

Specialist Reports



WETLAND/WATER COURSE IDENTIFICATION AND DELINEATION REPORT





REPORT

WETLAND / WATER COURSE IDENTIFICATION AND DELINEATION REPORT:

PROPOSED RASLOUW EXT. 15 SEWER LINE, GAUTENG PROVINCE

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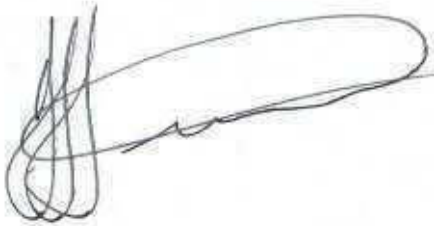
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- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
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- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



J.H. VAN DER WAALS
TERRA SOIL SCIENCE

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1. INTRODUCTION

1.1 TERMS OF REFERENCE

Terra Soil Science was appointed by **Bokamoso** to identify and delineate the wetlands and water courses along the transect of the proposed Raslouw Ext. 15sewer line in the Gauteng Province.

1.2 PROBLEM STATEMENT

The proposed sewer line transect is situated in a dolomite dominated area. The soils that are derived from dolomite (and its associated chert) constitute a special case as stipulated in the wetland delineation guidelines (DWA, 2005). The said guidelines do not provide any guidance in the delineation of wetlands in such landscapes. These landscapes pose a big challenge in the delineation of wetlands as there are distinct areas where wetland plants occur on red (apparently well-drained) soils. The standard wetland delineation approach is problematic as it focusses on the presence of wetlands rather than hydrological functioning of the landscape that feeds the wetlands.

1.3 AIM OF THIS REPORT

The aim of this report is to provide a perspective on the specific wetland conditions (soils, geology, landscape, topography) that occur on the site as well as provide recommendations regarding the management of these wetlands and summarise the impacts of a sewer line construction process. This will be done through the provision of a hydrogeological perspective of the site and broader area to aid in the identification and management of water impacts through the elucidation of broad surface hydrology and hydrogeology principles.

1.4 METHODOLOGY

1.4.1 Brief Background

The identification and delineation of wetlands rest on several parameters that include topographic, vegetation and soil indicators. Apart from the inherent flaws in the wetland delineation process, as discussed later in this report, the concept of wetland delineation implies an emphasis on the wetlands themselves and very little consideration of the processes driving the functioning and presence of the wetlands. One discipline that encompasses a number of tools to elucidate landscape hydrological processes is "hydrogeology" (Lin, 2012). The crux of the understanding of hydrogeology lies in the fact that pedology is the description and classification of soil on the basis of morphology that is the result of soil and landscape hydrological, physical and chemical processes. But, the soils of which the morphology are described, also take part in and intimately

influence the hydrology of the landscape. Soil is therefore both an indicator as well as a participator in the processes that require elucidation.

Wetlands are merely those areas in a landscape where the morphological indicators point to prolonged or intensive saturation near the surface to influence the distribution of wetland vegetation. Wetlands therefore form part of a larger hydrological entity that they cannot be separated from.

1.4.2 Proposed Methodology

In order to provide detailed pedohydrological information both detailed soil surveys and hydrological investigations are needed. In practice these intensive surveys are expensive and very seldom conducted. However, with the understanding of soil morphology, pedology and basic soil physics parameters as well as the collection and interpretation of existing soil survey information, assessments at different levels of detail and confidence can be conducted. In this sense four levels of investigation are proposed namely:

1. Level 1 Assessment: This level includes the collection and generation of all applicable remote sensing, topographic and land type parameters to provide a “desktop” product. This level of investigation rests on adequate experience in conducting such information collection and interpretation exercises and will provide a broad overview of dominant hydro-pedological parameters of a site. Within this context the presence, distribution and functioning of wetlands will be better understood than without such information.
2. Level 2 Assessment: This level of assessment will make use of the data generated during the Level 1 assessment and will include a reconnaissance soil and site survey to verify the information as well as elucidate many of the unknowns identified during the Level 1 assessment.
3. Level 3 Assessment: This level of assessment will build on the Level 1 and 2 assessments and will consist of a detailed soil survey with sampling and analysis of representative soils. The parameters to be analysed include soil physical, chemical and mineralogical parameters that elucidate and confirm the morphological parameters identified during the field survey.
4. Level 4 Assessment: This level of assessment will make use of the data generated during the previous three levels and will include the installation of adequate monitoring equipment and measurement of soil and landscape hydrological parameters for an adequate time period. The data generated can be used for the building of detailed hydrological models (in conjunction with groundwater and surface hydrologists) for the detailed water management on specific sites.

For most wetland delineation exercises a Level 2 or Level 3 assessment should be adequate.

1.4.3 Methodology Employed in this Investigation

The report was generated through:

1. The collection and presentation of baseline land type and topographic data for the site;
2. The thorough consideration of the statutory context of wetlands and the process of wetland delineation;
3. The identification of water related landscape parameters (conceptual and real) for the site for the generation of Level 1 hydrogeology information;
4. Aerial photograph interpretation of the site to aid in the Level 1 hydrogeology assessment;
5. Assessment of historical impacts and changes on the site through the accessing of various historical aerial photographs and topographic maps;
6. Reconnaissance soil and site survey in terms of soil properties as well as drainage feature properties to generate a Level 2 hydrology assessment; and
7. Presentation of the findings of the various components of the investigation.

2. SITE LOCALITY AND DESCRIPTION

2.1 SURVEY AREA BOUNDARY

The site lies between 25° 49' 54" and 25° 50' 55" south and 28° 06' 23" and 28° 06' 49" east immediately east of the light industrial area of Sunderland Ridge in the Gauteng Province (**Figure 1**).

2.2 GENERALISED GEOLOGY

The geology of the area surrounding and including the site consists predominantly of dolomite and chert with shale and quartzite also occurring in the general area.

2.3 LAND TYPE DATA

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (Soil Classification Working Group, 1991).

The Raslouw area is situated in the **Ab2** land type (Land Type Survey Staff, 1972 - 2006) with **Figure 2** providing the land type distribution for the area. Below follows a brief description of the land type in terms of soils as well as expected hydromorphic indicators.

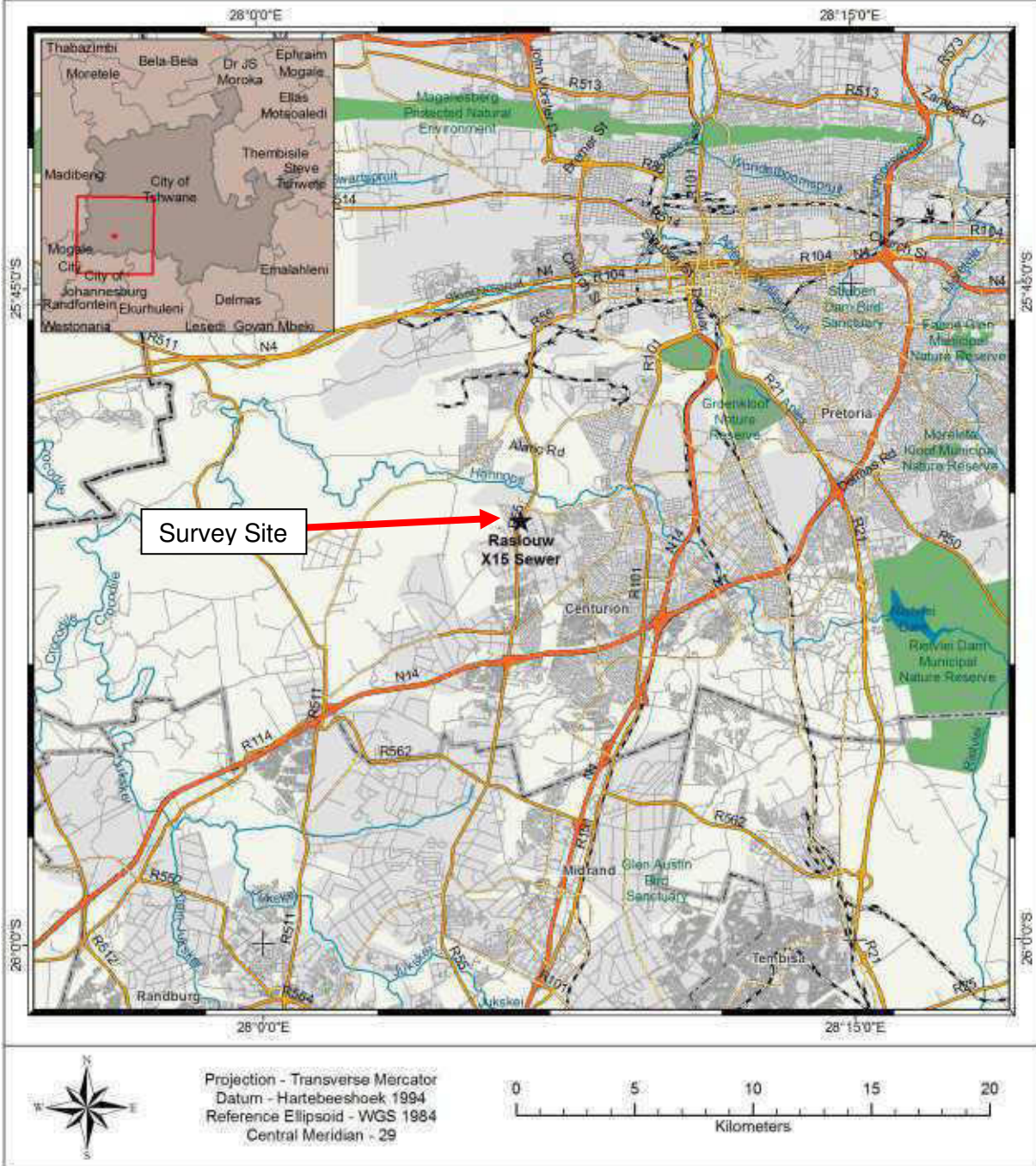


Figure 1 Locality of the survey site

RASLOUW X15 SEWER Land Types Map

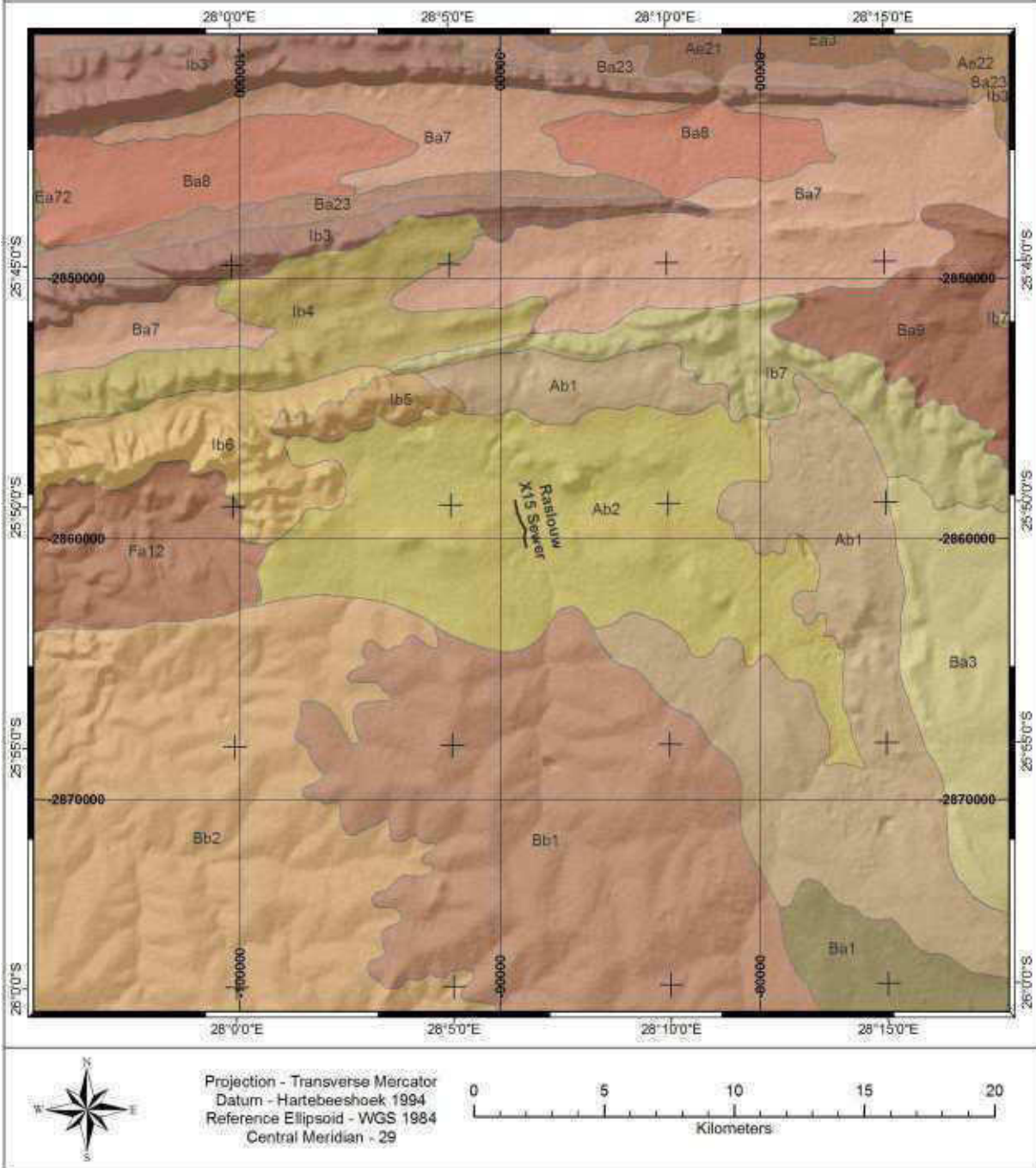


Figure 2 Land type map of the survey site

Land Type Ab2

Land Type – General: Ab land types denote areas with dominantly red well-drained dystrophic and mesotrophic soils.

Soils: From crest to valley bottom the dominant soil colour is red in profiles of varying depth. On crests red soils contain large proportions of chert rock and pebbles. In midslope and footslope positions either chert or dolomite occurs. The dolomite is often weather down to the soil surface but form deep (more than 2 m) tongues of weathering where pedologically old soils occur. The horizontal variation can be such that outcrops occur every 1 to 2 m with deep soils in between at the same frequency. Drainage lines are characterised by narrow bands of dark and brownish red structured soils on the bank with alluvial soils in the channel.

Indicators of Hydromorphy: In the bulk of the Ab2 landscape signs of wetness (hydromorphy) are not found even if plants indicate seasonal wetness. The mechanism is assumed to be the poisoning (buffering) of redox by Mn above the levels that would lead to the expression of Fe redox morphology (that is stipulated in the delineation guidelines). This aspect will be discussed in more detail in the report. Drainage channel soils exhibit limited expression of mottling and then usually associated with oxidised root channels in a clayey and structured matrix. These soils occur within the riparian zone.

2.4 TOPOGRAPHY

The topography of the site and stream channel is relatively flat to undulating. The contour data of the site, superimposed on a Google Earth image, is provided in **Figure 3**. From the contour data a digital elevation model (DEM) was generated for the survey area (**Figure 4**). From the contour data a slope map was generated (**Figure 6**) and from this data in turn a topographic wetness index (TWI) was calculated for the survey site (**Figure 7**). The TWI provides a very accurate indication of water flow paths and areas of water accumulation. This is a function of the topography of the site.

2.5 AERIAL PHOTOGRAPH INTERPRETATION

An aerial photograph interpretation exercise was conducted through the use of Google Earth images of the site. Historical images spanning the period from 2004 to 2012 were used for the purpose of identifying land use characteristics associated with the sewer line transect. In addition, the images were used to identify possible wetland areas that were investigated during the field survey (addressed in the next section). The land uses and characteristics associated with the drainage feature and proposed sewer line are indicated in **Figure 3**.

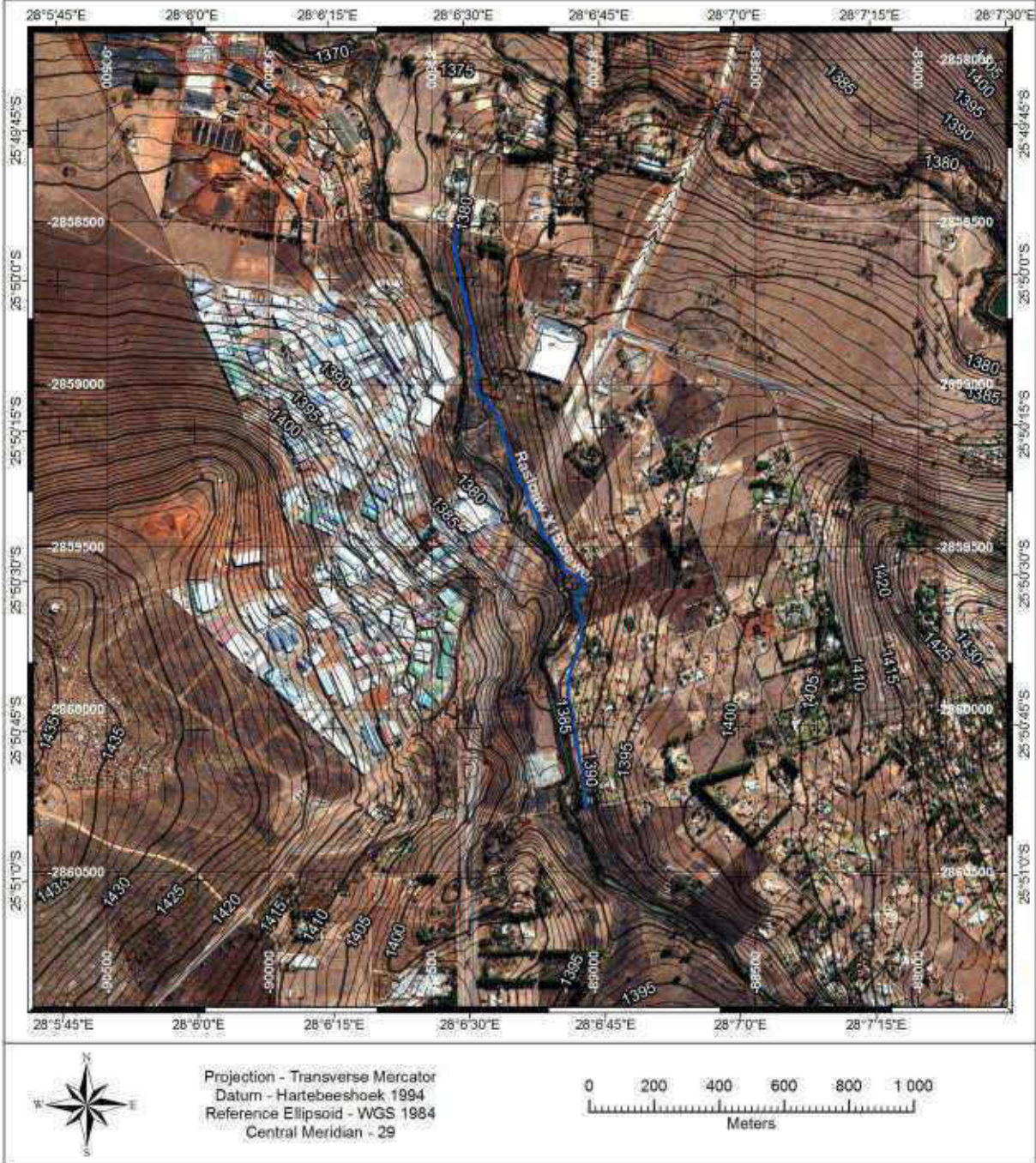


Figure 3 Contours of the site superimposed on a satellite image

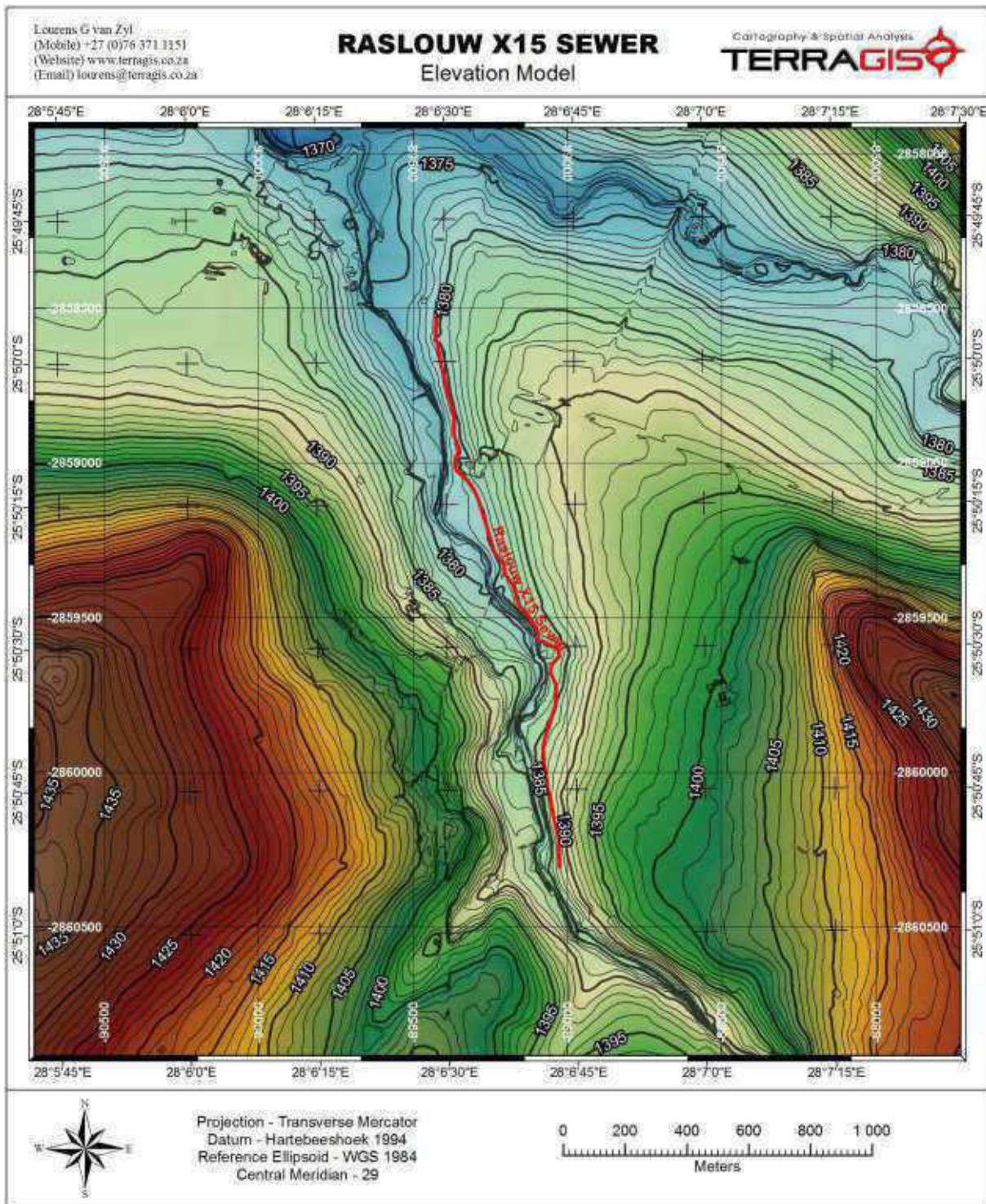


Figure 4 DEM of the area surrounding area and survey site

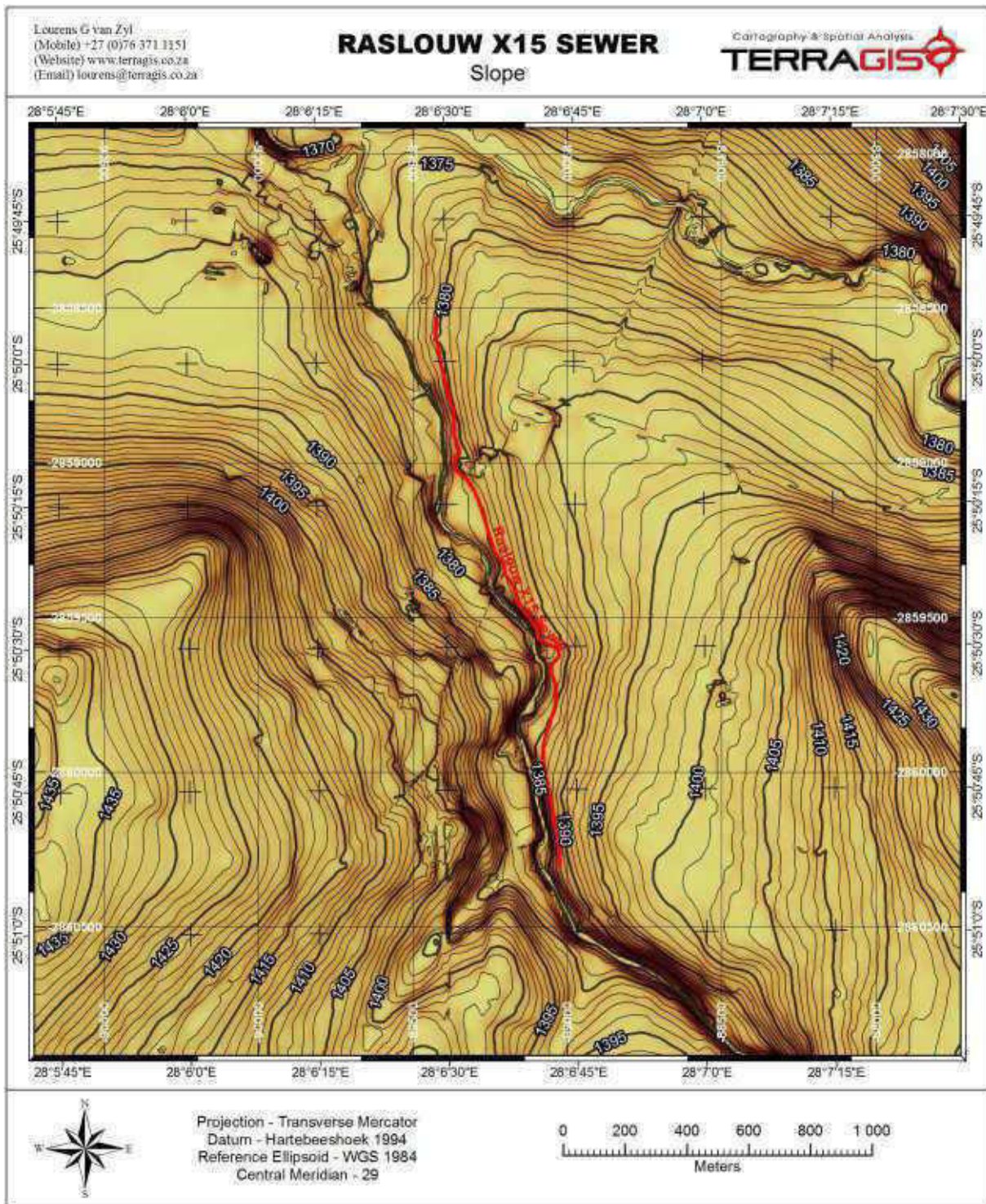


Figure 6 Slope map of the general area

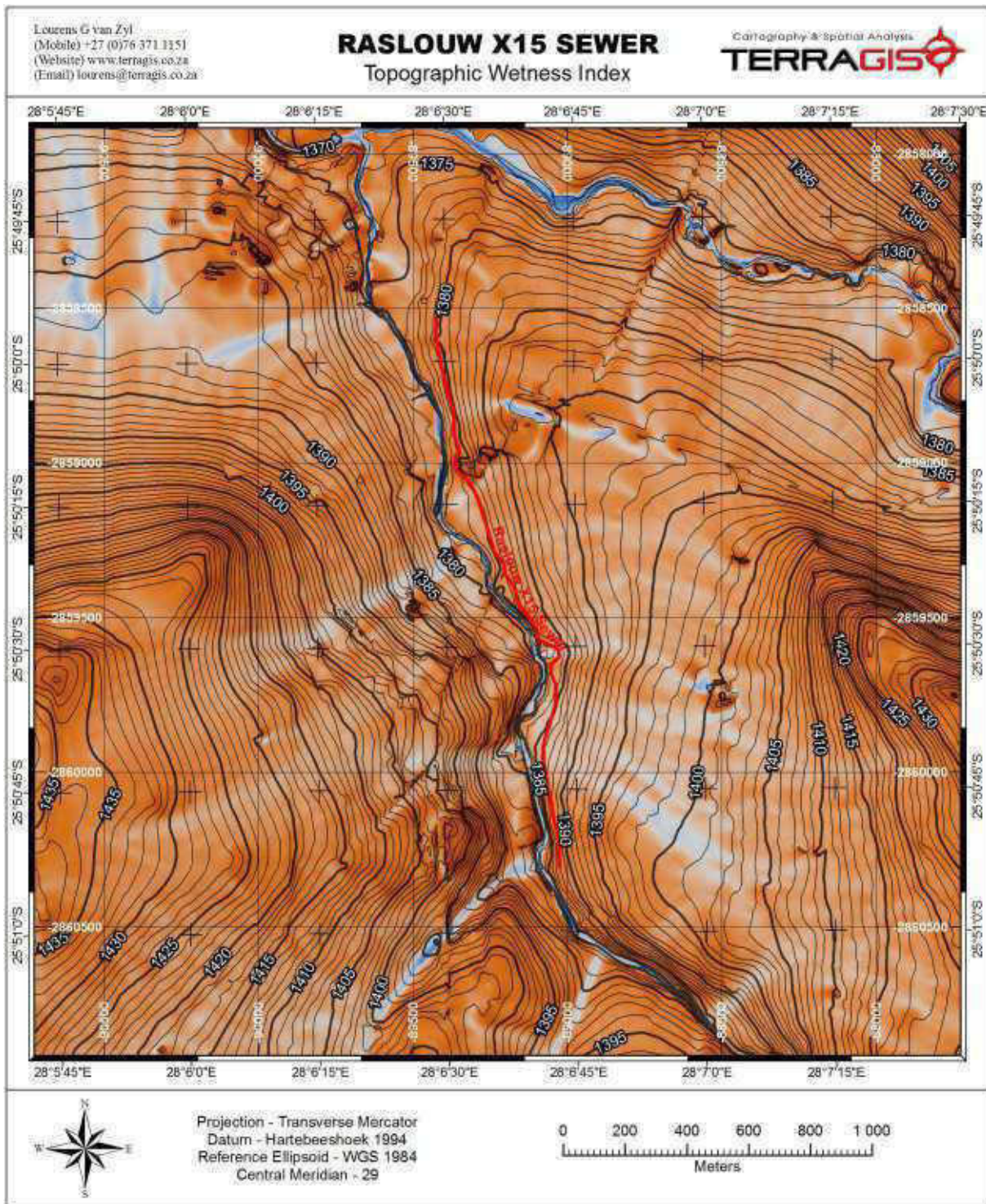


Figure 7 Topographic wetness index (TWI) for the survey site and surrounding area

3. WETLANDS: STATUTORY CONTEXT

3.1 WETLAND DEFINITION

Wetlands are defined, in terms of the National Water Act (Act no 36 of 1998) (NWA), as:

“Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

3.2 WATERCOURSE DEFINITION

“Catchment” is defined, in terms of the National Water Act (Act no 36 of 1998) (NWA), as:

“..., in relation to a watercourse or watercourses or part of a watercourse, means the area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points;”

“Watercourse” is defined, in terms of the National Water Act (Act no 36 of 1998) (NWA), as:

- “(a) a river or spring;
 - (b) a natural channel in which water flows regularly or intermittently;
 - (c) a wetland, lake or dam into which, or from which, water flows; and
 - (d) any collection of water which the Minister may, by notice in the *Gazette*, declare to be a water course,
- and a reference to a watercourse includes, where relevant, its bed and banks;”

3.3 THE WETLAND DELINEATION GUIDELINES

In 2005 the Department of Water Affairs and Forestry published a manual entitled “A practical field procedure for identification and delineation of wetland and riparian areas” (DWAFF, 2005). The “...manual describes field indicators and methods for determining whether an area is a wetland or riparian area, and for finding its boundaries.” The definition of a wetland in the guidelines is that of the NWA and it states that wetlands must have one or more of the following attributes:

- “**Wetland (hydromorphic) soils** that display characteristics resulting from prolonged saturation”
- “The presence, at least occasionally, of **water loving plants (hydrophytes)**”
- “A **high water table** that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.”

The guidelines further list four indicators to be used for the finding of the outer edge of a wetland. These are:

- Terrain Unit Indicator. The terrain unit indicator does not only identify valley bottom wetlands but also wetlands on steep and mild slopes in crest, midslope and footslope positions.
- Soil Form Indicator. A number of soil forms (as defined by MacVicar et al., 1991) are listed as indicative of permanent, seasonal and temporary wetland zones.
- Soil Wetness Indicator. Certain soil colours and mottles are indicated as colours of wet soils. The guidelines stipulate that this is the primary indicator for wetland soils. (Refer to the guidelines for a detailed description of the colour indicators.) In essence, the reduction and removal of Fe in the form of “bleaching” and the accumulation of Fe in the form of mottles are the two main criteria for the identification of soils that are periodically or permanently wet.
- Vegetation Indicator. This is a key component of the definition of a wetland in the NWA. It often happens though that vegetation is disturbed and the guidelines therefore place greater emphasis on the soil form and soil wetness indicators as these are more permanent whereas vegetation communities are dynamic and react rapidly to external factors such as climate and human activities.

The main emphasis of the guidelines is therefore the use soils (soil form and wetness) as the criteria for the delineation of wetlands. The applicability of these guidelines in the context of the survey site will be discussed in further detail later in the report.

Due to numerous problems with the delineation of wetlands there are a plethora of courses being presented to teach wetland practitioners and laymen the required techniques. Most of the courses and practitioners focus on ecological or vegetation characteristics of landscapes and soil characteristics are often interpreted incorrectly due to a lacking soil science background of these practitioners. As such this author regularly presents, in conjunction with a colleague (Prof. Cornie van Huysteen) from the University of the Free State, a course on the aspects related to soil classification and wetland delineation.

3.4 THE RESOURCE DIRECTED MEASURES FOR PROTECTION OF WATER RESOURCES.

The following are specific quotes from the “Resource Directed Measures for Protection of Water Resources. Volume 4: Wetland Ecosystems” as published by DWAF (1999).

From the Introduction:

“This set of documents on Resource Directed Measures (RDM) for protection of water resources, issued in September 1999 in Version 1.0, presents the procedures to be followed in undertaking **preliminary determinations of the class, Reserve and resource quality objectives for water resources**, as specified in sections 14 and 17 of the South African National Water Act (Act 36 of 1998).

The development of procedures to determine RDM was initiated by the Department of Water Affairs and Forestry in July 1997. Phase 3 of this project will end in March 2000. Additional refinement and development of the procedures, and development of the full water resource

classification system, will continue in Phase 4, until such time as the detailed procedures and full classification system are ready for publication in the Government Gazette.

It should be noted that until the final RDM procedures are published in the Gazette, and prescribed according to section 12 of the National Water Act, all determinations of RDM, whether at the rapid, the intermediate or the comprehensive level, will be considered to be preliminary determinations.”

From Appendix W1 (Ecoregional Typing for Wetland Ecosystems)

Artificial modifiers are explained namely:

“Many wetlands are man-made, while others have been modified from a natural state to some degree by the activities of humans. Since the nature of these alterations often greatly influences the character of such habitats, the inclusion of modifying terms to accommodate human influence is important. In addition, many human modifications, such as dam walls and drainage ditches, are visible in aerial photographs and can be easily mapped. The following Artificial Modifiers are defined and can be used singly or in combination wherever they apply to wetlands:

Farmed: the soil surface has been physically altered for crop production, but hydrophytes will become reestablished if farming is discontinued

Artificial: substrates placed by humans, using either natural materials such as dredge spoils or synthetic materials such as concrete. Jetties and breakwaters are examples of Non-vegetated Artificial habitats

Excavated: habitat lies within an excavated basin or channel

Diked/Impounded: created or modified by an artificial barrier which obstructs the inflow or outflow of water

Partially Drained: the water level has been artificially lowered, usually by means of ditches, but the area is still classified as wetland because soil moisture is sufficient to support hydrophytes.“

3.5 CHALLENGES REGARDING WETLAND DELINEATION IN DOLOMITE ENVIRONMENTS

Disclaimer: The following section represents sections of a discussion that I use as standard in describing the challenges regarding wetland delineation and management in various landscapes. This implies that the section is predominantly verbatim the same as in other reports provided to clients and the authorities. Copyright is strictly reserved.

In order to discuss the procedures followed and the results of the wetland identification exercise it is necessary at the outset to provide some theoretical background on soil forming processes, soil wetness indicators, water movement in soils and topographical sequences of soil forms (catena).

3.5.1 Pedogenesis

Pedogenesis is the process of soil formation. Soil formation is a function of five (5) factors namely (Jenny, 1941):

- Parent material;

- Climate;
- Topography;
- Living Organisms; and
- Time.

