DEPARTMENT OF LOCAL GOVERNMENT AND HUMAN SETTLEMENTS

POLICY FOR GEOTECHNICAL SITE INVESTIGATIONS IN RELATION TO EXTRA-ORDINARY HUMAN SETTLEMENT DEVELOPMENT CONDITIONS AND APPLICABLE VARIATIONS

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ABBREVIATIONS

ABBREVIATION	FULL DESCRIPTION
AMD	Acid mine drainage
CBR	California Bearing Ratio Test
CDS	Category of differential swell
CH	Inorganic clays of high plasticity
CL	Inorganic clays of low to medium plasticity
ConP	Consolidation potential
COP	Code of Practice
CP	Collapse potential
CSIR	Council for Scientific and Industrial Research
EIA	Environment Impact Assessment
DCP	Dynamic Cone Penetrometer
FPI	Footprint Investigation
GPS	Global Positioning System
HOD	Head of Department
HSS	Housing Subsidy System
IRC	Inherent Risk Class
LGHS	Local Government and Human Settlement

MEC	Member of the Executive Council
NHBRC	National Home Builders Registration Council
NRCS	National Regulator for Compulsory Specifications
PD	Provincial Department
PE	Potential expansiveness
SABS	South African Bureau of Standards
SAICE	South African Institution of Civil Engineering
SANAS	South African National Accreditation System
SANS	South African National Standards
SM	Silty sand
SP	Sand poorly graded
SPLUMA	Spatial Planning and Land Use Management Act, Act 16 of 2013
TLB	Tractor-Loader-Backhoe
USCS	Unified Soil Classification System

DEFINITIONS

Adjustment of subsidy amount refers to the quantum with which the subsidy amount must be increased to ensure a durable product with investment value.

Agrément Certificate refers to a certificate that confirms fitness-for-purpose of a non-standardised system, element or component and the conditions pertaining thereto (or both) issued by the Board of Agrément.

Appropriately qualified Professional Expert refers to a professional person with the necessary qualifications and relevant experience to provide the required input.

Asbestos refers to naturally occurring silicate materials, which all have in common their eponymous asbestiform habit, i.e. long thin fibrous crystals, with each visible fiber composed of millions of microscopic fibrils that can be released by abrasion and other processes. There are two main asbestos classes, i.e. the Serpentine class which includes Chrysotile; and the Amphibole class which includes Amosite, Crocidolite, Tremolite, Anthrophyllite and Actinolite. All types of asbestos fibers are known to cause serious health hazards in humans of which Amosite and Crocidolite are considered to be to most hazardous as it is the primary cause of asbestosis and malignant mesothelioma. Amosite, often referred to as brown asbestos, is mostly mined in South Africa, although under a microscope it is observed as a grey-white vitreous fiber.

Atterberg limits refers to a basic measure of the critical water contents of a fine-grained soil, its shrinkage limit, plastic limit, and liquid limit. Depending on the water content of the soil, it may appear in four states: solid, semi-solid, plastic and liquid. In each state, the consistency and behavior of a soil are different and consequently so are its engineering properties. Thus, the boundary between each state can be defined based on a change in the soils' behavior. The Atterberg limits can be used to distinguish between silt and clay, and to distinguish between the different types of silts and clays.

Blaster refers to a person in possession of a permit to handle/blast explosives for purposes of construction under the Explosives Act, Act 26 of 1956.

Board of Agrément South Africa refers to a body operating under the delegation of authority of the Minister of Public Works.

Building refers to construction works that have the provision of shelter for its occupants or contents as one of its main purposes, usually partially or totally enclosed and designed to stand permanently in one place.

California bearing ratio test refers to a penetration test for the evaluation of the mechanical strength of natural ground, subgrades and base courses beneath new carriageway construction. The basic test is performed by measuring the pressure required to penetrate soil or aggregate with a plunger of the standard area. The measured pressure is then divided by the pressure required to achieve an equal penetration on a standard crushed rock material.

Certification body refers to a member of a Council approved certification scheme who provides certification services through certifiers in their employ.

Certificate of compliance refers to a certificate with a unique number obtainable from an approved scheme issued by a certifier in terms of such a scheme.

Certifier refers to a member of a Council approved certification scheme who is in good standing and who is employed by the certification body appointed by the home builder to issue certificates or certificates of compliance with the NHBRC Technical Requirements.

Civil blasting refers to the breaking, removing, excavation or demolishing of hard rock or boulders for purposes of construction of building infrastructure.

Collapsible soils refers to soils that undergo sudden decrease in volume when trigger events occur of which trigger events may include wetting under-load, stress changes or even stresses (loading) due to earth tremors where underlying dolomitic or limestone bedrocks are, which can easily be eroded by acid water, and can cause sudden collapse (sinkholes) of the soil at the surface. In other words, it is soils 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.

Compliance method refers to the application of design and construction rules or compliance with referenced standards in order to achieve performance requirements.

Component refers to a product manufactured as a distinct unit to serve a specific function or functions.

Competent Person (in respect of Geotechnics, all reference in this policy to a Competent Person refers to Geotechnics) refers to a person registered as a Professional Engineer in terms of the Engineering Profession Act, Act 46 of 2000, or a person who has a Baccaluareus of Scientae/Bachelor of Science (BSc) degree, or higher, in geology or engineering geology and is registered in terms of Section 11 of the National Scientific Professions Act, Act 106 of 1993, who has the following experience in relation to the category of work contemplated:

a) *Category of Work 1:* (preliminary geotechnical site investigations in all areas and Phase I and Phase II geotechnical site investigations near surface soil horizons): not less than 1200 hours per annum experience over the last 6 years in geotechnical site investigations in Southern Africa in partially saturated soils.
b) *Category of Work 2:* (geotechnical site investigations in under-mined 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.

c) *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 25000 hours in geotechnical site investigations in Southern Africa in partially saturated soils with not less than 3500 hours experience in dolomitic related work.

Compressible soils refers to soil that experience gradual settlement as its volume decreases when subjected to an applied load.

Contaminated land refers to any land condition, by reason of substances in, or under the land, which presents an unacceptable risk to health and safety of occupants of housing units constructed on such land. Known contaminations in South Africa includes amongst others, asbestos, radon and uranium and appropriate testing should be conducted to determine the future safety of proposed human settlement developments on contaminated land.

Deflection refers to the movement under actions of a defined point in a structure, in a defined direction.

Delegation refers in terms of the Housing Act, Act 107 of 1997, Part 3, Section 7, Sub-sections (1), (2), (3) and (5):

(1) Every provincial government, through its MEC, must after consultation with the provincial organizations representing municipalities as contemplated in section 136(a) of the Constitution, do everything in its power to promote and facilitate the

provision of adequate housing in its province within the framework of national housing policy.

(2) For the purposes of sub-section (1) every provincial government must through its MEC:

(a) determine provincial policy in respect of housing development;

(b) promote the adoption of provincial legislation to ensure effective housing delivery;

(c) take all reasonable and necessary steps to support and strengthen the capacity of municipalities to effectively exercise their powers and perform their duties in respect of housing development;

(d) co-ordinate housing development in the province;

(e) take all reasonable and necessary steps to support municipalities in the exercise of their powers and the performance of their duties in respect of housing development;

(f) when a municipality cannot or does not perform a duty imposed by this Act, intervene by taking any appropriate steps in accordance with section 139 of the Constitution to ensure the performance of such duty; and

(g) prepare and maintain a multi-year plan in respect of the execution of the province of every national housing programme and every provincial housing programme, which is consistent with national housing policy and section 3(2)(b), in accordance with the guidelines that the Minister approves for the financing of such a plan with money from the Fund.

(3) An MEC must:

(a) administer every national housing programme and every provincial housing programme which is consistent with national housing policy in section 3(2)(b), and for this purpose may, in accordance with that programme and the prescripts contained in the Code, approve:

(I) any projects in respect thereof; and

(II) the financing thereof out of money paid into the provincial housing development fund as contemplated in section 12(2);

(b) determine provincial housing development priorities in accordance with national housing policy;

(c) apply procurement policy in respect of housing development determined by the Minister in terms of section 3(2)(c); and

(d) administer the assets contemplated in section 14.

(4) The MEC may, subject to conditions he or she may deem appropriate in any instance:

(a) delegate any power conferred on him or her by this Act; or

(b) assign any duty imposed upon him or her by this Act,

to an officer or employee of the department responsible for the administration of housing matters in a province, either in her or her personal capacity or by virtue of the rank he or she holds or the post he or she occupies: Provided that the delegation or assignment does not prevent the person who made the delegation or assignment from exercising that power or performing that duty to himself or herself.

Design life refers to the period of time for which the structural system, element or component performs above the specified level of structural safety and serviceability performance.

Design working life refers to the assumed period for which a home or a part thereof is to be used for its intended purposes without major repair being necessary.

Developer refers to the organ/institution planning and implementing human settlement developments. In the case of the North West Province, the Department of Local Government and Human Settlements remains the Developer, unless a local municipality have been assigned/accredited under the Housing Act, Act 107 of 1997, and the Municipal Accreditation Framework.

Development risk refers to the likelihood and extent of loss of life, loss or damage to property or financial loss.

Differential heave refers to the relative surface displacement between the centre of the 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 suppressions due to loading are made.

Differential movement refers to the differential heave or differential settlement.

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

Dolomite area designations refers to the precautionary measures that must be applied as follows:

Dolomitic Area Designations	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	-

Dolomite mineral refers to a single mineral consisting of the chemical combination of calcium and magnesium carbonate.

Dolomite rock or dolomitic limestone or dolomite refers to a natural sedimentary rock type of which rock consists of the mineral dolomite mixed with calcite and magnesite. Portions of the rock may be richer or poorer in either of the latter minerals.

Dolomite land refers to land underlain by dolomite or limestone residuum or bedrock (or both), within the Malmani Subgroup and Campbell Rand Subgroup, typically at depths of no more than:

a) 60m in areas underlain by limestone;
b) 60m in areas where no de-watering has taken place and the local authority has jurisdiction, is monitoring and has control over groundwater levels in the areas under consideration; or
c) 100m in areas where de-watering has taken place or where the local authority has no jurisdiction or control over groundwater levels.

Drainage installation refers to an assembly of pipes, fittings and apparatus such as septic tanks, conservancy tanks and fresh drains, which are used to collect, convey, store or treat the discharge from receptacles associated with a home to which water is supplied and from which waste water or foul water is discharged.

Dwelling unit refers to a single unit providing complete, independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking and sanitation which may be separated from or linked horizontally or vertically to other units.

Element refers to a major functional part of a building.

Erodible soils refers to soils that are affected by flowing water, i.e. water moving over or through the soil, will tend to physically remove particles from the exposed surface. The soil erodibility is an estimate of the ability of soils to resist erosion, based on the physical characteristics of each soil type. Soils with faster infiltration rates (velocity or speed at which water enters into the soil), higher levels of organic matter and improved soil structure, have a greater resistance to erosion. Sand, sandy loam and loam textured soils tend to be less erodible than silt, very fine sand, and certain clay textured soils.

Expansive soils refers to clay soils that change in volume in a seasonal cycle as the moisture content of the soil varies with the seasons and shrinkage occurs mainly in the dry season and swelling during the wet season and therefore damage to structures occur,

especially when the potential expansiveness of the soil has not been properly taken into account during the design of foundations. In other words, it is 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.

Extra-ordinary human settlement development conditions refers to site characteristics which necessitate that some measures over and above the "norm" are required to ensure satisfactory housing outcomes and therefore require intensive precautionary measures to ensure a durable product with investment value. Extra-ordinary human settlement development conditions relate to climatic, topographic (natural ground slope of a site) and geotechnical (inherent geology) conditions.

Factual data refers to materials, statistics, and properties that can be seen, measured or identified by means of accepted or standardised criteria, classifications and tests.

Fire resistance refers to the shortest period for which an element or component complies with requirements for stability, integrity and insulation when tested in accordance with SANS 10177-2 *Fire testing of materials, components and elements used in buildings – Part 2: Fire resistance tests for building elements.*

Fitness for purpose refers to the ability of a system, element or component to be consistently developed, manufactured, applied and installed such that it fulfills its intended purpose.

Foundation refers to the foundational structure with the primary function to provide adequate support to the structures which they carry, which implies sufficient load bearing capacity to safely resist the effects of the various combinations of permanent and transient loads transmitted to the founding strata, without excessive deformation, which could otherwise compromise the integrity of the structure or impair its use. The safe or

allowable bearing pressure is therefore a function of the ultimate load bearing capacity of the ground at the founding level and the load-settlement characteristics of the underlying layers.

Founding horizon refers to a stratum of soil that exhibits similar geotechnical and engineering properties and characteristics and supports a structure.

Geotechnical conditions refers to geologically related conditions (soil, groundwater, etc.) that can influence the quality of the housing product if precautionary measures are not implemented.

Geo-hazards refers to:

a) a geological state or an incipient geological condition that has the potential to develop further into a situation leading to harm, damage or uncontrolled risk;
b) phenomena that are related to geological and environmental conditions and involve long-term and short-term geological processes which range in magnitude from relatively small to large scale features and may affect the local and regional socio-economy; and
c) areas characterized by potential life-threatening geological conditions in South Africa, including dolomite land, under-mined areas, areas of potential slope stability problems and areas prone to severe seismicity and flood-line areas.

Geotechnical site investigations refers to the process of evaluating the geotechnical character of a site in the context of existing proposed works or land usage, which may include:

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 and the systematic description of the soil and rock profiles;
d) determining the depth of any fill that might be present;

e) *in-situ* assessment of geotechnical properties of materials;
f) recovery of samples of soil or rock for examination, identification, recording, testing or display;
g) testing of soil or rock samples to quantify properties relevant to the purposes of the investigation;
h) evaluation of geotechnical properties of tested soils;
i) reporting the results; and
j) solutions (where relevant) and conclusions.

Geotechnical solutions refers to a solution designed to reduce total ground movements to levels which can be tolerated by the surface beds, if any, and structural system.

Global positioning system refers to a device capable of receiving time and special information from a constellation of geostationary satellites and translating these degrees of latitude and longitude and elevation with respect to a universal coordinate system.

Greenfield site refers to an undeveloped site earmarked for a new human settlement development project.

Ground movement refers to the displacement of the founding stratum in any direction by influences not solely dependent on the actions applied by the structure of a home.

Hazard refers to the inherently dangerous quality of a substance, procedure or an event.

Hazard rating refers to the number of sinkhole and subsidence occurrences per hectare over a 200 year period.

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

Home refers to a meaning assigned in the Housing Consumer Protection Measures Act, Act 95 of 1998:

a) excluding:
    a. any building which is constructed with less than two thirds of the floor area designed for residential purposes;
    b. homes that are co-owned in terms of the Share Blocks Control Act, Act 59 of 1980 or Property Time-Sharing Control Act, Act 75 of 1983;
    c. any home forming part of an informal settlement;
    d. any temporary building as contemplated in the National Building Regulations issued in terms of the National Building Regulations and Building Standards Act, Act 103 of 1977; and
    e. a shack or caravan.
b) including:
    a. a unit to be occupied for residential purposes as contemplated in the definition of "social housing" in Section 1 of the Social Housing Act, Act 16 of 2008;
    b. a residential section registered in terms of the Sectional Titles Act, Act 95 of 1986, and any common building;
    c. a unit as contemplated in the Housing Development Schemes for Retired Persons Act, Act 65 of 1988;
    d. a unit forming part of a housing programme contemplated in the National Housing Code issued in terms of the Housing Act, Act 107 of 1997;
    e. the private drainage system from the home up to the municipal connection or up to and including a conservancy or septic tank;
    f. water services from the point of supply to the point of discharge at fixtures and appliances;

g. any ancillary buildings such as storerooms, covered walkways, garages, and common facilities;
h. any retaining wall necessary to ensure the structural integrity of the home; and
i. any adjacent building or wall on common property that has the potential to damage the home should it for any reason collapse.

