the building work remains the sole responsibility of the contractor.
* Do not scale the drawing. If uncertain about any of the dimensions, contact the Engineer.
* Report any discrepancies between the drawings and/or contract documentation to the Engineer prior to the commencement of the work.
* All the materials used must be of the best quality obtainable. The work must be done by skilled artisans and carried out in such a way as to ensure the highest quality workmanship obtainable in the local industry. The standard must at least be acceptable to members of the BIA and the M.B.A. Work not complying with afore said will be condemned and redone at the contractors expense.
* All the materials, fittings and equipment used on the project must be applied/installed strictly according to the manufacturer's specifications and guidelines.
* Great care must be taken when installing the damp proof courses to ensure that no damaged material is used. All joints to have 150mm overlaps and to be taped.
* It is important to note that the safety of any material brought onto the site and paid for by the client remains the responsibility of the Contractor even though ownership has been transferred to the Client.
* All materials on site must be stored properly to minimize any damage that might occur. Planning the work sequence is of the utmost importance when ordering materials to ensure that they are not stored for too long a period.
* Plastered wall surfaces must be given sufficient time to dry out before any paintwork commences.
* The contractor must insist that all site instructions be noted in writing in the site instruction book to avoid any later disputes.
* Contractor must familiarize himself with the 'Occupational Health and Safety act no. 85 of 1993' and fully comply with the contents thereof. The safety of the public, visitors and of the workers on site is of the utmost importance and remains his sole responsibility for the duration of the contract.
* The site must be kept clean at all times and builders rubble removed from time to time Temporary toilet facilities must be provided by the contractor for the workers and kept clean at all times.
* Contractor must not deviate from the plans and must notify the Engineer of any problems immediately as they arise.



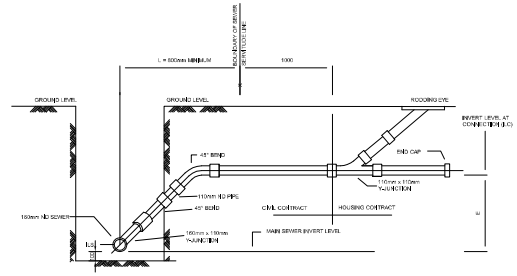
ERF CONNECTION DETAILS : TYPE 1 DETAILS FOR "E"
VARYING BETWEEN 150mm AND 405mm

N.T.S



ERF CONNECTION DETAILS : TYPE 2 DETAILS FOR "E"
VARYING BETWEEN 405mm AND 710mm

N.T.S

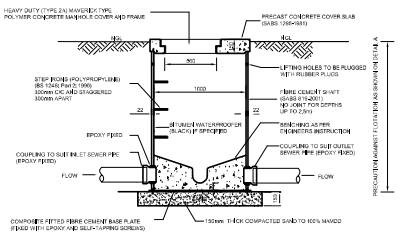


ERF CONNECTION DETAILS : TYPE 3 DETAILS FOR "E"
VARYING BETWEEN 710 AND 1015mm

N.T.S

Dimension of Anchoring Slab (B x B)						
D	T (mm)	L = 0m (B = B)	L = 0.25m (B = B)	L = 0.5m (B = B)	L = 0.75m (B = B)	L = 1.0m (B = B)
0 - 2.0	0.09	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only
2.0 - 2.5	0.10	1.2 x 1.2	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only
2.5 - 3.0	0.10	1.2 x 1.2	1.2 x 1.2	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only
3.0 - 3.5	0.135	1.2 x 1.2	1.2 x 1.2	Sand Bedding Only	Sand Bedding Only	Sand Bedding Only
3.5 - 4.0	0.135	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	Sand Bedding Only	Sand Bedding Only
4.0 - 4.5	0.190	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	Sand Bedding Only	Sand Bedding Only
4.5 - 5.0	0.190	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	Sand Bedding Only
5.0 - 5.5	0.190	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2	1.2 x 1.2