These factors interact to lead to a range of different soil forming processes that ultimately determine the specific soil formed in a specific location. Central to all soil forming processes is water and all the reactions (physical and chemical) associated with it. The physical processes include water movement onto, into, through and out of a soil unit. The movement can be vertically downwards, lateral or vertically upwards through capillary forces and evapotranspiration. The chemical processes are numerous and include dissolution, precipitation (of salts or other elements) and alteration through pH and reduction and oxidation (redox) changes. In many cases the reactions are promoted through the presence of organic material that is broken down through aerobic or anaerobic respiration by microorganisms. Both these processes alter the redox conditions of the soil and influence the oxidation state of elements such as Fe and Mn. Under reducing conditions Fe and Mn are reduced and become more mobile in the soil environment. Oxidizing conditions, in turn, lead to the precipitation of Fe and Mn and therefore lead to their immobilization. The dynamics of Fe and Mn in soil, their zones of depletion through mobilization and accumulation through precipitation, play an important role in the identification of the dominant water regime of a soil and could therefore be used to identify wetlands and wetland conditions.

3.5.2 Water Movement in the Soil Profile

In a specific soil profile, water can move upwards (through capillary movement), horizontally (owing to matric suction) and downwards under the influence of gravity.

The following needs to be highlighted in order to discuss water movement in soil:

- Capillary rise refers to the process where water rises from a deeper lying section of the soil profile to the soil surface or to a section closer to the soil surface. Soil pores can be regarded as miniature tubes. Water rises into these tubes owing to the adhesion (adsorption) of water molecules onto solid mineral surfaces and the surface tension of water.

The height of the rise is inversely proportional to the radius of the soil pore and the density of the liquid (water). It is also directly proportional to the liquid's surface tension and the degree of its adhesive attraction. In a soil-water system the following simplified equation can be used to calculate this rise:

$$\text{Height} = 0.15/\text{radius}$$

Usually the eventual height of rise is greater in fine textured soil, but the rate of flow may be slower (Brady and Weil, 1999; Hillel, 1983).

- Matric potential or suction refers to the attraction of water to solid surfaces. Matric potential is operational in unsaturated soil above the water table while pressure potential refers to

water in saturated soil or below the water table. Matric potential is always expressed as a negative value and pressure potential as a positive value.

Matric potential influences soil moisture retention and soil water movement. Differences in the matric potential of adjoining zones of a soil results in the movement of water from the moist zone (high state of energy) to the dry zone (low state of energy) or from large pores to small pores.

The maximum amount of water that a soil profile can hold before leaching occurs is called the field capacity of the soil. At a point of water saturation, a soil exhibits an energy state of 0 J.kg^{-1} . Field capacity usually falls within a range of -15 to -30 J.kg^{-1} with fine textured soils storing larger amounts of water (Brady and Weil, 1999; Hillel, 1983).

- Gravity acts on water in the soil profile in the same way as it acts on any other body; it attracts towards earth's centre. The gravitational potential of soil water can be expressed as:

$$\text{Gravitational potential} = \text{Gravity} \times \text{Height}$$

Following heavy rainfall, gravity plays an important part in the removal of excess water from the upper horizons of the soil profile and recharging groundwater sources below.

Excess water, or water subject to leaching, is the amount of water that falls between soil saturation (0 J.kg^{-1}) or oversaturation ($> 0 \text{ J.kg}^{-1}$), in the case of heavy rainfall resulting in a pressure potential, and field capacity (-15 to -30 J.kg^{-1}). This amount of water differs according to soil type, structure and texture (Brady and Weil, 1999; Hillel, 1983).

- Under some conditions, at least part of the soil profile may be saturated with water, resulting in so-called saturated flow of water. The lower portions of poorly drained soils are often saturated, as are well-drained soils above stratified (layers differing in soil texture) or impermeable layers after rainfall.

The quantity of water that flows through a saturated column of soil can be calculated using Darcy's law:

$$Q = K_{\text{sat}} \cdot A \cdot \Delta P / L$$

Where Q represents the quantity of water per unit time, K_{sat} is the saturated hydraulic conductivity, A is the cross sectional area of the column through which the water flows, ΔP is the hydrostatic pressure difference from the top to the bottom of the column, and L is the length of the column.

Saturated flow of water does not only occur downwards, but also horizontally and upwards. Horizontal and upward flows are not quite as rapid as downward flow. The latter is aided by gravity (Brady and Weil, 1999; Hillel, 1983).

- Mostly, water movement in soil is ascribed to the unsaturated flow of water. This is a much more complex scenario than water flow under saturated conditions. Under unsaturated conditions only the fine micropores are filled with water whereas the macropores are filled

with air. The water content, and the force with which water molecules are held by soil surfaces, can also vary considerably. The latter makes it difficult to assess the rate and direction of water flow. The driving force behind unsaturated water flow is matric potential. Water movement will be from a moist to a drier zone (Brady and Weil, 1999; Hillel, 1983).

The following processes influence the amount of water to be leached from a soil profile:

- Infiltration is the process by which water enters the soil pores and becomes soil water. The rate at which water can enter the soil is termed infiltration tempo and is calculated as follows:

$$I = Q/A.t$$

Where I represents infiltration tempo ($m.s^{-1}$), Q is the volume quantity of infiltrating water (m^3), A is the area of the soil surface exposed to infiltration (m^2), and t is time (s).

If the soil is quite dry when exposed to water, the macropores will be open to conduct water into the soil profile. Soils that exhibit a high 2:1 clay content (swelling-shrinking clays) will exhibit a high rate of infiltration initially. However, as infiltration proceeds, the macropores will become saturated and cracks, caused by dried out 2:1 clay, will swell and close, thus leading to a decline in infiltration (Brady and Weil, 1999; Hillel, 1983).

- Percolation is the process by which water moves downward in the soil profile. Saturated and unsaturated water flow is involved in the process of percolation, while the rate of percolation is determined by the hydraulic conductivity of the soil.

During a rain storm, especially the down pouring of heavy rain, water movement near the soil surface mainly occurs in the form of saturated flow in response to gravity. A sharp boundary, referred to as the wetting front, usually appears between the wet soil and the underlying dry soil. At the wetting front, water is moving into the underlying soil in response to both matric and gravitational potential. During light rain, water movement at the soil surface may be ascribed to unsaturated flow (Brady and Weil, 1999; Hillel, 1983).

The fact that water percolates through the soil profile by unsaturated flow has certain ramifications when an abrupt change in soil texture occurs (Brady and Weil, 1999; Hillel, 1983). A layer of coarse sand, underlying a fine textured soil, will impede downward movement of water. The macropores of the coarse textured sand offer less attraction to the water molecules than the macropores of the fine textured soil. When the unsaturated wetting front reaches the coarse sand, the matric potential is lower in the sand than in the overlying material. Water always moves from a higher to a lower state of energy. The water can, therefore, not move into the coarse textured sand. Eventually, the downward moving water will accumulate above the sand layer and nearly saturate the fine textured soil. Once this occurs, the water will be held so loosely that gravitational forces will be able to drag the water into the sand layer (Brady and Weil, 1999; Hillel, 1983).

A coarse layer of sand in an otherwise fine textured soil profile will also inhibit the rise of water by capillary movement (Brady and Weil, 1999; Hillel, 1983).

Field observations and laboratory based analysis can aid in assessing the soil-water relations of an area. The South African soil classification system (Soil Classification Working Group, 1991.) comments on certain field observable characteristics that shed light on water movement in soil. The more important of these are:

- Soil horizons that show clear signs of leaching such as the E-horizon – an horizon where predominantly lateral water movement has led to the mobilisation and transport of sesquioxide minerals and the removal of clay material;
- Soil horizons that show clear signs of a fluctuating water table where Fe and Mn mottles, amongst other characteristics, indicate alternating conditions of reduction and oxidation (soft plinthic B-horizon);
- Soil horizons where grey colouration (Fe reduction and redox depletion), in an otherwise yellowish or reddish matrix, indicate saturated (or close to saturated) water flow for at least three months of the year (Unconsolidated/Unspecified material with signs of wetness);
- Soil horizons that are uniform in colouration and indicative of well-drained and aerated (oxidising) conditions (e.g. yellow brown apedal B-horizon).

3.5.3 Water Movement in the Landscape

Water movement in a landscape is a combination of the different flow paths in the soils and geological materials. The movement of water in these materials is dominantly subject to gravity and as such it will follow the path of least resistance towards the lowest point. In the landscape there are a number of factors determining the paths along which this water moves. **Figure 8** provides a simplified schematic representation of an idealised landscape (in “profile curvature”). The total precipitation (rainfall) on the landscape from the crest to the lowest part or valley bottom is taken as 100 %. Most geohydrologists agree that total recharge, the water that seeps into the underlying geological strata, is less than 4 % of total precipitation for most geological settings. Surface runoff varies considerably according to rainfall intensity and distribution, plant cover and soil characteristics but is taken as a realistic 6 % of total precipitation for our idealised landscape. The total for surface runoff and recharge is therefore calculated as 10 % of total precipitation. If evapotranspiration (from plants as well as the soil surface) is taken as a very high 30 % of total precipitation it leaves 60 % of the total that has to move through the soil and/or geological strata from higher lying to lower lying areas. In the event of an average rainfall of 750 mm per year it results in 450 mm per year having to move laterally through the soil and geological strata. In a landscape there is an accumulation of water down the slope as water from higher lying areas flow to lower lying areas.

To illustrate: If the assumption is made that the area of interest is 100 m wide it follows that the first 100 m from the crest downwards has 4 500 m³ (or 4 500 000 litres) of water moving laterally through the soil (100 m X 100 m X 0.45 m) per rain season. The next section of 100 m down the slope has its own 4 500 m³ of water as well as the added 4 500 m³ from the upslope section to contend with, therefore 9 000 m³. The next section has 13 500 m³ to contend with and the following one 18 000 m³. It is therefore clear that, the longer the slope, the larger the volume of water that will move laterally through the soil profile.

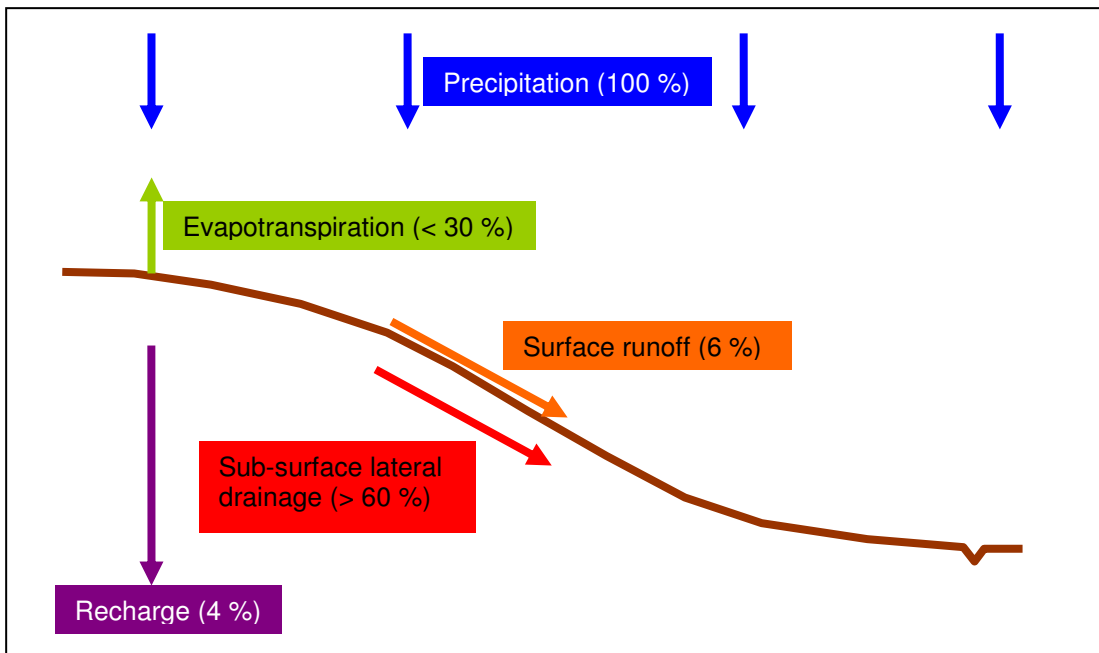


Figure 8 Idealised landscape with assumed quantities of water moving through the landscape expressed as a percentage of total precipitation (100 %).

Flow paths through soil and geological strata, referred to as “interflow” or “hillslope water”, are very varied and often complex due to difficulty in measurement and identification. The difficulty in identification stems more from the challenges related to the physical determination of these in soil profile pits, soil auger samples and core drilling samples for geological strata. The identification of the morphological signs of water movement in permeable materials or along planes of weakness (cracks and seams) is a well-established science and the expression is mostly referred to as “redox morphology”. In terms of the flow paths of water large variation exists but these can be grouped into a few simple categories. **Figure 9** provides a schematic representation of the different flow regimes that are usually encountered. The main types of water flow can be grouped as 1) recharge (vertically downwards) of groundwater; 2) lateral flow of water through the landscape along the hillslope (interflow or hillslope water); 3) return flow water that intercepts the soil/landscape surface; and 4) surface runoff. Significant variation exists with these flow paths and numerous combinations are often found. The main wetland types associated with the flow paths are: a) valley bottom wetlands (fed by groundwater, hillslope processes, surface runoff, and/or in-stream water); b) hillslope seepage wetlands (fed by interflow water and/or return flow water); and wetlands associated with surface runoff, ponding and surface ingress of water anywhere in the landscape.

Amongst other factors, the thickness of the soil profile at a specific point will influence the intensity of the physical and chemical reactions taking place in that soil. **Figure 10** illustrates the difference between a dominantly thick and a dominantly thin soil profile. If all factors are kept the same except for the soil profile thickness it can be assumed with confidence that the chemical and physical reactions associated with water in the landscape will be much more intense for the thin soil profile than for the thick soil profile. Stated differently: The volume of water moving through the soil per surface area of an imaginary plane perpendicular to the direction of water flow is much higher for the thin soil profile than for the thick soil profile. This aspect has a significant influence on the

expression of redox morphology in different landscapes of varying soil/geology/climate composition.

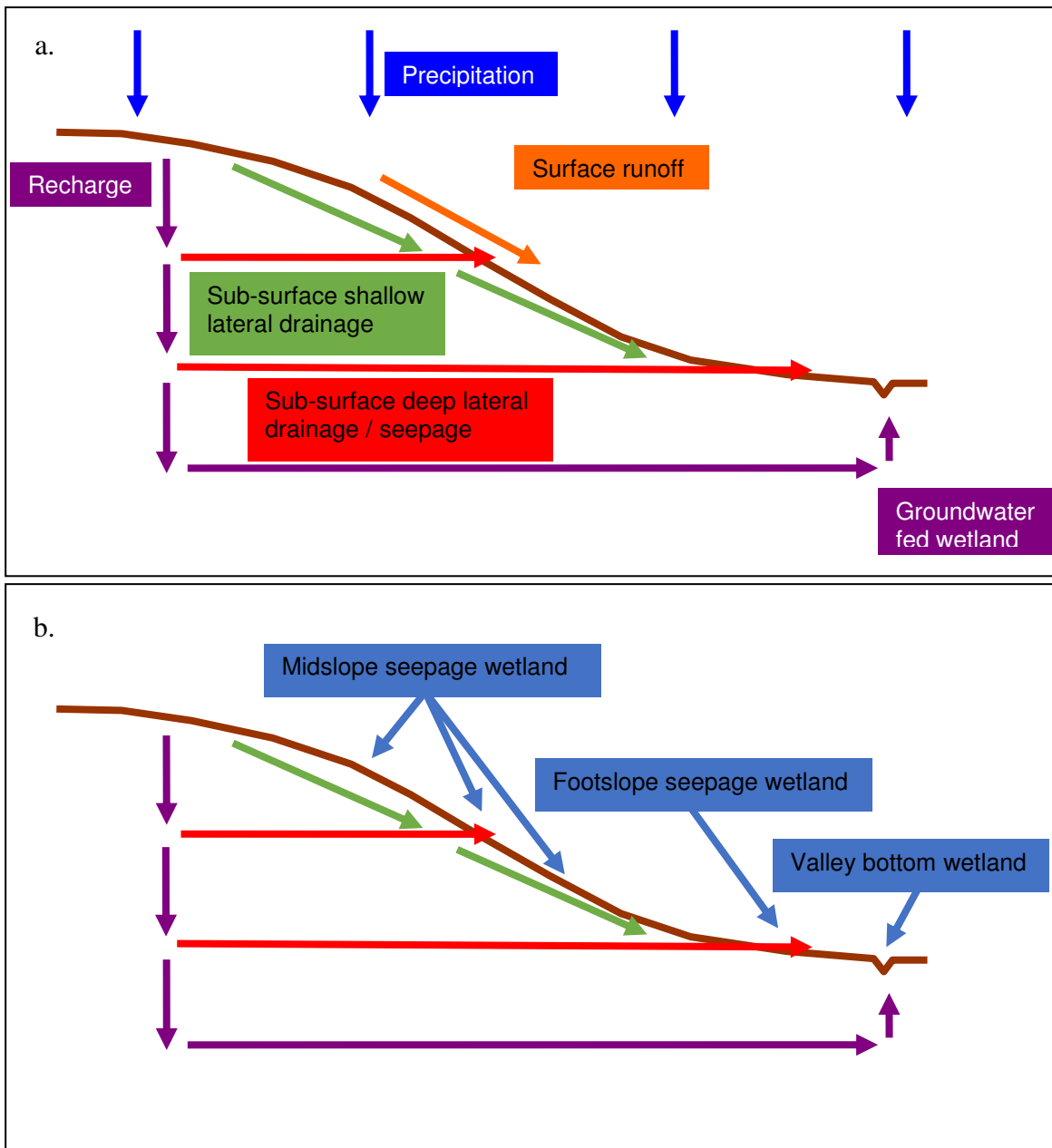


Figure 9 Different flow paths of water through a landscape (a) and typical wetland types associated with the water regime (b)

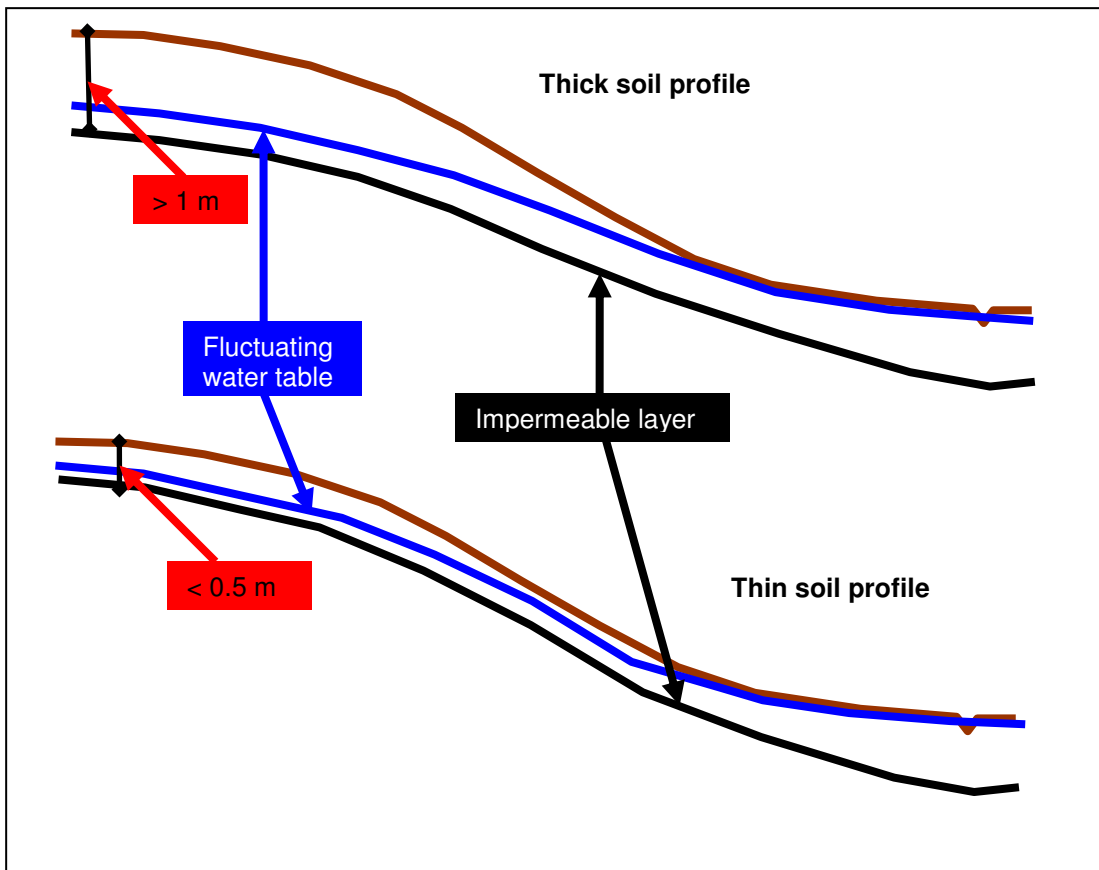


Figure 10 The difference in water flow between a dominantly thick and dominantly thin soil profile.

3.5.4 The Catena Concept

Here it is important to take note of the “catena” concept. This concept is one of a topographic sequence of soils in a homogenous geological setting where the water movement and presence in the soils determine the specific characteristics of the soils from the top to the bottom of the topography. **Figure 11** illustrates an idealised topographical sequence of soils in a catena for a quartz rich parent material. Soils at the top of the topographical sequence are typically red in colour (Hutton and Bainsvlei soil forms) and systematically grade to yellow further down the slope (Avalon soil form). As the volume of water that moves through the soil increases, typically in midslope areas, periodic saturated conditions are experienced and consequently Fe is reduced and removed in the laterally flowing water. In the event that the soils in the midslope positions are relatively sandy the resultant soil colour will be bleached or white due to the colour dominance of the sand quartz particles. The soils in these positions are typically of the Longlands and Kroonstad forms. Further down the slope there is an accumulation of clays and leaching products from higher lying soils and this leads to typical illuvial and clay rich horizons. Due to the regular presence of water the dominant conditions are anaerobic and reducing and the soils exhibit grey colours often with bright yellow and grey mottles (Katspruit soil form). In the event that there is a large depositional environment with prolonged saturation soils of the Champagne form may develop (typical peat land). Variations on this sequence (as is often found on the Mpumalanga Highveld) may include the presence of hard plinthic materials instead of soft plinthite with a consequent increase in the occurrence of bleached soil profiles. Extreme examples of such landscapes are discussed below.

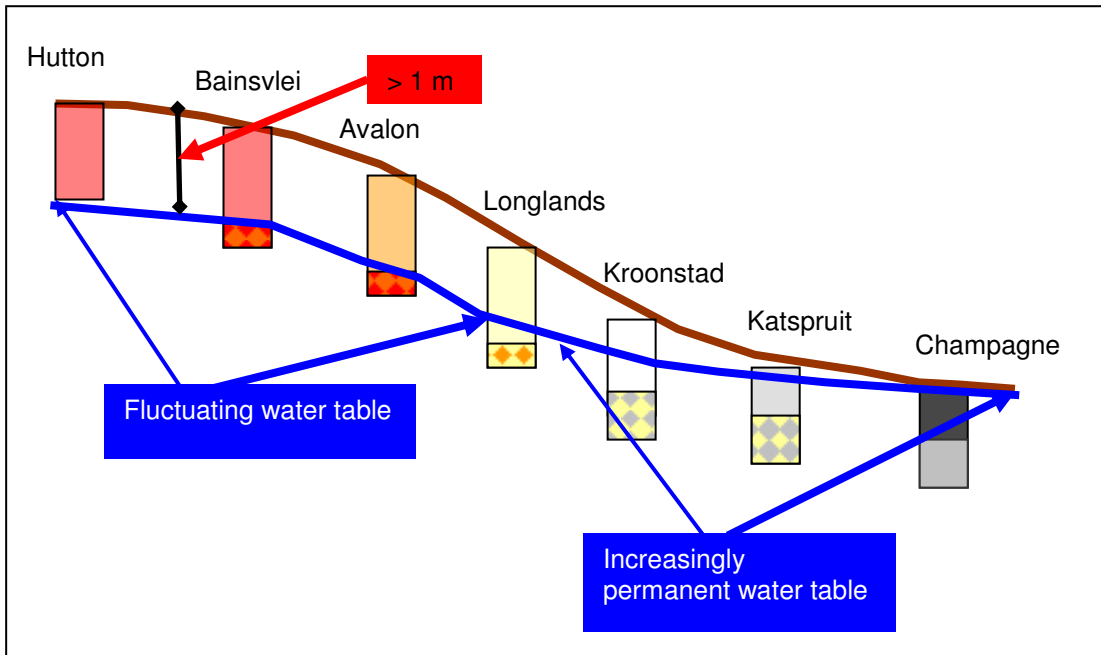


Figure 11 Idealised catena on a quartz rich parent material.

3.5.5 The Ab Land Types of Gauteng

The typical catena that forms in the **Ab** land types of Gauteng differ significantly from the idealised one discussed above. The main and obvious difference is the fact that all the soils the catena, except for those in the immediate drainage features, are red and structureless with varying degrees of rock (dolomite and/or chert) and pebble (predominantly quartz) occurrence (**Figure 12**). In the drainage features the soils are often reddish brown in colour with almost no visible signs of hydromorphism (morphological signs of wetness) with stratified alluvium in the channel itself.

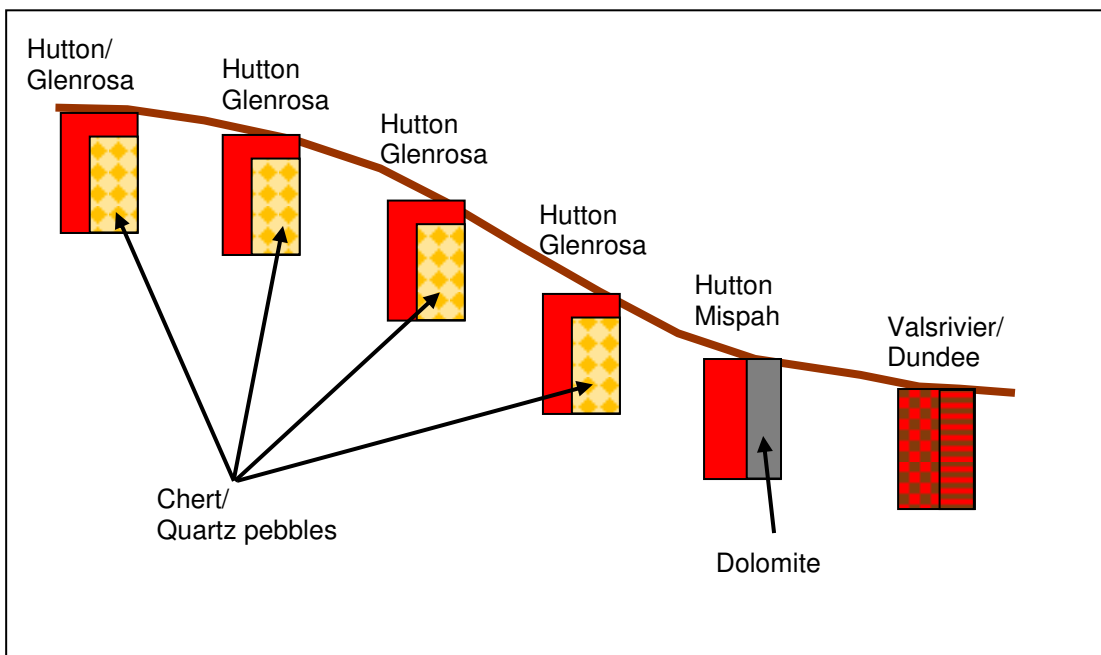


Figure 12 Conceptual catena in Ab land types of Gauteng

The lack of any significant expression of hydromorphism is ascribed to a combination of two factors namely: 1) the well-drained nature of the soil/rock profile and 2) the high Mn content of dolomite derived soils. The first factor leads to the near absence of any significant perched water tables as the dolomite rock and broken chert leads to the rapid percolation of water to deeper levels where hydromorphic features are limited to the occurrence of large quantities of Mn concretions and hard plinthic layers (manganocrete). The second factor relates to the redox poise (buffering) potential of the large quantities of Mn mineral particles in the soils. From unpublished data it is clear that Mn levels in dolomite derived soils can exceed 10 000 (mg/kg soil = ppm) occurring mainly in the form of a number of oxidised Mn minerals. These minerals can undergo solid state reduction as well as oxidation with the valency of Mn varying significantly during periods of water logging and drying. The solid state redox reactions are significant in that the oxidised Mn can oxidise reduce Mn in the same mineral particle. The implication is that Mn is not very soluble in these soils during periods of wetting and reduction, therefore not being leached out of the soils. The high Mn levels and solid state reduction and oxidation of the minerals also lead to the buffering of the redox (under conditions of reduction) to such a point that Fe reduction does not occur. Iron reduction is a prerequisite for the formation of redox morphology that is used in wetland delineation.

3.5.6 Implications for Wetland Delineation and Application of the Guidelines

The dominance of red soils in this landscape as well as the absence of signs of hydromorphism in the bulk of the soils leads to the identification of very small slivers of wetland along drainage features only. These are often associated with the riparian zone that is restricted to the channel and river banks only. Technically the areas outside of the drainage features do not qualify as wetlands. The challenge lies in the fact that some areas in depressions or on stream banks have vegetation communities that may indicate more prolonged periods of high water content. This aspect is the main contributor to problematic wetland delineation aspects of dolomite dominated landscapes.

At present there is no clear answer or approach to the solving of this challenge. Dedicated research is currently underway at the Department of Plant Production and Soil Science of the University of Pretoria (UP) to elucidate the contribution of Mn minerals in these soils to redox buffering. Reference to international norms will also not provide clarity as it is clear that in the USA only signs of Fe redox morphology are accepted for wetland delineation. This aspect poses a clear challenge for the specific South African conditions and should be elucidated in much more detail during urgent and relevant research.

4. SITE SURVEY RESULTS AND DISCUSSION

Access to the Rietspruit was severely constrained due to the extensive fence network that exists on the survey transect. The proposed sewer line runs mainly along contours about 5 m or more above the water level of the Rietspruit and between 15 and 130 m away from the channel (**Figure 3**). The transition from the terrestrial area outside of the drainage line into the drainage line is characterised by a steep slope, in most areas, as well as significant human impacts in the form of developments (residential, light commercial), roads and fences (**Figures 13 to 20**). The banks of the Rietspruit have been altered in many places due to different construction and earth moving activities. These activities are also evident on the Google Earth imagery (**Figures 21 to 25**).



Figure 13 Fence and gabion structures on the banks of the Rietspruit at the R55 river crossing (eastern side)



Figure 14 Proximity of the fence and soil/land disturbances close to the banks of the Rietspruit at the R55 river crossing (eastern side). Note the rubble on the opposing bank.



Figure 15 Proximity of developments on the western side of the Rietspruit at the R55 river crossing as well as old tar road in foreground on the banks of the river (with large quantities of exotic riparian vegetation)



Figure 16 Human impacts (old storm water structures?) and erosion/sedimentation on the eastern banks of the Rietspruit at the end of Poole Avenue



Figure 17 Human impacts (pipeline manhole) and sedimentation on the eastern banks of the Rietspruit at the end of Poole Avenue



Figure 18 Significant sedimentation (of granitic origin from upstream of the survey site) within the drainage channel the Rietspruit near the end of Poole Avenue



Figure 19 Significant sedimentation (of granitic origin from upstream of the survey site) within the drainage channel the Rietspruit as well as stream bank alteration near the end of Poole Avenue



Figure 20 Significant sedimentation (of granitic origin from upstream of the survey site) within the drainage channel of the Rietspruit near the end of Poole Avenue



Figure 21 Sedimentation (yellow arrow) at the end of Poole avenue as well as encroachment of infrastructure on the Rietspruit (red arrows) (sewer line transect indicated in blue)



Figure 22 Sedimentation (yellow arrow) near the end of Deltoidia street as well as encroachment of human activities on the Rietspruit (red arrow) (sewer line transect indicated in blue)



Figure 23 Encroachment of infrastructure and cut and fill activities on the Rietspruit (red arrows) (sewer line transect indicated in blue)



Figure 24 Encroachment of infrastructure on the Rietspruit (red arrow) as well as historical rubble dumping (yellow arrows) with sewer line transect indicated in blue

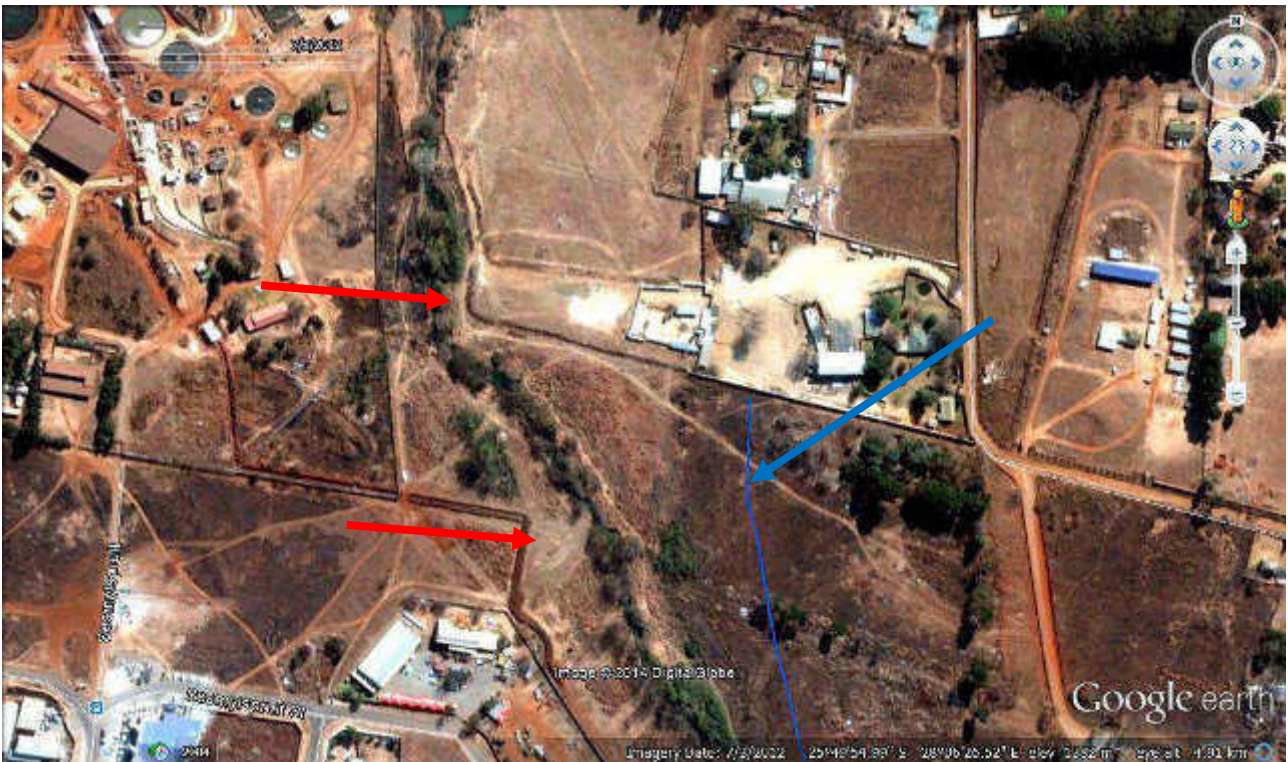


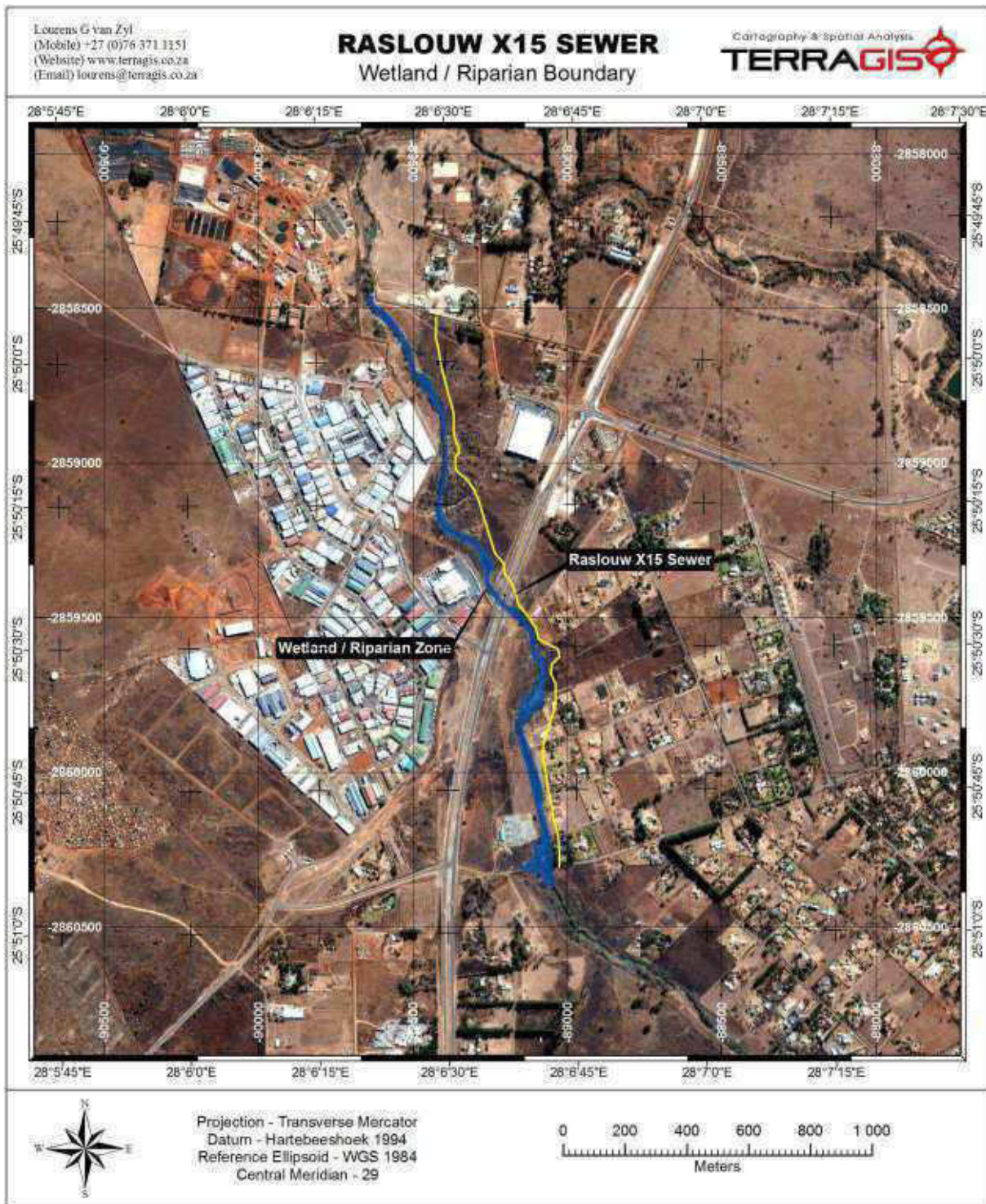
Figure 25 Encroachment of human structures on the Rietspruit (red arrows) with sewer line transect indicated in blue

The soils of the site are exclusively rocky Hutton (orthic A horizon / red apedal B horizon / unspecified material – usually hard or weathering rock) forms up to the immediate drainage channel. In depressions along the drainage channel of the Rietspruit as well as on the immediate banks structured soils of the Valsrivier (orthic A horizon / pedocutanic B horizon / unconsolidated material without signs of wetness) occur with the channel consisting of the soils of the Dundee (orthic A horizon / stratified alluvium) form. The materials that have been deposited in the drainage channel are predominantly of granitic origin (mainly coarse grained quartz particles with occasional primary minerals derive from granite). From an inspection of the material it appears that it has been transported in the stream 4 km and further south from the Halfway House Granite Dome (HHGD) area in Midrand. This aspect points to significant erosion and sediment generation on the HHGD.