Housing development is defined in terms of Housing Act, Act 107 of 1997, as the establishment and maintenance of habitable, stable and sustainable public and private residential environments to ensure viable households and communities in areas allowing convenient access to economic opportunities, and to health, education and social amenities in which all citizens and permanent residents of the Republic will, on a progressive basis, have access to permanent residential structures with secure tenure, ensuring internal and external privacy and providing adequate protection against the elements, and potable water, adequate sanitary facilities and domestic energy supply.

Identified land parcel refers to a tract of land, comprising of one or more farm portions or erven registered in a Deeds Registry, identified for the purpose of housing development under the subsidy scheme.

Infrastructure delivery refers to the combination of all planning, technical, administrative and managerial actions associated with the construction, supply, renovation, rehabilitation, alteration, maintenance, operation or disposal of infrastructure.

Infrastructure procurement refers to the procurement of goods and services including any combination thereof associated with acquisition, renovation, rehabilitation, alteration, maintenance, operation or disposal of infrastructure.

Inherent risk refers to the potential for an event (sinkhole or subsidence) to develop in a particular ground profile on dolomitic land.

Inherent risk class refers to a classification system whereby a site is characterized in terms of eight standard inherent hazard classes, demoting the likelihood of an event (sinkhole or subsidence) occurring, as well as its prescribed size (diameter). The inherent hazard risk class is based on two parameters, namely the inherent susceptibility to sinkhole formation and the maximum size of surface manifestation of a sinkhole as follows:

Inherent Hazard Class	Inherent susceptibility of sinkhole formation	Maximum size of surface manifestation of a sinkhole (m)			
		<2	2 – 5	5 – 15	>15
1	Low (up to 1 event per hectare per 200 years)	*	*	*	*
2	Medium (between 1 and 10 events per 200 years)	*			
3			*		
4				*	
5	High (greater than 10 events per 200 years)	*			
6			*		
7				*	
8					*

Permissible human settlement developments, based on the above inherent hazard risk classes of a site, the anticipated size of a sinkhole, the density of homes and the precautionary measures required to support development for homes to be constructed in dolomitic area designations of D2 and D3 are:

Inherent susceptibility characterization of the site	Maximum diameter of surface manifestation of sinkhole (m)			
	Small (less than 2m diameter)	Medium (2-5m diameter)	Large (5-15m diameter)	Very large (greater than 15m diameter)
Low – up to and including 1 event per hectare per 200 years	Up to 300 attached homes per hectare in buildings exceeding 3 storeys with D2 precautions and FPI.			
	More than 120 attached homes per hectare in buildings not exceeding 3 storeys with D3 precautions and FPI			
	Up to 120 attached homes per hectare in buildings not exceeding 3 storeys with D2 precautions and FPI.			
	Detached home on own site or an effective site having an area not less than 150m² with D2 precautions.			
	Up to 160 attached homes per hectare in buildings exceeding 3 storeys with D3 precautions and FPI.			

Medium – between 1 and 10 events per hectare per 200 years	More than 120 attached homes per hectare in buildings not exceeding 3 storeys with D3 precautions and FPI.	None.	Homes not permitted
	Up to 120 attached homes per hectare in buildings not exceeding 3 storeys with D2 precautions and FPI.	Up to 80 attached homes per hectare in buildings not exceeding 3 storeys with D3 precautions and FPI.	
	Detached home on own site or an effective site having an area greater than 150m² with D3 precautions.	Detached home on own site or an effective site having and not less than 300m² with D3 precautions.	
High – greater than 10 events anticipated per hectare per 200 years	Up to 160 attached homes per hectare in buildings exceeding 3 storeys with D3 precautions and FPI.	None	Homes not permitted
	Up to 80 attached homes per hectare in buildings not exceeding 3 storeys with D3 precautions and FPI.		
	Detached home on own site or an effective site having an area not less than 1000m² with D3 precautions and FPI.		

Interconnected complex refers to a complex of multiple homes where management of common property usually resides with (but is not limited to) a management body.

Interpretative data refers to information derived from factual data using accepted and proven techniques, or from reasonable judgement exercised in the assessment of geological conditions or processes evident at the site.

In situ refers to the original place.

Karst refers to the typical landforms and processes in areas that are underlain by dolomite rock. These rocks can dissolve in the presence of water combined with carbon dioxide.

Land slip refers to the sudden movement of soil/rock slope, or gradual creep of a slope (typically with both a vertical and horizontal movement component) over a period of time.

Listed competent person refers to a competent person whose credentials are accepted by the Council of Geoscience and/or the National Home Builders Registration Council, and is admitted to the Council's list of competent persons.

Municipality means a municipality as contemplated in Section 2 of the Local Government Municipal System Act, Act 32 of 2000.

National Department refers to the National Department of Human Settlements.

National Home Builders Registration Council is established in terms of the Housing Consumers Protection Measures Act, Act 95 of 1998 and the objectives of the Council includes to:

a) represent the interests of housing consumers by providing warranty protection against defects in new homes;
b) regulate the home building industry;
c) provide protection to housing consumers in respect of failure of home builders to comply with their obligations in terms of the Act;
d) establish and promote ethical standards in the home building industry;
e) improve structural quality in the interests of housing consumers and the home building industry;
f) promote housing consumer rights and provide housing consumer information;
g) communicate with and assist home builders to register in terms of the Act; and

h) assist home builders, through training and inspection, to achieve and maintain satisfactory technical standards of home building.

Opinion refers to conclusions or recommendations derived by a Competent Person from consideration of factual and interpretative data and from the exercise of judgment.

Precautionary measures refers to preventative measures required to ensure a durable product with investment value.

Procurement refers to procedures that must be fair, equitable and transparent for the acquisition of housing goods and services. However, municipalities/Provincial Department may employ current legislation authorizing the waiver of tender procedures and the introduction of replacement procedures appropriate for use in emergency housing situations. Proactive procurement procedures must be considered and can include annual contracts and the establishment of panels of suitable contractors and consultants.

Provincial Department refers to the North West Provincial Department of Local Government and Human Settlement.

Radon refers to a chemical element with symbol Rn and atomic number 8, which is a radioactive, colourless, odorless, tasteless noble gas, which occurs naturally in minute quantities as an intermediate step in the normal radioactive decay chains which thorium and uranium slowly decay into lead and various short-lived radioactive elements; radon itself is the immediate decay product of radium. Radon is a contaminant of which is the direct effect of breathing in high concentrations of radon leading to high incidences of lung cancer. Radon levels fluctuate naturally due to chancing weather conditions as levels are at a maximum during the coolest part of the day.

Reliability refers to the ability of a structure or a structural element to fulfill the specified requirements, including the design working life, for which it has been designed.

Risk management refers to the identification, assessment and prioritization of risks followed by coordinated and economical application or strategy of resources to minimize, monitor and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.

Risk management strategy refers to an approach or set of principles according to which plans are built to reduce risk.

Seismic activity refers to the types and frequency and size of earthquakes that happen over a period of time in a certain area, whether due to mining activities or natural causes.

Settlement refers to 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.

Sinkhole refers to a dolomite karst feature that manifests as a hole in the ground.

Site class refers to areas which have been designated as having common foundation and engineering statistics, 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 gravel soils	Compressible and potentially collapsible soils	Normal
C1			Modified normal / compaction of *in situ* soils below individual footings

			/ deep strips 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 gravelly soils	Compressible soils	Normal
S1			Modified normal / compaction of *in situ* soil below individual footings / deep strip foundations / soil raft
S2			Stiffened or cellular raft / deep strip foundations / compaction of *in situ* soils below individual footings / piled or pier foundations / soil raft

Soil creep refers to the slow downward progression of rock and soil down a low grade slope and it can also refer to slow deformation of such materials as a result of prolonged pressure and stress.

Soil profile refers to the record of a vertical succession of the different soil/rock horizons as they occur at any particular location on site.

South African National Accreditation System refers to a single National Accreditation Body that gives formal recognition that Laboratories, Certification Bodies, Inspection Bodies, Proficiency Testing Scheme Providers, and Good Laboratory Practice test facilities are competent to carry out specific tasks.

Standard refers to a document that provides for common and repeated use, rules, guidelines or characteristics for products, services, or processes and production methods, including terminology, symbols, packaging, marking or labelling requirements as they apply to a product, service, process or production method.

Structural system refers to the system of constructional elements and components of a home which is provided to resist the loads acting upon it and to transfer such load to the ground upon which the home is founded.

Subsidence refers to the downward movement of a foundation caused by loss of support beneath the foundation.

Talus movement refers to mass movements (also called mass-wasting) which is the down-slope movement of Regolith (loose uncemented mixture of soil and rock particles that cover the earth's surface) by force of gravity without the aid of a transporting medium such as water, ice or wind.

Technical Services Advisor refers to an employee of LGHS who is at a level of Assistant Director or Deputy Director or Director responsible for Technical Services in terms of Housing Planning.

Topographical conditions refers to the natural ground slope of the site that can influence the quality of the housing product if precautionary measures are not implemented.

Uranium is a chemical element with symbol U and atomic number 92, which is a silvery-white metal from the actinide series and is minimally radioactive because all isotopes of uranium are unstable with lives up to 4.5 billion year. Uranium is found naturally in low concentrations in soil, rock and water of which is commercially extracted from uranium-bearing minerals such as uraninite. Uranium ore is mined in parts of South Africa, as well

as in the North West Province. Normal functioning of kidneys, brain, liver, heart and other human bodily systems, can be negatively affected by uranium exposure because of the toxicity of the metal.

Variability refers to the change in the properties or conditions of common materials or horizons in the soil profile with time or over a short lateral and/or vertical distance.

Variation calculator refers to an electronic calculator has been developed for use when calculating the adjustment of the subsidy amount. The formulas used in the calculator are based on the extraordinary development conditions and the subsidy amount available during a specific financial year. Following the adjustment of the subsidy amount, an updated calculator is made available by the National Department of Human Settlement. To facilitate the evaluation of project applications, the Variation Manual is supported by an automatic variation amount calculator. This calculator operates through the software programme Microsoft Word Excel and is available from the National Department of Human Settlement. The calculator will annually adjusted by the Department in line with the building cost index. It is important to note that although the calculator can be used to determine variation amounts required for the adjustment of the project cost at project application stages, the actual variation amount must be determined based on professional assessment of the extraordinary development conditions and the costing of the precautionary measures designed by the professionals. A geotechnical calculator was developed for the Department, in line with the National Department's variation calculator, in 2004, by Sonderland and Schutte Consulting Engineers, to be used by the Department for the calculation of geotechnical variations, which remains in use in the Department until such time deemed otherwise by the Accounting Officer of the Department.

1. INTRODUCTION

It is the legislative mandate of the Department of Local Government and Human Settlements (LGHS) to ensure that beneficiaries of low cost housing development options are provided with quality housing that provides an investment value for beneficiaries in the long run. Technical norms and standards are set out in Volume 2 of the Housing Code, 2009, in conjunction with the Geotechnical Site Investigations and Generic Specifications, 2002, the National Home Building Registration Council (NHBRC) Home Building Manual, and other relevant legislation, prescribing the way in which the Department must implement human settlement development projects particular extra-ordinary human settlement development conditions. Geotechnical site investigations are essential to obtain information to make informed decisions regarding the design of foundations.

Extra-ordinary development conditions relate to climatic, topographic (natural ground slope of a site) and geotechnical (inherent geology) conditions. The other extra-ordinary human settlement development condition of importance, though not a topographical or geotechnical challenge, is that of geographical location, especially given the rural nature of the North West Province. The Housing Code, 2009, recognizes that government housing subsidies need to be adjusted for such conditions, i.e. more money needs to be made available to address conditions that require precautionary measures to ensure a durable product with investment value.

In instances where there are variations in terms of extra-ordinary human settlement development conditions, the Variation Manual, as contained in the Housing Code, 2009, Technical Norms and Standards, applies. Such variations results in the adjustment of the subsidy amounts that will be allowed to finance only the required precautionary measures as legislated to cater for extra-ordinary human settlement development conditions. These variations or adjustments of the subsidy amounts are based on geotechnical and topographical conditions and geographical location of the development areas. The

application for the adjustment of the subsidy amount for geotechnical conditions is based on the NHBRC phased geotechnical investigations.

This policy should therefore not be read and implemented in isolation from all the relevant, listed and referred legislation in this policy. It should further be read in conjunction with subsidy quantum adjustments and variations as published by the Minister of Human Settlements as an when adjustments are made and enacted.

Geotechnical site investigations by Competent Persons, as outlined in this policy, cannot be over-emphasized in order to ensure that the values and principles underlying the implementation of sustainable, safe and healthy human settlement environments are achieved. The main objective for geotechnical site investigations is to make preliminary and follow-up determinations in phases for identified land parcels as to whether the land is fit and suitable for human settlement development, inhabitance and consumption.

The following geotechnical conditions have been identified as extra-ordinary human settlement development conditions that will require precautionary measures to ensure high quality products: seepage/groundwater; erodibility of soil; hard excavation; dolomite; expansive clays; collapsing sands; compressible soils; mining subsidence; seismic activity (mining induced and natural seismic activity); topographical conditions; and geographical location in terms of excessive distances between major centres of supply vis-à-vis the development site given the rural nature of the Province. Presence of contaminated land in the form of asbestos is prevalent in some parts of the Province in the area referred to as the Kalahari Sub-group.

The policy is outlining precautionary measures as contained in the Variation Manual as contained in the Housing Code, 2009, as well as contained in various applicable legislation which should be consulted in conjunction with this policy at all times. The North West Province evidently is affected by extra-ordinary development conditions which requires

geotechnical site investigations in order to ensure that precautionary measures are put in place before housing development and construction commences.

2. PURPOSE OF THE POLICY

The purpose of this policy serves as guidelines in respect of extra-ordinary human settlements development conditions which may influence the design and economic appraisal of geotechnical site investigations performed by consultants who are Competent Persons appointed by the Department. It further provides a basis for decision-making regarding the application of variations in terms of extra-ordinary human settlement development conditions as well as to provide for the correct processes that should be followed to determine whether variations and which variations should be applied or not as precautionary measures in the development of human settlements in order to ensure the delivery of the highest quality of housing products that are acceptable to beneficiaries and that will ensure durable products with investment value.

Foundation work is usually part of the construction of structures which is the most uncertain and prone to risk. The sources of risk include factors, which affect the safety of work during construction and the utility of the structure on completion because inadequate data or inaccurate information and data was obtained from geotechnical site investigations, inadequate or inaccurate variable conditions encountered at the anticipated founding levels, difficulties experienced in the access and drainage and potential inundation in water environments, potential of collapse of excavation sites, especially in the presence of groundwater, and/or inadequate lateral support of excavations, which can lead to settlement damage of adjacent services or structures. Unreliable foundation data and information can result in possible delays and additional costs in the rectification, potential claims for delays and in some cases, foundation failure. Therefore, the need for thorough geotechnical site investigations by Competent Persons cannot be over-emphasized.