NOTES:
1. COMPLETE BEDDING, WELL COMPACTED BACKFILL (SB5, MANDO) TO NGL AND PLACE COVER SLAB BEFORE WATER TABLE IS ALLOWED TO RISE.
2. TO BE READ IN CONJUNCTION WITH DETAIL A.
3. RECOMMENDED BASE PLATE THICKNESS:
* 5mm BASEPLATE WITH 2 x 3mm INTERNAL REINFORCEMENT STRIPS FOR MANHOLES UP TO 1.5m DEEP
* 16mm BASEPLATE WITH 1 x 6mm INTERNAL REINFORCEMENT STRIP FOR MANHOLES 1.5m TO 2.5m DEEP
* 27mm BASEPLATE WITH 1 x 6mm BASEPLATE WITH 1 x 6mm INTERNAL REINFORCEMENT STRIP FOR MANHOLES DEEPER THAN 2.5m
4. PRECAST ANTI-FLOTATION CONCRETE SLAB AS SHOWN IN DETAIL A. (ASSUMED 1m2.25m UNLESS OTHERWISE STATED BY THE ENGINEER).
5. 20mm FALL BETWEEN INLET AND OUTLET UNLESS OTHERWISE SPECIFIED

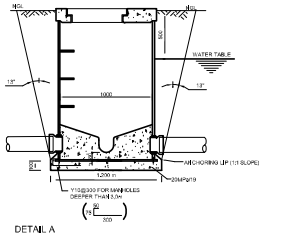


TYPICAL SECTION OF FIBRE CEMENT MANHOLE

N.T.S

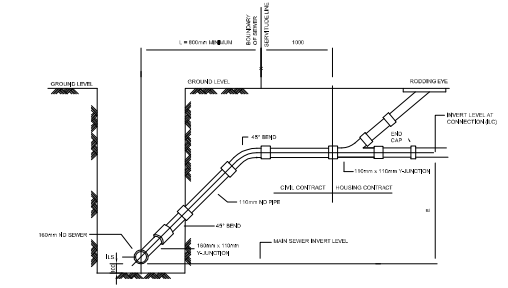
NOTES:
1. MANHOLE TO BE BEDDED INTO FRESH WET CONCRETE AND MITCHERING UP TO BE CAST IN ONE OPERATION WITH FOUNDATION SLAB.
2. COMPLETE WELL COMPACTED BACKFILL (MAVOD) BENCHING AND PLACE COVER SLAB BEFORE WATER TABLE IS ALLOWED TO RISE.
3. SUPPLIER TO BE INFORMED WHICH MANHOLES WILL BE BEDDED ONTO FOUNDATION CONCRETE (OUTSIDE OF BASE PLATE WILL THEN NOT BE BITUMEN COATED)

D = MANHOLE DEPTH
L = DEPTH TO WATER TABLE
B = DIMENSION OF SQUARE FOUNDATION CONCRETE SLAB (SQM)
C = 15° (ASSUMED INTERNAL SOIL FRICTION ANGLE)



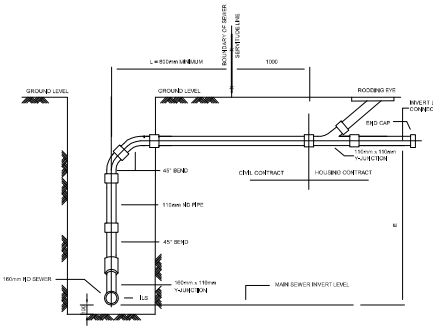
DETAIL A
TYPICAL FLOTATION PRECAUTION FOR MANHOLES IN HIGH WATER TABLE AREAS

N.T.S



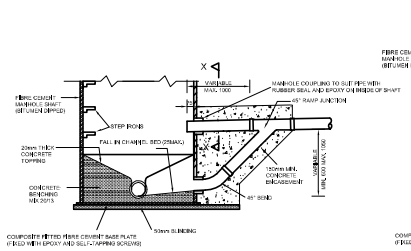
ERF CONNECTION DETAILS : TYPE 4 DETAILS FOR "E"
VARYING BETWEEN 1015mm AND 1500mm