5. PROPOSED DELINEATION

The proposed delineation of the wetland features associated with the Rietspruit drainage feature is presented in **Figure 26**. No other wetland features could be identified on the banks or along the sewer line transect – neither in terms of vegetation nor soil characteristics. The delineation result is based mainly on the riparian characteristics of the Rietspruit's associated vegetation. As indicated earlier the vegetation component consists of numerous exotic species (local and foreign) that have colonised the banks of the spruit. This phenomenon is due mainly due to the highly altered nature of the channel banks, edges and deposition zones.

A buffer is not included as the drainage feature has been impacted severely by human activities. The sewer line transect is outside of the delineated wetland/riparian zone for its entire length.



6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are drawn from the investigation:

1. The channel, banks and edges of the Rietspruit have been impacted severely by historical human impacts (artificial modifiers as listed in the RDM).

2. The soils on the edge of the drainage feature do not exhibit any signs of hydromorphism – mainly due to hydrological characteristics as well as the redox poisoning capacity of Mn minerals present in the soil.
3. The sewer line transect runs outside of the wetland/riparian zone for its entire length.
4. A wetland buffer is not proposed and included mainly due to the fact that there is no water ingress from the surrounding landscape into the Rietspruit other than through surface runoff and several man-made structures.
5. It is concluded that the construction of the sewer line, if conducted according to sound site management practices will not influence the status or nature of the Rietspruit in its current state.

The following recommendations are made:

1. Erosion control measures should be implemented during the construction of the sewer line in order to avoid additional sediment generation.
2. The construction footprint should be limited to the immediate zone of impact.
3. Soil restoration should be conducted in the form of re-vegetation of the impact footprint in order to minimise erosion and sediment generation post development.

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ECOLOGICAL RED LISTED SPECIES ASSESSMENT



Dear Bokamoso Clients and to whom it may concern;

In regard to the issue of the realignment for the Raslouw x 15 pipeline, please take note of the following:

- When specialist studies are conducted, the surrounding area is used as a context for the proposed development, allowing for data retention. This, to some degree, allows for changes in scopes of work and design changes.
- The changes were provided to Enviro-Insight (the specialist) via a PDF issued by Bokamoso (the consultant) and should be provided on request.
- It is the opinion of the specialist that the alignment changes will still be relevant to the fieldwork carried out by the client and subsequently validated in the report.
- It is the further opinion of the specialist that the alignment changes are relatively minor and in some areas, show an improvement in regards to ecological impacts (due to further proximity from the drainage line).
- Finally, the specialist can state, **only** given the evidence presented by Bokamoso, that further studies will not be required.

Please don't hesitate to call me for any queries.

Kind Regards

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Marine and Terrestrial Ecologist

Enviro-Insight

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Ecological Red Listed Species Assessment

Rasslouw 15 Sewer Pipeline

by

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¹ Intersect of drainage line within the study area

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1 INTRODUCTION

Enviro-Insight CC was commissioned by Bokamoso to perform a Red Data species biological assessment of the proposed Rasslow 15 Sewage line. The proposed development is that of sewage pipeline infrastructure and should be compared against the GDARD (2012) Minimum Requirements for Biodiversity Assessments, which drives much of the approach for this study. Figure 1 illustrates the alignment of the proposed pipeline which is situated in Gauteng province on the Carletonville Dolomite Grassland (Mucina and Rutherford 2006). The recommendations arising from this study are to be used by the client (Bokamoso) in order to facilitate the development process in accordance with the relevant legislation.

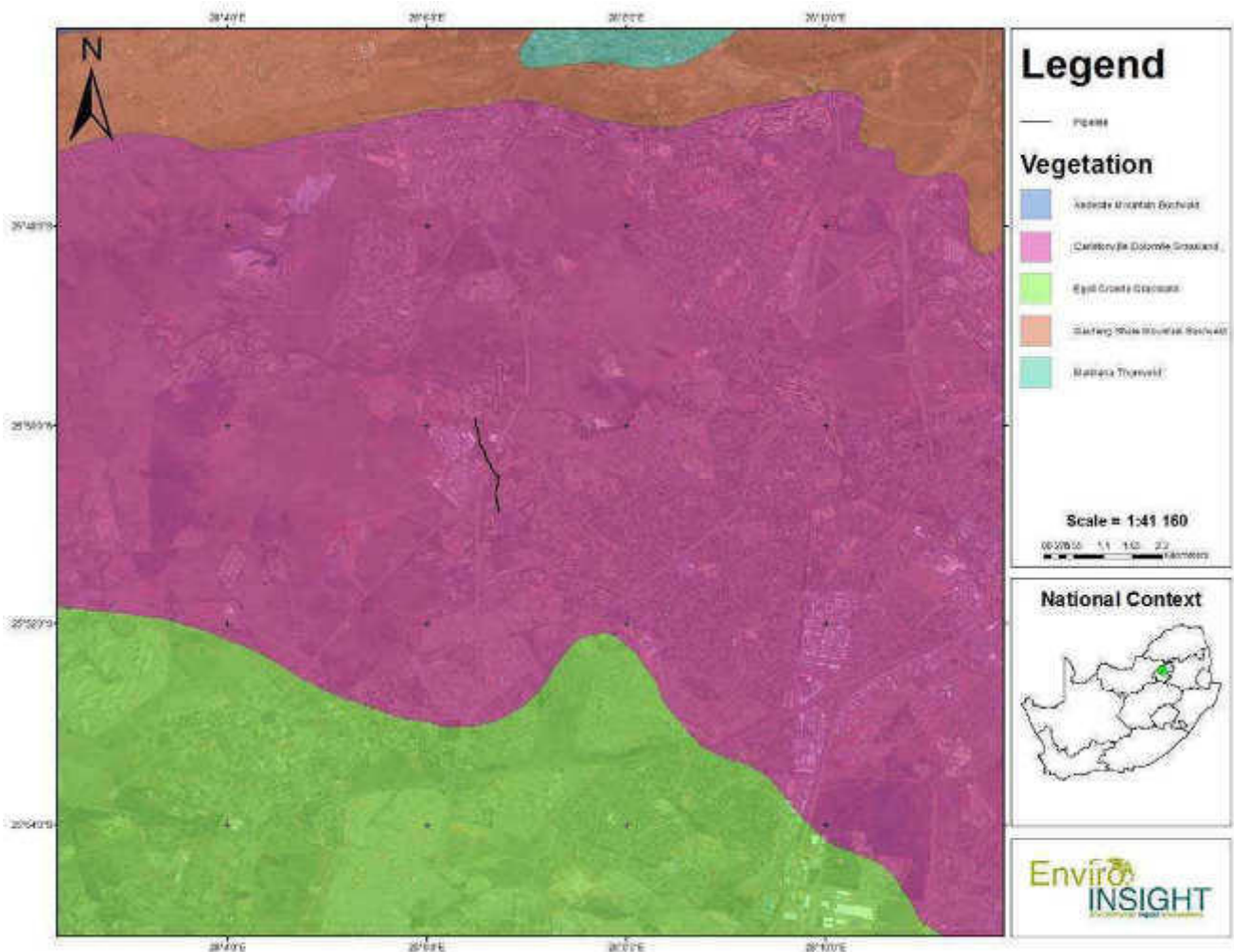


Figure 1: The proposed sewage pipeline in relation to the regional vegetation types

2 METHODS

2.1 FIELD SURVEY

A field survey was performed in April 2014 by a specialist ecologist where the faunal and botanical aspects of the study were assessed. During the field survey the proposed development site was covered on foot and by vehicle in order to obtain an understanding of the ecology. Numerous georeferenced photographs were taken and vegetation documentation was performed where the dominant plant species were recorded. The field survey focused upon the potential presence of Red Data species, especially species identified by GDARD (2012) which serve as sensitivity triggers.

2.2 DESKTOP SURVEY

2.2.1 Literature study

As mentioned above, much of the approach for this survey is based upon the GDARD (2012) Requirements for Biodiversity Assessments. The level of this study did not warrant intensive sampling but rather served to combine the aspects of the vegetation unit (Carletonville Dolomite Grassland; Mucina and Rutherford 2006) with the Gauteng C-plan (V3.3) analysis and GDARD minimum requirements in order to formulate a series of study recommendations. Many of the potential avifaunal triggers were referenced by the Southern Africa Bird Atlas Project (SABAP 2) and Hockey *et al.* (2005). Mammal information was referenced by Skinner and Chimimba (2005).

2.2.2 GIS

The Gauteng Conservation plan (C-plan V3.3) was used to initially evaluate ecologically sensitive areas. In addition, the vegetation of South Africa shapefiles (Mucina and Rutherford 2006) provided spatial information of the regional vegetation types. Due to the proximity of tall building infrastructure the shuttle radar topography mission (SRTM) digital elevation model (DEM) could not be used to perform a basic water channel network and wetness index model. Rather, remote sensing imagery (courtesy Bing Maps via ArcGIS online) was used to accurately map the drainage channel adjacent to the proposed pipeline.

3 RESULTS

Figure 2 shows the specialist coverage of the study area as well as the Gauteng C-Plan (V3.3) delineation of conservation areas. From this figure it is clear that portions of the proposed sewage intersect with both "Ecological Support" and "Important areas" of the Gauteng C-Plan (V3.3). Wetland / drainage line habitats are a critical component of the Gauteng minimum requirements assessment and vital to the assessment of the presence of Red Data faunal and floral species. It is clear from Figure 3 that the proposed pipeline alignment intersects the 30 m buffer of the drainage line in several places. The georeferenced photographs shown in Figure 2 are presented as thumbnail images in Appendix 1 to provide a photographic

overview of the study area.

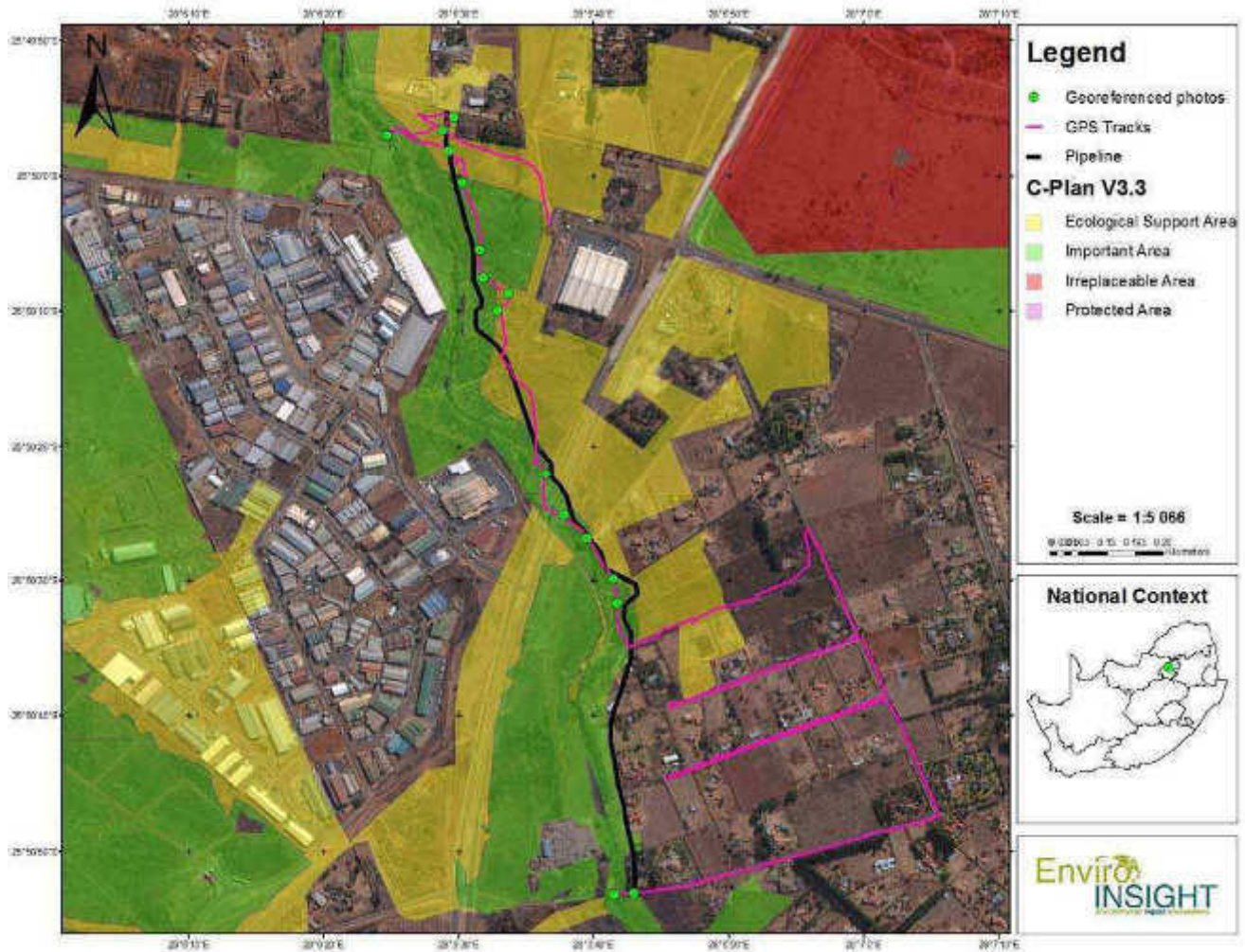


Figure 2: Proposed Rasslouw 15 sewage line in relation to the Gauteng C-plan (V3.3). Specialist coverage and geo-referenced photographs are also indicated

Additional forms of land use and impacts on the study area include existing roads, garden areas, security walls, security fencing, housing infrastructure and rock/ rubble dumping. These and additional impacts, such as from exotic plant species and existing infrastructure were also observed, some of which are shown in Table 1. Analysis of habitat types were discussed in contextual setting in regards to the potential or actual presence of Red Data species.

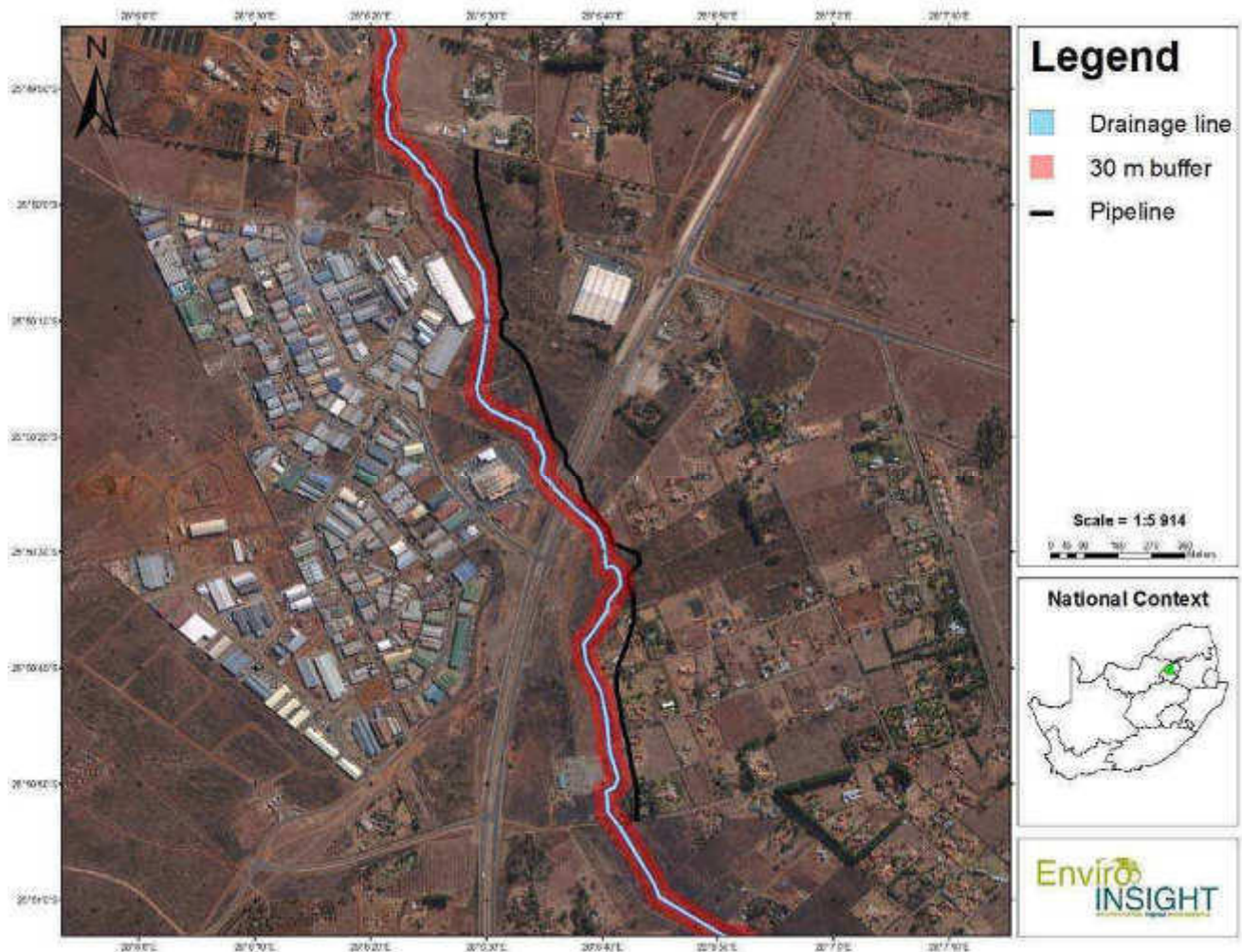


Figure 3: Proposed Rassouw 15 sewage line showing the relation to the drainage line and its 30 m buffer

Table 1: Examples of current impacts observed in the study area during the survey

		
Security Fencing and Alien Plants	Current Housing	Rock Dumping
		
Future Development	Invasive River Associated Species	Historical Agriculture

3.1 HABITAT UNIT 1- TRANSFORMED

Much of the proposed pipeline is aligned with areas of almost total transformation. Urban development is evident periodically along the alignment (Figure 3), characterised by existing housing, rock dumps, boundary fences with high security walls (effectively blocking all terrestrial animal migration) and roads. In this habitat type, no Red Data species are present and none are expected due to severe habitat modification.

3.2 HABITAT UNIT 2 – WETLAND/ DRAINAGE LINE

This habitat is identified by the actual drainage line and the 30 m buffer surrounding it (Figure 3). Ground truthing showed that this habitat is already largely disturbed through current impacts and show low potential for Red Data species. Some of the drainage areas can be classified as being functional to semi-functional, depending on the condition of the riparian vegetation and water flow maintenance. Due to the high moisture regime present in this habitat unit *Phragmites australis* and *Populus canescens* formed significant stands as well as the trees *Searsia lancea*, *Searsia pyroides* and *Celtis africana*. Alien species such as *Eucalyptus sp.* are prevalent and contribute significantly to the disturbance. Red Data species were not recorded

during the survey and due to the high level of disturbance, none are expected.

3.3 HABITAT UNIT 2 – SEMI-NATURAL TERRESTRIAL VEGETATED AREAS

This habitat unit is characterized by the presence of wet-land E horizon soils with relative high clay content, indicating prolonged periods of moisture retention. Almost no trees are present in this habitat unit as they tend to be associated with the drainage line. However, a few tree species such as *Searsia lancea*, *Searsia pyroides*, *Celtis africana* and the alien invader shrubs *Melia azedarach*, and *Lantana camara* are present.

A typical, yet slightly low in species diversity, composition of grasses representing sour veld was present in this habitat. Grass species recorded were *Cymbopogon excavatus*, *Cynodon dactylon*, *Brachiaria serrata*, *Hyparrhenia hirta*, *Diheteropogon amplexans*, *Digitaria eriantha*, *Eragrostis racemosa*, *Eragrostis gummiflua*, *Eragrostis curvula*, *Hyparrhenia hirta*, *Melinis repens*, *Setaria sphacelata*, *Schizachyrium sanguineum*, *Trichoneura grandiglumis* and *Themeda triandra*.

Tagetes minuta and *Zinnia peruviana* are forbs observed along the pipeline alignment that indicate environmental degradation. Other forbs encountered were *Fadogia homblei*, *Aloe greatheadii* var. *davyana*, *Hibiscus trionum*, *Lotononis* spp., *Helichrysum kraussi*, *Scadoxus puniceus*, *Commelina africana*, *Verbena bonariensis* (indicating high moisture regime present on the margins), *Nidorella hottentotta*, *Crabbea hirsuta*, *Chamaecrista mimosoides*, *Hypoxis rigidula* and *Sebaea grandis*.

4 DISCUSSION AND RECOMMENDATIONS

This section is driven by both the GDARD minimum requirements and the level of the study commissioned by the client (Basic Assessment). The section is also broken down into the various components of Fauna, Flora and Habitats.

4.1 FAUNA

According to GDARD's requirements for biodiversity assessments (GDARD 2012), no amphibian or reptile species assessments are required for the sensitivity analysis. However, when discussing the impacts on wetlands in the Province, an assessment of both reptiles and amphibians may be required (if deemed necessary). The recommendations regarding the habitats are addressed below.

Regarding species of conservation concern, three main trigger species were identified showing a relatively high probability of occurrence (based on habitat potential) along the proposed pipeline alignment. Habitat potential was very low for the possible avifauna trigger species African grass owl and African marsh harrier and their likelihood of occurrence in the area is therefore considered negligible. These two species are therefore omitted from the discussion below.

Giant Bull Frog *Pyxicephalus adspersus*

This Vulnerable (Du Preez & Carruthers 2009) frog is known to occur immediately adjacent to the study site (Yetman pers. comms) and is reported by Minter *et al.* (2004) to occur on the QDS 2528CC on which the proposed pipeline alignment resides. Although evaluation of the presence of this species is not a GDARD minimum requirement, the presence of wetland and potential foraging habitat on the site warrants mentioning in the study.

Water Rat *Dasymys incommisus*

The pipeline intersects a portion of drainage/wetland system (Figure 3). However, the habitat observed is considered to be sub-optimal habitat for water rat (due to the high levels of disturbance). The riparian vegetation edge is severely degraded and the species is not expected to show significant levels of colonisation within the area of influence of the pipeline.

Spotted-neck otter *Lutra maculicollis*

It was apparent that some potentially suitable migratory/dispersal habitat persists on site, especially in the form of the drainage line that is periodically intersected by the proposed pipeline. The drainage areas, in parts where characterised by flowing “river like” conditions. Although mostly sub-optimal for spotted-neck otters which prefer deep, clear pools which support large populations of fish, the drainage line could very well provide significant migratory habitat for the species and these areas should be buffered appropriately in accordance with legislation.

4.2 FLORA

Based on the vegetation analysis and the observations made during the survey it is evident that the area currently has moderate to very poor ecological functionality. Although no Red Data plant species were observed within the study area, the adjacent grassland and wetland habitats are marginally suited to orchids of the *Habenaria* genus. However, the high levels of degradation decrease the likelihood of Red Data orchids occurring within the influence of the proposed pipeline.

4.3 HABITAT AND GENERAL SUMMARY

For the study area as a whole, the proposed Rasslow 15 pipeline alignment is unlikely to affect any Red Data floral species as none were observed and none are expected since the environment is severely degraded. From a faunal perspective, the degradation of the habitat has limited the potential for Red Data species to occur on a permanent basis and at best, the drainage line could be viewed as a potential migratory corridor for faunal species. This fact alone warrants buffering of the drainage line from development which is also in accordance with the relevant legislation. The existing impacts are represented by historic land-use (farmstead and buildings/camp for intensive livestock), very large areas of rubble discard (Northern section) and further factory related dumpings of dolomitic rock. This disturbance has also given rise to broad-scale and severe infestation by alien plant species. The drainage line/river in the Northern section is also severely degraded by litter, plastic,

tyres and glass, alluding to periodic human colonisation (informal) and waste dumping. Finally, the proposed pipeline alignment can be seen to intersect with several houses of an existing housing development (Figure 3). Re-aligning the pipeline out of the housing area will bring it closer to the drainage line and well within the drainage buffer where large-scale excavation can potentially cause siltation and additional pollution of the drainage line.

Since **wetlands** are present within the buffer of the drainage line trigger, the following recommendations are suggested:














- The large areas of important and ecological support areas as determined by the C-Plan V3.3 are to be identified as potential legislation barriers and submitted for evaluation (by the client), taking into account the high levels of degradation observed during the ground-truthing phase.
- Wetland areas are to be avoided through alteration of design, potentially using bridging of the pipeline to avoid excavation of wetland areas and/or downstream effects such as siltation.
- Due to the levels of current disturbance and the lack of habitat potential, detailed assessments need not be carried out for the Red Data trigger mammal species namely, spotted-neck otter and water rat.

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6 APPENDIX

Appendix 1: Georeferenced photographs taken during the fieldwork survey (shown in Figure 2)

			
0130	0132	0133	0134
			
0135	0136	0138	0140
			
0141	0142	0143	0146
			
0148			

Heritage Impact Assessment



PHASE 1 HERITAGE IMPACT ASSESSMENT FOR THE INSTALLATION OF THE PROPOSED EXTERNAL SEWER PIPELINE, RASLOUW X15, GAUTENG PROVINCE

	
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April 2014

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Leonie Marais-Botes Heritage Practitioner/Archaetnos Archaeologists and
Heritage Consultants.

The information contained in this report is the sole intellectual property of Leonie
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commissioned for by the client.

DISCLAIMER:

Although all possible care is taken to identify/find all sites of cultural importance
during the initial survey of the study area, the nature of archaeological and
historical sites are as such that it is always possible that hidden or sub-surface
sites could be overlooked during the study. Leonie Marais-Botes Heritage
Practitioner/ Archaetnos Archaeologists and Heritage Consultants will not be held
liable will not be held liable for such oversights or for the costs incurred as a
result thereof.

ACKNOWLEDGEMENTS

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ABOUT THIS REPORT

The heritage report must reflect that consideration has been given to the history and heritage significance of the study area and that the proposed work is sensitive towards the heritage resources and does not alter or destroy the heritage significance of the study area.

The heritage report must refer to the heritage resources currently in the study area.

The opinion of an independent heritage consultant is required to evaluate if the proposed work generally follows a good approach that will ensure the conservation of the heritage resources.

The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) are the guideline documents for a report of this nature.

Leonie Marais-Botes Heritage Practitioner/Archaeologists and Heritage Consultants was appointed by Bokamoso Environmental to carry out a Phase 1 Heritage Impact Assessment (HIA) for the proposed new sewer line, Raslouw X15, Gauteng Province. The site investigation was conducted on 24 April 2014.

EXECUTIVE SUMMARY

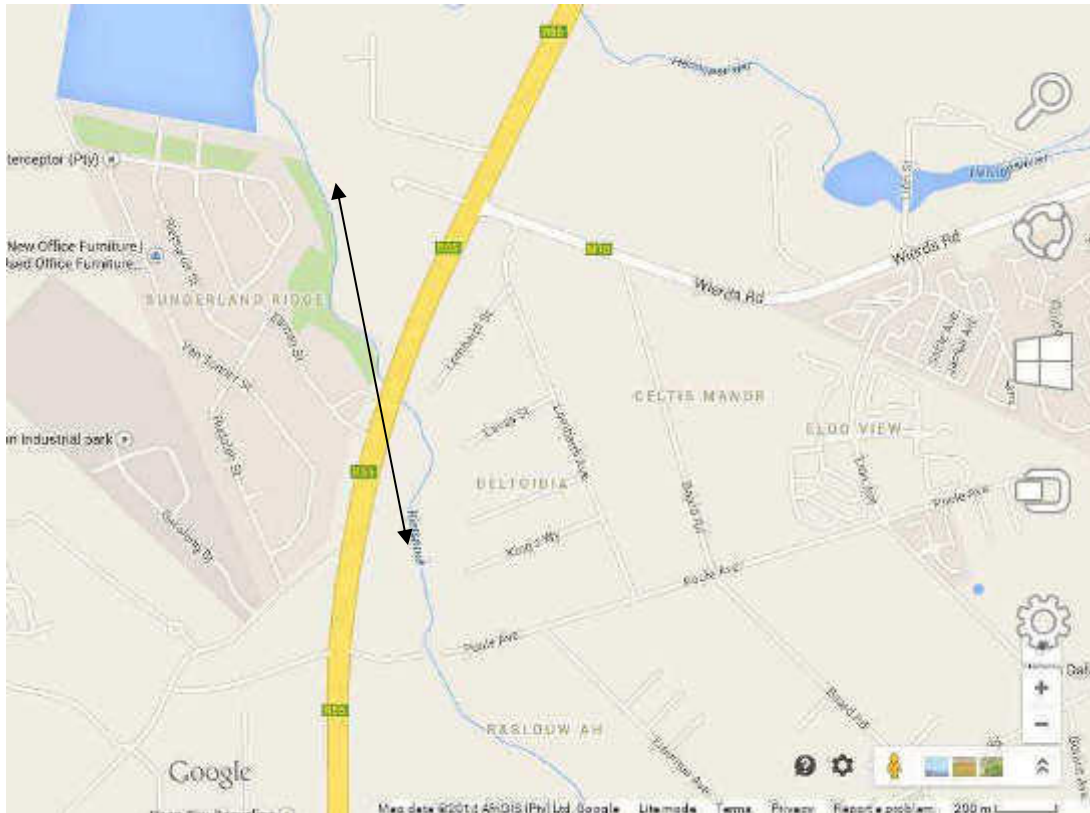
This project may impact on any types and ranges of heritage resources that are outlined in Section 3 of the National Heritage Resources Act (Act 25 of 1999). Consequently a Heritage Impact Assessment was commissioned by Bokamoso Environmental and conducted by Leonie Marais-Botes/Archaeon Archaeologists and Heritage Consultants.

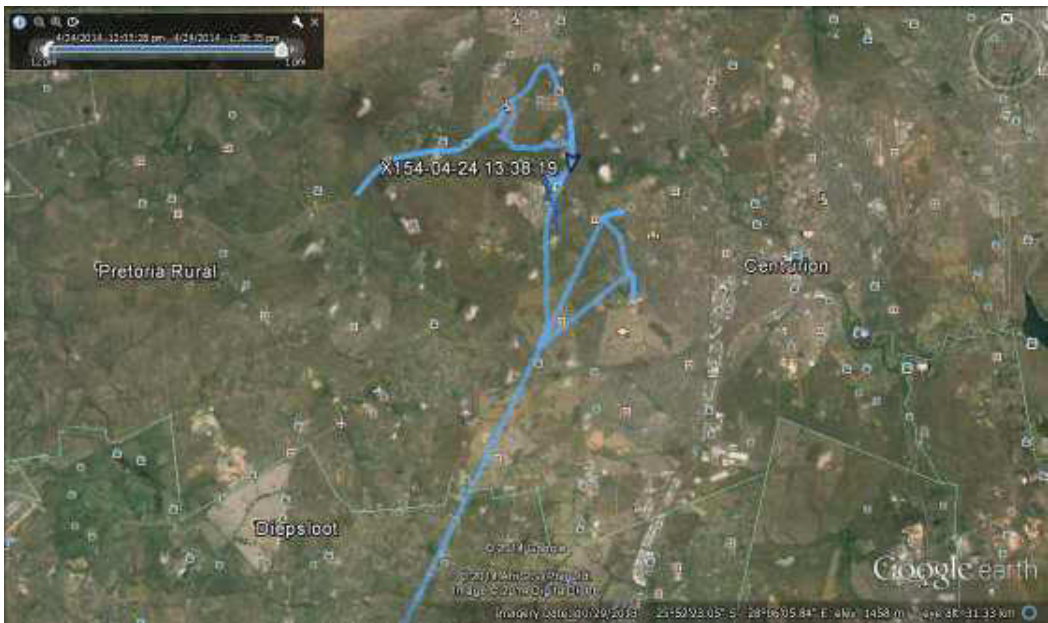
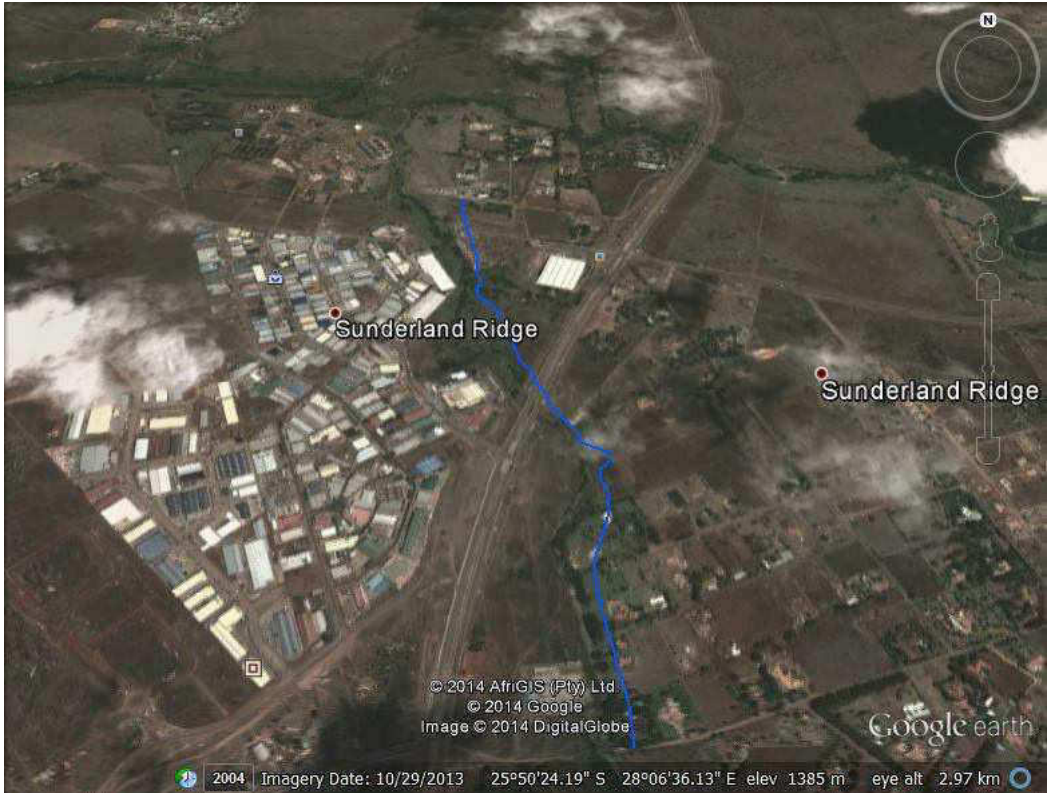
It is important to note that all graves and cemeteries are of high significance and are protected by various laws. Legislation with regard to graves includes the National Heritage Resources Act (Act 25 of 1999) whenever graves are 60 years and older. Other legislation with regard to graves includes those when graves are exhumed and relocated, namely the Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended).