The risk of not complying with the guidelines in this policy in conjunction with relevant legislation ultimately bears negative consequences of development and a legal risk of developing on land underlain with extra-ordinary development conditions, that can range from being accountable to justify actions or decisions made incorrectly and therefore knowingly accepting legal responsibility for loss of life. Therefore, the risks needs to be managed and the responsibility thereof lies with the accountable officials.

3. SCOPE OF APPLICATION

This policy applies to all subsidized human settlement development projects and housing subsidy options, irrespective the housing programme that is being implemented, as it pertains to geotechnical site investigations related to extra-ordinary human settlement development conditions.

4. OBJECTIVES OF THE POLICY

The main objective of this policy is to ensure that correct measures are applied through Competent Persons in cases where human settlement developments are taking place in areas where extra-ordinary development conditions are evident. To comply with this objective:

4.1. Developers must investigate the proposed development site through Competent Persons for any extra-ordinary development conditions as identified in the policy before submission of the application;

4.2. This investigation and confirmation of the existence of extra-ordinary human settlement development conditions must be done by appropriately qualified Competent Persons;

4.3. All precautionary measures must be confirmed and designed by appropriately qualified Competent Persons;

4.4. The construction and/or installation of the precautionary measures must be supervised by appropriately qualified Competent Persons and the departmental Technical Services Advisor;

4.5. The responsible appropriately qualified Competent Persons and the departmental Technical Services Advisor must certify in writing compliance with the design and construction specifications of the precautionary measures before any payment of milestones; and

4.6. Any housing subsidy project application that includes an application for an adjustment of the subsidy amount due to extra-ordinary development conditions will require quantitative verification in the form of a comprehensive report by an appropriately qualified Competent Persons to the specifications of the National Home Builders Regulation Council (NHBRC).

In line with the objectives of this policy, it becomes necessary to outline the objectives of geotechnical site investigations, which are:

4.7. To assess the general suitability of the site for the proposed human settlement.

4.8. For the appointed civil and/or structural engineer to be able to choose and design an economically and technically sound foundation system.

4.9. To prevent possible difficulties, delays and additional expenses during construction due to inadequate geotechnical information and analysis.

4.10. To obviate expensive foundation failures or overdesigns.

4.11. To prevent potential contractor claims based on inaccurate and/or inadequate geotechnical information and analysis.

4.12. To advise on the availability and suitability of local materials for construction purposes.

5. POLICY PRINCIPLES

This policy in underpinned by the following principles:

5.1. Creating healthy and safe human settlement environments.

5.2. Creating houses that are safe and healthy for human consumption.

5.3. Creating an enabling environment where applicable legislation, rules and regulations and observed and implemented to ensure health and safety of beneficiaries of housing programmes.

6. LEGISLATIVE MANDATE

6.1. Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, Act 19 of 2006

The South African National Accreditation System (SANAS) is responsible for carrying out accreditations in respect of conformity assessments mandated through this Act. It is a single National Accreditation Body that gives formal recognition that Laboratories, Certification Bodies, Inspection Bodies, Proficiency Testing Scheme Providers, and Good Laboratory Practice test facilities are competent to carry out specific tasks. What is of emphasis, is that all laboratories that are used for laboratory testing for purposes of geotechnical site investigations, must be accredited with the South African National Accreditation System.

6.2. Building Regulations and Building Standards Act, Act 103 of 1977

The Building Regulations and Building Standards Act provides for the promotion of uniformity in law relating to the construction of buildings and prescribing of building standards. The Regulations consists of the following parts, ALL equally applicable to human settlement developments for government: Part A: Administration; Part B: Structural Design; Part C: Dimensions; Part D: Public Safety; Part E: Demolition Work; Part F: Site Operations; Part G: Excavations; Part H: Foundations; Part J: Floors; Part K: Walls; Part L: Roofs; Part M: Stairways; Part N: Glazing; Part O: Lighting and Ventilation; Part P: Drainage; Part Q: Non-waterborne means of Sanitary Disposal; Part R: Storm

water Disposal; Part S: Facilities for Disabled Persons; Part T: Fire Protection; Part U: Refuse Disposal; Part V: Space Heating; Part W: Fire Installations.

The National Building Regulations are concerned with the protection of property and general safety, health and convenience of the public in relation to the building of homes, the design and construction of homes which are not harmful to the health or well-being of users and occupiers, and ensuring that certain solutions that are adopted for homes contribute positively to environmental sustainability. South African National Standards (SANS) establishes the level of performance (quantitative requirements) and "deemed-to-satisfy" provisions and the means by which functional requirements established in the regulations may be satisfied by application of a set of rules, national assessments or rational designs by a Competent Person and Agrément certification. All applicable SANS regulations should be consulted in conjunction with this policy.

6.3. Constitution of the Republic of South Africa, Act 108 of 1996

The Constitution of the Republic of South Africa, in Section 10, prescribes that everyone has an inherent right to dignity and the right to have their dignity respected and protected, which is critical in the implementation of housing programme. Essential for LGHS to observe is Section 26 which prescribes that everyone has a right to have access to adequate housing and that the state (LGHS) must take reasonable legislative measures within its available resources to achieve this progressive right.

Emphasis is on placed on adequate housing as adequate housing is inclusive of housing that is safe, meaning that all reasonable precaution should be taken where human settlements are developed such that safety of beneficiaries are guaranteed, as it also states in Section 24(a) that *everyone has the right to an environment that is not harmful to their health or well-being* whereas Section 152(1)(d) states that *the objective of local government is to promote health and safety of its inhabitants*.

6.4. Consumer Protection Act, Act 86 of 2008

This Act provides for the protection of the interests of consumers and for that purpose to make provision for the establishment of consumer councils and other authorities for the settlement of consumers' disputes and for matters connected therewith. This Act has an impact particular on the design of homes as it gives every consumer a right to receive goods (tangible objects) that are not only reasonable suitable for purposes of which they are generally intended, but also comply with any applicable standards as set out under the Standards Act, Act 8 of 2008.

6.5. Disaster Management Act, Act 57 of 2002, as amended

The Disaster Management Act provides for integrated and coordinated disaster management policy that focuses on preventing or reducing the risks of disasters, mitigating the severity of disasters, promoting emergency preparedness, ensuring rapid and effective response to disasters and proper post-disaster recovery. It further enacts the establishment of national, provincial and municipal disaster management centres. The North West Province Disaster Management Centre has developed a North West Provincial Disaster Management Framework to guide the development and implementation of disaster management in the Province. This policy should also be read in conjunction with the Disaster Management Act, as well as the North West Disaster Management Framework.

6.6. Engineering Profession Act, Act 46 of 2000

Of great emphasis in this Act relates to the definition and application of Competent Persons conducting geotechnical site investigations for LGHS, which should be strictly adhered to. Competent Person refers to a person registered as a Professional Engineer in terms of the Engineering Profession Act, Act 46 of 2000, or a person who has a Baccaluareus of Scientae (BSc) degree, or higher, in geology or engineering geology and

is registered in terms of Section 11 of the National Scientific Professions Act, Act 106 of 1993, who has the following experience in relation to the category of work contemplated:

a. *Category of Work 1:* (preliminary geotechnical site investigations in all areas and Phase I and Phase II geotechnical site investigations near surface soil horizons): not less than 1200 hours per annum experience over the last 6 years in geotechnical site investigations in Southern Africa in partially saturated soils.
b. *Category of Work 2:* (geotechnical site investigations in under-mined 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.
c. *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 geo-technical 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 25000 hours in geotechnical site investigations in Southern Africa in partially saturated soils with not less than 3500 hours experience in dolomitic related work.

6.7. Environment Conservation Act, Act 73 of 1989

This Act provides for the effective protection and controlled utilization of the environment and therefore forthrightly states that no development, which has a detrimental effect on the environment, can take place without the consideration of the Minister for Environmental Affairs and Tourism in terms of Part V of this act. The Minister may grant exemption from compliance with any or all of the provisions of the regulations in the Act, or may refuse to do so. The steps for application for exemption are listed in the Act.

6.8. Environmental Management Act, Act 107 of 1998

The main objective of this Act is to ensure that environmental management must place people and their needs at the forefront related to their environment. This Act states that *all actions by organs of state that may significantly affect the environment shall apply alongside all other appropriate and relevant considerations* which includes government's obligation to protect, respect, fulfill and promote the economic and social rights of all people. When placing environmental management's principles in context with extra-ordinary conditions, it is necessary to understand that one cannot manage such conditions, but that one can manage the behaviour and activities of people that will impact on such areas. These principles gives rise to "precautionary measures" being implemented where applicable given extra-ordinary housing development conditions.

6.9. Environmental Management: Waste Act, Act 59 of 2008

This Act provides for rules and regulations with regards to contaminated land. In line with this Act, contaminated land refers to the *presence in or under any land, site, buildings or structures of a substance or micro-organism above the concentration that is normally present in or under that land, which substance or micro-organism directly or indirectly affects or may affect the quality of soil or the environment adversely.*

What is of great importance under this Act, relates to asbestos, as the North West Province has areas prominent regions (Kalahari Sub-group) which is known to be contaminated by asbestos. The regulations set out in this Act, prohibits the total development of such areas for human use and consumption as it is dangerous for humans to inhabit such land. In the event the Department wishes to develop human settlements in or near such areas, it should follow the rules and regulations set out in this Act in terms of the testing of water in such areas to deem it safe for occupation or not. Asbestos, according to the Act, is not tested in soil like in other extra-ordinary housing development

conditions, but is tested in water and the Act sets out exactly how and by who such testing should be done.

This Act applies to all hazardous substances that can contaminate land and water and therefore, in the event there is any suspicion of contamination of land and water in an area of proposed human settlement development, the Department of Environment and Conservation and the Department of Water Affairs should be consulted on the basis of this Act to test for the contaminants to be able to establish whether development in such areas should take place or not.

6.10. Explosives Act, Act 26 of 1956, as amended to Act 15 of 2003

This Act provides for the rules and regulations regarding explosives-handling, basic blaster requirements, blasting permits, responsibilities of blasters, allowable types of blasting, and blasting sire inspections. It is very important to note that no person shall use any blasting material unless in possession of a permit issued by or under the authority of an inspector or under the immediate and constant supervision of a person who is in possession of such a permit. The important of this Act relates to hard rock excavations and boulder blasting for construction purposes. It is important for blasters on human settlement development construction sites to follow blaster responsibilities and perform only the work outlined in a permit to the latter as set out in this Act.

6.11. Geoscience Amendment Act, Act 16 of 2010

This Act provides for the establishment of the Council for Geoscience as the custodians of geotechnical information and to act as an advisory authority in respect of geohazards related to infrastructure and development. The Act permits the Council to review and evaluate all geotechnical reports in respect of geohazards that may affect infrastructure and development. Emphasis remains on LGHS obligation to work hand-in-hand with the

Council for Geoscience in relation to geotechnical investigation pertaining to extra-ordinary human settlement development conditions.

6.12. Housing Act, Act 107 of 1997

The Housing Act is the primary piece of legislation for the housing mandate in South Africa and it legally entrenches policy principles outlined in the 1994 White Paper on Housing which provides for sustainable housing development processes, laying down general principles for housing development in all spheres of government, defining functions of national, provincial and local governments in relations to housing development; and it lays a foundation for the financing of national housing programmes.

In terms of this Act, Section 1 (vi) housing development can be seen as the *establishment and maintenance of habitable, stable and sustainable public and private residential environments to ensure viable households and communities in areas allowing convenient access to economic opportunities, and to health, educational and social amenities in which all citizens and permanent residents of the country will on a progressive basis have access to permanent residential structures with secure tenure, ensuring internal and external privacy and providing adequate protection against all the elements and potable water, adequate sanitary facilities and domestic energy supply.*

Part 3, Section 7, Sub-sections (1), (2), (3) and (5) delegate provincial policy making functions in terms of human settlement development in a Province to the Member of the Executive Council (MEC) for Human Settlements. It further provides for the Housing Code setting out principles, guidelines, and norms and standards which apply to government's various housing assistance programmes that were introduced since 1994 and which were updated on a regular basis.

6.13. Housing Code, 2009

The National Housing Code sets out the underlying principles, guidelines, and norms and standards which apply to government's various housing assistance programmes that were introduced since 1994. The main purpose is to provide an easy to understand overview of the various housing subsidy instruments available to assist low income households to access adequate housing. Of particular reference and relevance to this policy, is the Technical Norms and Standards as set out in Volume 2 of the Housing Code, which also contains the exceptions in the application of national norms and standards and the Variation Manual related to extra-ordinary human settlement development conditions.

6.14. Housing Consumer Protection Measures Act, Act 95 of 1998

This Act requires the NHRBC to publish a Home Building Manual, which contains the Technical Requirements (2014) prescribed by the Minister and guidelines established by the NHBRC to satisfy such requirements. The NHBRC Home Building Manual, amongst others, describes the roles and responsibilities of different role players assigned in terms of the primary pieces of legislation governing the design and construction of homes, i.e. the National Building Regulations and Building Standards Act, Act 103 of 1977; the Housing Consumer Protection Measures Act, Act 95 of 1998; and the Occupational Health and Safety Act, Act 85 of 1993. The NHBRC Technical Requirements includes standards in line with the prescripts of the National Standards Act, Act 8 of 2008, i.e. performance requirements, evaluation, geotechnical investigations to determine foundation parameters, development of land underlain by dolomite, greenfield developments, approved certification schemes, and a Council list of Competent Persons.

6.12. National Treasury Standard for Infrastructure Procurement and Delivery Management, 2016

This Policy establishes a control framework for the planning, design and execution of infrastructure projects and infrastructure procurement as it relates to institutional arrangements, demand management, acquisition management, contract management, logistics management, disposal management, risk management, as well as providing minimum requirements for infrastructure procurement. It of great importance that the Department adheres to these guidelines in all instances of procurement that is related to infrastructure management.

6.13. National Regulator for Compulsory Specifications Act, Act 5 of 2008

This Act enables the National Regulator for Compulsory Specifications (NRCS) to issue compulsory specifications, especially technical requirements that require conformity of a product or service to health, safety or environmental protection requirements of a standard, or specific provision/s of a standard.

6.14. Occupational Health and Safety Act, Act 85 of 1993

This Act provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery and the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work. Geotechnical site investigations are regarded as construction activities and is governed by the Construction Regulations, 2014, as part of this Act. The Act further enacted a guide pertaining to asbestos, the Asbestos Regulations, 2001, as it is intended to protect the health of any person who may be exposed to asbestos, in or outside the workplace, employee or non-employee. It further prohibits the use of construction materials that have an active asbestos ingredient, due to the dangerous nature and effects of asbestos. Of further importance to this Act

is the Schedule providing explosives regulations that applies to any employer who uses or operates explosives and the regulations surrounding explosives handling, which should be taken into practices on human settlement development sites using explosives for civil blasting.

6.15. Policy for Emergency Housing Assistance for the Department of Local Government and Human Settlements, 2017

The main objective of this policy is to provide temporary assistance in the form of secure access to land and/or basic municipal engineering services and/or shelter in a wide range of emergency housing situations of exceptional need through the allocation of grants. Emphasis is placed on the categories of responses available under this programme, especially where beneficiaries of housing opportunities have been negatively affected by extra-ordinary human settlement development conditions.