N.T.S



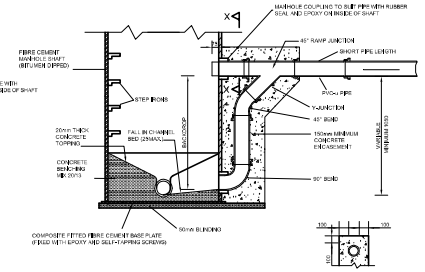
ERF CONNECTION DETAILS : TYPE 5 DETAILS
FOR "E" GREATER THAN 1500

N.T.S



RAMP MANHOLE DETAIL FOR SEWER MANHOLE

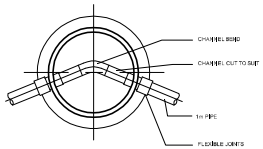
N.T.S



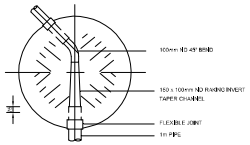
BACKDROP DETAIL FOR SEWER MANHOLE

N.T.S

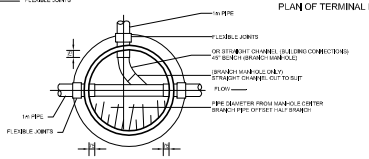
SECTION X-X



PLAN OF MANHOLE AT BENDS



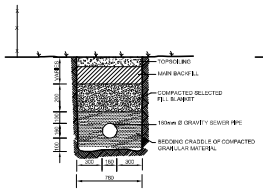
PLAN OF TERMINAL MANHOLES



PLAN OF 90° BRANCH & BUILDING CONNECTION

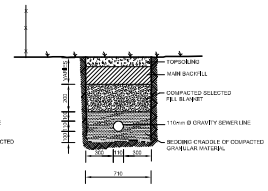
TYPICAL CHANNEL LAYOUTS
MANHOLES

NTS



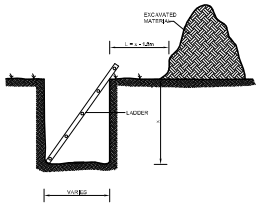
TYPICAL DETAIL OF
GRAVITY SEWER TRENCH

N.T.S



TYPICAL DETAIL OF
SEWER CONNECTION TRENCH

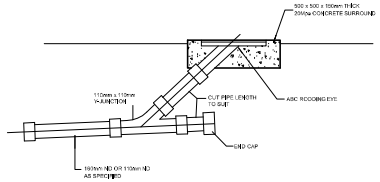
N.T.S



TYPICAL EXCAVATION DETAIL FOR
TRENCHES DEEPER THAN 1,5m

N.T.S

NOTE
1. KEEP TOP SURFACE OF RODDING EYES AND BOLTS CLEAR DURING CASTING OF CONCRETE SURROUNDS.
2. LEVEL OF RODDING EYE
* 25mm ABOVE SURROUNDING SURFACE IN OPEN AREAS.
* SAME LEVEL AS SURROUNDING SURFACE IN SURFACED/PAVED AREAS/ PUBLIC AREAS.



TYPICAL DETAIL OF RODDING EYE

N.T.S

NOTES:

1. ALL CONSTRUCTION MUST BE DONE IN ACCORDANCE WITH SANS 1200.

0 100
100 MILLIMETRES ON ORIGINAL DRAWING

A BEFORE CONTRACT COMMENCES
A AFTER CONTRACT HAS COMMENCED

NO.	DATE	AMENDMENTS

COGHSTA
Department:
Cooperative Governance, Human Settlements and Traditional Affairs
NORTHERN CAPE PROVINCE