1.1 INTRODUCTION

The proposed development entails the installation of a new external sewer pipeline.

1.2 LOCATION AND TRACK ROUTE





1.3 METHOD

The objective of this Phase 1 Heritage Impact Assessment (HIA) was to gain an overall understanding of the heritage sensitivities of the area and indicate how they may be impacted on through development activities. The survey took place on 24 March 2014.

In order to establish heritage significance the following method was followed:

- Investigation of primary resources (archival information)
- Investigation of secondary resources (literature and maps)
- Physical evidence (site investigation)
- Determining Heritage Significance

1.4 BACKGROUND HISTORY OF THE GREATER STUDY AREA

The greater study area previously consisted mainly of agricultural holdings. Some areas of the greater study area can now be described as industrial (Sunderland Ridge). The site earmarked for development is not situated in an area with great historical significance.

1.5 PHOTOGRAPHIC RECORD OF SITE EARMARKED FOR DEVELOPMENT



1. **S 25°49'33.0" E 025°06'51.7"**



2. **S25°49'22.6" E 028°06'42.5"**



3. **S 25°49'22.2" E 028°06'33.5"**



4. S 25°49'23.0" E 028°06'24.9



5. S 25°49'23.8" E 028°05'50.7"

2. FINDINGS

2.1 PRE-COLONIAL HERITAGE SITES

Possibilities: Greater study area taken into account.

Stone Age

The Stone Age is the period in human history when stone material was mainly used to produce tools¹. In South Africa the Stone Age can be divided in three periods²;

- Early Stone Age 2 000 000 – 150 000 years ago
- Middle Stone Age 150 000 – 30 000 years ago
- Late Stone Age 40 000 years ago - +/- 1850 AD

Iron Age

The Iron Age is the period in human history when metal was mainly used to produce artefacts³. In South Africa the Iron Age can be divided in three periods;

- Early Iron Age 250-900 AD
- Middle Iron Age 900-1300 AD
- Late Iron Age 1300-1840 AD⁴

There are no pre-colonial heritage sites evident in the study area. This can be attributed to previous infra-structure development activities in the greater study area.

2.2 HISTORICAL PERIOD HERITAGE SITES

Possibilities: Greater study area taken into account.

- Pioneer sites (Voortrekker sites cc 1836-1850's)
- Anglo-Boer War (1899-1902) sites.
- Structures older than 60 years.
- Historical graves.

There are structures older than 60 years in the study area. See photographs 3 and 5 of the photographic record of the study area. Picture 3 depicts an old dwelling and picture 5 a workers house circa middle of the 20th century.

2.3 ORIGINAL LANDSCAPE

Infrastructure and other development have altered the original landscape in most of the greater study area.

¹ P. J. Coertze & R.D. Coertze, Verklarende vakwoordeboek vir Antropologie en Argeologie.

² S.A. Korsman & A. Meyer, Die Steentydperk en rotskuns in J.S. Bergh (red) Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies.

³ P.J. Coertze & R.D. Coertze, Verklarende vakwoordeboek vir Antropologie en Argeologie.

⁴ M.M. van der Ryst & A Meyer. Die Ystertydperk in J.S. Bergh (red) Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies and T.N Huffman, A Handbook to the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa.

2.4 INTANGIBLE HERITAGE

The intangible heritage of the greater study area can be found in the stories of past and present inhabitants.

3 CATEGORIES OF HERITAGE VALUE (ACT 25 OF 1999)

The National Heritage Resources Act (Act 25 of 1999) identifies the following categories of value under section 3(1) and (2) of the Act under the heading "National Estate":

- "3 (1) For the purpose of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
- (2) Without limiting the generality of subsection (1), the national estate may include-
- (a) places, buildings, structures and equipment of cultural significance;
 - (b) places which oral traditions are attached or which are associated with living heritage;
 - (c) historical settlements and townscapes;
 - (d) landscapes and natural features of cultural significance;
 - (e) geological sites of scientific or cultural importance;
 - (f) archaeological and palaeontological sites;
 - (g) graves and burial grounds, including-
 - (i) ancestral graves;
 - (ii) royal graves and graves of traditional leaders;
 - (iii) graves of victims of conflict;
 - (iv) graves of individuals designated by the Minister by notice in the Gazette
 - (v) historical graves and cemeteries; and
 - (vi) other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
 - (h) sites of significance relating to the history in South Africa;
 - (i) movable objects, including-
 - (i) objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - (ii) objects to which oral traditions are attached or which are associated with living heritage;
 - (iii) ethnographic art and objects;
 - (iv) military objects
 - (v) objects of decorative or fine art;
 - (vi) objects of scientific or technological interests; and
 - (vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section I (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).
- (3) Without limiting the generality of the subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of-
- (a) Its importance in the community, or pattern of South Africa's history;
 - (b) Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

- (c) Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- (d) Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural objects;
- (e) Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- (f) Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- (g) Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- (h) Its strong or special association with the life and work of a person, group or organisation of importance in the history of South Africa; and
- (i) Sites of significance relating to the history of slavery in South Africa."

3.1 HERITAGE VALUE OF WEIGHED AGAINST CULTURAL SIGNIFICANCE CATEGORIES

3.1.1 Spiritual value

During the site visit/field work no indication of any spiritual activity was observed on/near the proposed site. Thus no sites of spiritual value will be impacted on by the proposed project.

3.1.2 Scientific value

No sites of scientific value was observed on or near the site earmarked for development.

3.1.3 Historical value

No historical value associated with the proposed site could be found in primary and secondary sources.⁵

3.1.4 Aesthetic value

No heritage item with exceptional aesthetic (architectural) value was identified in the study area.

3.1.5 Social value

Social value is attributed to sites that are used by the community for recreation and formal and informal meetings regarding matters that are important to the community. These sites include parks, community halls, sport fields etc. Visually none of the above is evident in the study area.

⁵ Standard Encyclopaedia of Southern Africa and the Transvaalse Argiefbewaarpark (TAB) database at the National Archives, Pretoria;
 J.S. Bergh (red), Geskiedenisatlas van Suid-Afrika: Die Vier Noordelike Provinsies.

3.2 SPECIFIC CATEGORIES INVESTIGATED AS PER SECTION 3 (1) AND (2) OF THE NATIONAL HERITAGE LEGISLATION (ACT 25 OF 1999)

3.2.1 Does the site/s provide the context for a wider number of places, buildings, structures and equipment of cultural significance?

The study area does not provide context for a wider number of places, buildings, structures and equipment of cultural significance. The reason is the low density of heritage structures/sites in the study area, near or on the proposed site.

3.2.2 Does the site/s contain places to which oral traditions are attached or which are associated with living heritage?

Places to which oral traditions are attached or associated with living heritage are usually found in conjunction with traditional settlements and villages which still practise age old traditions. None of these are evident near or on the proposed site.

3.2.3 Does the site/s contain historical settlements?

No historical settlements are located on or near the proposed site.

3.2.4 Does the site/s contain landscapes and natural features of cultural significance?

Due to previous infra-structure development activities the original character of the landscape have been altered significantly in the study area.

3.2.5 Does the site/s contain geological sites of cultural importance?

Geological sites of cultural importance include meteorite sites (Tswaing Crater and Vredefort Dome), fossil sites (Karoo and Krugersdorp area), important mountain ranges or ridges (Magaliesburg, Drakensberg etc.). The proposed site is not located in an area known for sites of this importance.

3.2.6 Does the site/s contain a wide range of archaeological sites?

The proposed site does not contain any surface archaeological deposits, the reason being the large scale alteration of the original landscape.

The possibility of sub-surface findings always exists and should be taken into consideration in the Environmental Management Plan.

If sub-surface archaeological material is discovered work must stop and a heritage practitioner preferably an archaeologist contacted to assess the find and make recommendations.

3.2.7 Does the site/s contain any marked graves and burial grounds?

The site does not contain marked graves. The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management Plan.

It is important to note that all graves and cemeteries are of high significance and are protected by various laws. Legislation with regard to graves includes the National Heritage Resources Act (Act 25 of 1999) whenever graves are 60 years and older. Other legislation with regard to graves includes those when graves are exhumed and relocated, namely the Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended).

If sub-surface graves are discovered work should stop and a professional preferably an archaeologist contacted to assess the age of the grave/graves and to advise on the way forward.

3.2.8 Does the site/s contain aspects that relate to the history of slavery?

This is not an area associated with the history of slavery like the Western Cape Province.

3.2.9 Can the place be considered as a place that is important to the community or in the pattern of South African history?

In primary and secondary sources the proposed site is not described as important to the community or in the pattern of South African history.⁶

3.2.10 Does the site/s embody the quality of a place possessing uncommon or rare endangered aspects of South Africa's natural and cultural heritage?

The proposed site does not possess uncommon, rare or endangered aspects of South Africa's natural and cultural heritage. These sites are usually regarded as Grade 1 or World Heritage Sites.

3.2.11 Does the site/s demonstrate the principal characteristics of South Africa's natural or cultural places?

The proposed site does not demonstrate the principal characteristics of South Africa's natural or cultural places. These characteristics are usually associated with aesthetic significance.

3.2.12 Does the site/s exhibit particular aesthetic characteristics valued by the community or cultural groups?

This part of the greater study area does not exhibit particular aesthetic characteristics valued by the community or cultural groups. The reason being the low density of heritage buildings and structures located in the greater study area.

3.2.13 Does the site/s contain elements, which are important in demonstrating a high degree of creative technical achievement?

The site does not contain elements which are important in demonstrating a high degree of creative technical achievement. Reason being none of the above evident on site.

⁶ Standard Encyclopaedia of Southern Africa and the Transvaalse Argiefbewaarplek (TAB) database at the National Archives, Pretoria.

J.S. Bergh (red), Geskiedenisatlas van Suid-Afrika. Die Vier Noordelike Provinsies.

3.2.14 Does the site/s have strong and special associations with particular communities and cultural groups for social, cultural and spiritual reasons?

The proposed site does not have a strong or special association with particular communities and cultural groups for social, cultural and spiritual reasons, the reason being that the particular site is located on mainly developed land and it is evident that the site is not utilised for social, cultural or spiritual reasons.

3.2.15 Does the site/s have a strong and special association with the life or work of a person, group or organisation?

The greater study area does not have a strong and special association with the life or work of a person, group or organisation.

4. OPPORTUNITIES, RESTRICTIONS, IMPACTS

- Because of the good summer rains grass is long and vegetation dense.
- If any of the structures older than 60 years are earmarked for demolition a demolition permit must be obtained from the Provincial Heritage Authority of Gauteng (PHRAG).
- There are no visible restrictions or negative impacts in terms of heritage associated with the site other than the structures older than 60 years. In terms of heritage this project can proceed.
- 3.2.6 and 3.2.7 must be taken into account in the Environmental Management Plan.

5. THE WAY FORWARD

- **Submit this report as a Section 38 application to the South African Heritage Resources Authority (SAHRA) for comment/approval.**

Precautionary measures on dolomite



PRECAUTIONARY MEASURES

1 General measures to be implemented on all dolomitic sites. General compliance is required with NHBRC Standards

Water acts as a triggering mechanism, in the majority of cases. It is therefore imperative that the concentrated ingress of water into the ground be avoided at all times, including in the construction period.

An emergency reaction plan should be in place in the event of a sinkhole or doline developing under a water-bearing service. Such a plan should consider the following question, 'Who should residents phone in case of such an emergency?' In the event of the sinkhole occurring in a townhouse complex, for instance, the Body Corporate must know the emergency procedures and residents should know how to get in contact with the acting members. In township developments use should be made of community awareness campaigns to involve residents and inform them of whom to contact and what to do. It is important that responsible persons know how to close the mains and then cordon the area off at least 3 - 5 m clear of the sinkhole edge.

- a. Brick and precast concrete walls must be so designed as to provide drainage ports at ground level permitting passage of maximum probable quantities of water.
- b. When courtyards are designed, the free flow of surface water should be ensured. Where gutter downpipes are to be found in such a courtyard, a lined canal should permit passage of water into a drain or onto the lawn away from the structure. The courtyard should preferably be paved and no garden beds should be created at gutter discharge points.
- c. Residents should be informed of where services traverse their garden so that accidental puncturing of pipes can be avoided.

Wet services of individual and entire development -

- a. All wet services should be of good quality in order to ensure low maintenance.
- b. Piping materials selected should also be appropriate to local subsurface conditions. If clay pipes are utilized in areas of shallow dolomite, a higher standard of pipe bedding is recommended, e.g. stabilized bedding or over excavation and recompaction with an approved material (minimum specification to be G7 material) in layers of 150 mm thickness, compacted to 93% mod AASHTO.

Some soils may have low pH values, which will render the use of ferrous material for underground services unsuitable. Chapter II in 'A Technical Guide to Good House Construction' NBRI of the CSIR (July 1984) should be consulted concerning the potential corrosion of pipes.

- c. The NHBRC¹ makes the following recommendations:

Waterpiping materials shall be one or more of the following:

- High impact PVC pipes with vitualic joints.
 - Other flexible (as defined in SABS 0102, Part 1) water pipes with flexible, self anchoring connections.
- Pipes having a diameter of less than 75 mm.
- HDPE type IV.

¹ National Home Builders Registration Council

- Polypropylene.

Pipes should be flexible, while joints should be minimised.

- d. Water pipes entering buildings should either be fitted with flexible couplings or kinked with a Z to allow opportunity for relative movement. A flexible connection at the junction with all outlet pipes should be used, which includes WC pan connections.
- e. Pressure release systems tend to leak after a couple of years. This leaking water must flow directly into the storm- or sewerage water system.
- f. Water reticulation to houses should be kept at a minimum depth of 500 mm up to the structure and above ground wherever possible along the structure.
- g. As many services as possible should be placed within a single trench.
- h. Encasement of pipes in concrete or soilcrete should be avoided. Preferably place pipes in sleeves. If this cannot be achieved, care must be taken to ensure that differential movement can still be accommodated without the pipe breaking.
- i. All stormwater water, sewerage and water pipes and channels must be watertight. All laid wet services should be tested for leakage on installation using the air test (see NBRI Info Sheet X/BOU 2-34) for water pipes, and the water test for sewerage pipes.
- j. Placement of wet services below the footprint of structures must be avoided. No plumbing and drainage pipes should be placed under floor slabs, as far as practicable. Where this situation is unavoidable, specify piping materials of good quality and durability with a long anticipated life span.
- k. Where practical, pipes running parallel to structures should be kept at a distance of at least 5 m from the structure.
- l. Each stand should have a rodding eye or some similar access to the sewer connection in addition to the inspection eye.
- m. Each stand should have a water meter. Water leakage testing must be undertaken at least once every two years.
- n. The roots of trees planted in close proximity to the line of water-bearing services often cause leaks in or malfunctioning of the services. Care should therefore be taken to avoid the unfortunate positioning of trees and other plants.

Entire development

- a. The design of wet services should be governed by the need to create low maintenance systems. Wherever possible keep services above ground to facilitate detection of leaks, maintenance and repair.
- b. The stability of the center line of all bulk water services should be considered.
- c. Piping used in mains and communication pipes should be flexible, while joints should be minimised and, where required, self anchoring type (i.e. not reliant on thrust blocks for their anchorage at fittings, except at valves and end caps).
- d. The relevant provision of SABS 1200 DB, L, LB, LC, LD and LE shall be observed in the installation of all underground services.

- e. Water mains shall be laid only in road reserves.
- f. Provision for future connections shall be made in order to minimise the cutting into pipes to provide such connections.
- g. Water pipe entries into the building shall be in accordance with those of the JSD's code of practice.
- h. The use of pre-manufactured, unjointed manholes are preferred. The manhole should be placed on a properly prepared foundation.
- i. Use flexible couplings either side of manholes.
- j. Water-borne sewerage reticulation must be installed. French drains are unacceptable.
- k. A detailed sanitation plan should be drawn up for the development according to the local geological setting and engineering geological characteristics. The plan must be incorporated into the services management system of the local authority.

Stormwater drainage

- a. No accumulation of surface water is to be permitted and the entire development must be properly drained.
- b. A minimum gradient of 1:150 should be maintained along stormwater systems.
- c. In order to deal with rainwater run-off from the roofs of structures the following is recommended:
 - If guttering is required by the local authority, then the down pipes should discharge into a lined or precast furrow. This furrow should remove the water from the structure. The stormwater should be trained, without ponding, off the property and into the municipal stormwater system.
 - If no guttering is to be utilized, then it is recommended that a sealed surface with a width of 1,5 m be cast along those walls of the structure where water will be discharged from the roof. Roof water will cascade off this sloping roof onto the apron into a lined or precast furrow. The stormwater should be trained, without ponding, off the property and into the municipal stormwater system.
 - The ground immediately against the buildings shall be shaped to fall in excess of 75 mm over the first 1,5 m beyond the perimeter of the building, from where it shall drain freely away from housing units. Apron slabs, where provided shall have the same fall.
- d. All ponds, water courses and road surfaces should be rendered impervious.
- e. No trees shall be planted within 1,5 times their eventual height from the line of stormwater services.
- f. The stormwater drainage system shall incorporate measures to ensure water tightness of conduits and other compartments. Whenever possible, stormwater should be channeled in lined, surface canals.
- g. Concrete non-pressure pipes should be of the spigot and socket type with rubber ring seals. Joints in box culverts, channels etc. should be sealed.
- h. Stormwater drainage conduits shall be constructed at gradients which will not permit the deposition of silt, or sand, of the type present in the catchment area.

Trenching

- a. Trenches and excavation works should be opened and closed as rapidly as possible. Avoid leaving trenches open over weekends or holidays. A berm should be created to divert surface water away from the trenches while they are open. All trenches and excavation works must be properly backfilled and compacted according to specifications given in subclause 5.2.4 of SABS 1200 DA, but specifically to ground surface to prevent them acting as french drains. Once services/cables are installed and backfilling is completed, it must be ensured that ground surface is graded to match the slope of the surrounding area. No rocks in the top layer.
- b. Berms should be constructed on the up-slope side of trenches to prevent the inflow of water during storms.
- c. The fall of trenches shall be away from buildings. Wherever practical, service trenches shall not be excavated along the length of housing units within the first 3 m beyond the perimeter of such units.
- d. No ponding of surface water is to be permitted over, in, or in the vicinity of trenches and excavations.

Roads

- a. Ensure that roadways are in fact placed below the site level so as to facilitate drainage. If the road network is the sole stormwater system, in a township, care must be taken that the roads are surfaced.
- b. Ponding of surface water on or next to roads that are not tarred should be avoided.
- c. Roadways which have a gradient of less than 1:80 shall be surfaced/sealed.
- d. The velocity of the 1 in 20 year stormwater, flowing along unsurfaced roadways shall not exceed 1,5 m/s.

Swimming pools

- a. The installation of swimming pools may only be considered with the permission of the Local Council, advised by an appropriately experienced person.
- b. Backwash from swimming pools must be piped to the stormwater system.

2 Additional precautionary measures for residential affordable, residential group housing (single and double storey) and gentleman's estates

These measures are to be considered additionally for areas that reflect an even greater degree of risk (of sinkhole or doline formation). The *degree of risk* is not the only factor that plays a role: The selection of precautions also depend on the *hazard type*, in other words, should precautions be considered in terms of the occurrence of small sinkholes, in which event a re-enforced mattress will suffice, or medium to large sinkholes, in which even concrete rafts or blanket banning of structures would apply. The *likely triggering mechanism* should also be considered i.e. in the event of the water table being at depth but bedrock being above the water table, the triggering mechanism will be infiltrating water. In such a case, emphasis would have to be placed on the prevention of such infiltration by, for instance, paving the entire area. In case where watertable drawdown is of consideration, emphasis must be placed on the blanket ban of borehole sinking or water table drawdown by mines etc. in the relevant dolomitic

groundwater compartment.

- a. Place bulk services in road reserves or servitudes with a minimum width of 5 m. Servitudes may be utilised as parks or 'bridle paths'. If these services are placed mid-block, a building line restriction of a minimum width of 5 m must be imposed. Place water and sewer connections of every two units along their common property boundary. Shared sewer connections should be implemented if this arrangement leads to a reduction in the meterage of service and minimizes the disturbance of the environment. Property and unit entrances should be placed at points furthest from the trenches of these water and sewer connections.
- b. It is recommended that structures be placed on earth mattresses, which serve to ensure load distribution and to prevent water ingress. A continuous mattress can be considered for high density development, where it is emplaced in strips for block lengths and with widths exceeding the house footprint by at least 2 m. This exercise must be completed prior to the installation of services.
- c. Water and sewer connections to households should be placed within the mattress of enhanced earth. The mattress will retard the flow of water from a leaking service but material will eventually be mobilised sufficiently for structural damage to occur. It is thus evident that testing of water-borne services on a regular basis is very important. Consideration should be given to the placement of sewer lines in inspectable canals as these are not so easy to test. If the mattress is penetrated, wet services must be placed in sleeves for 5 m beyond the structure so that leaking services immediately beyond the mattress cannot result in instability in close vicinity to the foundation.
- d. Roadways must be sealed and be constructed below the level of stands.
- e. Property and unit entrances should be placed at points away from the trenches of water and sewer connections.
- f. Each stand should either have a rodding eye or some similar access to the sewer connection in addition to the inspection eyes so that sensible monitoring may be possible.

3 Additional precautionary measures for High-rise, Light Industrial and Light Commercial sites

- a. It is recommended that structures be placed on stiffened rafts on earth mattresses, which serves to ensure load distribution and to prevent water ingress. The mattresses must be emplaced prior to the installation of services.
- b. The principal water bearing services must be placed either in the mattress or in sleeves for a distance of at least 5 m beyond the periphery of the building.
- c. The surfaces around buildings should be sealed and sloped so that no surface run-off water is allowed to pond against buildings.
- d. Downpipes bearing accumulated roof water can be discharged either onto the sealed surfaces to drain away from the structure, or into lined furrows and into stormwater systems.
- e. Roadways should be sealed.
- f. Portions should be identified at which 'plugs' can be installed to stop flow in sewer and water lines at short notice in the event of rupture or sinkhole formation underneath the service. The Local Authority must ensure that contingency plans are in place to deal with such emergencies.

- g. No swimming pools should be permitted in this zone.
- h. Lined channels are preferred to pipes for stormwater systems in these zones.
- i. Structures must be correctly and safely founded.
- j. A monitoring programme must be embarked upon by either the owner of the property/buildings, the appropriate Local Council or Metropolitan Substructure to regularly check for any leaks in services, unauthorized structures which could lead to concentration of water and, where necessary, monitor the groundwater level (refer to risk management systems).
- k. With respect to commercial, industrial or high-rise structures, the principal water-bearing services should preferably be placed above ground or in sleeves when within 5 m of the structure.

4 Precautionary measures for sites unsuitable for development

- a. No buildings should be allowed in this zone.
- b. The entire site must be properly sealed.
- c. No water-borne services must be allowed in this area. Ablution blocks should be avoided.
- d. Surface water run-off management is critical in these areas.

Environmental Management Plan (EMP)



May 2015

Final Environmental Management Plan (EMP) for the proposed Raslouw X15 Sewer pipeline, Gauteng Province

Ref nr: Gaut: 002/13-14/E0287

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1. Project Outline

1.1 Background

Bokamoso Environmental Consultants was appointed by **Purple Roof Developers (Pty) Ltd** to compile a Basic Assessment Report for the installation of the Raslow X15 sewer pipeline. The EMP had been prepared to comply with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).

The EMP will be a binding document for purposes of compliance.

1.2 Project description

The involved section of Raslow X15 is approximately 2 km in length and falls within the area of jurisdiction of the City of Tshwane Metropolitan Municipality. **Refer to figure 1,**

Locality Map



Figure 1 – LocalityMap

Timeframe for construction:

This will be provided when/ if the application for the proposed development is approved.

1.3 Receiving Environment

Refer to Figure 2, Sensitive issues Map

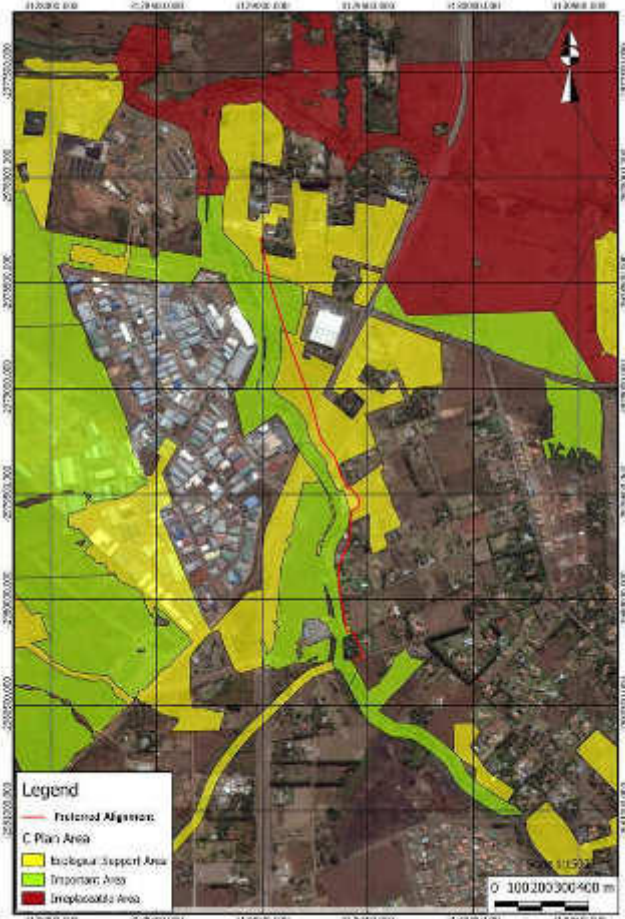


Figure 2 – Sensitive Issues Maps

Geology:

- The proposed sewer line is situated in an area comprising mainly of dolomite. Chert with shale and quartzite also occurs in the general area.

Fauna and flora:

- No red data flora species was found. Although a small section of the proposed sewer pipeline might possibly have some Orange Listed Plant species present

according to C-Plan data, but this will only be confirmed when a specialist study has been conducted. No fauna (both vertebrate and invertebrate) species was found on site, with no connectivity to any functional habitats. The proposed sewer pipeline traverses Natural grassland areas which were deemed sensitive; however it does not traverse any irreplaceable sites.

Hydrology:

- The proposed sewer pipeline is planned to mainly be aligned along the contours that is 5m or more above the **water** level of the Rietspruit and the sewer line will be between 15 and 130m away from the channel. It is also planned to run just outside the 1:100 year floodline, thus it will be less than 500 meters away from the river. However, the proposed sewer line does not transect the wetland or riparian zone at any point. The construction and operational phase of the proposed sewer pipeline could cause erosion, siltation and pollution of these water bodies if mitigation measures are not implemented. The wetlands and riparian vegetation are regarded as sensitive.

The proposed sewer line runs outside of the wetland/riparian zone for its entire length.

Impact on agricultural land and agricultural holdings:

- The pipeline alignment cut through agricultural land and urban area. But the general agricultural potential of the soils traversed by the alignments of sewer pipeline are moderate to low and the study areas does not fall within a GDARD Agricultural Hub.

Noise Impact:

- Pro-active planning in the area should be considered around the sewer pipeline area especially for during construction. During the operational phase, there will be no noise impacts.

Blasting:

- Some blasting may be required during the construction of the sewer pipeline.

2. EMP Objectives and context

Objectives

The objectives of this plan are to:

- Identify the possible environmental impacts of the proposed activity;
- Develop measures to minimise, mitigate and manage these impacts;
- Meet the requirements of the Environmental Authorisation of GDARD and other of other Authorities; and
- Monitor the project.

EMP context

This EMP fits into the overall planning process of the project by carrying out the conditions of consent set out by the GDARD. In addition, all mitigation measures recommended in the EIA report are included in the EMP.

This EMP addresses the following phase of the development:

- Planning and Design phase.

3. Monitoring

In order for the EMP to be successfully implemented all the role players involved must have a clear understanding of their roles and responsibilities in the project.

These role players may include the Authorities (A), other Authorities (OA), Developer/proponent(D), Environmental Control Officer (ECO), Project Manager (PM), Contractors (C), Environmental Assessment Practitioner (EAP) and Environmental Site Officer (ESO). Landowners interested and affected parties and the relevant environmental and project specialists are also important role players.

3.8 Acts

3.8.1. The National Water Act, 1998 (Act No: 36 of 1998)

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- ❑ Meeting the basic human needs of present and future generations;
- ❑ Promoting equitable access to water;
- ❑ Promoting the efficient, sustainable and beneficial use of water in the public interest;
- ❑ Reducing and preventing pollution and degradation of water resources;
- ❑ Facilitating social and economic development; and
- ❑ Providing for the growing demand for water use.

Impact on proposed pipeline:

The Raslow X 15 sewer pipeline will require a water license application in terms of section 21 (c) and (i) of the National Water Act (Act 36 of 1998).

3.8.2 National Environmental Management Act (Act 107 of 1998)

The NEMA is primarily an enabling Act in that it provides for the development of environmental implementation plans and environmental management plans. The principles listed in the act serve as a general framework within which environmental management and implementation plans must be formulated.

The principles in essence state that environmental management must place people and their needs at the forefront of its concern and that development must be socially, environmentally and economically sustainable.

In terms of Section 24G of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environments Impact Assessment (EIA) as part of the application for rectification (Section 24G) must be submitted to the delegated authority for consideration. Section 24G (1) (b) (vii) lists all the items that must be included and discussed in the EIA Report to be compiled and submitted.

Impact on proposed pipeline:

The proposed section of the pipeline is listed under the activities as regulated under NEMA and therefore a Basic Assessment Process is being conducted.

3.8.3 The National Environmental Management: Waste Act (Act 59 of 2008)

This Act came into effect on 11 June 2009. It aims to consolidate waste management in South Africa, and contains a number of commendable provisions, including:

- The establishment of a national waste management strategy, and national and provincial norms and standards for, amongst others, the classification of waste, waste service delivery, and tariffs for such waste services;
- Addressing reduction, reuse, recycling and recovery of waste;
- The requirement for industry and local government to prepare integrated waste management plans;
- The establishment of control over contaminated land;
- Identifying waste management activities that requires a licence, which currently include facilities for the storage, transfer, recycling, recovery, treatment and disposal of waste on land;
- Co-operative governance in issuing licenses for waste management facilities, by means of which a licensing authority can issue an integrated or consolidated license jointly with other organs of state that has legislative control over the activity; and
- The establishment of a national waste information system.

On 29 November 2013 the Minister of Environmental Affairs and Tourism amended the list of waste management activities that might have a detrimental effect on the environment.

Impact on proposed pipeline:

No Waste Management License will be required during the construction phase of the proposed pipeline.

3.8.4 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act legislates the necessity and heritage impact assessment in areas earmarked for development, which exceed 0.5ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

Impact on proposed pipeline:

No cultural/historical significant areas were identified within the application site and thus no areas of historical or cultural value will be affected. It is although important that if any such features are discovered during construction activities and clearing of the application site, the correct "procedures for an Environmental incident" (at the end of this EMP) must be followed.

3.8.5 The Municipal Systems Act (Act 32 of 2000)

This Act was introduced to provide for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic upliftment of local communities, and ensure universal access to essential services that are affordable to all.

The proposed development will support the local authority in complying with the principles of the Municipal Systems Act, by assisting in providing the community with essential services, such as sewage infrastructure.

Impact on proposed pipeline:

The proposed section of the pipeline will contribute to the Municipal system.

3.8.6 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

Impact on proposed pipeline:

According to the Gauteng Agricultural Potential Atlas (GAPA 3), the Raslow X 15 sewer pipeline is located on land with high and low agricultural potential. However, it should be noted that the surrounding areas is in the process of being developed or already developed for industrial, residential or other land uses. Construction of the proposed section of the pipeline will possibly cause erosion and pollution of water sources if these impacts are not mitigated.

3.8.7 National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management of South Africa's biodiversity within the Framework of the NEMA and the protection of species and ecosystems that warrant National protection. As part of the implementation strategy, the National Spatial Biodiversity Assessment was developed.

Impact on proposed pipeline:

No red data species were found on site.

3.8.8 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes.

Impact on proposed pipeline:

The pipeline does not affect any protected areas.

3.8.9 GDARD Draft Ridges Policy

The main purpose of the draft Red Data Policy is to protect red data plant species in Gauteng Province. This policy requires that red data species remain in situ and it gives priority ratings (based on where they occur) to the different Red Data species. If Red Data species are discovered on the study area this policy will have relevance and it should be described in detail as to how it is applicable to this application.

According to the GDARD C-Plan, the study area is not affected by ridges and the Draft Ridges Policy is therefore not applicable.

Impact on proposed pipeline:

The study area is not affected by any ridges.

3.8.10 GDARD Red List Plant Species Guidelines

The purpose of these guidelines is to promote the conservation of Red List Plant Species in Gauteng, which are species of flora that face risk of extinction in the wild. By protecting Red List Plant Species, conservation of diverse landscapes is promoted which forms part of the overall environmental preservation of diverse ecosystems, habitats, communities, populations, species and genes in Gauteng.

These Guidelines are intended to provide a decision-making support tool to any person or organization that is responsible for managing, or whose actions affect, areas in Gauteng where populations of Red List Plant Species grow, whether such person or organization be an organ of state or private entity or individual; thereby enabling the conservation of the Red List Plant Species that occur in Gauteng.

Impact on proposed pipeline:

No red data species were observed by specialist on the study area.

3.8.11 National Veld and Forest Fire Act, 1998 (Act No. 101, 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

Impact on proposed pipeline:

No open fires will be allowed. It is important that a site development camp be located on a part of the application site that is already disturbed. The camp should not be located in close proximity of natural veld grass areas, areas that can be easily susceptible for fires, and the floodline zone area.

3.8.12 Environmental Conservation Act: Noise Regulations, 1989 (Act no.73 of 1989)

The purpose of this Act is to provide measures and management relating Noise levels. This Act enables Noise levels to be acceptable to standards within a specific area and community.

Impact on proposed pipeline:

The proposed development will include some noisy activities with the construction of the proposed section of the external sewer pipeline and but there will be no noise during the operational phase.