6.16. Spatial Planning and Land Use Management Act, Act 16 of 2013

This Act provides a framework for spatial planning and land use management and specifies the relationship between spatial planning and land use management systems and other kinds of planning by providing a framework for policies, principles, norms and standards for spatial development planning and land use management. This Act redresses past spatial and regulatory imbalances and promotes greater consistency and uniformity in the application procedures and decision making by authorities responsible for land use decisions and development applications. This Act seeks to address sustainable development of land which requires integration of social, economic and environmental considerations in both forward planning and ongoing land use management to ensure that development of land serves past, present and future generations and promote ongoing social and economic inclusion.

6.17. Standards Act, Act 8 of 2008

The Standards Act provides for the development, promotion and maintenance of standardization and quality in connection and rendering of related conformity assessment services to ensure provision of an internationally recognized standardization system that continue to support the needs of South African enterprises. The South African Bureau of Standards (SABS) is a statutory body that was established in terms of the this Act as the national standardization institution of South Africa which is mandated to develop, promote and maintain South African national standards, promote quality in connection with commodities, products and services, and render conformity assessment services and assist in matter connected therewith.

It becomes necessary to differentiate between the SABS and the Board of Agrément South Africa, of which the latter is an independent body under a ministerial delegation of authority from the Minister of Public Works. Agrément South Africa assesses and certifies fitness for purposes of systems, elements and components intended for use in construction of buildings and infrastructure which fall outside the scope of existing standards established by the SABS. Fitness for purpose in this context means the ability of the system, element or component to be consistently developed, manufactured, applied and installed such that it fulfills its intended purposes.

6.18. Supply Chain Management Policy for Infrastructure Procurement and Delivery Management (SIPDM) for the Department of Local Government and Human Settlements, 2017

This Policy was established to regulate infrastructure delivery management in LGHS in accordance with the provisions of the regulatory frameworks for procurement and supply chain management and includes the procurement of goods and services necessary for the building of new facilities to be used as functional entities. The Policy directs that all infrastructure procurement and delivery management shall be undertaken in accordance

with the applicable legislation and relevant requirements of the National Treasury Standard for Infrastructure Procurement and Delivery Management and that no departure will be made from the provisions of this Policy without the approval of the Accounting Officer of LGHS and the National Treasury.

7. ROLES AND RESPONSIBILITIES

7.1. National Department of Human Settlements

7.1.1. Sets national policy in terms of technical requirements and publish subsidy quanta with applicable variations under the authority of the Minister for Human Settlements on a regular basis.

7.2. Provincial Department of Local Government and Human Settlements

7.2.1. The Department must under all circumstances ensure that a Competent Person is appointed to conduct and provide reports with recommendations in relation to geotechnical site investigations of extra-ordinary housing development conditions. The following criteria shall be exclusively used in assessing the competence of Competent Persons (referring to the definition of a "Competent Person" as stated under the definitions related to this policy):

7.2.1.1. Tertiary qualifications.
7.2.1.2. Category of professional registration.
7.2.1.3. Experience.
7.2.1.4. Knowledge.
7.2.1.5. Recognition by the profession.

7.2.2. Upon completion of geotechnical site investigations, the Competent Person should submit the geotechnical reports to the Technical Services Advisor/s of the Department to verify compliance in respect of the geotechnical site investigation scope, reports, tests conducted and the relevant information required to be submitted. This compliance verification must be confirmed in writing by the Technical Services Advisor/s.

7.2.3. The Department must ensure that during construction, the Technical Services Advisor/s of the Department, besides the Competent Person, should monitor project implementation to ensure that the recommendations made in the geotechnical report by the Competent Person is implemented and verified at every stage of construction and verify each milestone before payment can take place. The importance of the Technical Services Advisor/s' presence on site cannot be over-emphasized in order to ensure compliance and value for money. Such on site monitoring, evaluation and verification of milestones in line with recommendations made in the geotechnical site investigation report is applicable to all extra-ordinary human settlement development conditions.

7.3. Municipalities

7.3.1. Municipalities are obliged to ensure that the health and safety of inhabitants living within its jurisdiction is ensured in line with Section 152(1)(d) of the Constitution of South Africa, Act 108 of 1996, meaning that Municipalities must put in place risk prevention mechanisms to deal with the health and safety of its inhabitants, especially if the Municipality is experiences extra-ordinary geotechnical conditions.

7.3.2. Municipalities experiencing dolomitic conditions, should ensure that a Dolomite Risk Management Strategy is developed and a Dolomite Risk

Manager is appointed to manage, implement and monitor the implementation of the Dolomite Risk Management Strategy.

7.4. Competent Person registered in terms of the Engineering Professions of South Africa Act, Act 46 of 2000 or the National Scientific Professions Act, Act 106 of 1993

7.4.1. Perform duties relating to the determination of site designations and dolomite area designations and confirming compliance with the NHBRC's technical requirements and outlined in this policy.

7.4.2. Should conduct regular on site visits during implementation of human settlement projects where geotechnical conditions were confirmed through geotechnical site investigations, to ensure that recommendations made in the report are adhered to and implemented to the latter.

8. DELIVERABLES OF THE POLICY

SECTION 1:
CONDUCTING GEOTECHNICAL INVESTIGATIONS

SECTON 1.1: THE COMPENENT PERSON

8.1. Geotechnical site investigations shall only be undertaken under the direction of Competent Persons (Geotechnics) who has the necessary experience in relation to the Category of Work that is required (refer to *Definitions* to determine the category of work to determine the exact qualifications and experience that is required). Such a person shall spend 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 of Geoscience, the Government Mining Engineer and the NHBRC. The Competent Person shall formulate all opinions in such a manner that a peer review, if conducted in the same factual and interpretative data, will arrive at substantially similar opinions. The Competent Person (Geotechnics) shall demonstrate in the case of contaminated land, that the risk to the health and safety of its occupants of subsidy housing is acceptable, or not.

SECTION 1.2.: PRELIMINARY GEOTECHNICAL SITE INVESTIGATIONS

8.2. LGHS commissions preliminary geotechnical site investigations when project descriptions are required and such investigations comprises of the gathering of all known information relating to geotechnical conditions of the land earmarked for human settlement development, and the interpretation of this information leading to a preliminary determination of the suitability of the land for the implementation of human settlements' projects as the primary objective of preliminary investigations. These geotechnical investigations must conform to the Geotechnical Site Investigations for Housing Developments: Generic Specification GFSH-2, dated September 2002, as published by the National Department of Human Settlements.

8.3. The Competent Person shall as a minimum:

8.3.1. Approach the following organizations, as necessary, in order the gather data:

8.3.1.1. Mining Houses;

8.3.1.2. Council for Geoscience;

8.3.1.3. Deeds Office;

8.3.1.4. Department of Land Affairs;

8.3.1.5. Department of Water Affairs;

8.3.1.6. District Councils;

8.3.1.7. Government Mining Engineer;

8.3.1.8. Local Authority or regional databank of geotechnical data;

8.3.1.9. NHBRC;

8.3.1.10. Surveyor General; and

8.3.1.11. Relevant consultants.

8.3.2. Gather and assimilate available data pertaining to the site from the following sources, as necessary:

8.3.2.1. Orthophotographic coverage (scale 1:10 000);

8.3.2.2. Aerial photographic coverage;

8.3.2.3. Geological data and mapping concerning the site and immediate environs;

8.3.2.4. Topographic maps;

8.3.2.5. Geohrydological data (regional and local in the case of dolomitic areas);

8.3.2.6. Geotechnical reports from surrounding developments, infrastructure and the like;

8.3.2.7. Geotechnical problems previously recorded in the area, e.g. sinkholes in dolomitic areas, seismic activity, and the like; and

8.3.2.8. Seismological data.

8.3.3. Review published geotechnical literature for the region.

8.3.4. 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.

8.3.5. Analyze data and identify and categorize terrain types.

8.3.6. 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 or orthophotos or aerial photographs.

8.3.7. Indicate appropriate land use.

8.3.8. Comment on potential sources and uses of construction materials.

8.3.9. 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.

8.3.10. Where 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 in fully coordinated drawings, based on the Government Mining Engineer's records, on aerial photographs or ortho-mapping, as appropriate.

8.4. The Competent Person shall document and report all findings and opinions in a written report using the following standard headings:

8.4.1. Executive summary

8.4.2. Introduction

8.4.3. Information:

8.4.3.1. Description and list of the information assimilated and used in the study

8.4.3.2. General location and description of the site

8.4.3.3. Evaluation procedures used in the investigations

8.4.3.4. Geology and geohydrology of the site

8.4.3.5. Geotechnical conditions and constraints

8.4.3.6. Terrain mapping

8.4.4. Impact of the geotechnical character of the site on subsidy housing developments:

8.4.4.1. Land usage

8.4.4.2. Installation of services

8.4.4.3. House construction

8.4.4.4. Housing subsidy variations

8.4.5. Conclusions and recommendations

8.5. The report must:

8.5.1. Include a discussion on the process followed to arrive at the terrain mapping unit.

8.5.2. Include a locality plan of the site complete with site boundaries, co-ordinates and property descriptions.

8.5.3. Indicate topographic and geological conditions clearly on appropriately coordinated and scaled maps with superimposed or overlaid property boundaries.

8.5.4. 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 photographs, orthophotos, available information and observations from the walk-over survey or inspection.

8.5.5. Provide a physical description of the surface soil condition, e.g. in alluvial floodplains, side gullies, undrained depressions or talus slopes, supported with photographic documentation of features of significance.

8.5.6. Contain appropriate comments on the presence of prominent water-courses and preferred drainage routes.

8.5.7. Present interpretations of groundwater seepage indications.

8.5.8. Contain comments on the structural condition of any buildings or improvements on the land as an indicator of the influence of ground conditions.

8.5.9. Include a drawing of the site showing terrain mapping units complete with approximate co-ordinates.

8.6. The report and all drawings and maps and photographs must also be made available in electronic format.

SECTION 1.3.: PHASE I GEOTECHNICAL SITE INVESTIGATIONS

8.7. Phase I geotechnical site investigations are commissioned by LGHS when feasibility reports are required. Such investigations comprises of stability investigations, if underlain by dolomites or under-mined ground, or in undulating terrain where there is 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, Act 95 of 1998, and the Joint Structural Division of the South African Institute of Civil Engineering and Institutions of Structural Engineers' Code of Practice for Foundations and superstructures for single storey buildings of masonry construction.

Requirements for near surface soil horizons investigations

8.8. The Competent Person shall as a minimum:

8.8.1. Conduct a detailed geotechnical site investigation involving an *in situ* evaluation of the ground profile to a minimum depth of 3m or to the machine refusal depth at a frequency derived from exploratory holes in near surface soil horizons where the site is not greater than 10ha, or exploratory holes in near surface soil horizons where site is greater than 10ha, 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 including:

8.8.1.1. Foundations and structural nature of residential housing.

8.8.1.2. Construction of roads (surfaced and gravel).

8.8.1.3. Excavations for and construction of buried services including appropriate trench backfills.

8.8.1.4. Landslip (slope instability).

8.8.1.5. Present and past mining activities.

8.8.2. 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:

8.8.2.1. Water-bearing service disruptions arising from loss of positive gradients, rupture due to ground settlement.

8.8.2.2. Loss of positive storm water run-off from zones of substantial settlement and resulting flooding, infiltration and exacerbated water-induced settlement.

8.8.2.3. Loss of serviceability in structures due to rotation/tilt or settlement even where structural distress is controlled by adequate foundation stiffness.

8.8.2.4. Restrictions that will inevitably be placed on housing development to mitigate the negative impacts of the settlement process.

8.8.3. Prepare a comprehensive geotechnical report which:

8.8.3.1. Provides the township description and defines the extent and boundaries of the township.

8.8.3.2. Describes the local geology.

8.8.3.3. Describes the soil profile by site classification unit.

8.8.3.4. Provides geotechnical interpretation of each soil profile unit.

8.8.3.5. Provides a provisional site classification of the site.

8.8.3.6. Contains foundation recommendations by site classification unit.

8.8.3.7. Assesses the stability and related geological parameters.

8.8.3.8. Identified conditions and constraints such as mining related problems, areas of outcrop, slope instability, contaminated land, unconsolidated fill, etc.

8.8.3.9. Provides information on the drainage of the site.

8.9. In terms of field work:

8.9.1. Exploratory holes shall be set out using a hand-held GPS, coordinated by survey or positioning using referenced landmarks or survey pegs.

8.9.2. Field work shall as a minimum consist of the excavation of exploratory holes, *in situ* profiling or sampling holes in a fashion appropriate to the ground conditions, groundwater, sampling requirements, personal safety considerations and the like, using one or more of the following methods:

8.9.2.1. Tractor-Loader-Backhoe (TLB) or excavator pits or trenches.

8.9.2.2. Penetrometer probes (continuous standard penetrometer test and/or dynamic probe super heavy penetrometer tests) with sample recovery.

8.9.2.3. Large diameter (not less than 750mm) auger holes.

8.9.2.4. Using hand-held Dynamic Cone Penetrometers' (DCP's) supplemented by methods 8.9.2.1. and 8.9.2.3.

8.9.2.5. Hand dug pits supplemented by other methods.

8.9.2.6. Percussion drilling with sample recovery supplemented by other methods.

8.9.2.7. Rotary core drilling with sample recovery.

8.9.3. All *in situ* soil profiling shall be in accordance with the provisions of 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 exploratory holes:

8.9.3.1. Moisture.

8.9.3.2. Colour.

8.9.3.3. Consistency.

8.9.3.4. Structure.

8.9.3.5. Soil type.

8.9.3.6. Origin.

8.9.3.7. Any other detail relevant to the engineering assessment of the *in situ* soil conditions.

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

8.9.5. The Competent Person shall take all reasonable measures and steps to ensure that all 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.

8.10. The Competent Person shall arrange for the following laboratory test procedures to be undertaken by an accredited soil mechanics test laboratory, that is an accredited SANAS 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:

8.10.1. Particle size distribution/grading.
8.10.2. Atterberg limits.
8.10.3. Moisture content.
8.10.4. Compressibility/potential collapse.
8.10.5. Swell underload.
8.10.6. pH and conductivity.
8.10.7. Compaction (moisture:density relationship).
8.10.8. California Bearing Ration tests (CBR).

8.11. The Competent Person shall document and report all findings and opinions in a written report using the following standard headings:

8.11.1. Introduction and terms of reference
8.11.2. Information used in the study
8.11.3. Site description
8.11.4. Nature of investigation

8.11.5. Site geology and groundwater conditions:

8.11.5.1. General

8.11.5.2. Soil profile

8.11.5.3. Water table

8.11.6. Geotechnical evaluation:

8.11.6.1. Engineering and material characteristics

8.11.6.2. Slope stability and erosion

8.11.6.3. Excavation classification with respect to services

8.11.6.4. Impact of the geotechnical character of the site on subsidy housing developments

8.11.7. Site classification

8.11.8. Foundation recommendations and solutions

8.11.9. Drainage

8.11.10. Special precautionary measures

8.11.11. Conclusions

8.11.12. Appendices

8.12. The report must:

8.12.1. Describe and list the information assimilated and used in the study.

8.12.2. Provide particulars of site boundaries and a description of the property.

8.12.3. Describe the field investigation procedures used and laboratory tests undertaken as prescribed in 8.9. and 8.10.

8.12.4. State engineering and material characteristics which will affect development and construction including the identification of conditions and constraints such as mining related problems, areas of outcrop, slope instability, contaminated land, unconsolidated fill, etc.