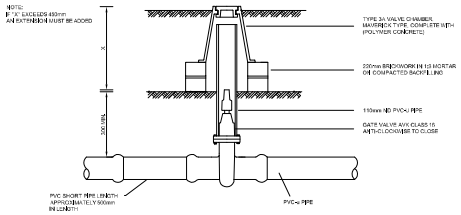
V3 CONSULTING ENGINEERS
T : +27 (0) 87 285 0620
F : +27 (0) 53 831 2460
155 Du Toitspan Road, Kimberley, 8301
PO Box 1178, Kimberley, 8300, South Africa
CESA

PROJECT
THE CONSTRUCTION OF 25 BNG HOUSES IN TJOKSVILLE, UMSOMBOMVU LOCAL MUNICIPALITY

DRAWING DESCRIPTION
SEWER: DETAILS

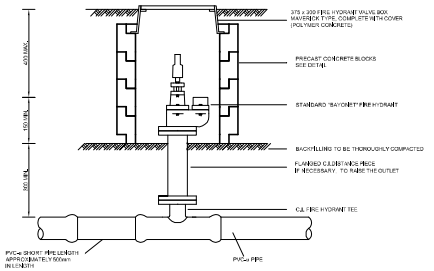
DRAWING NO.
MV-SD-100

SCALE	AS SHOWN	A1	CHECKED	
DATE	OCT 2016		DRAWN	RUDI BEESLAAR



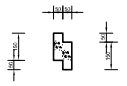
VALVE CHAMBER

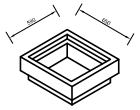
N.T.S.



FIRE HYDRANT CHAMBER

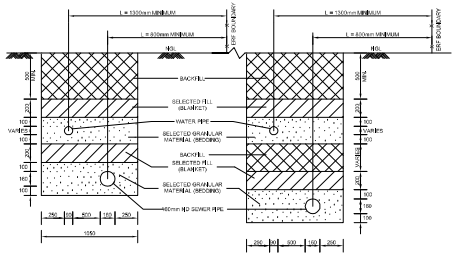
N.T.S.





PRECAST CONCRETE BLOCKS

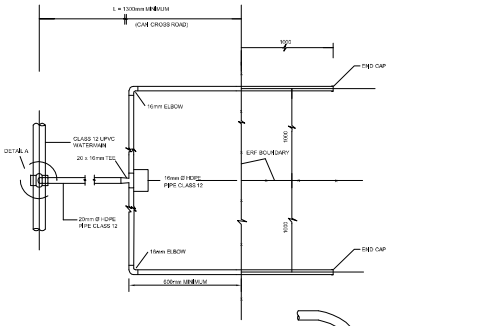
N.T.S



TRENCHES APPROX. 1.5m DEEP TRENCHES DEEPER THAN 1.5m

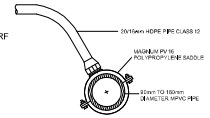
DETAIL OF COMBINED PIPE TRENCHES FOR WATER AND SEWER

N.T.S



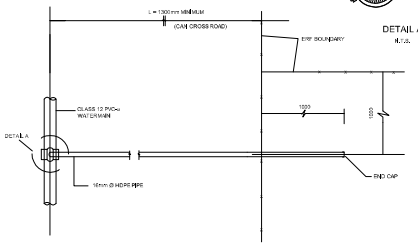
WATER ERF CONNECTION FOR DOUBLE ERF

N.T.S.



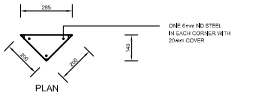
DETAIL A

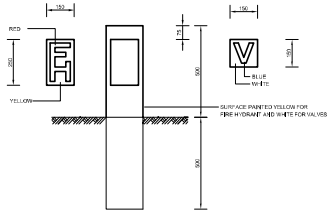
N.T.S.



WATER ERF CONNECTION FOR SINGLE ERF

N.T.S

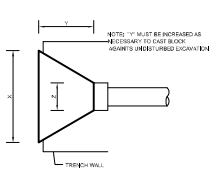




VALVE AND FIRE HYDRANT MARKER

N.T.S.