4. Project activities

4.1 Pre-Construction Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
General	Project contract	To make the EMP enforceable under the general conditions of the contract.	The EMP document must be included as part of the tender documentation.	The EMP is included as part of the tender documentation.	Developer
Design and planning	Stability of structures	To ensure stability of structures and embankments.	Geotechnical constraints that must be taken into consideration during the planning and designing of the pipeline, i.e. collapsible sands, expansive clays, excavatability etc.	Geotechnical constraints had been taken into consideration during the planning and designing of the pipeline.	Engineer
			1) The dolomite stability along the pipeline should be investigated in detail by conducting a gravity survey and percussion boreholes. 2) More detailed foundation investigations should be conducted for structures such as bridges and culverts. 3) The granite is covered by collapsible material and will have to be pre-collapsed, possibly by impact rolling if the collapse potential is too high. 4) The low-density material encountered within the Oaktree Formation must be compacted with a vibrating or impact roller. In extremely poor conditions the material must be excavated and backfilled with granular material. 5) Embankments will only be required where structures such as bridges and culverts are constructed. 6) The NHBRC precautionary measures for development in dolomitic areas must be implemented.	More detailed foundation investigations done.	Engineer Individual Developer

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
			<p>7) Stormwater management is extremely important and must be designed to prevent the concentrated ingress and ponding of water.</p> <p>8) Wet surfaces such as water supply lines must preferably not run close to (within 10m) along the pipeline. Where such a service crosses the pipeline alignment, all due care should be taken to ensure that the pipe does not leak.</p>		
			<p>1) Special drainage designs will be required in areas with shallow ground water, especially for areas underlain by granite and syenite.</p> <p>2) Precautionary measures to prevent seepage of groundwater into excavations should be implemented.</p>	Special drainage designs and precautionary measures are implemented.	Engineer Contractor
	Storm water design	To prevent and restrict erosion, siltation and groundwater pollution.	<p>1) A storm water management plan must be compiled for the construction and operational phases of the proposed pipeline.</p> <p>2) The storm water design for the proposed development must be designed to:</p> <ul style="list-style-type: none"> - Reduce and / or prevent siltation, erosion and water pollution - Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area. <p>and</p> <ul style="list-style-type: none"> - Ensure that no ponding of water and concentrated ingress of water take place. <p>3) No storm water must be allowed to enter the natural drainage systems directly. The stormwater should be diverted through forms of storm water retention facilities for containing and releasing flood water in a way that simulate natural flow into the natural drainage systems to assuage associated erosion and siltation problems that may arise.</p> <p>4) Due to the fact that most of the study area is</p>	Compilation and approval of storm water management plan.	Engineer Individual Developer

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
			underlain by dolomite no natural channels will be allowed. All open channels and attenuation ponds must be lined with concrete. No grass lined channels will be permitted due to the geotechnical conditions. Concentrated surface drainage is also not permitted.		
Climate	Damage to the environment during the rainy season	To minimize damage to the environment and structures	It is recommended that the construction of pipeline next to stream crossings be scheduled for the dry season.	Construction of bridge structures scheduled for rainy season.	Engineers
Geology and soils	Risk of sinkholes	To prevent the reaction of a sinkhole after the construction of the pipeline.	1) Special precautionary measures for construction on dolomite must be implemented. 2) A dolomite risk management plan must be compiled to manage the pipeline.	Precautionary measures implemented.	Geotechnical Engineer Dolomite Risk manager
Fauna and flora	Floral biodiversity and ecological health	To ensure that the species introduced to the area, are compatible with the current and future quality of the ecological processes.	1) As many as possible of the mature indigenous trees that occur naturally in the vicinity of the proposed pipeline should be retained. These vegetation communities should be connected to natural vegetation on neighbouring properties to facilitate connectivity. This area should be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics to ensure biodiversity. 2) No plants which are not indigenous to the area or exotic plant species, especially lawn grasses and other ground-covering plants should be used as soil-binding agents along new pipeline verges as they will drastically interfere with the nature of the area. 3) All category 1 declared weeds and other alien species must be removed from the vicinity of the proposed pipeline.	As many as possible of the mature trees are retained and exotics are eradicated	Landscape Architect Contractor
		To ensure protection of wetland system	1) A fence/ safety netting should be erected between the Riparian vegetation and the areas which may be affected for the planned pipeline	Fence erected	Contractor

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
		and river/drainage line	reserve. This will prevent entry into the drainage line by construction material and other waste in the drainage line. 2) Care must be taken to ensure that construction activities remain within the boundary of the planned pipeline. 3) Limited access to the water of the Rietspruit should be given to construction vehicles by fencing of all access points to the water, except at the predetermined water-intake point.		
			The edge of the wetland must be clearly demarcated in the field with poles, sticks, or any solid structure that will last for the duration of the development, colour-coded as follows: o Red – Indicating the edge of the wetlands, or parts thereof; and no vehicles or building materials are allowed in this zone. (These should be put along the entire length of the property / site). o Orange – Indicating the edge of the buffer zone (50m outside the urban edge). However, allowance must be made for sensitive species that require larger areas, e.g. Grass Owl, Giant Bullfrog, etc. o Green – Indicating where the first structures will be built (e.g. stands / plots building, paving, wall fencing, etc.	Fence erected.	Contractor
Preparing Site Access	Environmental integrity	To avoid erosion and Disturbance to indigenous vegetation.	Designated route shall be determined for the construction vehicles and designated areas for storage of equipment. Clearly mark the site access point and routes on site to be used by construction vehicle and pedestrians. Provide an access map to all contractors whom in tum must provide copies to the construction workers. Instruct all drivers to use access point	Access to site is erosion free. Minimum disturbance to surrounding vegetation. Vehicles make use of established routes.	Contractor

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
			and determined routes.		
	Waste storage	To control the temporary storage of waste.	Temporary waste points on site shall be determined. These storage points shall be accessible by waste removal trucks and these points should not be located in sensitive areas / areas highly visible from the properties of the surrounding land-owners / tenants / in areas where the wind direction will carry bad odours across the properties of adjacent tenants or landowners.		Contractor ESO
		Ensure waste storage area does not generate pollution.	Build a bund around waste storage area to stop overflow into storm water.		Contractor
	Cultural Resources	To ensure protection of cultural resources.	1) In terms of the South African Resources Act (Act 25 of 1999) Section 35 (4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or Palaeontological site or material. 2) Section 34 (1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial resources authority	No cultural resources destroyed or removed.	
	Servitudes		Servitudes must be indicated on engineering drawings.	Servitudes indicated on engineering drawings.	Engineer
	Expropriation of properties		The expropriation of properties must be finalized prior to the construction of the pipeline.		
	Impact on surrounding properties	To minimize impact on possible mining activities	1) The construction of the section of the pipeline that affects the nearby neighbors should be planned properly. 2) Should there be mined areas on the site, then they must be rehabilitated according to an EMP		Contractor

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility
			prior to construction of the pipeline.		
		To access to surrounding properties.	1) The properties affected by the proposed sewer pipeline must be taken into consideration during the planning phases. 2) The design of the pipeline must make provision for access to local routes and properties as well as future routes.	Access provided to affected properties.	Engineer
	Impact on Waste Water Works	To prevent impact on sewage facility.	The design of the pipeline must take other existing pipeline facility into consideration. No pipes or outlet structures of the sewage facility may be affected by the new proposed sewer pipeline.	No pipes or outlet structures affected by the sewer pipeline.	Engineer

4.2 Construction Phase

Contractor's camp	Vegetation and topsoil	To minimize damage to and loss of vegetation and retain quality of topsoil.	1) Site offices, parking areas for construction vehicles, etc. should be confined to non-sensitive areas. 2) Site to be established under supervision of ECO. 3) Clearing and relocation of plants to be undertaken in accordance with site specific requirements.	Site erected in an area that is not sensitive. Minimal vegetation removed / damaged during site activities.	Contractor
	Surface and ground water pollution	To minimize pollution of surface and ground water resources.	1) Sufficient and temporary facilities including ablution facilities must be provided for construction workers operating on the site. 2) A minimum of one chemical toilet shall be provided per 10 persons. The contractor shall keep the toilets in a clean, neat and hygienic condition. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilized. The contractor (who must use reputable toilet-servicing company) shall be responsible for the	Effluents managed effectively. No water pollution of water resources from site. Workforce use toilets provided.	Contractor ESO

			<p>cleaning, maintenance and servicing of the toilets. The contractor (using reputable toilet-servicing company) shall ensure that all toilets are cleaned and emptied before the builders' or other public holidays.</p> <p>3) No person is allowed to use any other area than chemical toilets.</p> <p>4) No French drain systems may be installed.</p> <p>5) No chemical or waste water must be allowed to contaminate the run-off on site.</p> <p>6) Avoid the clearing of the site camp (of specific phase) or paved surfaces with soap.</p>		
		To minimize pollution of surface and groundwater resources due to spilling of materials.	<p>1) Drip trays and / or lined earth bunds must be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil and cement.</p> <p>2) Repair and storage of vehicles only within the demarcated site area.</p> <p>3) Spill kits must be available on site.</p> <p>4) Oils and chemicals must be confined to specific secured areas within the site camp. These areas must be banded with adequate containment (at least 1.5 times the volume of the fuel) for potential spills or leaks.</p> <p>5) All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site.</p> <p>6) No leaking vehicle shall be allowed on site. The mechanic / the mechanic of the appointed contractor must supply the environmental officer with a letter of confirmation that the vehicles and equipment are leak proof.</p> <p>7) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p>	No pollution of the environment.	Contractor ESO
		To minimize pollution of	The mixing of concrete shall only be done at specifically selected sites, as close as possible to	No evidence of contaminated soil on the	Contractor ESO

		surface and groundwater resources by cement.	entrance, on mortar boards or similar structures to prevent run-off into drainage lines, streams and natural vegetation.	construction site.	
		To minimise pollution of surface and groundwater resources due to effluent.	No effluent (including effluent from any storage areas) may be discharged into any water surface or ground water resource.	No evidence of contaminated water resources.	Contractor ESO
	Pollution of the environment	To prevent unhygienic usage on the site and pollution of the natural assets.	<ol style="list-style-type: none"> 1) Weather proof waste bins must be provided and emptied regularly. 2) The contractor shall provide laborers to clean up the contractor's camp and construction site on a daily basis. 3) Temporary waste storage points on the site areas should be determined. THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT IS ALREADY DISTURBED. These storage points should be accessible by waste removal trucks and these points should be located in already disturbed areas / areas not highly visible from properties of the surrounding land-owners / in areas where the wind direction will not carry bad odours across the properties of adjacent landowners. This site should comply with the following: <ul style="list-style-type: none"> ◆ Skips for containment and disposal of waste that could cause soil and water pollution, i.e. paint, lubricants, etc. ◆ Small lightweight waste items should be contained in skips with lids to prevent wind littering. ◆ Bunded areas for containment and holding of dry building waste. 4) No solid waste may be disposed of on the site. 5) No waste materials shall at any stage be disposed of in the open veld of adjacent 		

			<p>properties.</p> <p>6) The storage of solid waste on the site, until such time as it may be disposed of, must be in a manner acceptable to local authority and DWA.</p> <p>7) Cover any wastes that are likely to wash away or contaminate storm water.</p>		
		Recycle material where possible and correctly dispose of unusable wastes.	<p>1) Waste shall be separated into recyclable and non-recyclable waste, and shall be separated as follows:</p> <ul style="list-style-type: none"> • General waste: including (but not limited to) construction rubble. • Reusable construction material <p>2) Recyclable waste shall preferably be deposited in separate bins.</p> <p>3) All solid waste including excess spoil (soil, rock, rubble, etc.) must be removed to a permitted waste disposal site on a weekly basis.</p> <p>4) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.</p> <p>5) Keep records of waste reuse, recycling and disposal for future reference. Provide information to ECO.</p>	<p>Sufficient containers available on site</p> <p>No visible signs of pollution.</p>	Contractor ESO
	Increased fire risk to site and surrounding areas	To decrease fire risk	<p>1) Fires shall only be permitted in specifically designated areas and under controlled circumstances.</p> <p>2) Food vendors shall be allowed within specified areas.</p> <p>3) Fire extinguishers to be provided in all vehicles and fire beaters must be available on site.</p> <p>4) Emergency numbers / contact details must be available on site, where applicable.</p>	No open fires on site that have been left unattended.	Contractor
Construction site	Geology and soils	To prevent the damaging of existing soils and geology.	1) The top layer of all areas to be excavated for the purpose of construction shall be stripped and stockpiled in areas where this material will not be damaged, removed or compacted.	<p>Excavated materials correctly stockpiled.</p> <p>No signs of erosion.</p>	Contractor

			2) All surfaces that are susceptible to erosion, shall be protected either by cladding with biodegradable material or with the top layer of soil being seeded with grass seed / planted with a suitable groundcover.		
		To prevent the loss of topsoil	<p>1) Stockpiling will only be done in designated places where it will not interfere with the natural drainage paths of the environment.</p> <p>2) In order to minimize erosion and siltation and disturbance to existing vegetation, it is recommended that stockpiling be done / equipment is stored in already disturbed / exposed areas.</p> <p>3) Cover stockpiles and surround downhill sides with a sediment fence to stop materials washing away.</p> <p>4) Remove vegetation only in areas designated during the planning stage.</p> <p>5) Rehabilitation / landscaping is to be done immediately after the involved works are completed.</p> <p>6) All compacted areas should be ripped prior to them being rehabilitated / landscaped by the contractor as appointed by the individual erf owner.</p> <p>7) The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes.</p> <p>8) Strip topsoil at start of works and store in stockpiles no more than 1,5 m high in designated materials storage area.</p> <p>9) During the laying of any cables, pipelines or infrastructure (on or adjacent to the site) topsoil shall be kept aside to cover the disturbed areas immediately after such activities are completed.</p>	<p>Excavated materials correctly stockpiled.</p> <p>No visible signs of erosion and sedimentation.</p> <p>Minimal invasive weed growth.</p> <p>Vegetation only removed in designated areas.</p>	Contractor of individual developer

	Erosion and siltation	To prevent erosion and siltation.	<ol style="list-style-type: none"> 1) Cut-off of drains should be excavated up- and down-hill of denuded areas to reduce run-off across these areas. 2) Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas. 3) Rehabilitate exposed areas immediately after construction in these areas is completed (not at the end of the project). 4) Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided. 5) All embankments must be adequately compacted and planted with grass to stop any excessive soils erosion and scouring of the landscape. 6) Storm water diversion measures are recommended to control peak flows during thunder storms. 7) The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas. 	<p>No erosion scars.</p> <p>No loss of topsoil.</p> <p>All damaged areas successfully rehabilitated.</p>	Contractor ESO
	Stability of structures due to geology	To ensure stability of structures.	The affected quarries must be filled and proper layer works undertaken to prevent damage to the pipeline structure.	Quarries filled by layerworks undertaken to the satisfaction of the engineer.	Engineers / Contractor
	Corrosivity of soils	To prevent potential damage to metallic elements placed underground due to corrosive soils	All metallic elements must be galvanized or protected by other anti-corrosive methods.	Metallic elements are galvanised or protected by anti-corrosive methods.	Engineers / Contractor

		in dolomitic areas.			
	Hydrology	To minimise pollution of soil, surface and groundwater.	<p>1) Containment of run-off from construction areas should be implemented and the streams closed off from access by construction workers.</p> <p>2) Cut-off drains should be trenched between the streams and the construction activities and hay bales should be stacked along the trenches where possible to contain siltation.</p> <p>3) All spillages must be cleaned up and contaminated soil removed as hazardous waste.</p> <p>5) Affected soil must be treated with DRIZIT or similar product.</p>	<p>No visible signs of erosion.</p> <p>No visible signs of pollution.</p>	Contractor
		To ensure protection of wetlands and rivers	The wetland crossings should take place at 90 degree angles to the drainage line to minimize the length of the crossing within the wetland areas.	River and wetland crossings designed accordingly	Engineer
		To minimise impacts on wetland system	<p>1) Compacted earth berms should be constructed at suitable intervals to reduce the volume and speed of runoff from construction areas into the storm water and wetland systems for the duration of the construction phase of the pipeline. The following guidelines should be used:</p> <ul style="list-style-type: none"> - Where the area has a slope of less than 2%, berms every 50m should be installed. - Where the area slopes between 2% and 10% berms every 25m should be installed. - Where the area slopes between 10% - 15%, berms every 20m should be installed. - Where the area has a slope greater than 15% berms every 10m should be installed. <p>2) Reduce runoff from surface areas as far as possible. The storm water should be introduced into the system at a shallow angle to prevent erosion of the opposite bank of the system.</p> <p>3) No vehicles should be allowed to indiscriminately drive through the wetland areas. A fence should be erected to prevent entry into</p>	<p>Berms constructed.</p> <p>NGL with vegetation coverage (dense) Constructed accordingly.</p>	Contractor / Engineer

			<p>the wetland areas and drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the wetland / drainage line.</p> <p>4) All areas affected by construction should be rehabilitated upon completion of the construction phase of the pipeline. Areas should be reseeded with indigenous grasses as required.</p> <p>5) Upon completion of the construction in the area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made:</p> <ul style="list-style-type: none"> ◆ All areas of disturbed and compacted soils need to be compacted and reprofiled. ◆ Ongoing removal of alien vegetation from the area must take place after the completion of the structure to prevent the uncontrollable species. <p>6) Care must be taken to ensure that construction activities remain within the boundary of the planned sewer pipeline.</p> <p>7) Limited access to the water of the Rietspruit should be given to construction vehicles by fencing off all access points to the water, except at the predetermined water-intake point.</p>	<p>Fence erected</p> <p>Affected areas continuously rehabilitated.</p>	
		To minimise impact on river and wetland system during wet periods	<p>Construction workers and construction vehicles and machinery must stay out of the soggy areas during the wet periods. Barrier tape should be used to demarcate the areas that are drenched with water (especially the ecologically sensitive wetland area and the areas covered with valuable topsoil) and it should only be removed when the appointed Environmental Control Officer (ECO) / site supervisor / project manager / main contractor regard the conditions in the affected areas as favourable.</p>	<p>Areas that are drenched with water (especially the ecologically sensitive wetland area and the areas covered with valuable topsoil) are demarcated with barrier tape.</p>	Contractor / ESO
	Fauna and flora	To protect the existing fauna	<p>1) No plants not indigenous to the area or exotic plant species, especially lawn grasses and other</p>	<p>Only indigenous plants used.</p>	Contractor ESO

		<p>and flora.</p>	<p>ground-covering plants should be used as soil-binding agents along new pipeline as they will drastically interfere with the nature of the area.</p> <p>2) All Category Declared Weeds and other alien species must be removed from the vicinity of the proposed pipeline.</p> <p>3) Ongoing removal of alien vegetation stands which show signs of dominance or active recruitment should take place throughout the construction and operational phase of the development.</p> <p>4) All areas affected by construction should be rehabilitated upon completion of the construction phase of the pipeline. Areas should be reseeded with indigenous grasses as required.</p> <p>5) Trees that are intended to be retained shall be clearly marked on site.</p> <p>6) Snaring and hunting of fauna by construction workers on or adjacent to the study area are strictly prohibited and the Council shall prosecute offenders.</p> <p>7) All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.</p> <p>8) Wood harvesting of any trees or shrubs on the study area or adjacent areas shall be prohibited.</p> <p>9) Where possible work should be restricted to one area at a time.</p> <p>10) Noise should be kept to a minimum and the developer should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.</p> <p>11) The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed.</p>	<p>All Category 1 Declared Weeds and other alien species removed</p>	
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			<p>Caught animals should be relocated to the conservation areas in the vicinity.</p> <p>12) Conservation-orientated clauses should be built into contracts of construction personnel complete with penalty clauses for non-compliance.</p>		
Social	Noise Impact	To maintain noise levels below "disturbing" as defined in the national Noise Regulations.	<p>1) Site workers must comply with the Provincial noise requirements as outlined in Provincial Notice No. 5479 of 1999: Gauteng Noise Control Regulations.</p> <p>2) Noise activities shall only take place during working hours.</p>	No complaints from surrounding residents and I & AP	Contractor
	Dust Impact	Minimise dust from the site	<p>1) Dust pollution could occur during the construction works, especially during the dry months. Regular and effective damping down of working areas (especially during the dry and windy periods) must be carried out to avoid dust pollution that will have a negative impact on the surrounding environment.</p> <p>2) When necessary, these working areas should be damped down in the mornings and afternoons.</p> <p>3) Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, pipelines etc.) must take place at least once a day.</p>	<p>No visible signs of dust pollution</p> <p>No complaints from surrounding residents I & AP</p>	Contractor
	Blasting	To ensure safety during blasting operations.	<p>1) Surrounding residents must be informed of blasting exercises at least one week in advance.</p> <p>2) Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.</p>	Surrounding residents informed. Safety precautions in place.	Engineer Project Manager
	Safety and security	To ensure the safety and security of the public.	<p>1) Although regarded as a normal practice, it is important to erect proper signs indicating the operations of heavy vehicles in the vicinity of dangerous crossings and access routes or even in the development in the development site if necessary.</p>	No incidences reported	Contractor ESO

			<p>2) With the exception of the appointed security personnel, no other workers, friend or relatives will be allowed to sleep on the construction site (weekends included).</p> <p>3) Construction vehicles and activities to avoid peak hour traffic times i.e. between 7am. and 9 am. and again between 4 pm. and 6 pm. On weekdays. Sewer pipeline should be well planned to avoid construction vehicles travelling through residential areas where possible.</p> <p>4) Presence of law enforcement officials at strategic places must be ensured.</p> <p>5) Following actions would assist in management of safety along the sewer pipeline area.</p> <ul style="list-style-type: none"> ▪ Adequate pipeline marking ▪ Although regarded as a normal practice, it is important to erect proper signs indicating the danger of the excavation in and around the development site. Putting temporary fencing around excavations where possible. <p>6) It is important to erect warning signs on existing routes when impacted on by the construction of the pipeline (i.e. construction of intersections / bridges).</p> <p>7) Traffic on existing routes should be controlled during construction activities impacting on these routes (i.e. construction works at intersections, construction of bridges).</p>		
	Influx of people from other areas	In order to limit the influx of people from other areas.	It is recommended that (where possible) only people from the local communities in and around Centurion employed.	People from local community employed.	Contractor
	Infrastructure and services	Installation of services	Determine areas where services will be upgraded and relocated well in advance. Discuss possible disruptions with affected parties to determine most convenient times for services disruptions and warn affected parties well in advance of dates that service disruptions will take place	No complaints from I & AP	Contractor ESO

	Cultural Resources	To ensure the protection of cultural resources	<p>1) If any graves or archaeological sites are exposed during construction work it would immediately be reported to a museum. The report from the archaeologist must be provided to SAHRA if any graves are recovered.</p> <p>2) It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or material.</p> <p>3) Also important is that Section 34(1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.</p>	No destruction of or damage to graves or known archaeological sites.	Contractor ESO
	Visual impact	To minimize the visual impact of the proposed development.	Establish dense vegetation at strategic points to screen-off the most visible sections of the pipeline/ construction of berms adjacent to the pipeline / a combination of berms with vegetation.	Visual impact minimized	Architect
	Vegetation	Landscaping	<p>1) The proposed planting materials for the areas to be landscaped should preferably be endemic and indigenous.</p> <p>2) All new trees and shrubs to be planted on the study area shall be inspected for pests and diseases prior to them being planted.</p> <p>3) The inspection shall be carried out by the maintenance contractor at property of the supplier and not on the study area.</p> <p>4) All trees to be planted shall be in 20L containers with a height of approximately 1,8 metres and a main stem diameter of approximately 300 mm.</p>	Landscaping done according to street master plan.	Landscape architect Contractor / individual Developer
		Loss of plants	1) Aerate compacted soil and check and correct pH for soils affected by construction activities.	Landscaping done according to landscape development plan.	Landscape architect Contractor /

			<p>2) Make sure plant material will be matured enough and hardened of ready for planting. Water in plants immediately as planting proceeds.</p> <p>3) Apply much to conserve moisture plant according to the layout and planting techniques specified by the Landscape Architect in the Landscape Development plans for the site.</p>		Individual Developer
		Spread of weeds	Ensure that materials used for mulching and topsoil / fertilisers are certified weed free. Collect certifications where available. Control weed growth that appears during construction.	Weed growth controlled	Landscape architect Contractor / individual developer
		To ensure rehabilitation of the site	<p>1) All areas affected by construction should be rehabilitated upon completion of the construction phase of the pipeline.</p> <p>2) Compacted soils shall be ripped at least 200 mm.</p> <p>3) All clumps and rocks larger than 30 mm diameter shall be removed from the soil to be rehabilitated.</p> <p>4) The soil shall be leveled before seeding.</p> <p>5) Areas should be reseeded with indigenous grasses as required.</p> <p>6) Watering shall take place at least once per day for the first 14 days until germination of seeds have taken place.</p> <p>7) Thereafter watering should take place at least for 20 minutes every 4 days until grass have hardened off.</p>	Grass have hardened off	Landscape architect Contractor
			<p>1) Upon completion of the construction in around the wetland area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made:</p> <ul style="list-style-type: none"> ◆ All areas of disturbed and compacted soils 	Rehabilitation of wetland area	Contractor ESO

			<p>need to be compacted and reprofiled.</p> <p>◆ Ongoing removal of alien vegetation from the area must take place after the completion of the structure to prevent the uncontrollable recruitment of these species.</p> <p>2) Ongoing removal of alien vegetation stands which show signs of dominance or active recruitment should take place throughout the construction and operational phase of the development.</p>		
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4.3 Operational Phase

Site clean up and prepared for use	Storm water pollution	Do not allow any materials to wash into the storm water system.	Remove erosion and sediment controls only if all bare soil is sealed, covered or re-vegetate.		Contractor
		Minimise waste	Decontaminate and collect waste in storage area ready for off-site recycling or disposal. Arrange for final collection and removal of excess and waste materials.		Contractor
Establishing plants	Slow or no revegetation to stabilize soil, loss or degradation of habitat	To ensure revegetation to stabilize soil	Agreed schedule for regular follow-up watering, weed control, mulch supplements and amenity pruning, if needed. Replace all plant failures within three month period after planting		Contractor
Drainage failure	On-site and downstream drainage pollution or flooding	Storm water management plan	Inspect all site drainage works and repair any failures. Confer with design engineer and to correct site problems as part of the Dolomite Risk Management Plan.		Contractor / Dolomite Risk manager
Site audit	Eventual project failure	Successful project establishment	Routinely audit the works and adjust maintenance schedule accordingly.		Contractor

General			Open fires and smoking during maintenance works are strictly prohibited.		Contractor
Geology	Dolomite Risk Management		1) A Dolomite Risk Management Plan must be established and adhered to at all times. 2) A monitoring plan must form part of the general maintenance plan for the pipeline and allowance must be made for stability problems to be addressed immediately.		Dolomite Risk manager
Hydrology	Water pollution	To prevent water pollution of river and wetland systems	1) All spillages must be cleaned up and contaminated soil removed as hazardous waste. 2) Affected soil must be treated with DRIZIT or similar product.		Contractor

5. Procedures for environmental incidents

5.1 Leakages & spills

- Identify source of problem.
- Stop goods leaking, if safe to do so.
- Contain spilt material, using spills kit or sand.
- Notify Environmental Control Officer
- Remove spilt material and place in sealed container for disposal (if possible).
- Environmental Control Officer to follow Incident Management Plan.

5.2 Failure of erosion/sediment control devices

- Prevent further escape of sediment.
- Contain escaped material using silt fence, hay bales, pipes, etc.
- Notify ECO.
- Repair or replace failed device as appropriate.
- Dig/scrape up escaped material; take care not to damage vegetation.
- Remove escaped material from site.
- ECO to follow Incident Management plan.
- Monitor for effectiveness until re-establishment.

5.3 Bank/slope failure

- Stabilize toe of slope to prevent sediment escape using aggregate bags, silt fence, logs, hay bales, pipes, etc.
- Notify ECO.
- ECO to follow Incident Management plan.
- Divert water upslope from failed fence.
- Protect area from further collapse as appropriate.
- Restore as advised by ECO.
- Monitor for effectiveness until stabilized.

5.4 Discovery of rare or endangered species

- Stop work.
- Notify ECO.
- If a plant is found, mark location of plants.
- If an animal, mark location where sighted.
- ECO to identify or arrange for identification of species and or the relocation of the species if possible.
- If confirmed significant, ECO to liaise with Endangered Wildlife Trust.
- Recommence work when cleared by ECO.

5.5 Discovery of archeological or heritage items

- Stop work.
- Do not further disturb the area.
- Notify ECO.
- ECO to arrange appraisal of specimen.

- If confirmed significant, ECO to liaise with National, Cultural and History Museum.
P.O. Box 28088
SUNNYSIDE, 0132
Contact Mr. J. van Schalkwyk
or Mr. Naude
- Recommence work when cleared by ECO.

6. EMP review

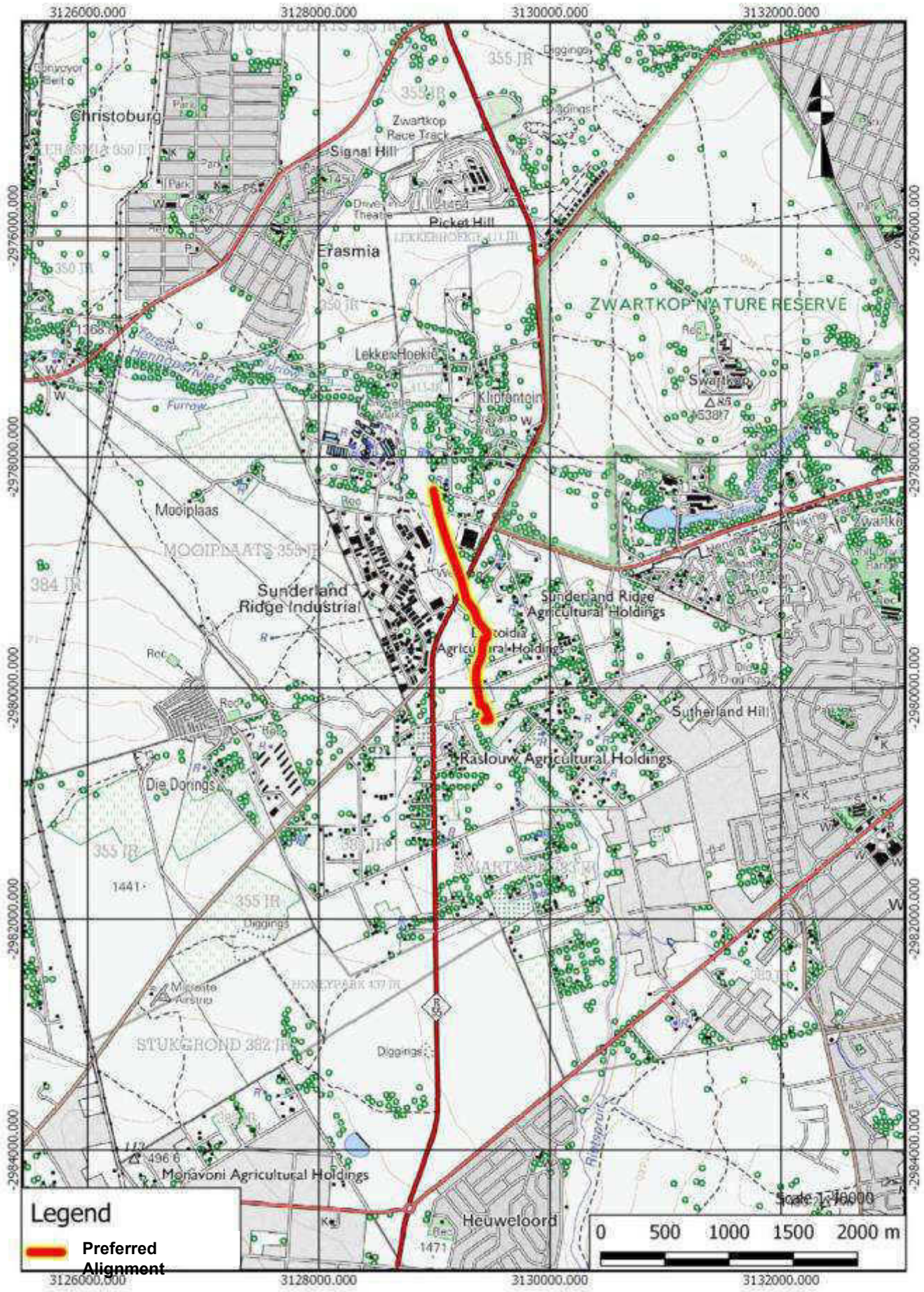
1. The Site supervisor is responsible for ensuring the work crew is complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes that may have been implemented by GDARD before starting any works.
2. If the contractor cannot comply with any of the activities as described above, they should inform the ECO with reasons within 7 working days.

Enlarged Figures



Locality Map Figure 1





Legend
 Preferred Alignment

Scale 1:10000
 0 500 1000 1500 2000 m

Aerial Map Figure 2



3130000.000



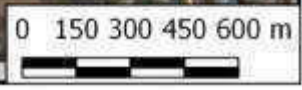
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Legend

— Preferred Alignment

Scale 1:20000

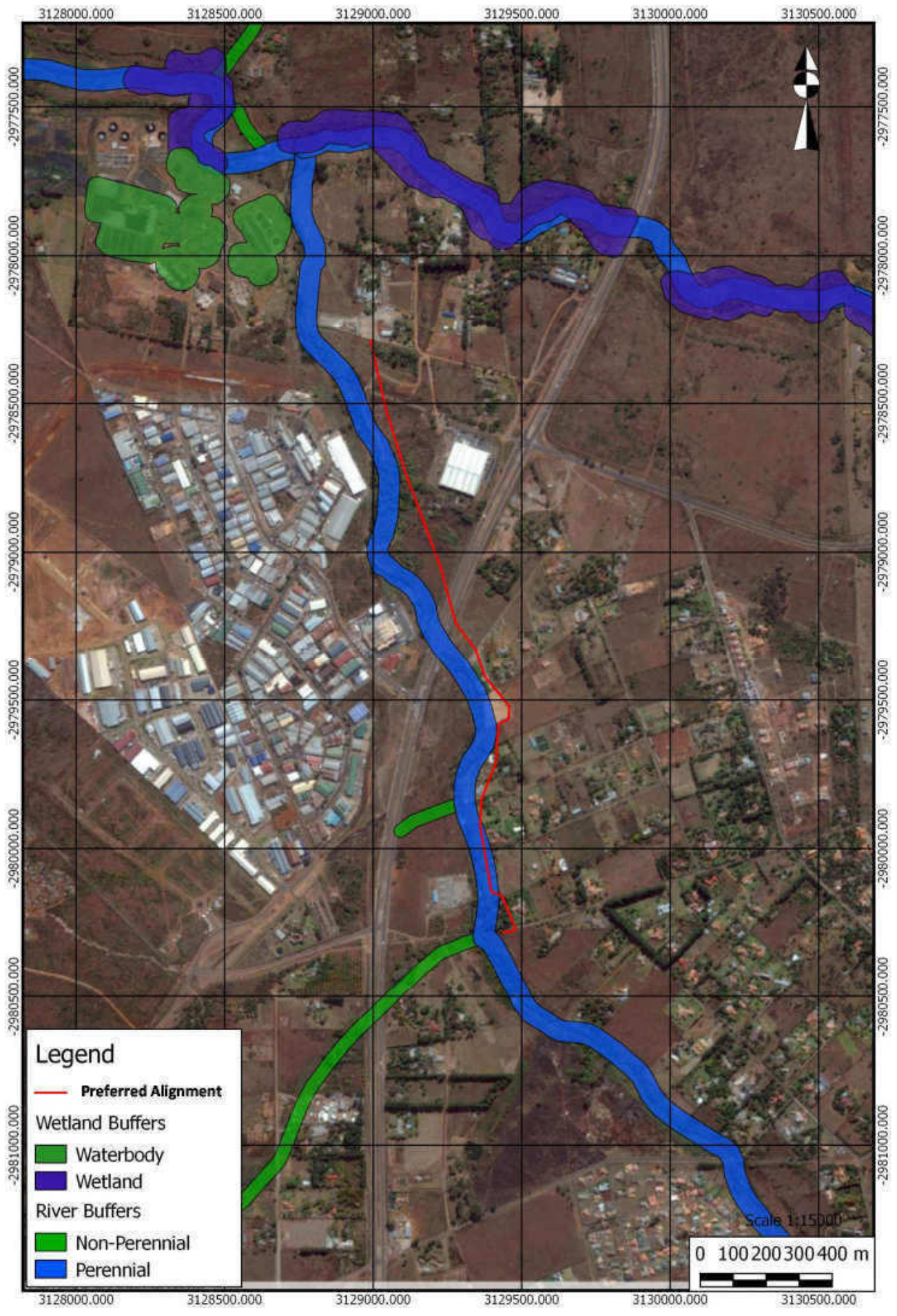


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Hydrology Map Figure 3





Protected Areas

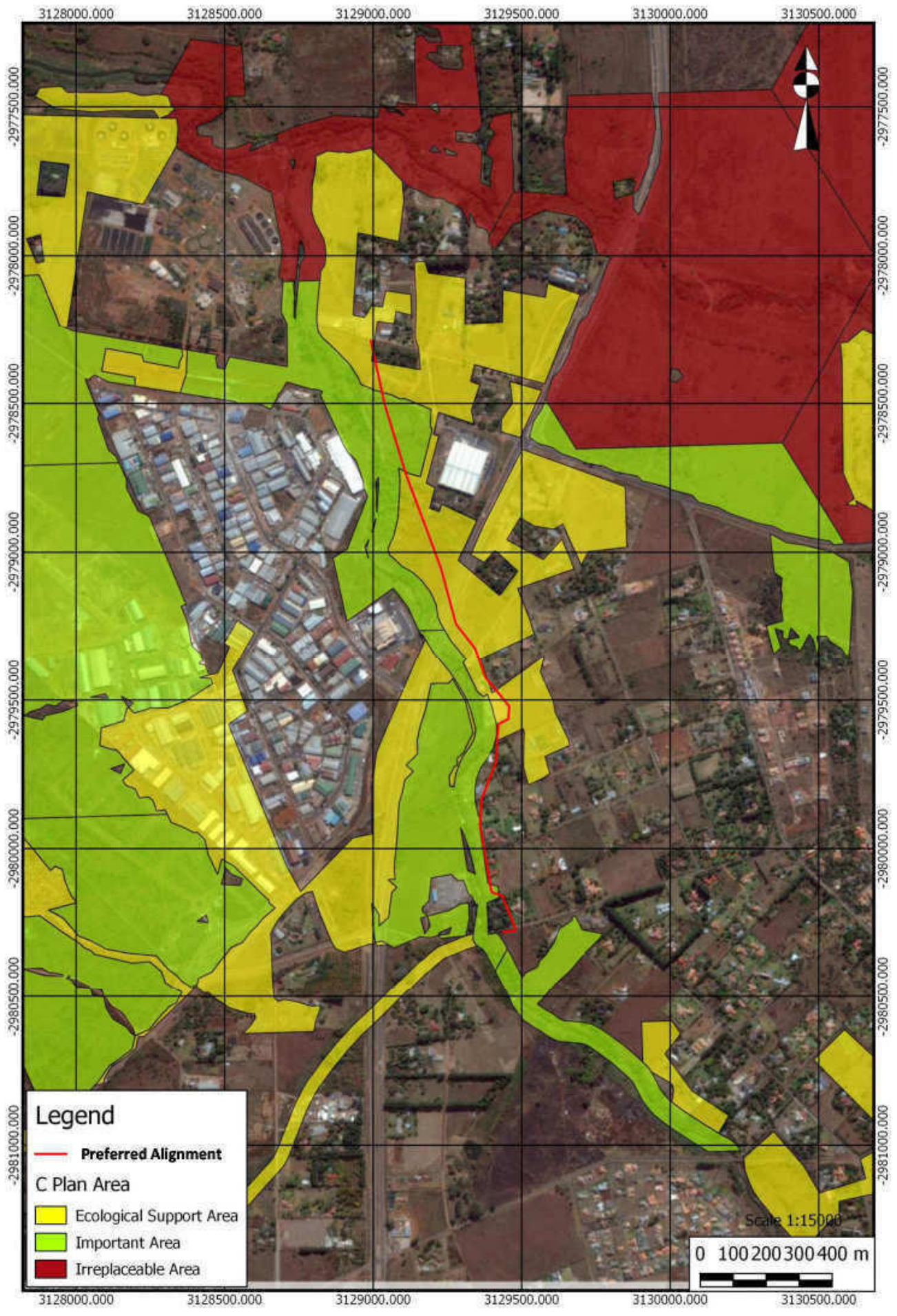
Figure 4





**Irreplaceable Map
Figure 5**





Legend

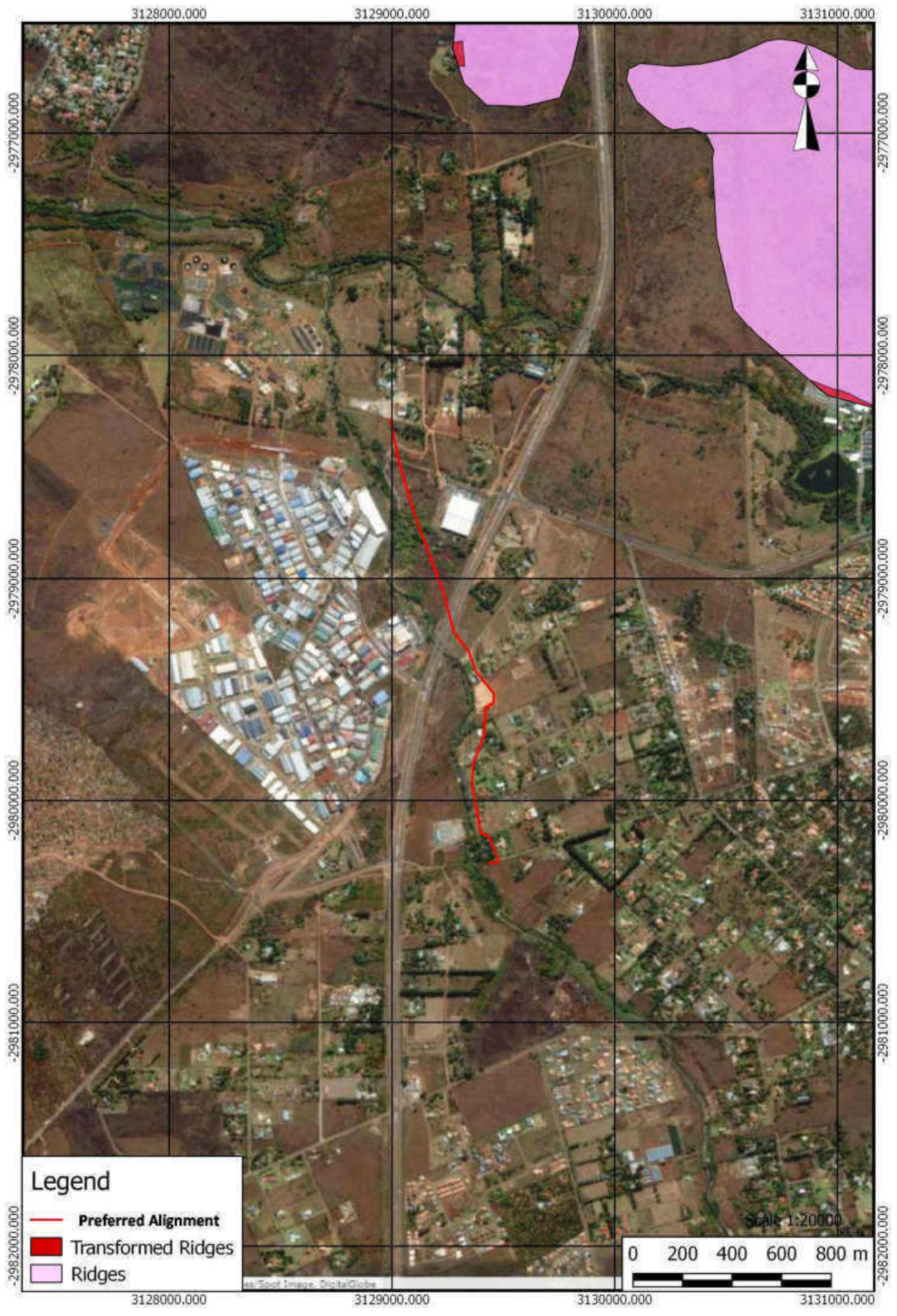
- Preferred Alignment
- Ecological Support Area
- Important Area
- Irreplaceable Area