8.12.5. Evaluate and establish the potential for lateral soil movement arising from surface erosion, soil creep, talus movement and slope instability.

8.12.6. Establish, for the purposes of estimating subsidy variations, the presence and extent of:

8.12.6.1. Permanent or perched water tables less than 1,0 below ground surface.

8.12.6.2. Permanent of perched water tables less than 1,5 below ground surface.

8.12.6.3. The USCS of the uppermost soil horizon (0-750mm) where the average slope is steeper than or equal to 1:7,5.

8.12.6.4. The presence of hard rock and/or boulder class excavation in future service trenches up to a depth of 1,5m.

8.12.7. Assess the suitability of material in the upper 1.5m of the site for excavation by hand.

8.12.8. Discuss foundation recommendations and provide geotechnical engineering data associated with the design of such foundations.

8.12.9. Discuss the effect of both surface water (flooding and ponding) and groundwater (marshy conditions, underground erosion, hydrostatic pressure and fluctuating water levels in the development) and comment on whether or not the groundwater will be potentially harmful with respect to buried concrete and steel.

8.12.10. Contain all soil profiles and the results of laboratory tests and *in situ* tests including penetrometer test results in an orderly manner in the Appendices.

8.12.11. Include the following drawings:

8.12.11.1. A locality plan of the site.

8.12.11.2. A site plan showing positions of exploratory holes.

8.12.11.3. A soil map defining approximate boundaries of areas with common site class designations.

8.13. The Competent Person shall, where 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.

8.14. Drawing shall be to a common scale, legible and easily reviewed. All drawing must be correctly referenced with a clear indication of co-ordinates.

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

Requirements for stability investigations in dolomite areas

8.16. The Competent Person shall as a minimum:

8.16.1. Map the basic geology and geomorphological features of the site as well as any sinkholes and dolines within or in close proximity of the site.

8.16.2. Formulate an opinion as to risk characterization and land use of the site using geophysics, the assessment of the morphology, subsurface profile from ground surface to dolomite bedrock and the geohrydological regime conditions and groundwater compartmentalization.

8.16.3. Conduct a detailed geotechnical site investigation comprising a gravity survey and drilling to a minimum depth of 6.0 into the bedrock at a frequency derived from percussion boreholes in dolomitic areas for study areas not greater than 10ha or percussion boreholes in dolomitic areas for study areas greater than 10ha.

8.16.4. Prepare a comprehensive geotechnical report which:

8.16.4.1. Provides the township description and defines the extent and boundaries of the township.

8.16.4.2. Establishes the geological changes of the site.

8.16.4.3. Establishes the nature, fluctuations, compartmentalization, and original groundwater levels from geohrydological data.

8.16.4.4. Describes and interprets the local geology by site classification unit.

8.16.4.5. Provides appropriate land use proposals by site classification unit.

8.16.4.6. Provides a site classification.

8.16.4.7. Contains recommendations for geotechnical and structural solutions in sites designated as D3 by site classification unit.

8.16.4.8. Presents appropriate water precautionary measures.

8.16.4.9. Identifies precautionary measures in addition to mandatory measures contained in the NHBRC Home Building Manual.

8.16.4.10. Outlines an appropriate risk management plan.

8.17. In terms of gravity surveys:

8.17.1. 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.

8.17.2. The grid spacing for gravity surveys shall not exceed the lesser of 30m and the anticipated thickness of the overburden above the dolomites or limestone.

8.17.3. 5 – 10% of observations shall be repeated for control purposes.

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

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

8.17.6. Contour intervals of not more than 0,1 milligals are to be used.

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

8.18. In terms of drilling works:

8.18.1. Rotary percussion boreholes shall be drilled on the site utilizing geophysical data to select the positions. Samples for every 1m drilled shall be retrieved.

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

8.18.3. Drilling equipment shall comprise of the following mobile units:

8.18.3.1. Compressor unit with measured and calibrated constant air delivery rating at 750 cfm (cubic foot per minute) and 16 bar minimum.

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

8.18.4. The following minimum information shall be recorded on the drilling sheet during the drilling of each borehole:

8.18.4.1. Driller/drilling contractor.

8.18.4.2. Date of drilling borehole.

8.18.4.3. Drilling rig.

8.18.4.4. Compressor type, capacity and delivery.

8.18.4.5. Hammer size.

8.18.4.6. Depth intervals for sampling (1m).

8.18.4.7. Penetration times.

8.18.4.8. Formation e.g. cavity, very soft, soft, reasonably hard, hard, solid.

8.18.4.9. Air loss e.g. none, partial, total.

8.18.4.10. Moisture condition e.g. water intercepted, wet, moist, dry.

8.18.4.11. Borehole raveling/collapsing.

8.18.4.12. Water or foam added.

8.18.4.13. Casing used.

8.18.4.14. Sample retrieval e.g. good, medium, poor, none.

8.18.4.15. Other remarks or comments.

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

8.18.6. 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.

8.19. In terms of borehole chip samples:

8.19.1. The method of borehole chip sample description must be in line with the published recommendations of the South African Institutions of Engineering and Environmental Geologists.

8.19.2. Descriptions of borehole chip samples recovered shall include the following:

8.19.2.1. Soil component:

8.19.2.1.1. Colour.

8.19.2.1.2. Soil type.

8.19.2.2. Rock component:

8.19.2.2.1. Chip shape e.g. sub-angular, sub-rounded, rounded, etc.

8.19.2.2.2. Colour.

8.19.2.2.3. Weathering described in terms of unweathered, slightly, medium, highly an completed weathered.

8.19.2.2.4. Rock type.

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

8.19.3.1. Trace.

8.19.3.2. Minor.

8.19.3.3. Abundant.

8.19.3.4. Equal amounts.

8.19.4. 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 recorded on the profile sheet together with any problematic conditions such as air loss, sample loss and cavitation.

8.20. In terms of gathering geohrydological data:

8.20.1. The available geohrydological data shall be obtained from the Department of Water Affairs.

8.20.2. 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.

8.21. In terms of Hazard and Risk Zone determination:

8.21.1. The Hazard Inherent Risk and Development Risk shall be determined in accordance with the procedure outlined by Buttrick, Van Schalkwyk, Kleywegt and Watermeyer.

8.22. The Competent Person shall document and report all findings and opinions in a written report using the following standard headings:

8.22.1. Executive summary
8.22.2. Introduction and terms of reference
8.22.3. Information used in the study
8.22.4. Site description
8.22.5. Nature of investigation
8.22.6. Site geology and groundwater conditions:
  8.22.6.1. General
  8.22.6.2. Profile
  8.22.6.3. Groundwater levels
8.22.7. Stability evaluation:
  8.22.7.1. Dolomite stability characterization
  8.22.7.2. Characterization procedure
  8.22.7.3. Stability characterization of the site
8.22.8. Conclusions and recommendations:
  8.22.8.1. Summary of Risk Zonation
  8.22.8.2. Appropriate land use recommendations
  8.22.8.3. Water and foundation precautionary measures
  8.22.8.4. Development of densities and types
  8.22.8.5. Dolomite area designations for each inherent risk zone
  8.22.8.6. Specific founding measures in D3 areas
  8.22.8.7. Outline of the preliminary risk management plan
8.22.9. Appendices

8.23. The report must:

8.23.1. Describe and list the information assimilated and used in the studies.
8.23.2. Provide particulars of site boundaries and a description of the property.

8.23.3. Describe the field investigation procedures used and laboratory tests undertaken.

8.23.4. Discuss the geology and geohydrology in both the regional and site specific context.

8.23.5. Explain and motivate the risk characterization of the site.

8.23.6. Specify water precautionary and special founding measures for each risk zone.

8.23.7. Assess the impact of the site classes on subsidy housing developments.

8.23.8. Discuss the foundation recommendations in D3 zones and provide geotechnical engineering data associated with the design of such foundations.

8.23.9. Contain all data from the gravity survey, boreholes and the results of laboratory and *in situ* field tests in an orderly manner in Appendices.

8.23.10. Include the following drawings:

8.23.10.1.1. Locality plan of site.

8.23.10.1.2. Site plan showing positions of boreholes and gravity contours.

8.23.10.1.3. Zone map defining approximate boundaries of areas with common site class designations.

8.24. 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.

8.25. The report and all drawings and test results must be also made available in an electronic format.

SECTION 1.4.: PHASE II GEOTECHNICAL SITE INVESTIGATIONS

8.26. Phase II investigations are commissioned by LGHS during the installation of township services. Such investigations comprises of 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 NHBRC enrolment of top structures in the Warranty Scheme under the provisions of the Housing Consumer Protection Measures Act, Act 95 of 1998, and the Joint Structural Division of the South African Institute of Civil Engineering and Institutions of Structural Engineers' Code of Practice for Foundations and superstructures for single storey buildings of masonry construction.

Requirements for non-dolomitic areas

8.27. The Competent Person shall as a minimum:

8.27.1. Establish 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.

8.27.2. Coordinate activities associated with the profiling procedures.

8.27.3. Observe and record soil profiles in exposed service trenches at not more than 100m intervals or wherever soil type changes occur.

8.27.4. Undertake, where justified, supplementary geotechnical site investigations.

8.27.5. 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.

8.27.6. Record data on field sheets and the points in the trenches which were profiles on a site layout plan.

8.28. The Competent Person shall prepare a report as an addendum to the Phase I report which must contain:

8.28.1. A drawing indicating the location of the points profiles in the service trenches.

8.28.2. Records of all profiles and tests.

8.28.3. A marked up township layout drawing which confirms the site classes of each individual erf.

8.29. The report and all drawings and all records of profiles and tests must be also made available in an electronic format.

Requirements for dolomitic areas

8.30. The Competent Person must as a minimum:

8.30.1. Interact with town planners, civil engineers and the developer concerning appropriate planning, design of infrastructure and housing units.

8.30.2. Develop a risk management plan specific to the development.

8.30.3. 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.

8.31. The Competent Person shall prepare a brief report as an addendum to the Phase I report which must contain:

8.31.1. A drawing indicating the location of the points profiled in the service trenches.

8.31.2. Records of all profiles and tests.

8.31.3. A township layout drawing which confirms the site classes of each individual erf.

8.32. The report and all drawings and profiles and tests must also be made available in an electronic format.

SECTION 2:

AREAS IN THE NORTH WEST PROVINCE THAT EXPERIENCE EXTRA-ORDINARY HUMAN SETTLEMENT DEVELOPMENT CONDITIONS

The following areas are known areas in the North West Province to experience extra-ordinary human settlement development conditions, however, this does not mean geotechnical studies must not be conducted, it should still be conducted. This also does not limit areas not know as experiencing extra-ordinary human settlement development conditions for geotechnical studies. Refer to the attached maps as obtained from the National Department of Human Settlements, Housing Development Agency and Department of Environmental Affairs as ease of reference.

8.33. Asbestos (Anthrophyllite, Amosite, Chrysotile, Crocidolite, and Tremolite types) – Map 1:

8.33.1. Transvaal Supergroups.

8.33.2. Kalahari Group.

8.33.3. Namaqua and Natal Metamorphic Provinces.

8.34. Seepage/Groundwater where the groundwater level is less than 10m– Map 2:

8.34.1. Widespread areas in Dr Kenneth Kaunda District.

8.34.2. Southern areas in Dr Ruth Segomotsi Mompati District.

8.35. Erodibility potential of soil – Map 3:

8.35.1. Low potential – widespread in the Province.

8.35.2. Medium potential – Northern areas in Ngaka Modiri Molema District; widespread in Bojanala District; central areas in Dr Ruth Segomotsi Mompati District; and central areas in Dr Kenneth Kaunda District.

8.36. Dolomite – Map 4:

8.36.1. Brits area.

8.36.2. Ganyesa area.

8.36.3. Klerksdorp area.

8.36.4. Koster area.

8.36.5. Lichtenburg area.

8.36.6. Mafikeng area.

8.36.7. Mogwase area.

8.36.8. Pomfret area.

8.36.9. Potchefstroom area.

8.36.10. Reivilo area.

8.36.11. Rustenburg area.

8.36.12. Zeerust area.

8.37. Collapsing sands – Map 5:

8.37.1. Widespread across the Province.

8.38. Compressible soils – Map 6:

8.38.1. Widespread across the Province.

8.39. Mining subsidence – Map 7:

8.39.1. Widespread majority in the Districts of Ngaka Modiri Molema, Dr Kenneth Kaunda and Bojanala.

8.39.2. At minority scale in isolated areas in Dr Ruth Segomotsi Mompati District.

8.40. Seismic activity – Map 8:

8.40.1. Mostly mining induced in Dr Kenneth Kaunda District.

SECTION 3:
GEOTECHNICAL CONDITIONS IDENTIFIED AS EXTRA-ORDINARY HUMAN SETTLEMENT DEVELOPMENT CONDITIONS THAT REQUIRES PRECAUTIONARY MEASURES THAT QUALIFIES FOR VARIATION

8.41. Seepage/Groundwater

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Permanent or perched water table less than 1.0m below ground level.	Subsurface drainage: • Improved damp proofing to houses. • Dewatering of service trenches during construction.	• Definitive quantification of seepage/ groundwater conditions can only be done through the standard inspection pit profiling required during the completion of the NHBRC Phase I geotechnical site investigation. • Seepage/groundwater levels should be measured at the time of profiling and again at least 1 hour after the excavation.
Category 2: Permanent or perched water table more than 1.0m but less than 1.5m below ground level.	Dewatering of service trenches during construction.	

8.42. Erodibility of Soil

Verification Category	Precautionary Measures	Verification Methodology
Category 1 (high risk): An erodibility index of 1-8 and Unified Soil Classification System (USCS) classification of the upper 750mm of SP (sand poorly graded), SM (silty sand), CL (inorganic clays of low to medium plasticity) or CH (inorganic clays of high plasticity) and ground slope greater than 1:7.5 or degree of dispersion greater than 40%.	Provision of retaining walls: • Earthworks to reduce slopes. • Surface drainage.	• Site specific information contained in the Phase I geotechnical site investigation report should include standard foundation indicator testing including a grading analysis and soil classification according to the USCS together with double hydrometer tests to confirm if dispersion is suspected. • The provision of these parameters and indications will be used to identify qualifications for subsidy adjustments.
Category 2 (medium risk): An erodibility index of 9-15 and USCS classification of the upper 750mm of SP, SM, CL, or CH and ground slope greater than 1:7.5 or degree of dispersion greater than 40%.	Provision of retaining walls: • Earthworks to reduce slopes.	

8.43. **Hard Excavation**

Verification Category (according to SANS 1200d)	Precautionary Measures	Verification Methodology
Category 1: Hard rock excavation (material that cannot be removed without blasting or wedging and splitting) as % to a depth of 1.5m.	Additional cost of trench excavation.	• The Phase I geotechnical site investigation report must identify areas within a development site where the different categories of shallow hard excavation occur.
Category 2: Boulder excavation (material containing boulders ranging in size between 0.03m³ and 20m³) to a depth of 1.5m.	Additional cost of trench excavation: • Additional cost of road excavation. • Additional cost of foundation excavation.	