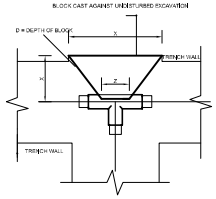
PIPE DIAMETER	DEPTH OF BLOCK	X	Y	Z
75	550	550	300	150
90	550	600	300	150
110	600	600	300	150



TRUST BLOCK FOR END CAPS

NTS

PIPE DIAMETER	X	D	Z
75	500	300	150
90	550	400	200
110	600	400	200

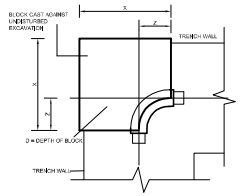


THRUST BLOCK FOR T-JUNCTIONS

NTS

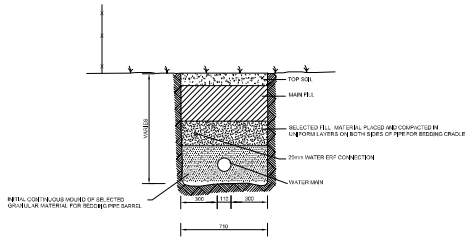
NOTES:
1. TO CAST CONCRETE AGAINST UNDISTURBED EXCAVATION 'Y' MUST BE INCREASED AS NEEDED
2. BEARING PRESSURE OF SOIL BEHIND THRUST BLOCK MUST BE AT LEAST 450 kPa AND THE TEST PRESSURE HEAD IN PIPELINE NOT GREATER THAN 1350kPa
3. THRUST BLOCKS MUST BE BUILT SYMMETRICAL AROUND FITTINGS

PIPE DIAMETER	X	D	Z
75	500	300	175
90	650	400	250
110	650	400	250



THRUST BLOCK FOR 90° BENDS

NTS



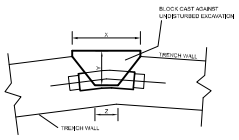
TYPICAL DETAIL OF WATER AND WATER ERF CONNECTION

N.T.S.

FOR 11.25° BENDS				
PIPE DIA.	DEPTH OF CONCRETE	X	Y	Z
75	200	200	300	100
90	200	300	300	100
110	200	300	300	100

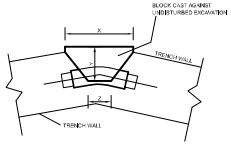
FOR 22.5° BEND				
PIPE DIA.	DEPTH OF CONCRETE	X	Y	Z
75	250	250	300	100
90	300	350	300	150
110	300	350	300	150

PIPE DIAMETERS	X	D	Z
75	375	300	125
90	500	400	175
110	500	400	175



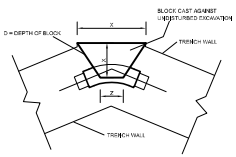
TRUST BLOCK FOR 11.25° BENDS

NTS



TRUST BLOCK FOR 22.5° BENDS

NTS



THRUST BLOCK FOR 45° BENDS

NTS

NOTES:

1. ALL CONSTRUCTION MUST BE DONE IN ACCORDANCE WITH SANS 1200.

0 100

100 MILLIMETRES ON ORIGINAL DRAWING

A BEFORE CONTRACT COMMENCES

A AFTER CONTRACT HAS COMMENCED

Nr.	DATE	AMENDMENTS

COGHSTA
Department:
Cooperative Governance, Human Settlements and Traditional Affairs
NORTHERN CAPE PROVINCE

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CESA

PROJECT

THE CONSTRUCTION OF 25 BNG HOUSES IN TJOKSVILLE, UMSOMBOMVU LOCAL MUNICIPALITY

DRAWING DESCRIPTION

WATER: DETAILS

DRAWING NO.

MV-WD-100

SCALE	AS SHOWN	A1	CHECKED
DATE	SEP 2016		DRAWN RUDI BEESLAAR