Scale 1:15000
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Ridges

Figure 6





Legend

- Preferred Alignment
- Transformed Ridges
- Ridges

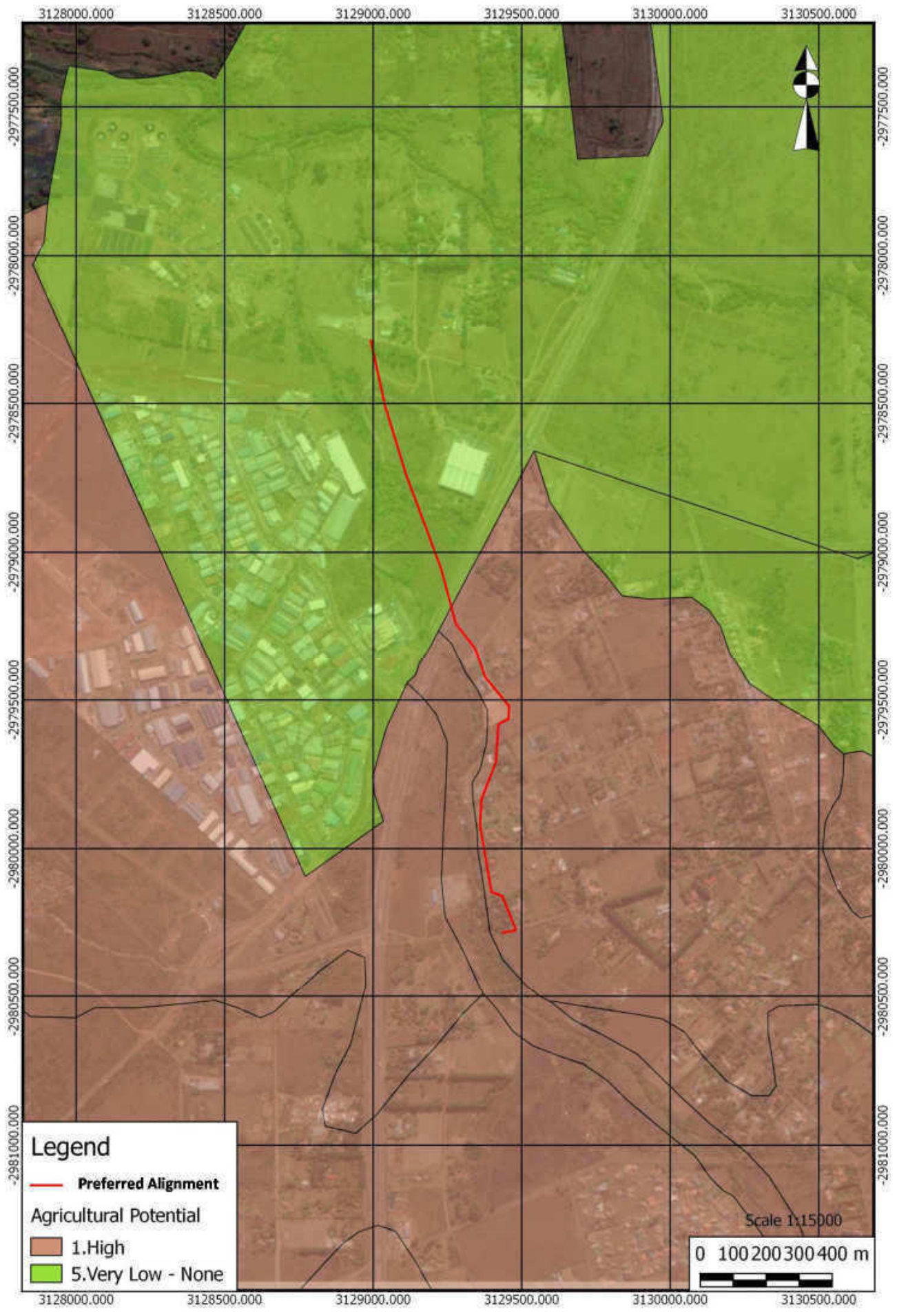


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Agricultural Potential

Figure 7

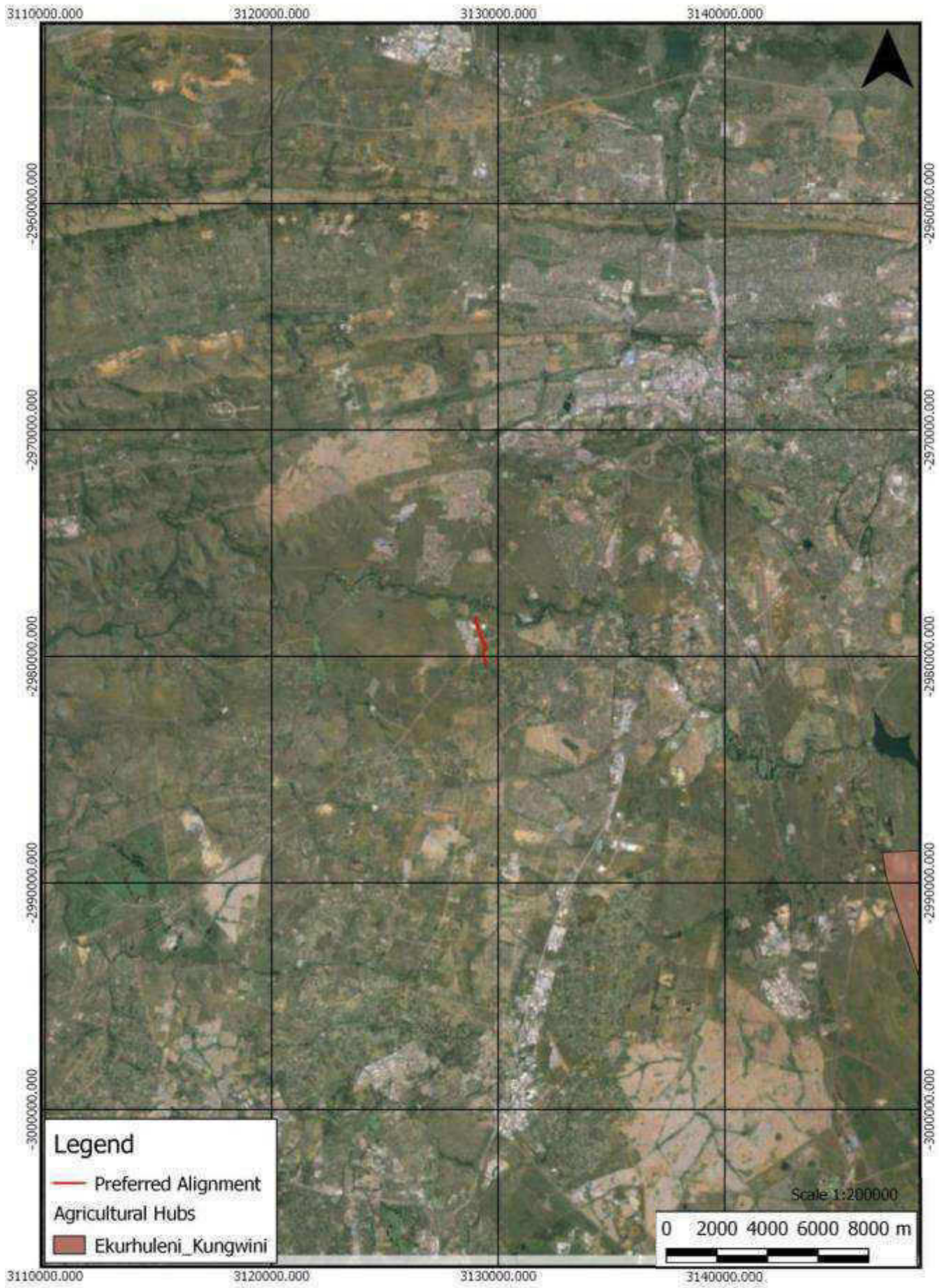




Agricultural Hubs

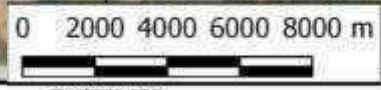
Figure 8





Legend

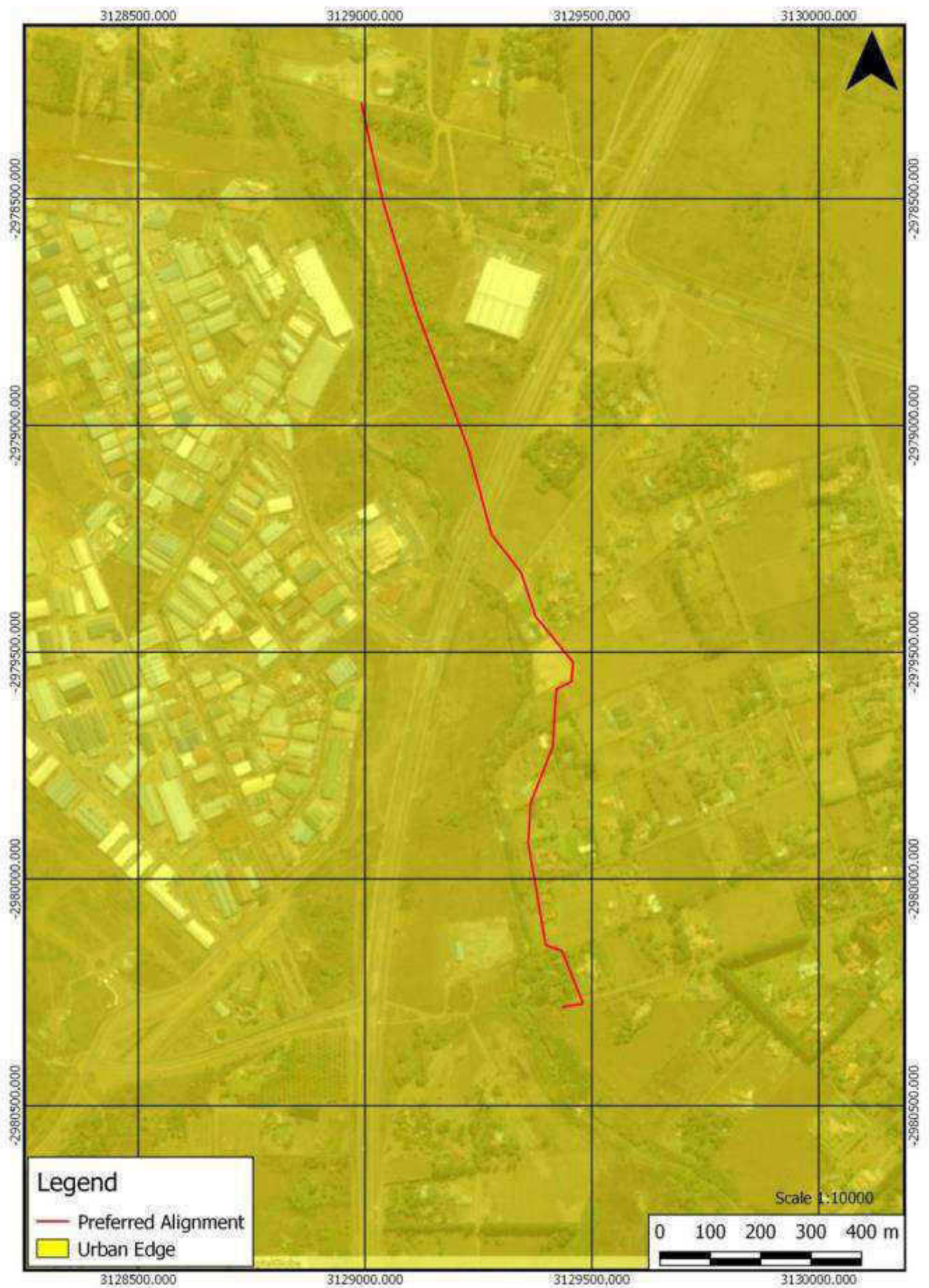
- Preferred Alignment
- Agricultural Hubs
- Ekurhuleni_Kungwini



Scale 1:200000

Urban Edge
Figure 9

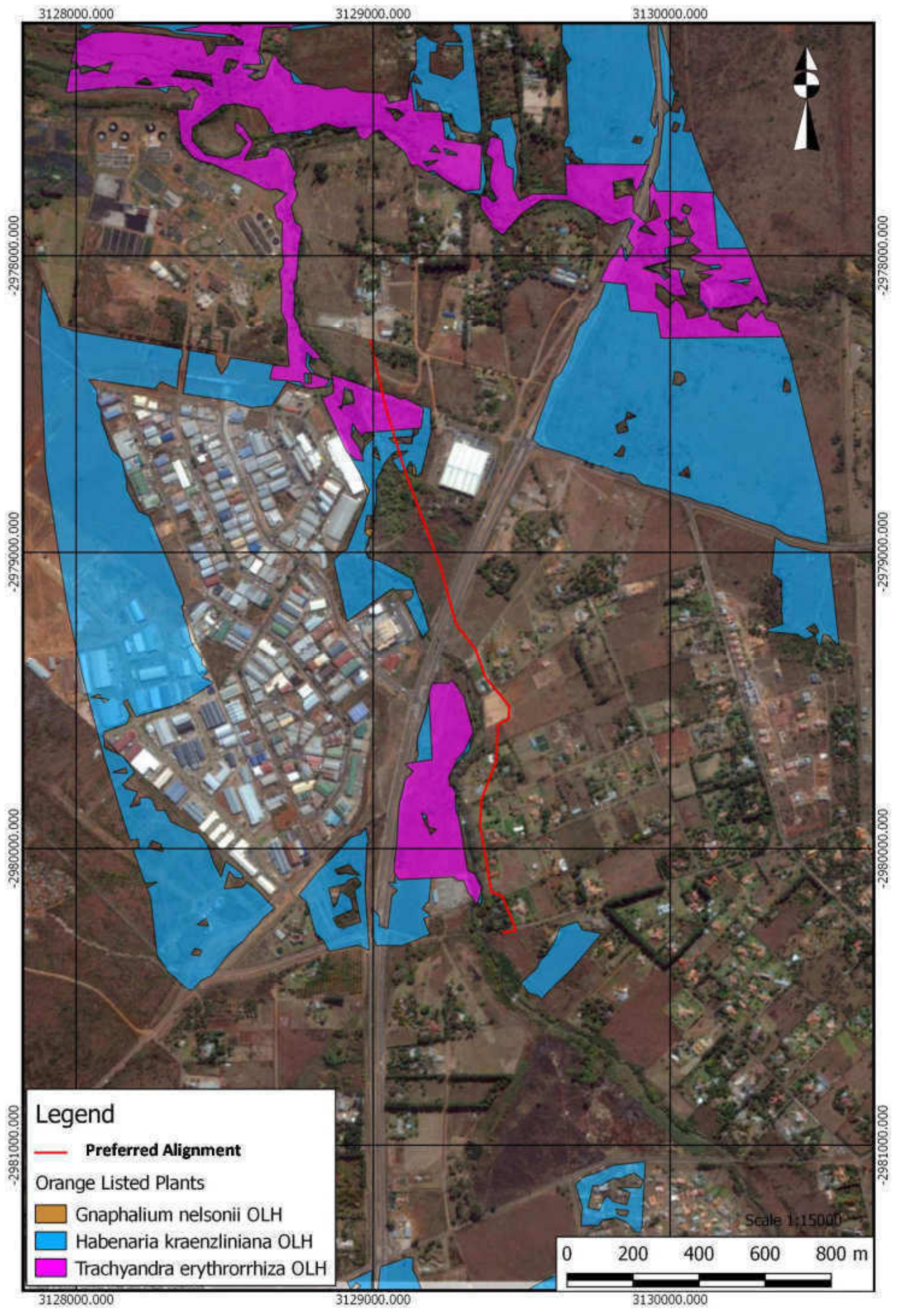




Orange Listed Plants

Figure 10





Legend

- Preferred Alignment
- Orange Listed Plants
- *Gnaphalium nelsonii* OLH
- *Habenaria kraenzliniana* OLH
- *Trachyandra erythrorrhiza* OLH



Scale 1:15000

Roads and Railways

Figure 11





Street Map
 — Preferred Alignment

Scale 1:50000
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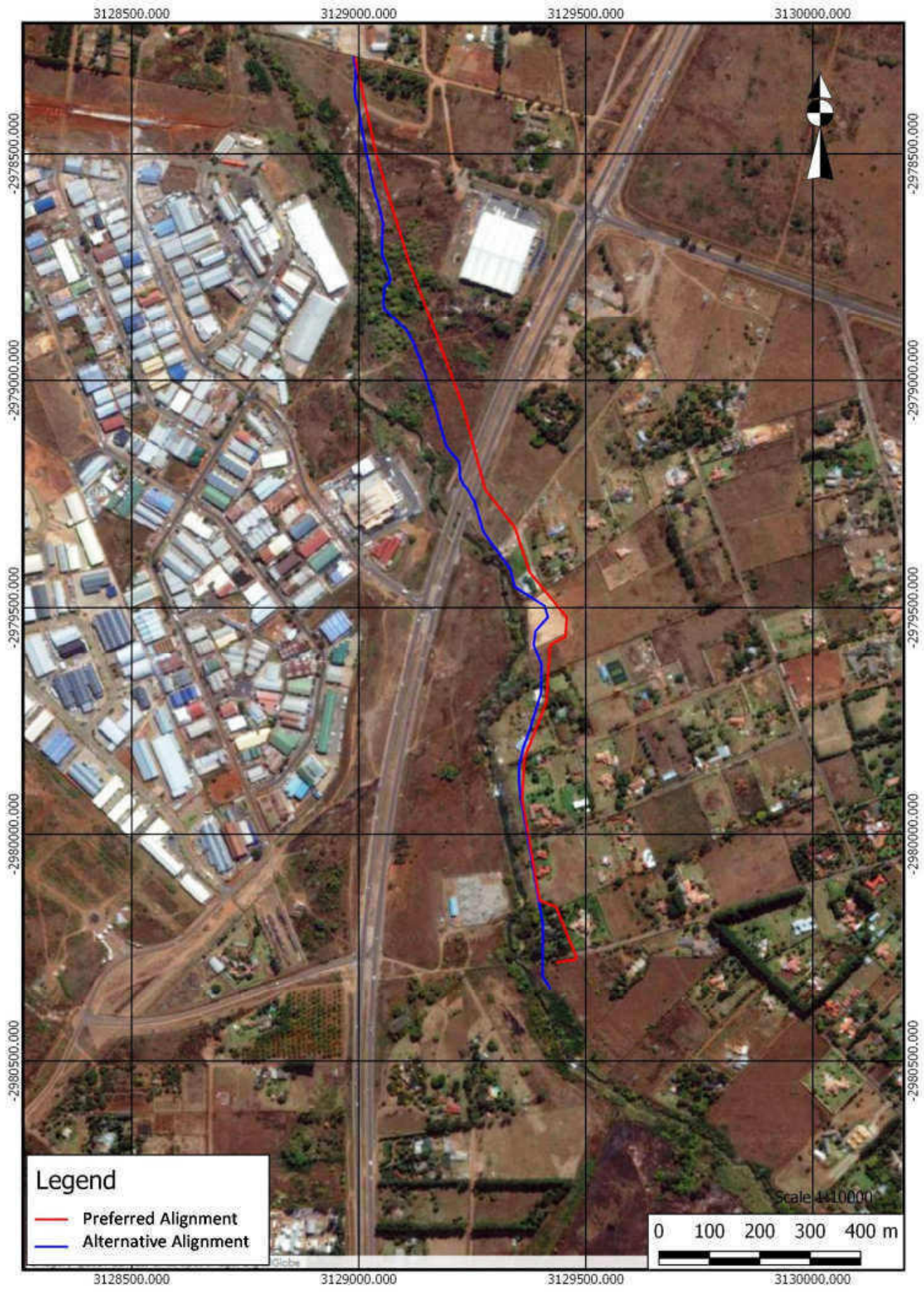
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-2976000.000 -2978000.000 -2980000.000 -2982000.000 -2984000.000

Proposed and Alternative Alignments

Figure 12



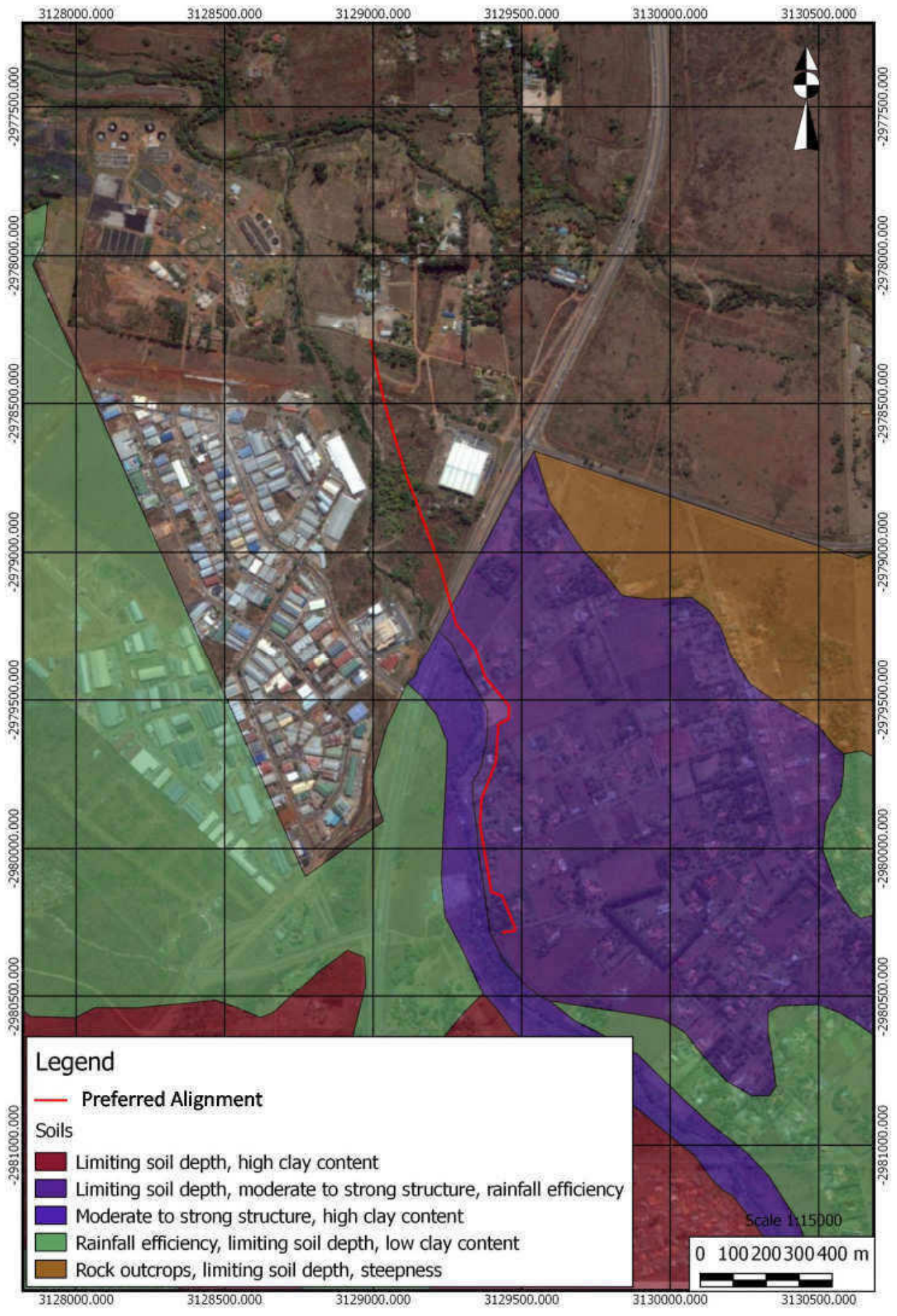


Legend
— Preferred Alignment
— Alternative Alignment

Scale 1:10,000
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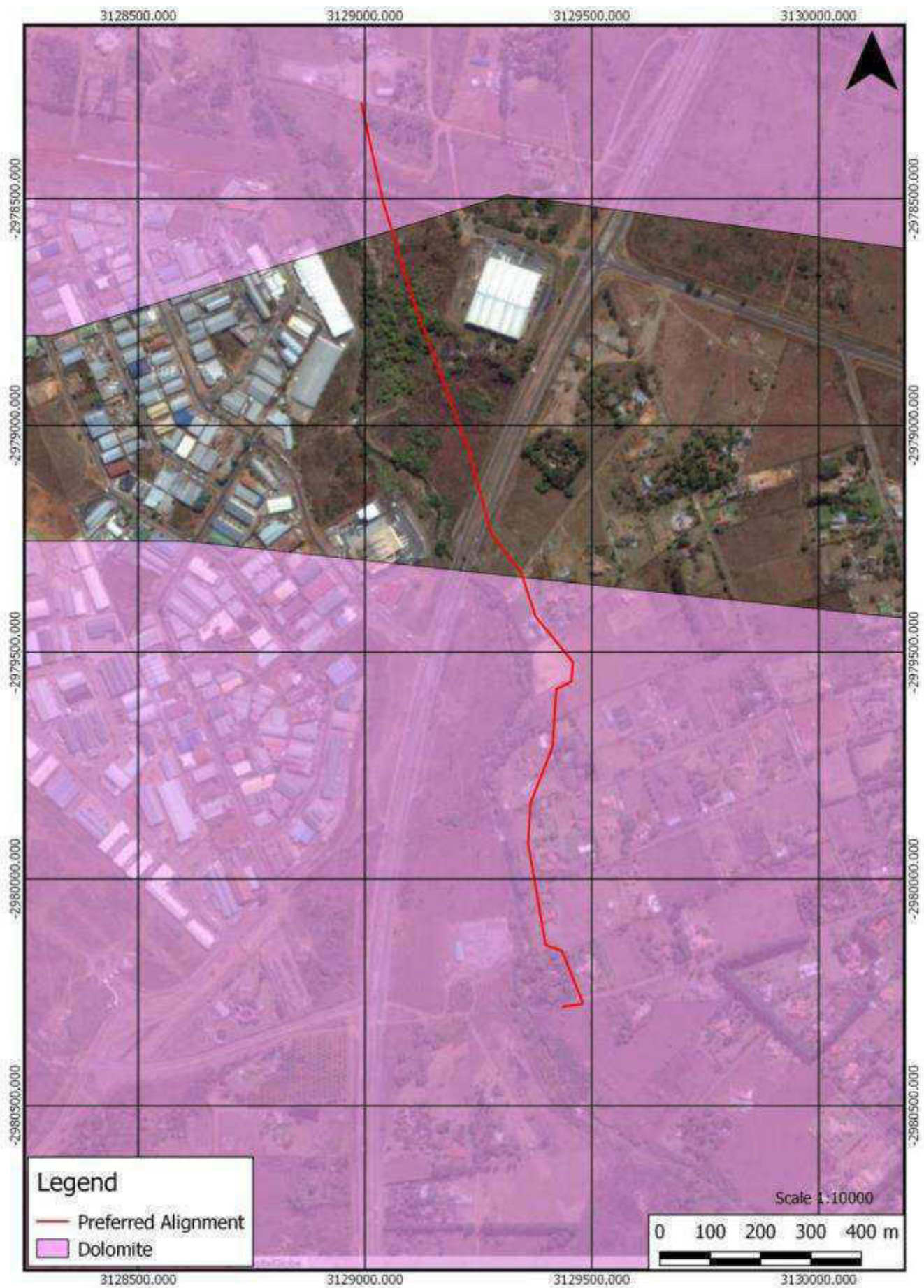
Soils
Figure 13





Dolomite
Figure 14





Wetland/River Boundary
Figure 15

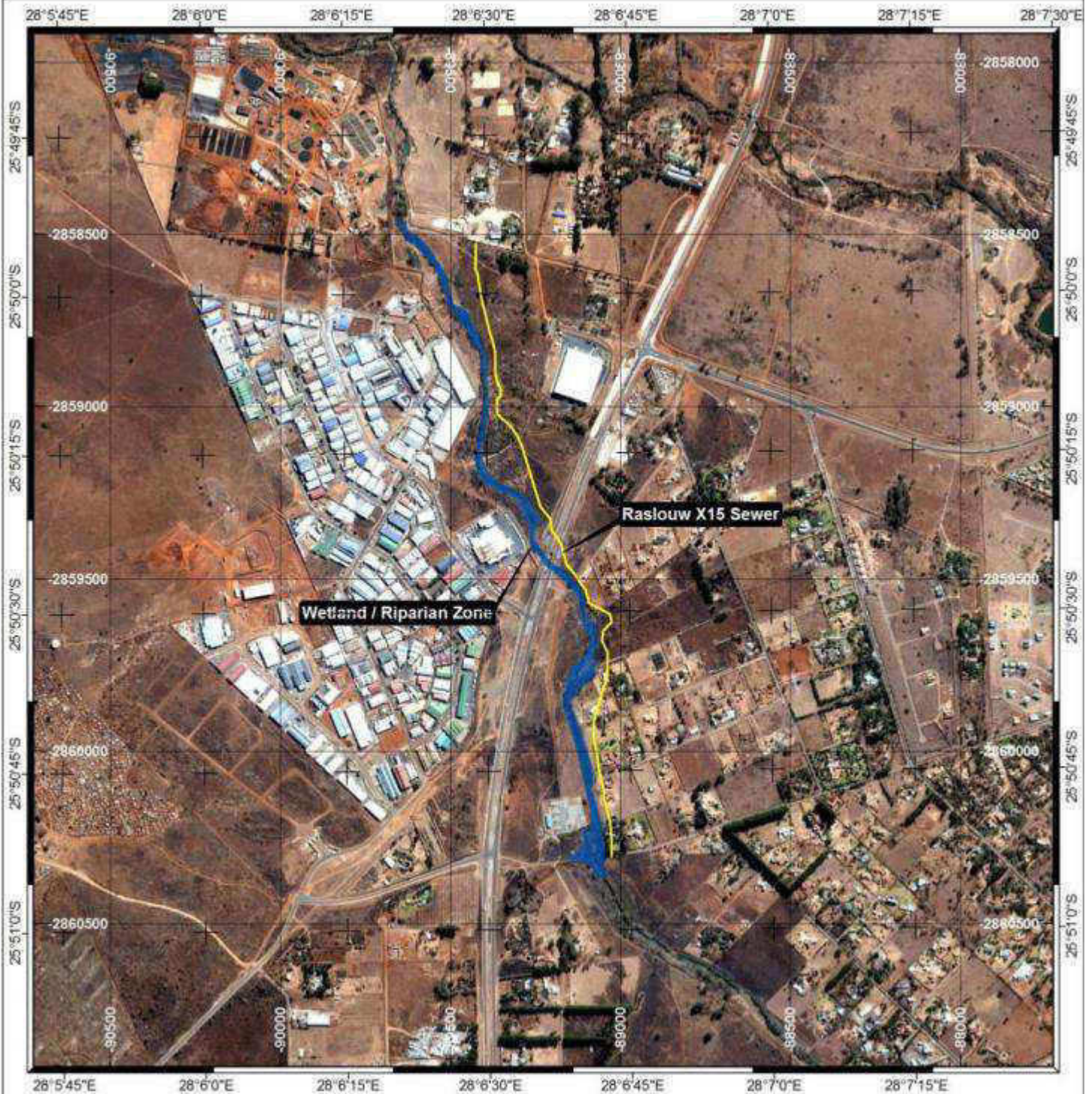


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(Email) lourens@terragis.co.za

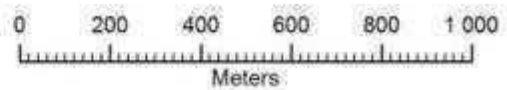
RASLOUW X15 SEWER

Wetland / Riparian Boundary

Cartography & Spatial Analysis
TERRAGIS



Projection - Transverse Mercator
Datum - Hartebeeshoek 1994
Reference Ellipsoid - WGS 1984
Central Meridian - 29