8.44. **Dolomite**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Class P (dolomite) and anticipated Inherent Risk Class 1 and 2: Dolomite Area Class D2. Site Class designation must be done in accordance with Sections 2.5. and 2.8. of Part 1	Design and construction of township services in accordance with Section 2.8.3. of Part 1 of the NHBRC Home Building Manual: • Additional Cost of foundations in accordance	• Areas underlain by dolomite (including those areas with up to 100m cover of Karoo or other inert overburden material) will also require the additional submission of a dolomite stability

of the NHBRC Home Building Manual.	with Joint Structural Divisions COP (1995). L Raft.	investigation report comprising of a gravity survey and target percussion drilling. • The Inherent Dolomite Stability Risk Class and Dolomite Area Class will be done by a thorough dolomite stability investigation comprising of a gravity survey and percussion drilling according to accepted norms and standards and under the guidance of the Council for Geo-Science.
Category 2: Class P (dolomite) and anticipated Inherent Risk Class 3,4 and 5: Dolomite Area Class D3. Site Class designation must be done in accordance with Sections 2.5. and 2.8. of Part 1 of the NHBRC Home Building Manual.	Design and construction of township services in accordance with Section 2.8.3. of Part 1 of the NHBRC Home Building Manual. L raft.	

8.45. **Expansive Clays (Site Class H2 and H3)**

Verification Category	Precautionary Measures	Verification Methodology
Category 1 (Medium): Class H1 classified in accordance with Section 2.5. of Part 1 of the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 5 of Section 2, Part 1, NHBRC Home Building Manual: • Modified normal.	• As a preliminary estimate of the potential ground movements, the unit potential expansiveness (or potential expansiveness or PE) method is suggested. • The empirical method expresses unit potential expansiveness in millimeters of heave movement per meter of potentially expansive profile according to the following ranges: • Low potential expansiveness – 0mm heave; • Medium potential expansiveness – 20mm heave; • High potential expansiveness – 40mm heave; and • Very high potential expansiveness – 80mm heave. • The alternative and more precise adapted method of Weston (1982) is also advised. Weston's percent swell equation has been adapted to provide a more
Category 2 (High): Class H2 classified in accordance with Section 2.5. of Part 1 of the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 5 of Section 2, Part 1, NHBRC Home Building Manual: • L raft (low PE 5<CDS<20); or • M raft (med PE 20<CDS<40).	
Category 3 (Very high): Class H3 classified in accordance with Section 2.5. of Part 1 of the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 5 of Section 2, Part 1, NHBRC Home Building Manual: • H raft (high PE 40<CDS<60); or • Sp raft (v high PE and CDS>60).	

		realistic indication of the swell difference between the projected "driest" and "wettest" conditions. These conditions will be dependent on the prevailing climate at the site but in general has been conservatively established by CSIR research (for "red soils") as: • Driest moisture condition = 0.4 x (liquid limit x % passing 425 micron); and • Wettest moisture condition = 0.8 x (liquid limit x % passing 425 micron). • Weston's percent swell equation is then manipulated for each extreme condition and the swell difference in % is taken as the representative swell for the profile. • The CDS proposed by Pellisier (JP Pellisier, 1993: SAICE Journal: Technical Note: Third Quarter: pp29-32) can then be calculated using the following expression: • CDS: $L_p.C_m.M_s.1000$ {SUM PDEiFi}; • L_p: load factor taking the effect of the perimeter load into account; • C_m: climatic factor taking the effect of the climate into account; • M_s: modification factor taking settlement into the overlying soft soil into account; • i: layer number; • n: number of 1m thick layers defined in the expansive profile; • PDEi: potential differential expansiveness for the layer; and • F: correction factor for the layer, taking the

		heave suppression into consideration. • Determination of the required stiffness in detailed raft design is dependent on the perimeter wall load and the correct prediction of the hang-off distance, which in turn is dependent on the swelling properties of the clay, the moisture change due to the building coverage, the heave suppression of the clay and the cushioning effect of any overlying inert layer. • The CDS empirically incorporates the two most important factors controlling the hang-off distance of a raft, and these are the differential swell of the expansive soil and the modulus of reaction of the soil.

8.46. **Collapsing Sands (Site Class C2)**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Class C1 classified in accordance with Section 2.5. of Part 1 of the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 6 of Section 2, Part 1 of the NHBRC Home Building Manual: Modified normal; or Compaction below footings; or Deep strip footings.	• In order to estimate the required raft size (light, medium, heavy or special) the collapse potential proposed by Jennings and Knight (1975) is the suggested determinant. • The collapse potential (CP_{200}) of the soil is determined from a single consolidometer test performed on the sample soaked under a loading of 200kPa. The collapse potential is given by $CP_{200} = \{ec2 - ec1 / 1 + e_0\}$. 100% where • ec2 is the measured void ratio of the sample just prior to inundation at 200kPa;
Category 2: Class C2 classified in accordance with Section 2.5. of Part 1 of the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 6 of Section 2, Part 1 of the NHBRC Home Building Manual: Stiffened strip footings; or Deep strip foundations; or Compaction below footings; or L raft (collapse potential 1 – 5%); or M raft (collapse potential 5 – 10%);	

	H raft (collapse potential 10 – 20%); or Sp raft (collapse potential >20%).	• ec1 represents the void ratio of the sample measured just after inundation at 200kPa; • e_0 represents the initial void of the sample at the bedding-in loading; and • The higher value of CP_{200}, the more severe the problem becomes.

8.47. **Compressible Soils (Site Class S2)**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Class S1 classified in accordance with Section 2.5. of Part 1 the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 7 of Section 2, Part 1 of the NHBRC Home Building Manual: Modified normal; or Compaction below footings; or Deep strip footings.	• The verification criteria for compressible soils are similar to collapsing sands with the exception that the percent consolidation should be determined using the single consolidometer test, measuring the consolidation potential at the loading equivalent to a single-storey house. i.e. 20kPa to 30 kPa.
Category 2: Class S2 classified in accordance with Section 2.5. of Part 1 the NHBRC Home Building Manual.	Foundation design, building procedures and precautionary measures in accordance with table 7 of Section 2, Part 1 of the NHBRC Home Building Manual: Stiffened strip footings; or Deep strip footings; or Compaction below footings; or L raft (consolidation potential 1 – 5%); or M raft (consolidation potential 5 – 10%); or H raft (consolidation potential 10 – 20%); or Sp (consolidation potential >20%).	

8.48. **Mining Subsidence**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Old under-mining to a depth of between 90m – 240m below the surface where stope closure has ceased and designation in	Additional cost of foundation design and building procedures as per specialist literature and may include: Compaction below footings; or	• The information includes operating mines, existing un-mined resources and abandoned or exhausted

accordance with Section 2.5. of the NHBRC Home Building Manual.	M raft.	mines. These areas by no means indicate that under-mining will be a condition but give a suggestion that will be required to identify the following possible conditions: • Old under-mining to a depth 90m to 240m below surface where stope closure has ceased; • Mining to within <90m to 240m of surface or where total extraction mining has taken place; • Presence of un-mined resources and/ or long term mining lease agreements; and • Contamination of sub-soils and/or groundwater by either acid mine drainage or high uranium/radon levels.
Category 2: Mining within a depth of between 90m – 240m below the surface or where total extraction has taken place and designation in accordance with Section 2.5. of the NHBRC Home Building Manual.	Additional cost of foundation design and building procedures as per specialist literature and may include: Additional earthworks to fill open outcrop; or Soil mattress.	

8.49. **Seismic Activity**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Mining induced seismic activity >100cm/s².	Additional cost of: Stiffened strip footings; or H raft.	• The lower limit of 100cm/s² has been used as the base level for qualification for subsidy adjustments.
Category 2: Natural seismic activity >100cm/s².	Additional cost of: Stiffened strip footings; or H raft.	

8.50. **Topographical conditions**

Verification Category	Precautionary Measures	Verification Methodology
Category 1: Average ground slope flatter than 1:100.	Increase depth of sewer trenches + provision of pump stations	• The topography of the site will be determined by a land survey completed to 1m contour interval accuracy. • Alternatively, existing published ortho-photographs at a scale of 1:10,000 may be used with a contour interval of not more than 5m.
Category 2: Average ground slope of between 1:10 and 1:20	Terracing for houses + additional earthworks to roads + storm water control measures	
Category 3: Average ground slope of between 1:7.5 and 1:10	Terracing for houses + additional earthworks to roads + storm water control measures	
Category 4:	Terracing for houses + additional earthworks to roads	

Average ground slope of between 1:5 and 1:7.5	+ storm water control measures	• The average slope of the site should be measured along a 100m line in any direction from any of the boundaries of the proposed development site.
Category 5: Average ground slope of more than 1:5	Terracing for houses + additional earthworks to roads + storm water control measures	

8.51. **Location**

Verification Category	Precautionary Measures	Verification Methodology
Only sites in excess of 20km from major centres will qualify for this adjustment of the subsidy amount. The major centres in the North West Province are: • Mafikeng • Rustenburg • Potchefstroom • Klerksdorp	Two trips with a ten ton truck to deliver material in one direction.	The delivery of material for the prescribed 40m² with two trips with a ten ton truck measured in one direction from the major centre to the development site.

9. EFFECTIVE DATE OF THE POLICY

This policy shall come into effect from the date of approval.

10. POLICY REVIEW

This policy will be reviewed as and when changes are made in national legislation pertaining to extra-ordinary human settlement development conditions.

11. APPROVAL

Policy Developer:

MS HH DU PLESSIS — **DATE** 10/09/2018

Recommendation:

MR T PHETLHU
CHIEF DIRECTOR: HOUSING NEEDS, RESEARCH, PLANNING AND TECHNICAL SERVICES

11/09/18
DATE

MR PE MOTOKO
HEAD OF DEPARTMENT

11/09/2018
DATE

Approval:

MEC GF GAOLAOLWE

14/09/2018
DATE

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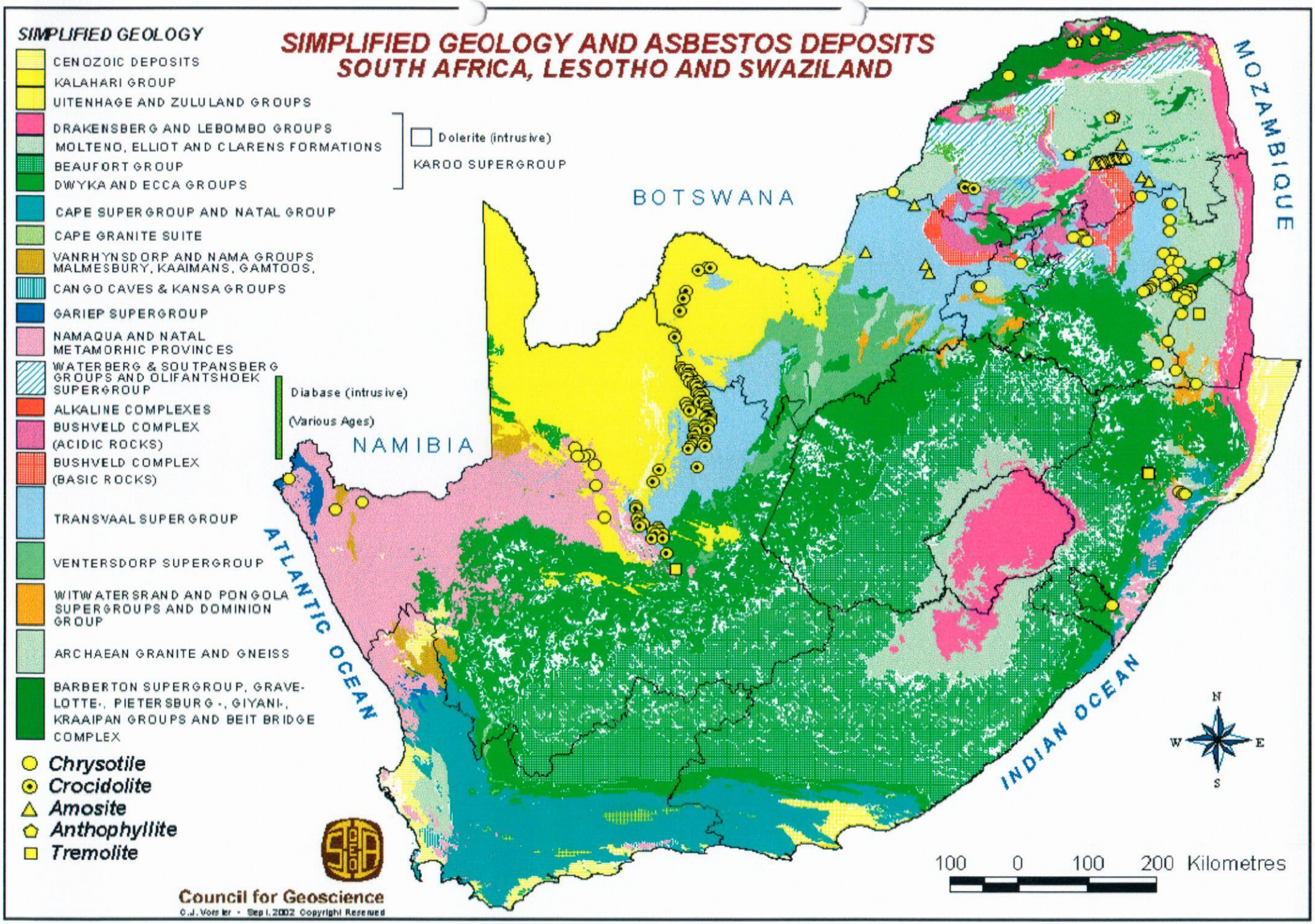
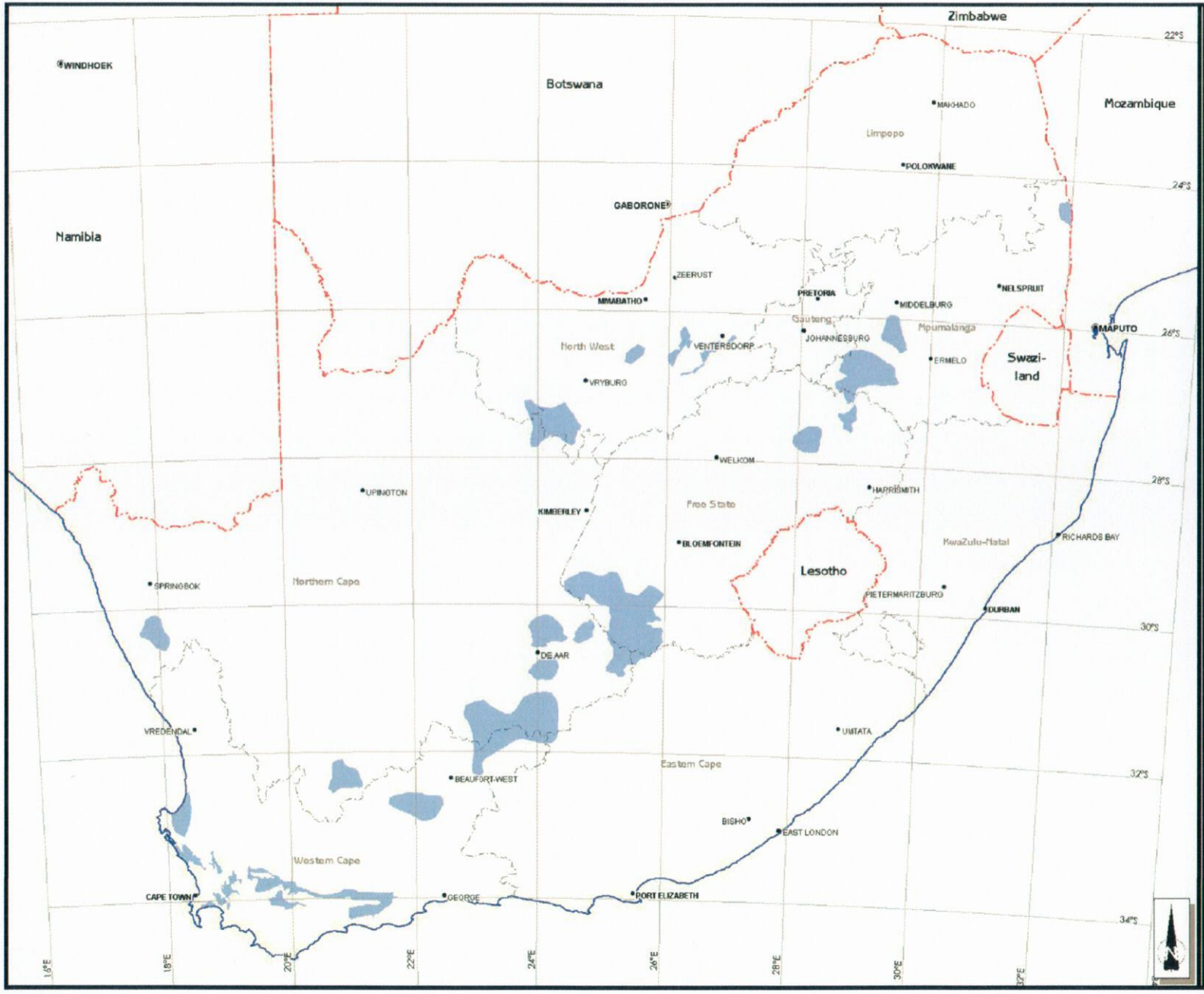
SIMPLIFIED GEOLOGY AND ASBESTOS DEPOSITS
SOUTH AFRICA, LESOTHO AND SWAZILAND





LEGEND

Boundaries

- Coastal
- International
- Provincial

Groundwater less than 10m

human settlements
Department:
Human Settlements
REPUBLIC OF SOUTH AFRICA

Drawn	S.Schnaidt
Date	October 2005
Project	2005170 Policy Variation
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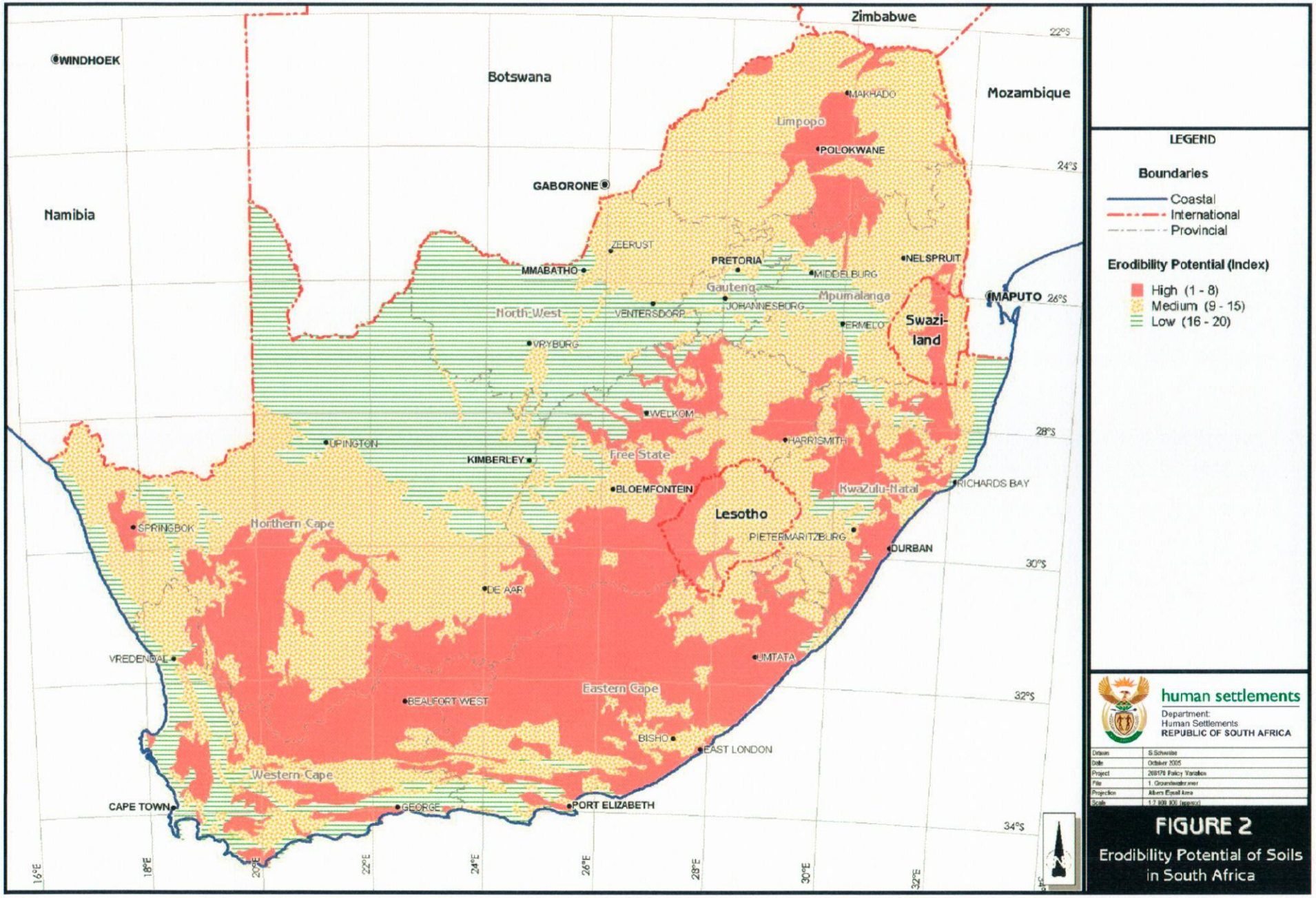
Scale	1:5 500 000 (approx)

FIGURE 1

Shallow Groundwater in South Africa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MMABATHO
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Gauteng
Mpumalanga
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ERMELO
Swazi-land
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WELKOM
UPINGTON
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Free State
BLOEMFONTEIN
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SPRINGBOK
Northern Cape
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DURBAN
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Erodibility Potential (Index)
High (1 - 8)
Medium (9 - 15)
Low (16 - 20)
human settlements
Department:
Human Settlements
REPUBLIC OF SOUTH AFRICA
Drawn S.Schwitte
Date October 2005
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FIGURE 2
Erodibility Potential of Soils in South Africa

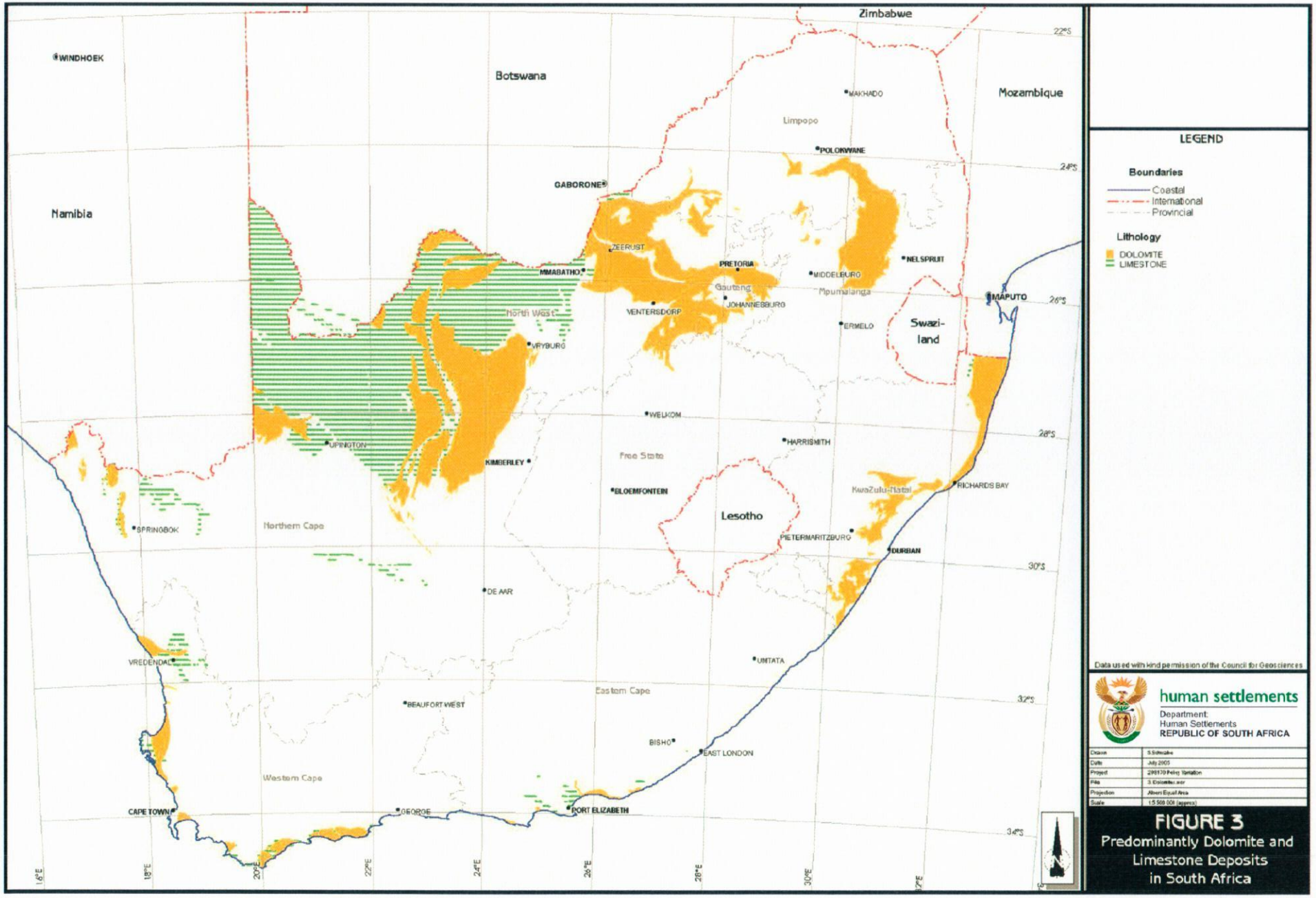
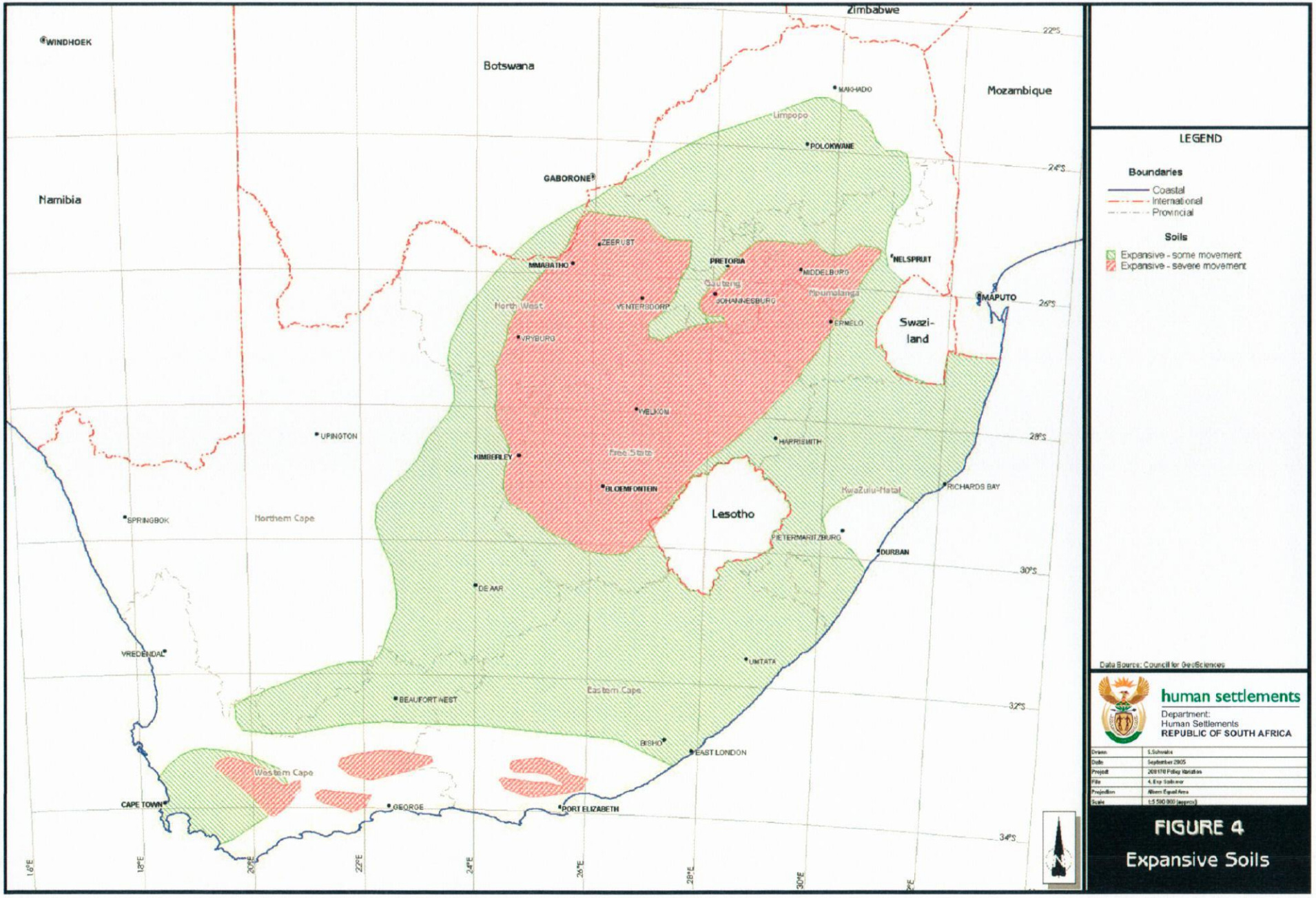


FIGURE 3
Predominantly Dolomite and Limestone Deposits in South Africa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Expansive - some movement
Expansive - severe movement
Data Source: Council for GeoSciences
human settlements
Department:
Human Settlements
REPUBLIC OF SOUTH AFRICA
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Date
September 2005
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FIGURE 4
Expansive Soils