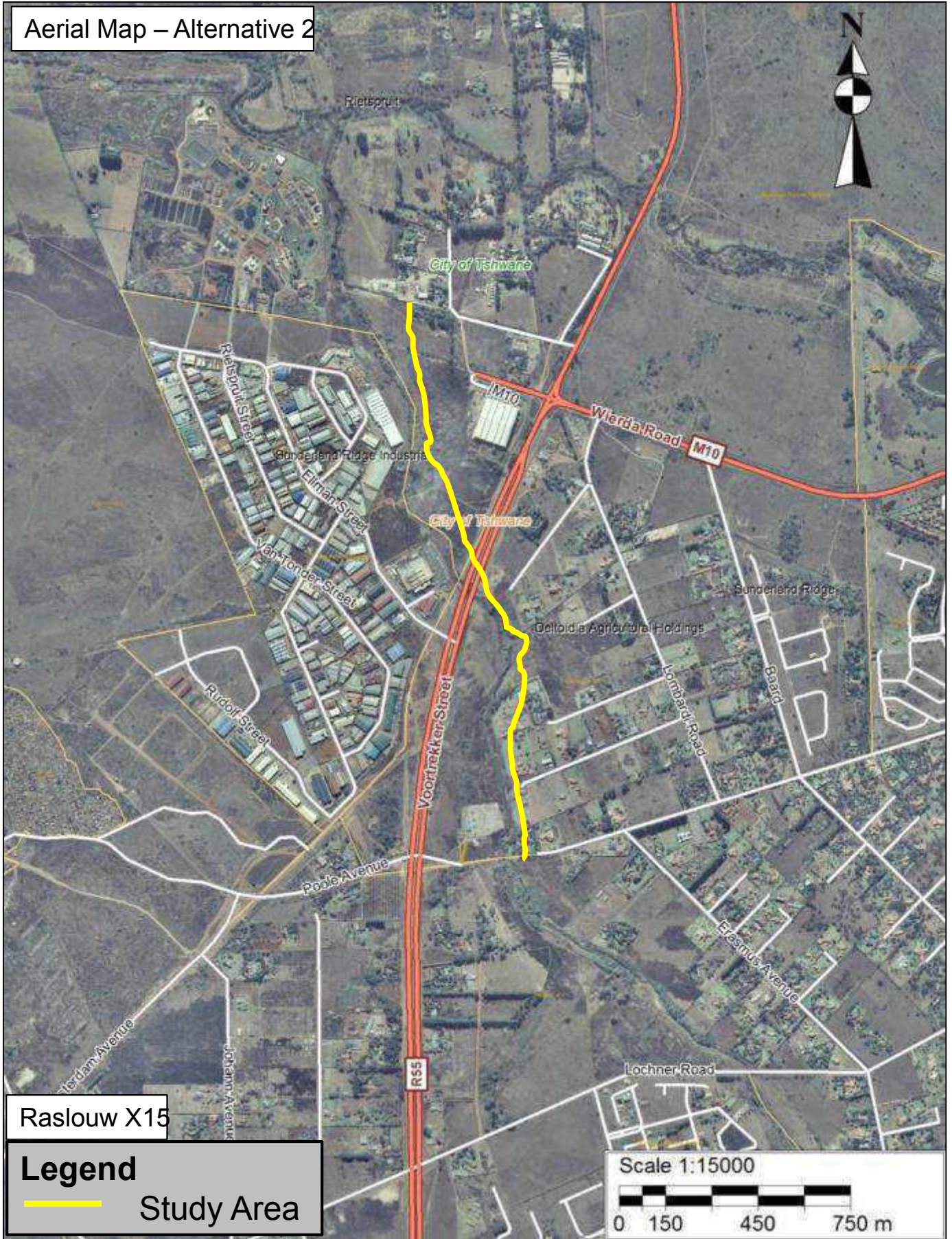
Locality Map for Alternative 2
Figure 16



Aerial Map for Alternative 2 Figure 17



Aerial Map – Alternative 2



Raslouw X15

Legend

— Study Area

Scale 1:15000

0 150 450 750 m

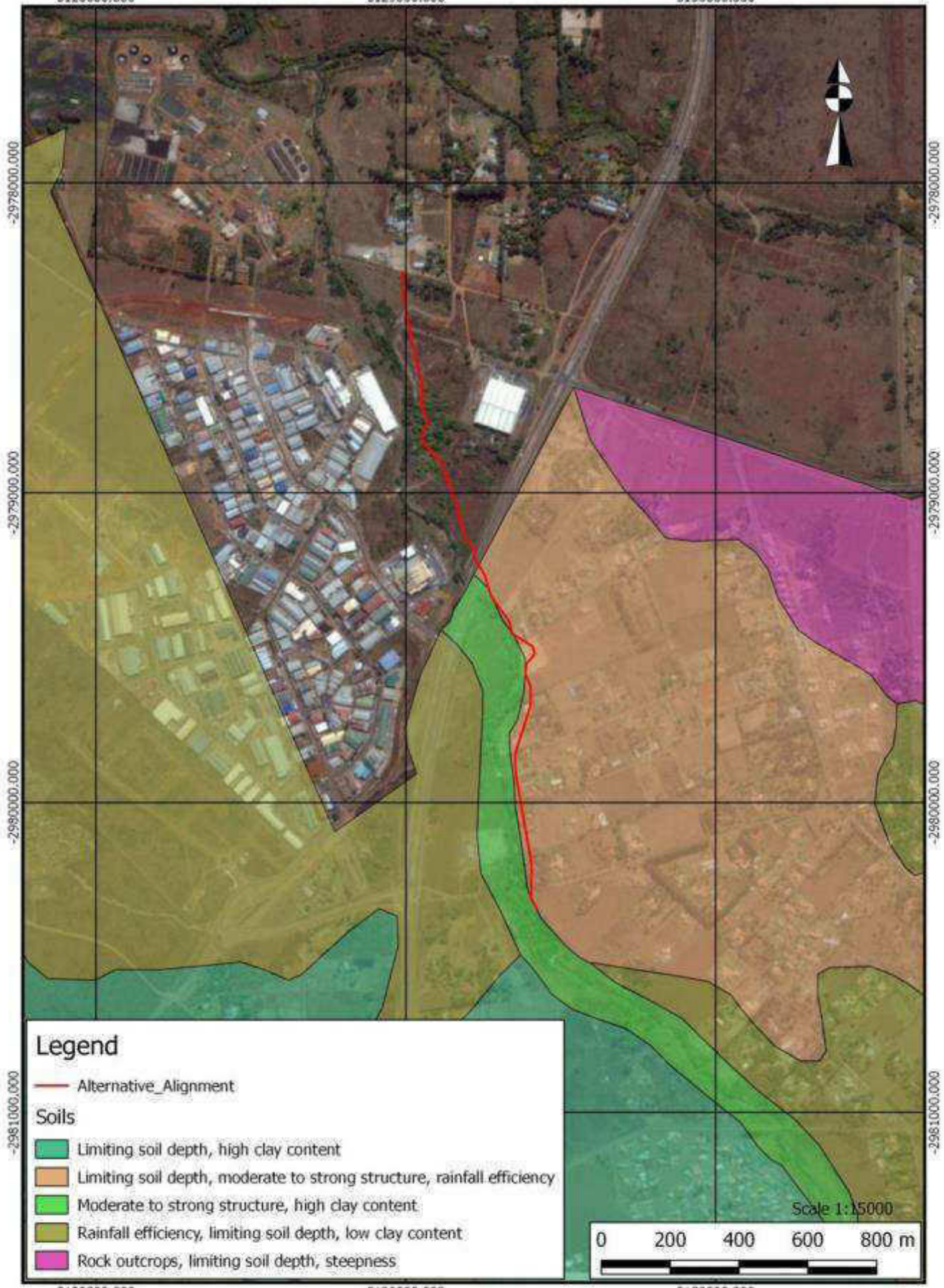
**Alternative 2 Soils
Figure 18**



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-2979000.000
-2980000.000
-2981000.000

-2978000.000
-2979000.000
-2980000.000
-2981000.000

Legend

— Alternative_Alignment

Soils

-  Limiting soil depth, high clay content
-  Limiting soil depth, moderate to strong structure, rainfall efficiency
-  Moderate to strong structure, high clay content
-  Rainfall efficiency, limiting soil depth, low clay content
-  Rock outcrops, limiting soil depth, steepness

0 200 400 600 800 m

Scale 1:15000

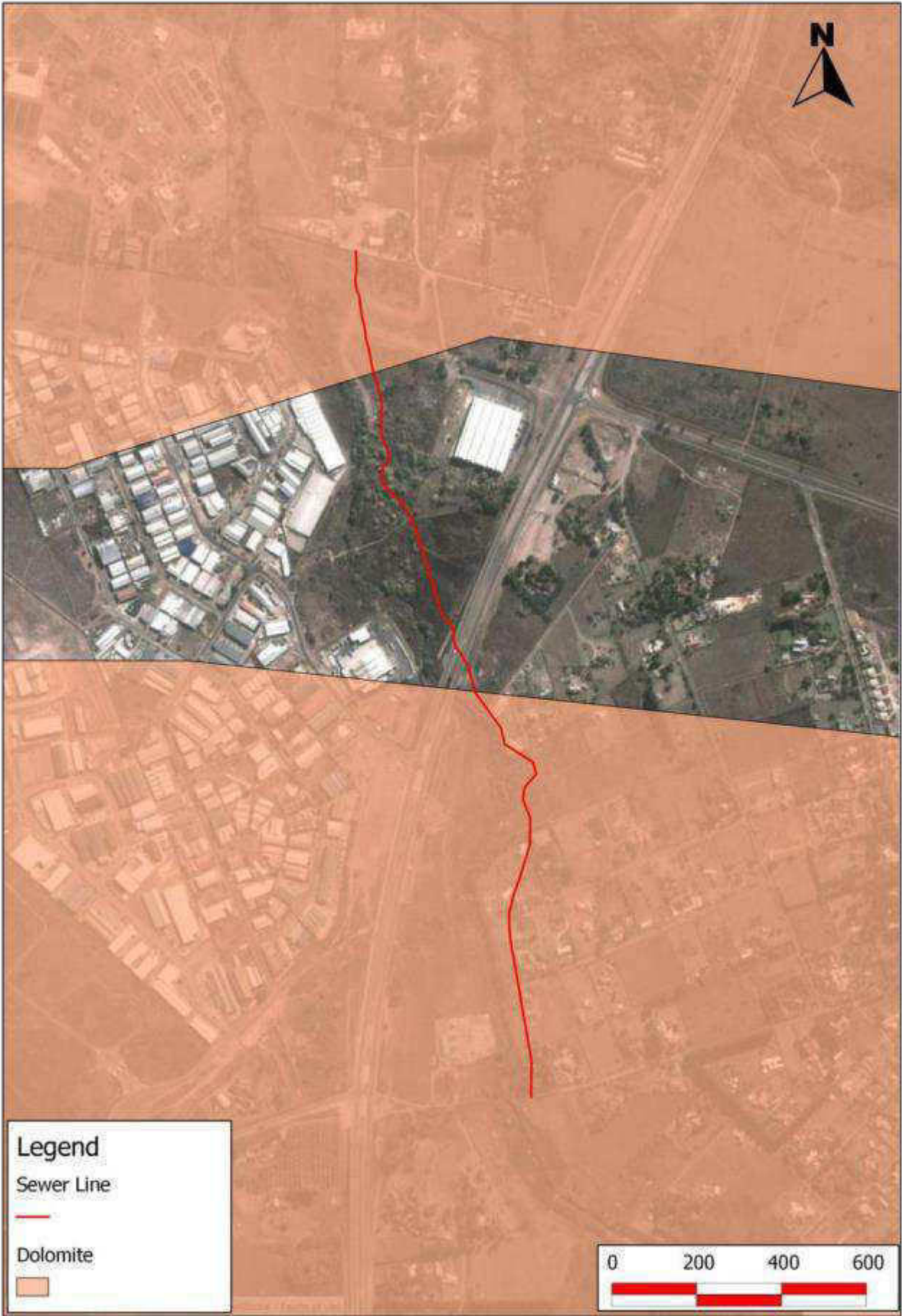
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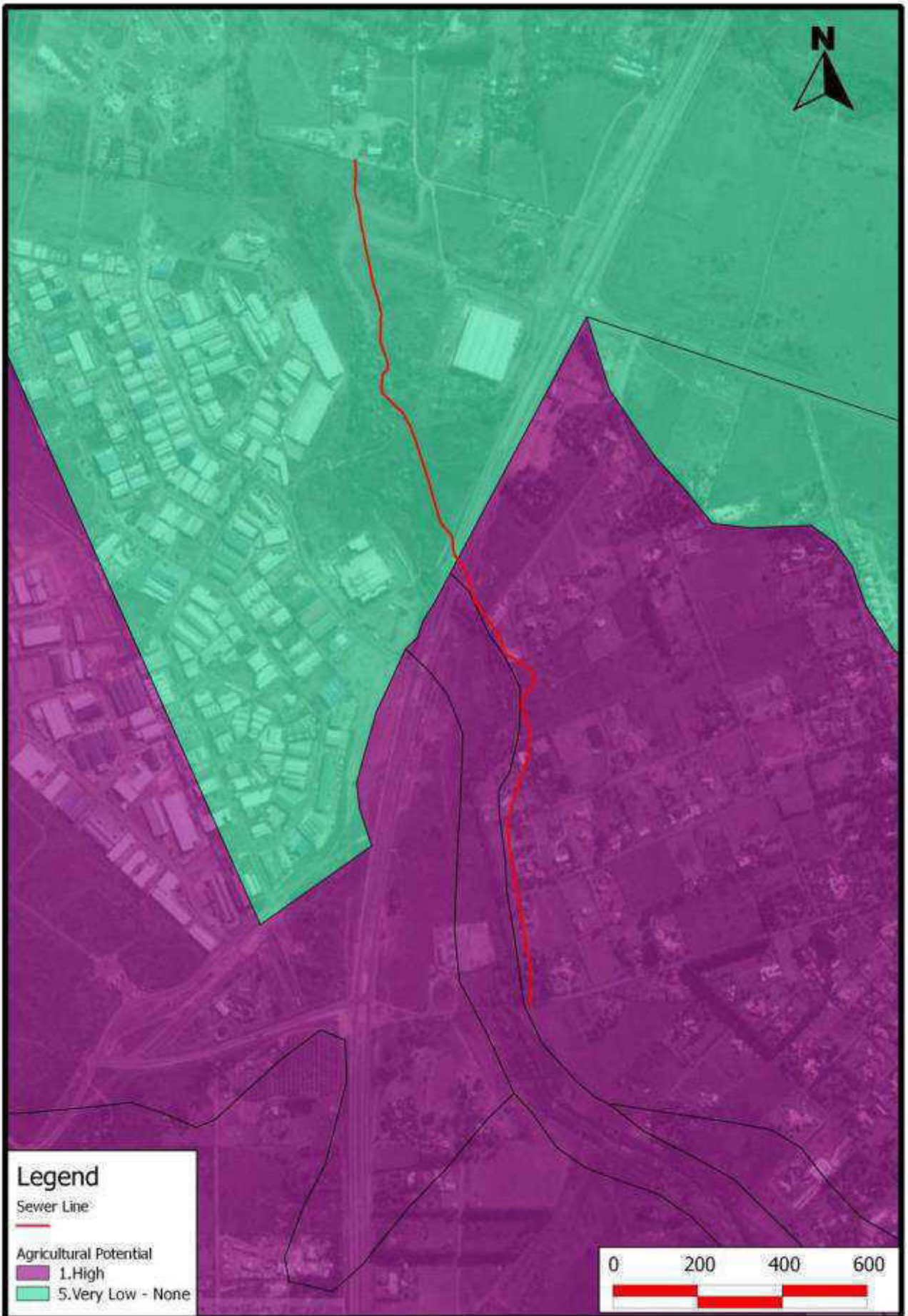
**Alternative 2 Dolomite
Figure 19**





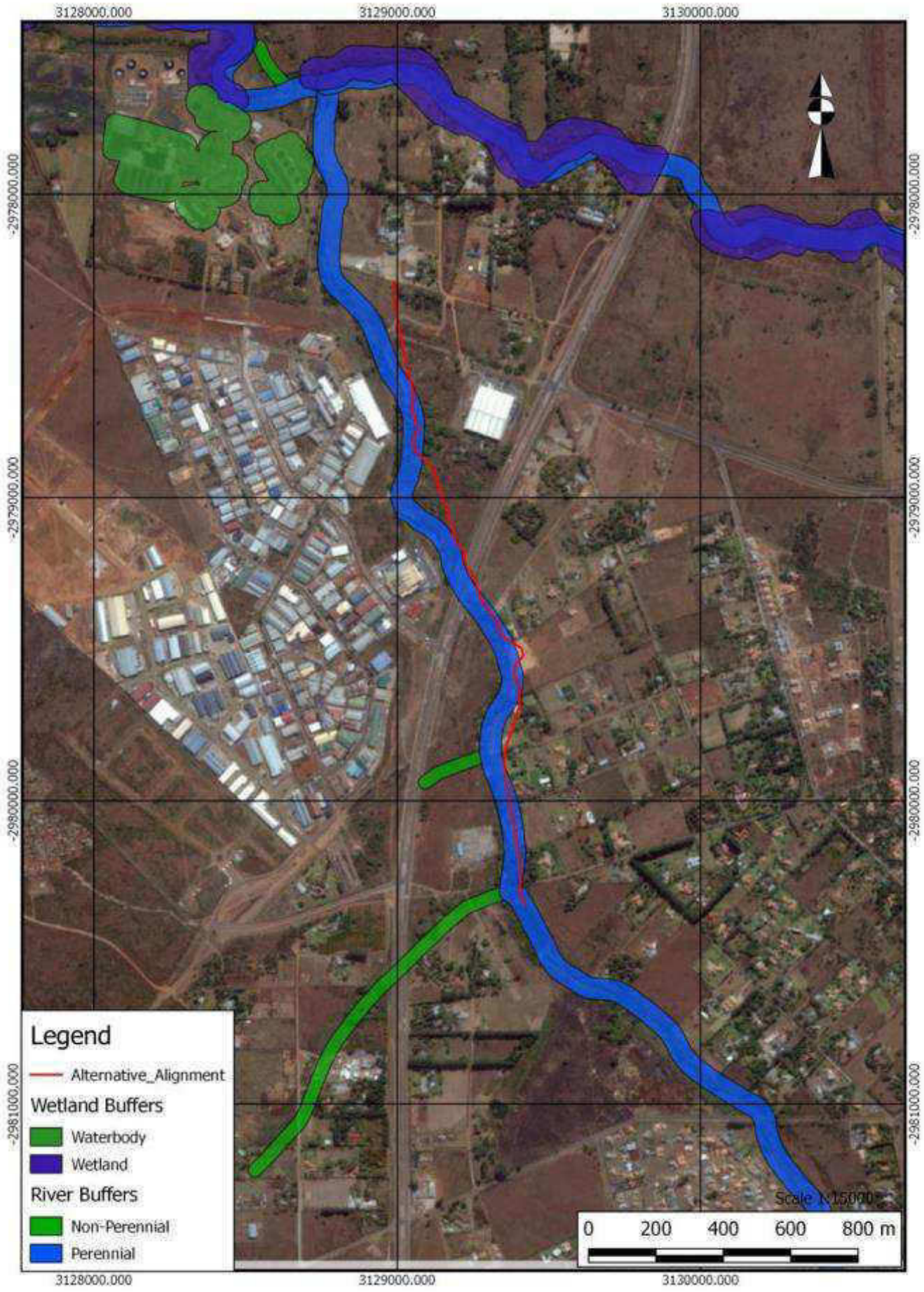
Alternative 2 Agricultural Potential Figure 20





Alternative 2 Rivers Figure 21





Company Profile & CV of Lizelle Gregory (Environmental Assessment Practitioner)





Bokamoso

**Landscape Architects &
Environmental consultants**

**P.O.BOX 11375
Maroelana
0161**

**Tel: (012) 346 3810
Fax: (086) 570 5559**

**E-mail: lizelle@mweb.co.za
Website: www.bokamoso.biz**

- 01** Executive Summary
- 02** Vision, Mission & Values
- 03** Human Resources
- 04** Services
- 05** Landscape Projects
- 06** Corporate Highlights
- 07** Environmental Projects
- 08** Indicative Clients
- 09** Tools

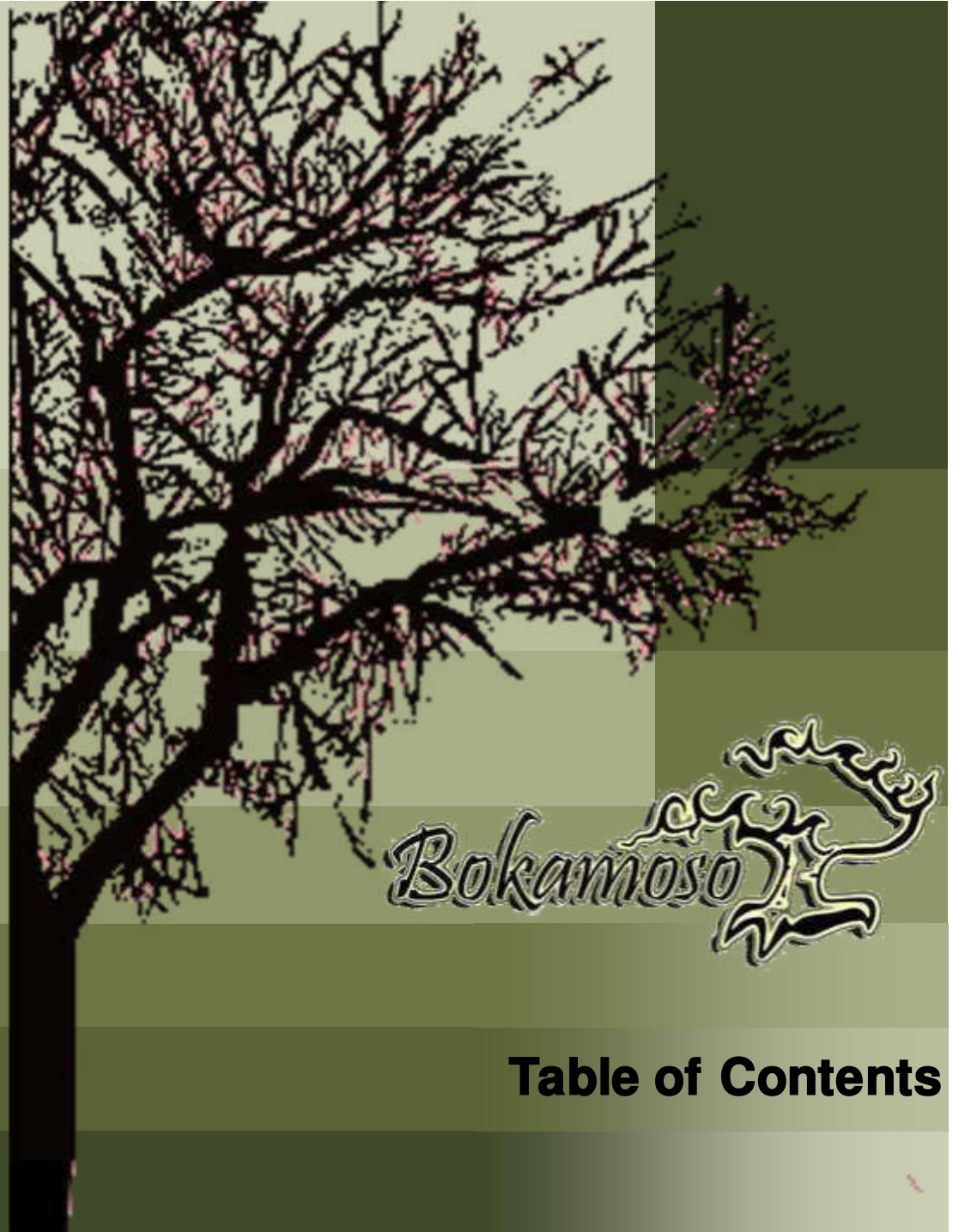


Table of Contents

Bokamoso specialises in the fields of Landscape Architecture and all aspects of Environmental Management and Planning. Bokamoso was founded in 1992 and has shown growth by continually meeting the needs of our clients. Our area of expertise stretches throughout the whole of South Africa. Our projects reflect the competence of our well compiled team. The diversity of our members enables us to tend to a variety of needs. Our integrated approach establishes a basis for outstanding quality. We are well known to clients in the private, commercial as well as governmental sector.

At Bokamoso we stand on a firm basis of environmental investigation in order to find unique solutions to the requirements of our clients and add value to their operations.



01 Executive Summary

011 Company Overview



Vision:

At Bokamoso we strive to find the best planning solutions by taking into account the functions of a healthy ecosystem. Man and nature should be in balance with each other.

Mission:

We design according to our ethical responsibility, take responsibility for successful completion of projects and constitute a landscape that contributes to a sustainable environment. We add value to the operations of our clients and build long term relationships that are mutually beneficial.

Values:

Integrity

Respect



Bokamoso stands on the basis of fairness. This include respect within our multicultural team and equal opportunities in terms of gender, nationality and race.

We have a wide variety of projects to tend to, from complicated reports to landscape installation. This wide range of projects enables us to combine a variety of professionals and skilled employees in our team.

Bokamoso further aids in the development of proficiency within the working environment. Each project, whether in need of skilled or unskilled tasks has its own variety of facets to bring to the table.

We are currently in the process of receiving our BEE scorecard. We support transformation in all areas of our company dynamics.



03 Human Resources

031 Employment Equity

Lizelle Gregory (100% interest)

Lizelle Gregory obtained a degree in Landscape Architecture from the University of Pretoria in 1992 and passed her board exam in 1995.

Her professional practice number is PrLArch 97078.

Ms. Gregory has been a member of both the Institute for Landscape Architecture in South Africa (ILASA) and South African Council for the Landscape Architecture Profession (SACLAP), since 1995.

Although the existing Environmental Legislation doesn't yet stipulate the academic requirements of an Environmental Assessment Practitioner (EAP), it is recommended that the Environmental Consultant be registered at the International Association of Impact Assessments (IAIA). Ms. Gregory has been registered as a member of IAIA in 2007.

Ms. Gregory attended and passed an International Environmental Auditing course in 2008. She is a registered member of the International Environmental Management and Assessment Council (IEMA).

She has lectured at the Tshwane University of Technology (TUT) and the University of Pretoria (UP). The lecturing included fields of Landscape Architecture and Environmental Management.

Ms. Gregory has more than 20 years experience in the compilation of Environmental Evaluation Reports:

Environmental Management Plans (EMP);

Strategic Environmental Assessments;

All stages of Environmental input ;

EIA under ECA and the new and amended NEMA regulations and various other Environmental reports and documents.

Ms. Gregory has compiled and submitted more than 600 Impact Assessments within the last 5-6 years. Furthermore, Ms. L. Gregory is also familiar with all the GDARD/Provincial Environmental policies and guidelines. She assisted and supplied GAUTRANS/former PWV Consortium with Environmental input and reports regarding road network plans, road determinations, preliminary and detailed designs for the past 12 years.



03 Human Resources

032 Members

Consulting

Anè Agenbacht

Introduction to Sustainable Environmental Management—An overview of Principles, Tools, & Issues (Potch 2006)
Leadership Training School (Lewende Woord 2010)
BA Environmental Management (UNISA 2011)
PGCE Education (Unisa 2013) - CUM LAUDE
Project Manager
More than 10 years experience in the compilation of various environmental reports

Mary-Lee Van Zyl

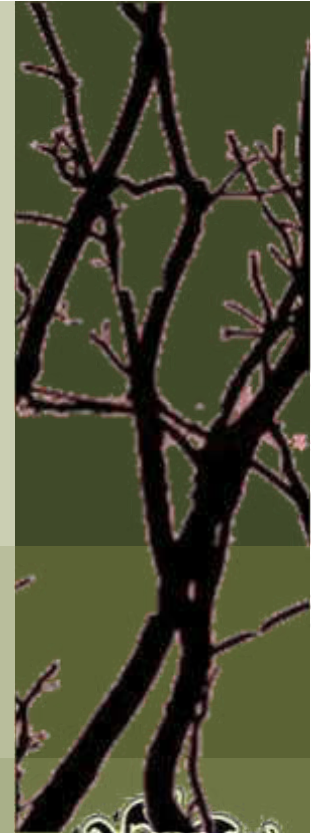
Msc. Plant Science (UP)
BSc (Hons) Plant Science (UP)
BSc Ecology (UP)
More than 3 years working experience in the Environmental field
Specialises in ECO works, Basic Assessments, EIA's, and Flora Reports
Compilation of various Environmental Reports

Dashentha Naidoo

BA Honours Degree in Environmental Management (UNISA) - CUM LAUDE
Bachelor Social Science in Geography & Environmental Management (UKZN)
More than 4 years experience in WUL Application & Integrated Environmental Management within water resource management.
Senior Environmental Practitioner & Water Use Licences Consultant
Specialises in Water Use License & Compilation of various Env. Reports

Ben Bhukwana

BSc Landscape Architecture (UP)
More than 5 years experience in the field of Landscape Architecture (Design, Construction, and Implementation).
Specialises in Landscape Design, ECO, Rehabilitation Plans and Compilation Basic Assessment Reports
Compilation of Tender documents



03 Human Resources

033 Personnel

Anton Nel

B-Tech Landscape Technology (TUT)
N Dip Landscape Technology (TUT)
Hazardous Waste Management Short Course
2 years experience in ECO.
Specialises in Basic Assessment Reports.

Juanita de Beer

Diploma Events Management and Marketing (Damelin)
Specializes in Public relations and Public Participation Processes (3 years experience)

Alfred Thomas

CIW Foundation& Internet Marketing (IT Academy)
12 years experience in GIS and IT in general.
GIS Operator and Multimedia Specialist.

Bianca Reyneke

Applying SHE Principles and Procedures (NOSA)
Intro to SAMTRAC Course (NOSA)
SHEQ Coordinator and compilation of environmental reports
Specialises in compiling various environmental reports

A.E. van Wyk

BSc. Environmental Sciences (Zoology and Geography)
Specialises in compiling various environmental reports



03 Human Resources

034 Personnel

Elsa Viviers

Interior Decorating (Centurion College)

(Accounting/ Receptionist) and Secretary to Lizelle Gregory

Loura du Toit

N. Dip. Professional Teacher (Heidelberg Teachers Training College)

Librarian and PA to Project Manager

Merriam Mogalaki

Administration Assistant with in-house training in bookkeeping

Landscape Contracting

Elias Maloka

Site manager overseeing landscape installations.

Irrigation design and implementation.

Landscape maintenance

18 years experience in landscape contracting works.

The contracting section comprises of six permanently employed black male workers. In many cases the team consists of up to 12 workers, depending on the quantity of work.



03 Human Resources

035 Personnel

01 Environmental Management Services

- Basic Assessment Reports
- EIA & Scoping Reports
- Environmental Management Plans
- Environmental Scans
- Strategic Environmental Assessments
- EMP for Mines
- Environmental Input and Evaluation of Spatial Development Frameworks
- State of Environmental Reports
- Compilation of Environmental Legislation and Policy Documents
- Environmental Auditing and Monitoring
- Environmental Control Officer (ECO)
- Visual Impact assessments
- Specialist Assistance with Environmental Legislation Issues and Appeals
- Development Process Management
- Water Use License applications to DWA
- Waste License Application



04 Services

041 Consulting Services

02 Landscape Architecture

- Master Planning
- Sketch Plans
- Planting Plans
- Working Drawings
- Furniture Design
- Detail Design
- Landscape Development Frameworks
- Landscape Development Plans (LDP)
- Contract and Tender Documentation
- Landscape Rehabilitation Works

03 Landscape Contracting

Implementation of Plans for:

- Office Parks
- Commercial/ Retail / Recreational Development
- Residential Complexes
- Private Residential Gardens
- Implementation of irrigation systems