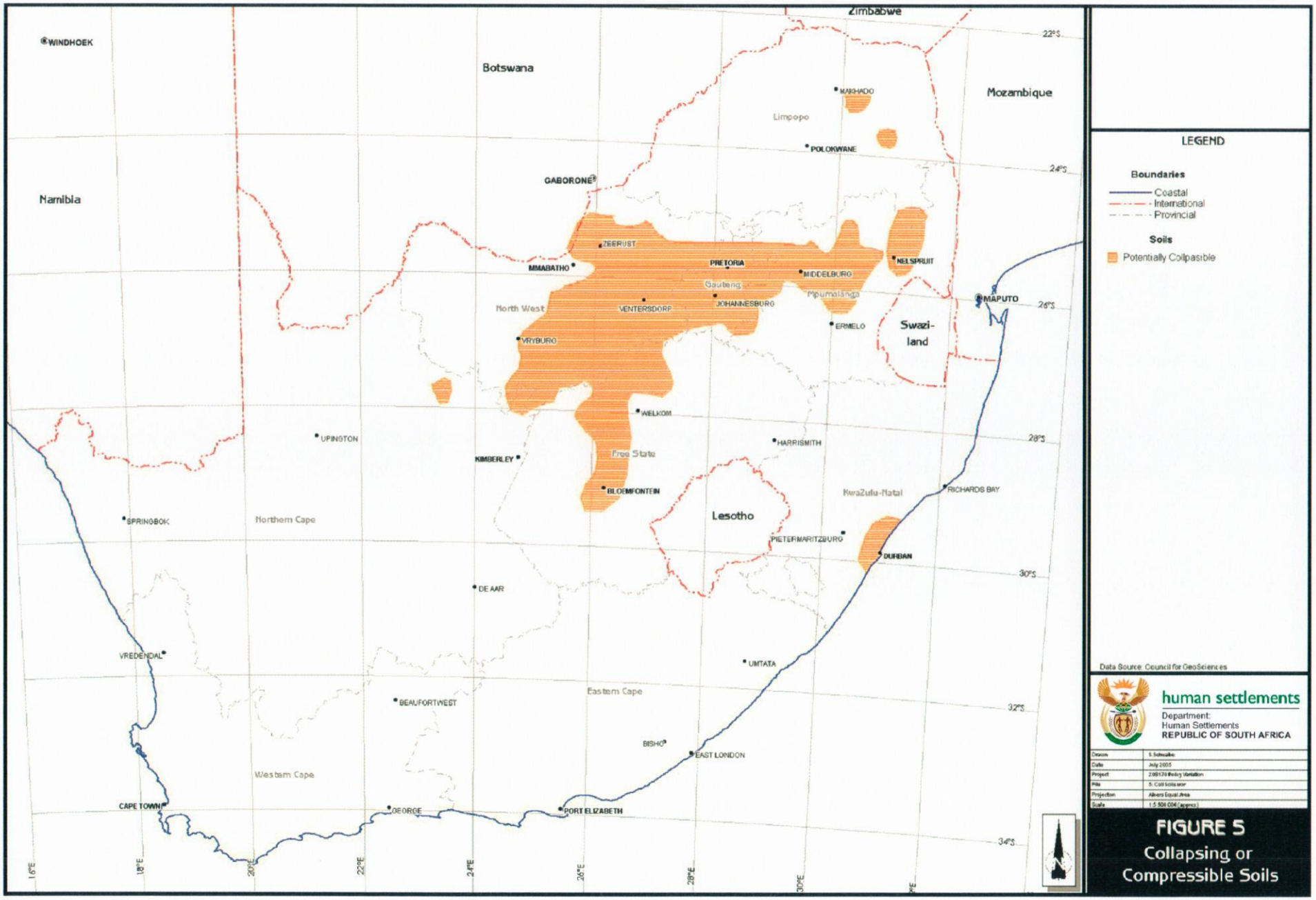


FIGURE 5
Collapsing or Compressible Soils

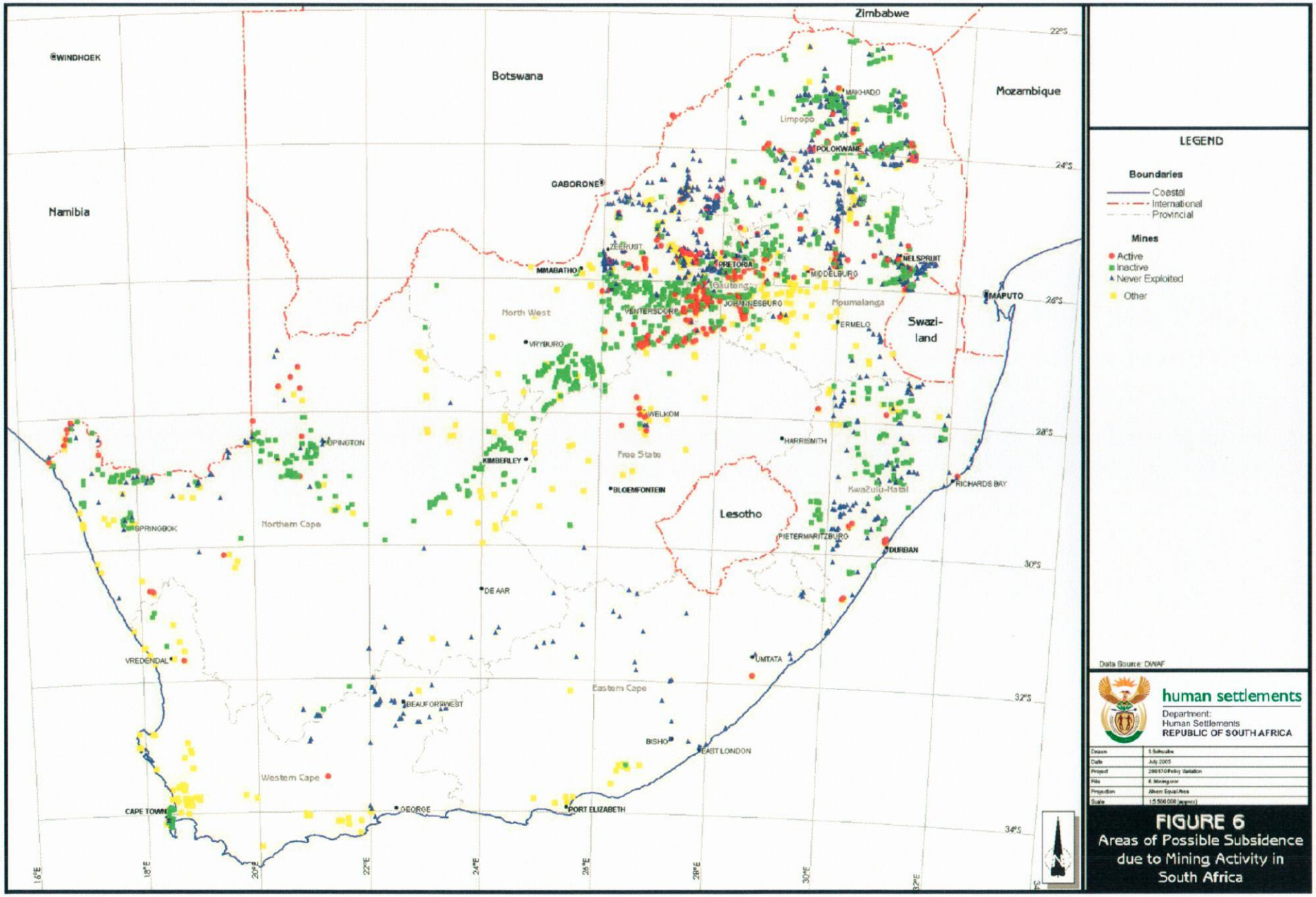


FIGURE 6
Areas of Possible Subsidence due to Mining Activity in South Africa

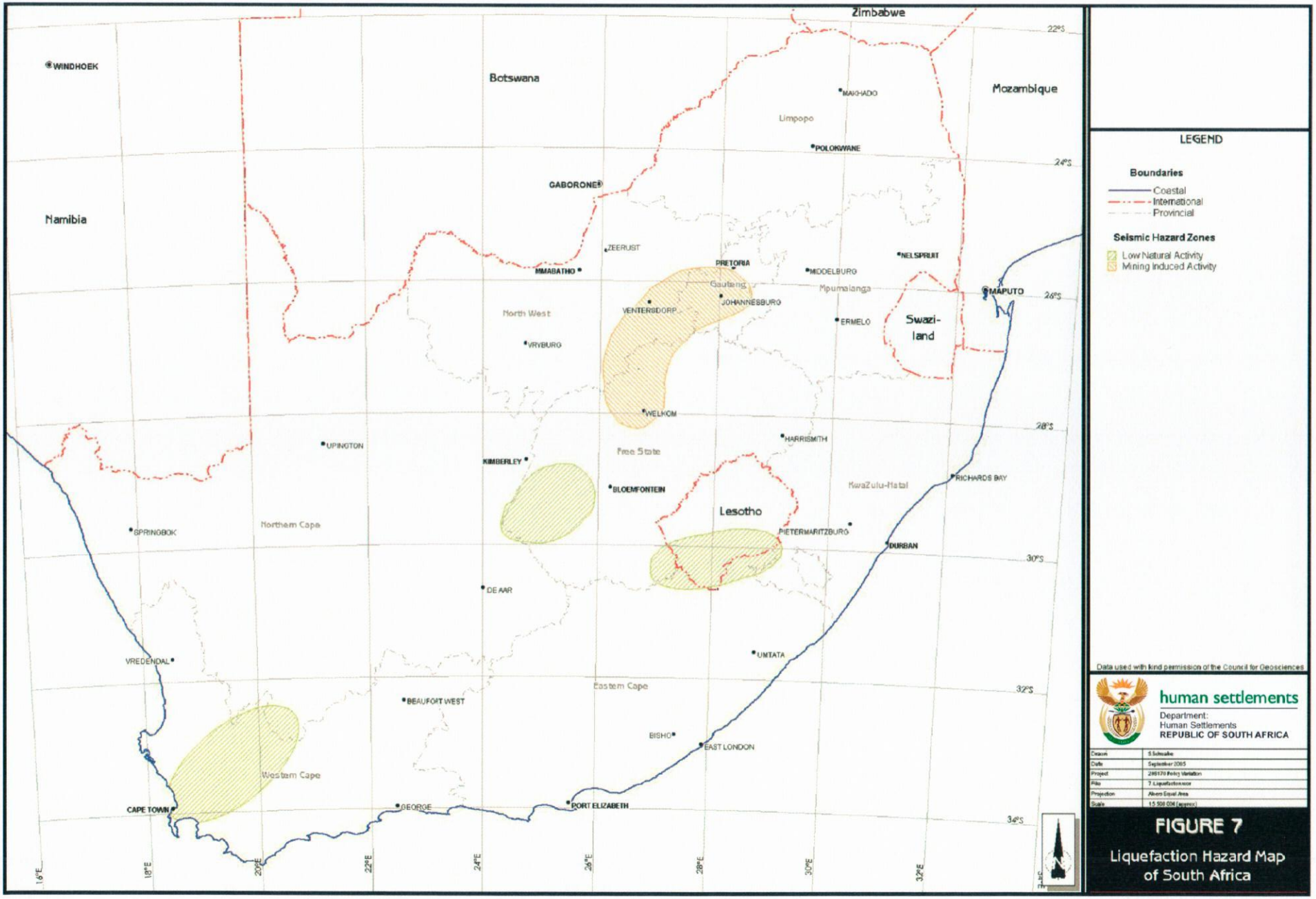
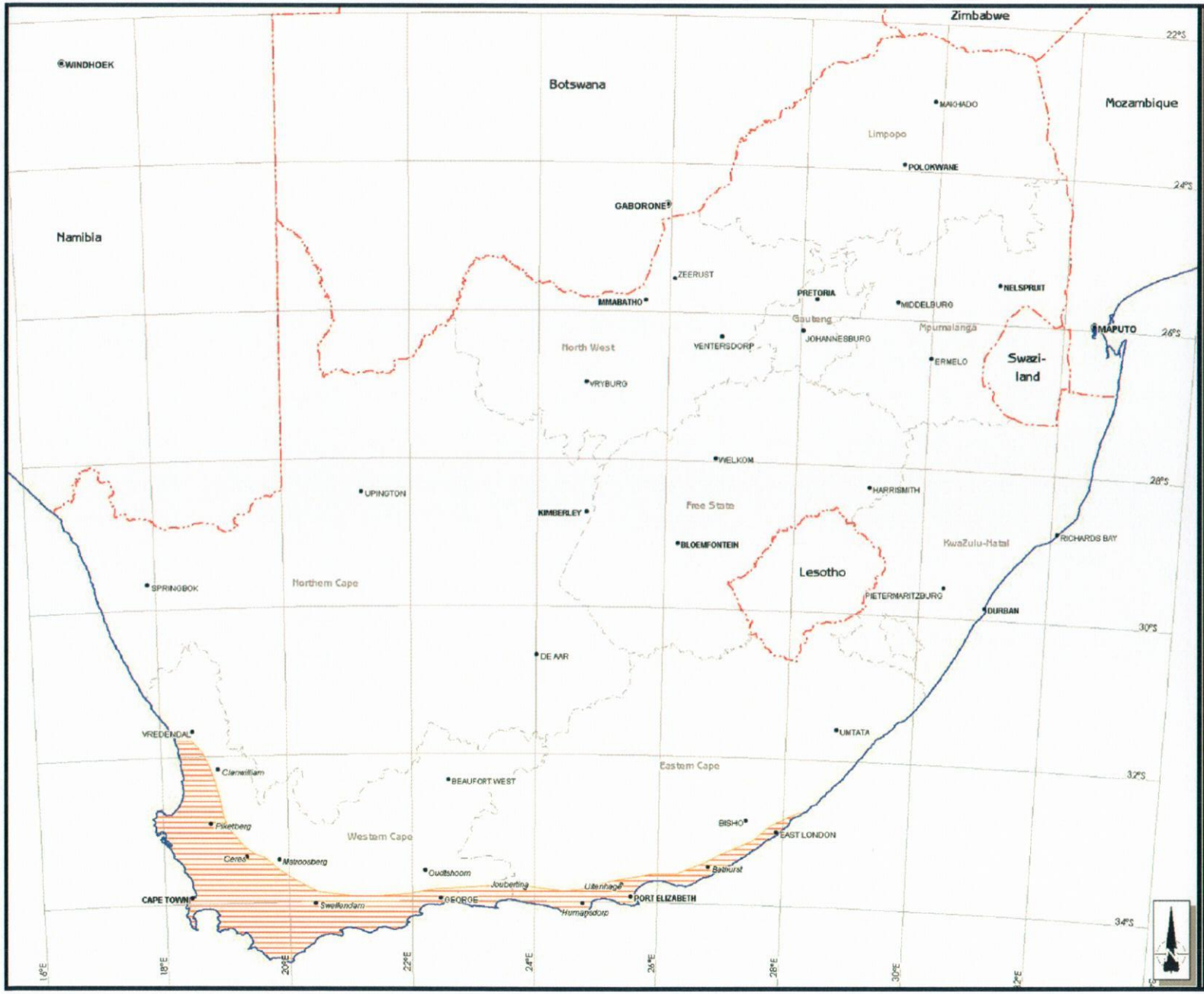


FIGURE 7

Liquefaction Hazard Map of South Africa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Southern Cape Coastal Condensation Area
Data from NHBRC Manual: Demarcation is approximate
human settlements
Department:
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REPUBLIC OF SOUTH AFRICA
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October 2005
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FIGURE 8
Southern Cape Coastal Condensation Problem Area