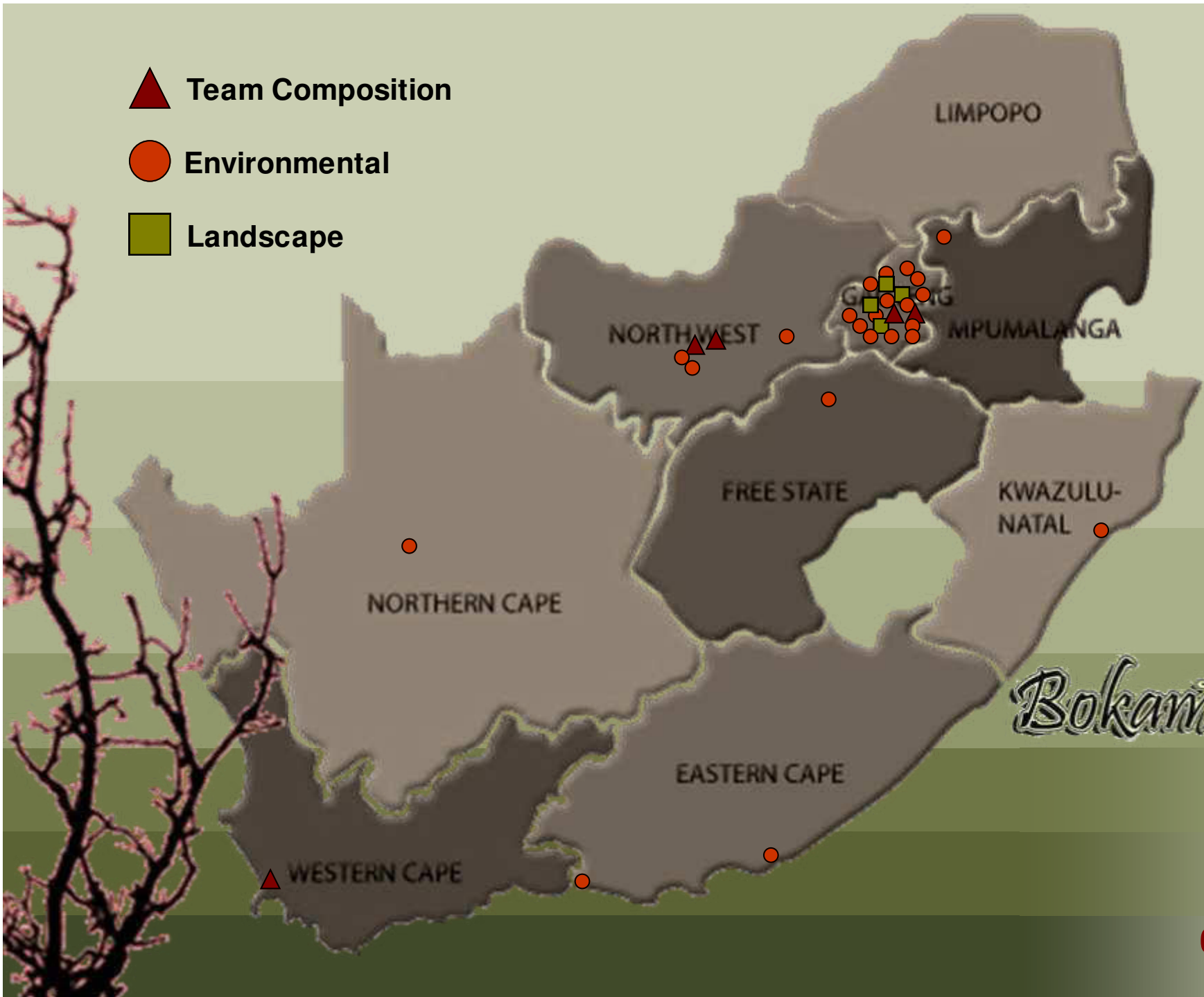
04 Services

042 Contracting Services

▲ Team Composition

● Environmental

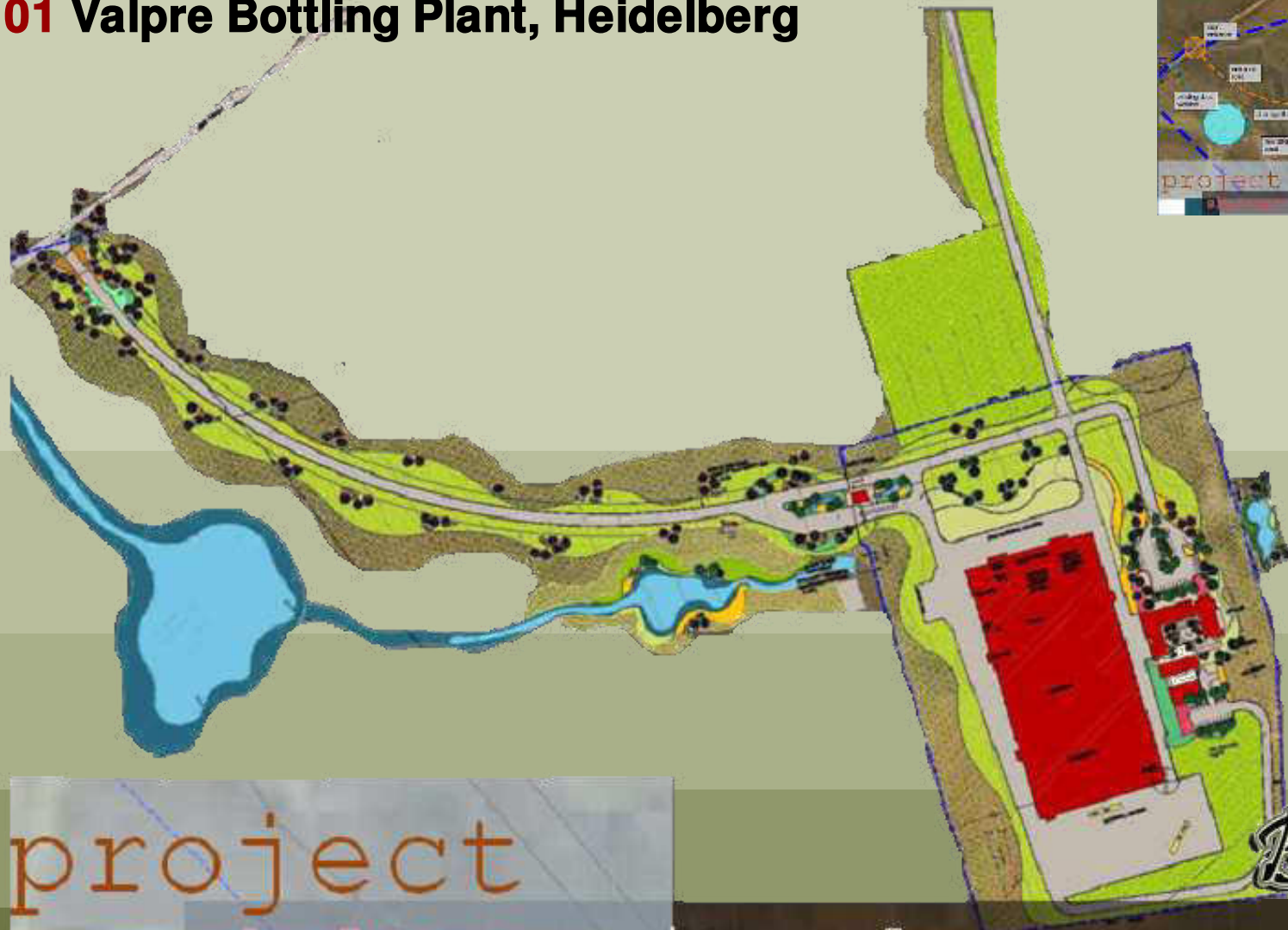
■ Landscape



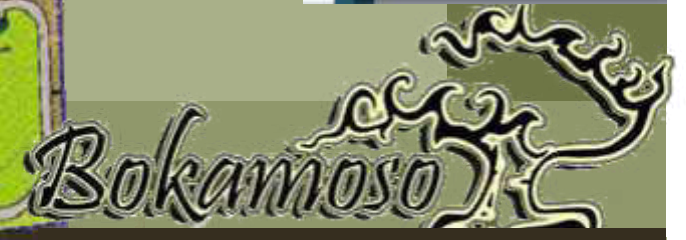
04 Services

043 Orientation

01 Valpre Bottling Plant, Heidelberg



project
shelter- site plan

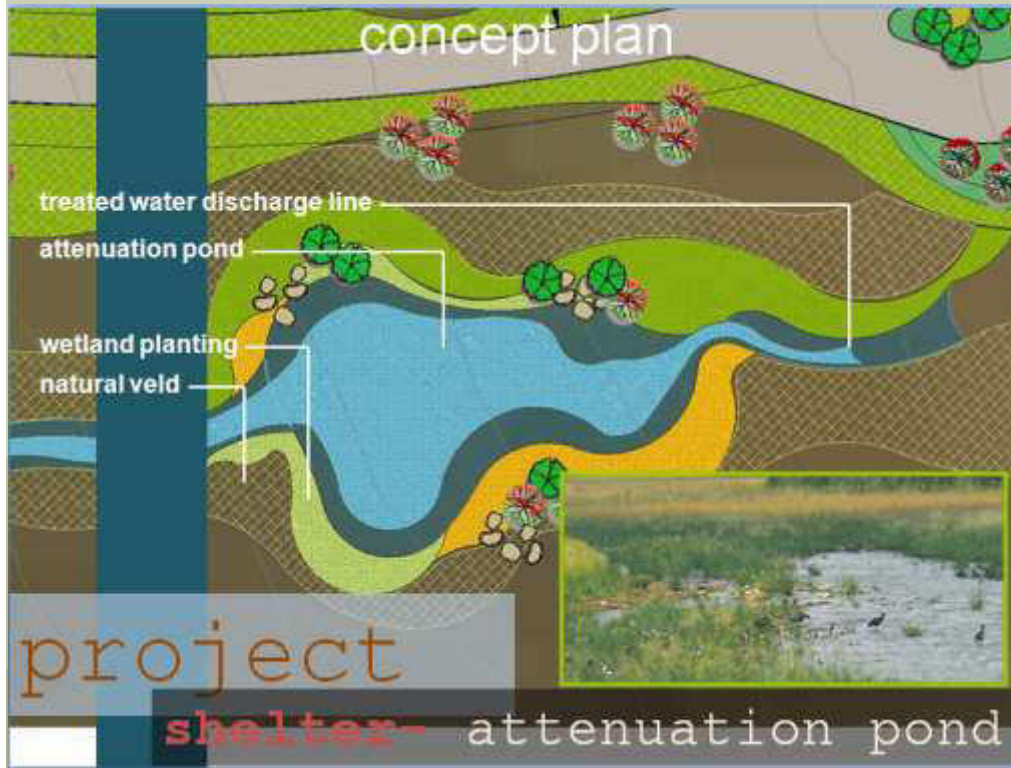


05 Landscape Projects- Current

051 Commercial



01 Valpre Bottling Plant, Heidelberg

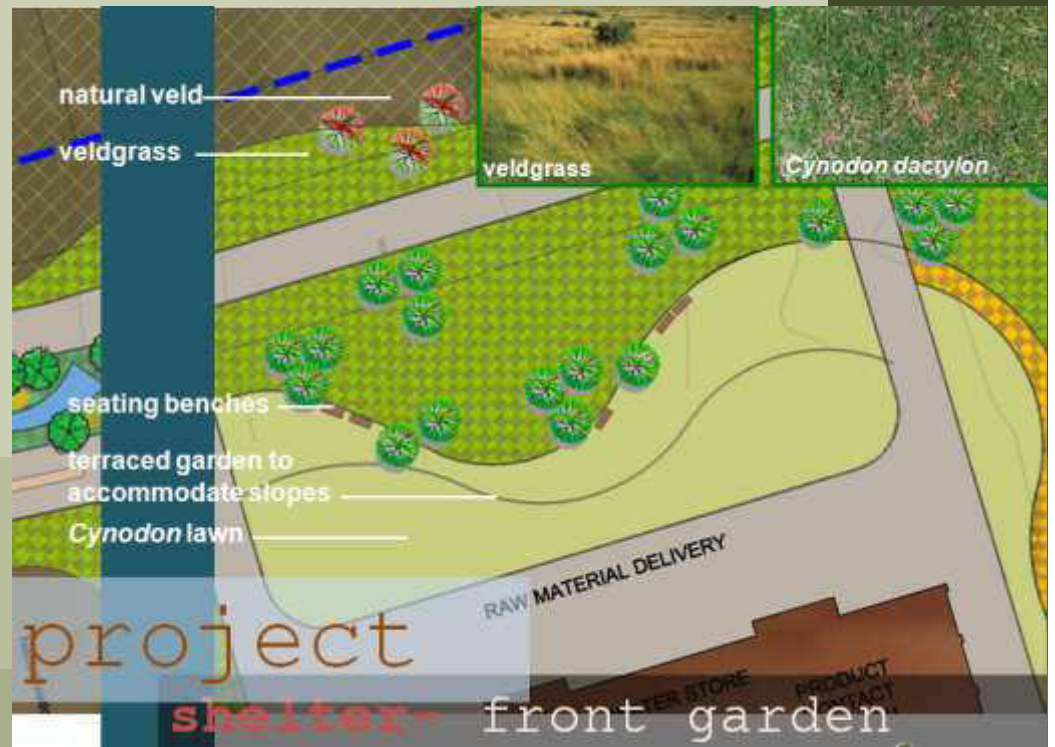


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05 Landscape Projects– Current

051 Commercial

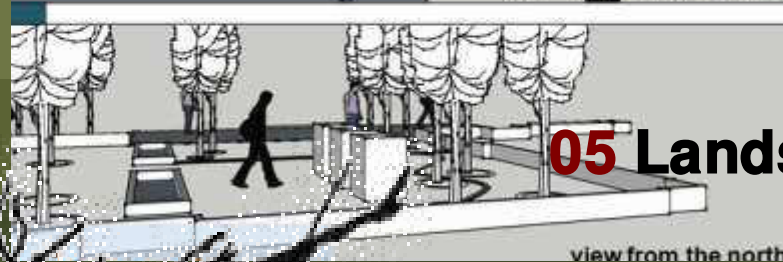
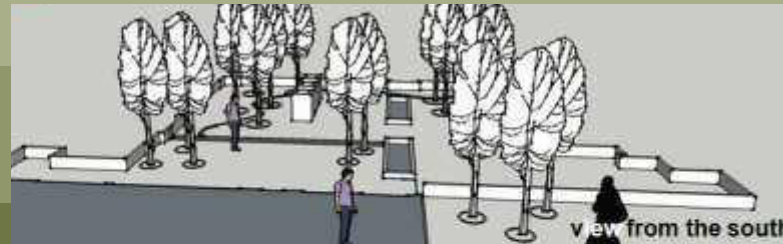
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

02 Melodie Waters, Hartebeespoortdam



Streetscape

Indigenous Planting

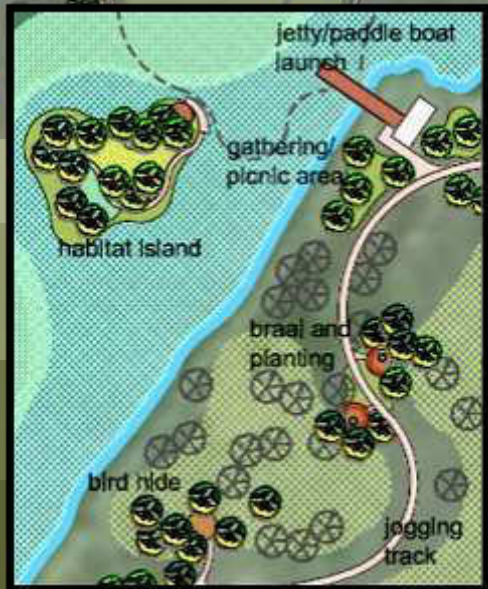


05 Landscape Projects – Current

052 Commercial/Recreational



02 Melodie waters, Hartebeestpoortdam



Rehabilitation



Area Layout

Development Framework



05 Landscape Projects– Current

052 Commercial/Recreational

03 Grain Building, Pretoria



Bokamoso

05 Landscape Projects– Completed

053 Offices

04 Ismail Dawson offices, Pretoria



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05 Landscape Projects – Conceptual

053 Offices

05 Celtic Manor, Pretoria

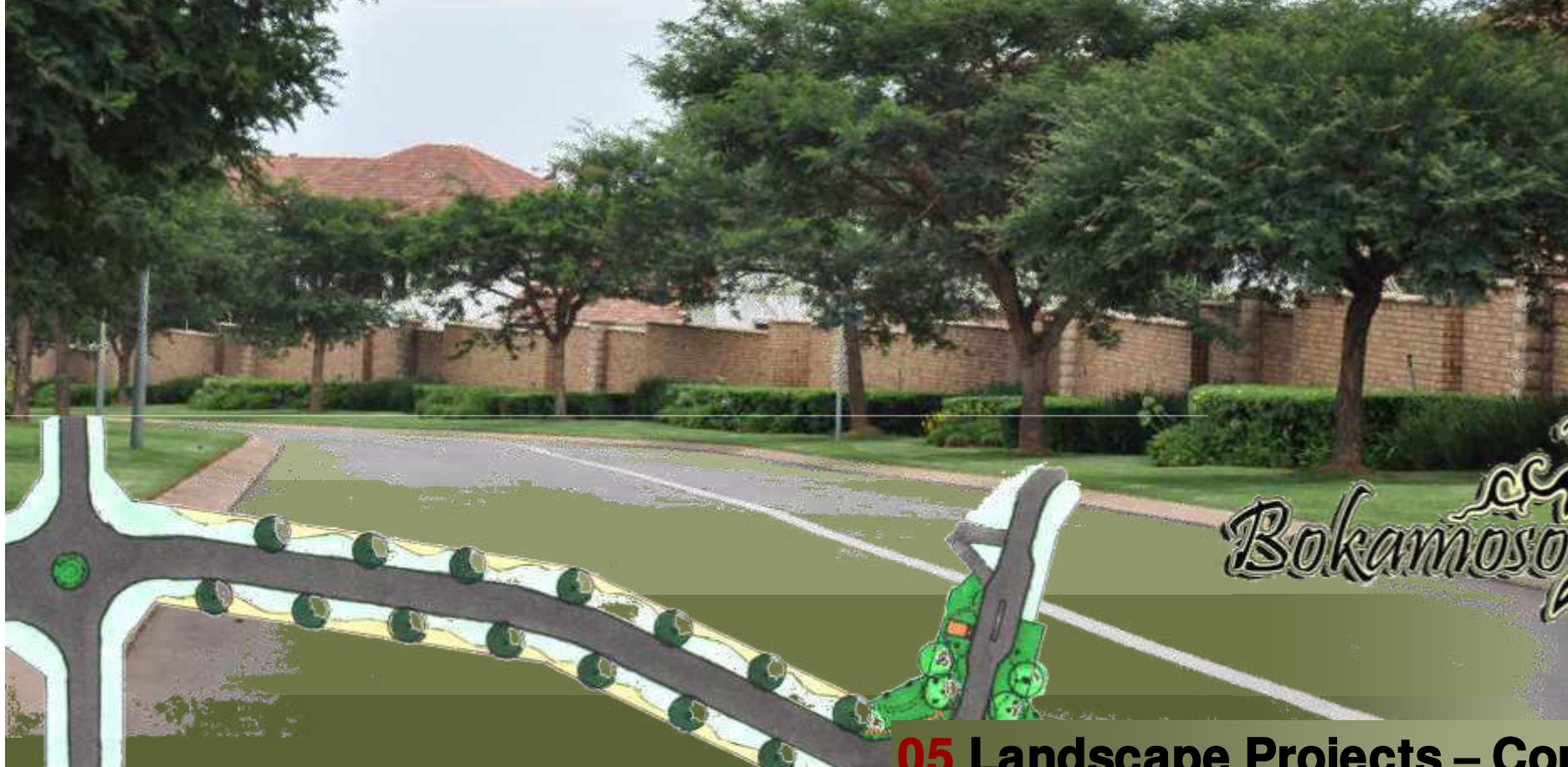


Bokamoso

05 Landscape Projects - Completed

054 Complex Development

06 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

054 Complex Development

07 The Wilds, Pretoria

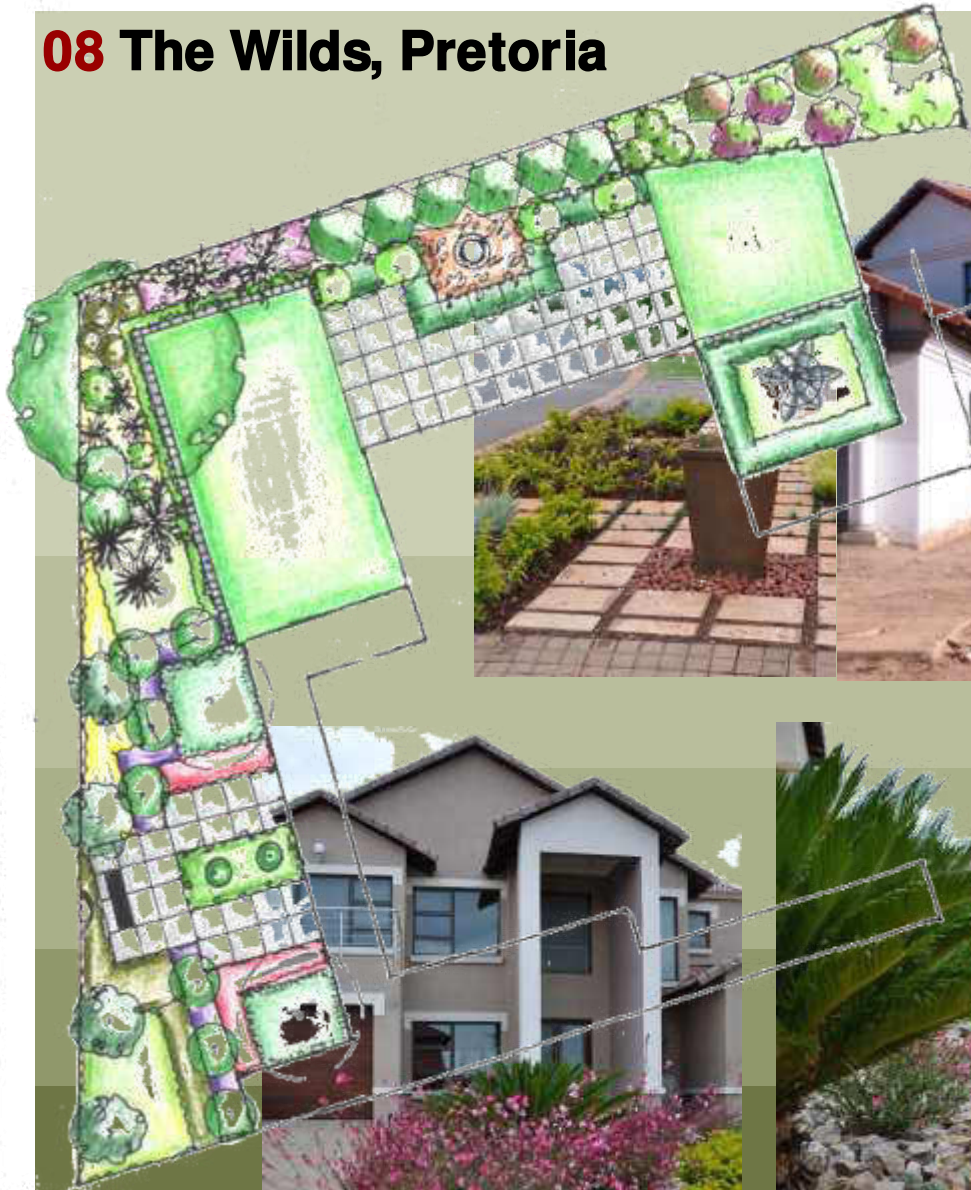


Bokamoso

05 Landscape Projects – Completed

055 Residential

08 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

09 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

010 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

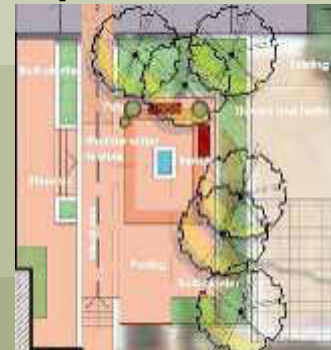
011 Governor of Reserve Bank's Residence, Pretoria



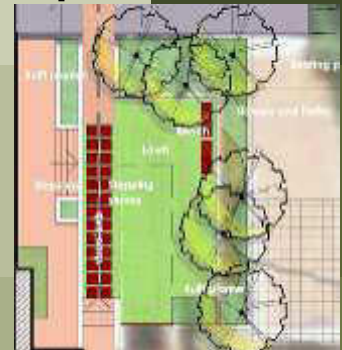
Plant Palette



Option 1



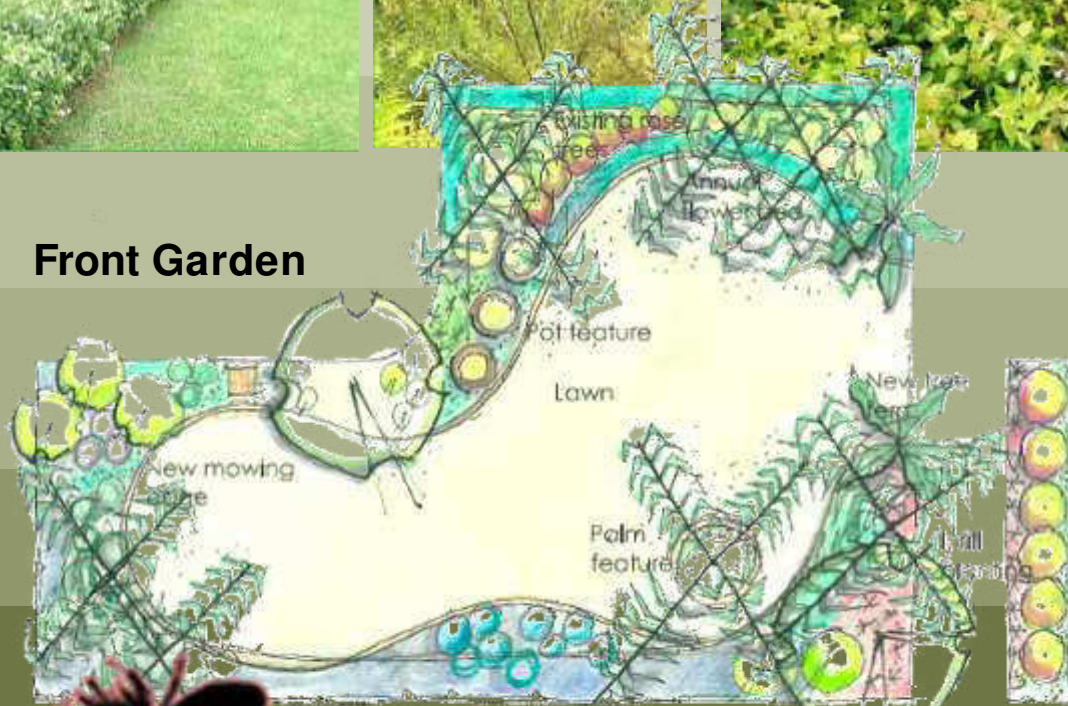
Option 2



012 House Ismail, Pretoria



Front Garden



Back Garden



05 Landscape Projects - Conceptual

055 Residential



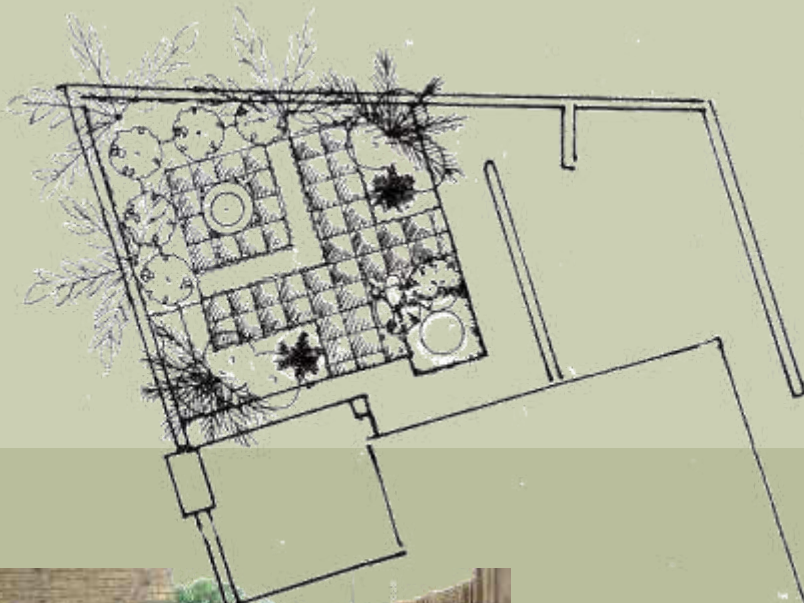
013 Forest Garden, Pretoria



05 Landscape Projects – Completed

055 Residential

015 Forest Garden, Pretoria



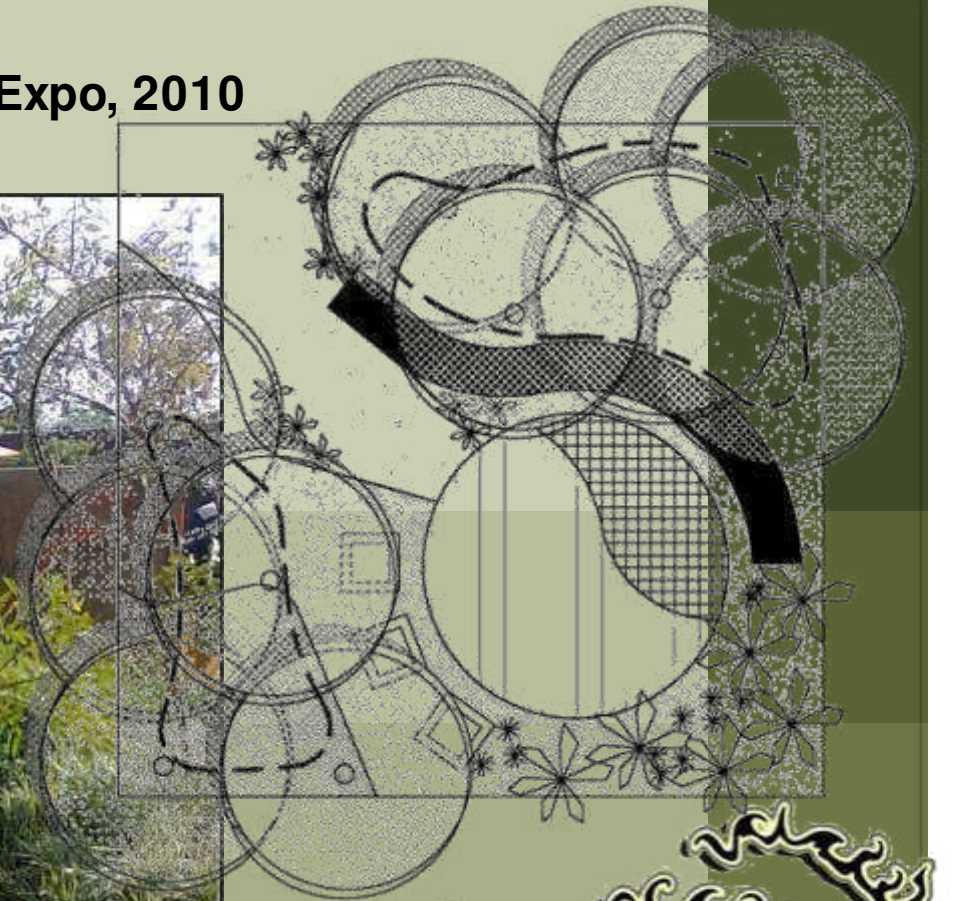
Bokamoso

05 Landscape Projects - Completed

055 Residential

01 Safari Garden Expo

Received a Silver Certificate at the Safari Garden Expo, 2010



Bokamoso 

06 Corporate Highlights

061 Awards

02 UNISA Sunnyside Campus, Pretoria

Best Commercial Paving Plan in Gauteng, 1997



06 Corporate Highlights

061 Awards

Project Name	Status	Project
Environmental Impact Assessment(EIA) and Scoping Report		
Junction 21	ROD	EIA
5 O'clock site access	In Progress	EIA
Bokamoso X 1	In Progress	Scoping & EIA
Doornvallei Phase 6 & 7	In Progress	EIA
Engen Interchange	In Progress	Scoping & EIA
Erasmia X15	In Progress	EIA
Franschkloof	In Progress	EIA
K113	Amendment of ROD	EIA
K220 East	ROD	EIA
K220 West	ROD	EIA
K54 ROD conditions	In Progress	EIA
Knopjeslaagte 95/Peachtree	ROD	EIA
Knopjeslaagte portion 20 & 21	ROD	EIA
Lillieslief/Nooitgedacht	In Progress	EIA
Mooiplaats 70 (Sutherland)	In Progress	EIA
Naauwpoort 1 - 12/Valley View	In Progress	EIA
PeachTree X5	In Progress	EIA
Strydfontein 60	In Progress	EIA
Thabe Motswere	In Progress	Scoping & EIA
Vlakplaats	In Progress	EIA
Waterval Valley	In Progress	EIA
Environmental Opinion		
Doornkloof 68 (Ross)	In Progress	Opinion
Monavoni X 53	In Progress	BA & Opinion
Mooikloof (USN)	In Progress	Opinion
Norwood Mall/Sandspruit	In Progress	Opinion
Riversong X 9	In Progress	Opinion
Sud Chemie	In Progress	Opinion
USN Benjoh Fishing Resort	In Progress	Opinion



The adjacent list host the status of our current projects. Only a selected amount of projects are displayed.



07 Current Environmental Projects

071 EIA, Scoping & Opinion

Project Name	Status	Project
Basic Assessment(BA)		
Annlin X 138	In Progress	BA
Clubview X 29	ROD	BA
Darrenwood Dam	In Progress	BA
Durley Holding 90 & 91	In Progress	BA
Elim	In Progress	BA
Fochville X 3	In Progress	BA
Hartebeeshoek 251	In Progress	BA
Klerksdorp (Matlosana Mall)	In Progress	BA
Monavoni External Services	ROD	BA
Monavoni X 45	Amendment of ROD	BA
Montana X 146	In Progress	BA
Rooihuiskraal X29	In Progress	BA
Thorntree Mall	In Progress	BA

Environmental control officer (ECO)		
Grace Point Church	In Progress	ECO
R 81	In Progress	ECO
Highveld X 61	In Progress	ECO
Mall of the North	In Progress	ECO
Olievenhoutbosch Road	In Progress	ECO
Orchards 39	In Progress	ECO
Pierre van Ryneveld Reservoir	In Progress	ECO
Project Shelter	In Progress	ECO

S24 G		
Wonderboom	In Progress	S24 G
Mogwasi Guest houses	Completed	S24 G



07 Current Environmental Projects

072 BA, ECO & S24 G

Project Name	Status	Project
Objection		
Colesberg WWTW	In Progress	Objection
Nigel Steelmill	Completed	Objection
Chantilly Waters	Completed	Objection

Development facilitation Act- Input (DFA)		
Burgersfort	In Progress	DFA & BA
Doornpoort Filling Station	In Progress	DFA & EIA & Scoping
Eastwood Junction	In Progress	DFA
Ingersol Road (Erf 78, 81 - 83)	In Progress	DFA
Roos Senekal	In Progress	DFA & EIA & Scoping
Thaba Meetse 1	In Progress	DFA & EIA & Scoping

Water Use License Act (WULA)		
Britstown Bulk Water Supply	In Progress	WULA
Celery Road / Green Channel	In Progress	WULA
Clayville X 46	In Progress	WULA
Dindingwe Lodge	In Progress	WULA
Doornpoort Filling Station	In Progress	WULA+DFA+EIA+SC
Eco Park Dam	In Progress	WULA
Groote Drift Potch	In Progress	WULA
Jozini Shopping Centre	In Progress	WULA+BA
K60	Completed	WULA
Maloto Roads	In Progress	WULA
Kwazele Sewage Works	In Progress	WULA
Monavoni External Services	In Progress	WULA+BA
Nyathi Eco Estate	In Progress	WULA
Prairie Giants X 3	In Progress	WULA
Waveside Water Bottling Plant	Completed	WULA



07 Current Environmental Projects

073 Objection, DFA & WULA

Project Name	Status	Project
Environmental Management Plan(EMP)		
Heidelberg X 12	ROD	EMP
Monavoni Shopping Centre	Completed	EMP
Forest Hill Development	Completed	EMP
Weltevreden Farm 105KQ	Completed	EMP+EIA
Raslouw Holding 93	Completed	EMP+BA
Durley Development	Completed	EMP+BA
Rooihuiskraal North X 28	Completed	EMP

Rehabilitation Plan		
Norwood Mall/Sandspruit	In Progress	Rehabilitation
Project Shelter Heidelberg	In Progress	Rehabilitation
Sagewood Attenuation Pond	ROD	Rehabilitation
Velmore Hotel	Completed	Rehabilitation
Grace Point Church	Completed	Rehabilitation
Mmamelodi Pipeline	Completed	Rehabilitation

Visual Impact Assessment		
Swatzkop Industrial Developme	Completed	Assessment +DFA
Erasmia	Completed	Assessment

Signage Application		
Menlyn Advertising	Completed	Signage
The Villa Mall	Completed	Signage+EMP+BA



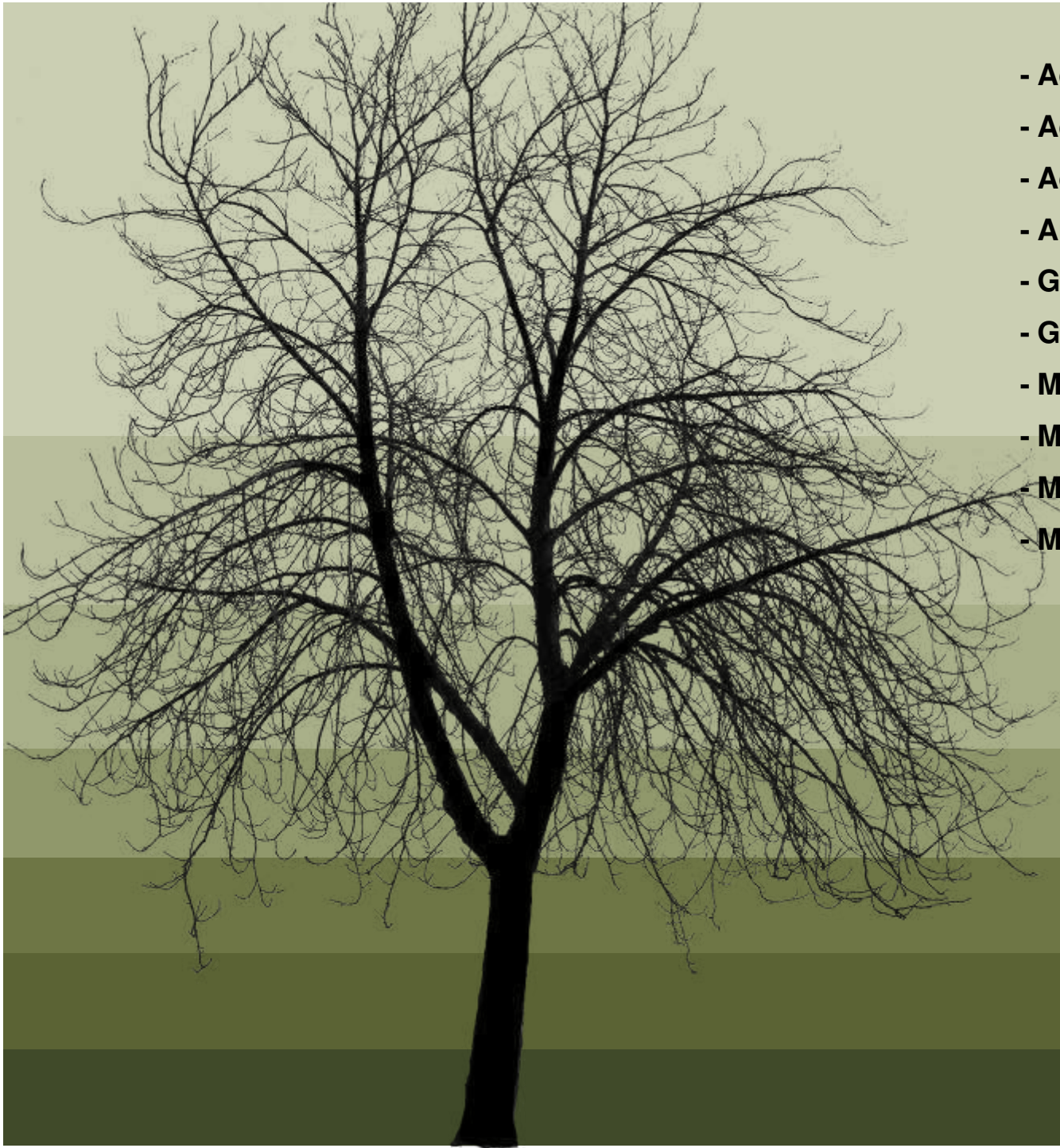
07 Current Environmental Projects

074 EMP, Rehabilitation , Waste Management & Signage Application

- Billion Property Group
- Cavaleros Developments
- Centro Developers
- Chaimberlains
- Chieftain
- Century Property Group
- Coca Cola
- Elmado Property Development
- Flanagan & Gerard
- Gautrans
- Hartland Property Group
- Moolman Group
- MTN
- M&T Development
- Old Mutual
- Property Investment Company
- Petroland Developments
- RSD Construction
- SAND
- Stephan Parsons
- Twin City Developments
- Urban Construction
- USN



08 Indicative Clients



- Adobe Illustrator CS3
- Adobe Photoshop CS3
- Adobe InDesign CS3
- AutoCAD
- Google SketchUP
- GIS
- Microsoft Office Word
- Microsoft Office Excel
- Microsoft Office Publisher
- Microsoft Office Power Point

Bokamoso 

Qualifications And Experience In The Field Of Environmental Planning And Management (Lizelle Gregory (Member Bokamoso)):

Qualifications:

- Qualified as **Landscape Architect** at UP 1991;
- Qualified as **Professional Landscape Architect in 1997**;
- A Registered Member at The **South African Council for the Landscape Architect Profession (SACLAP)** with Practise Number: **PrLArch97078**;
- A Registered Member at the **International Association for Impact Assessment Practitioners (IAIA)**;
- Qualified as an **Environmental Auditor in July 2008** and also became a Member of the International Environmental Management Association (IEMAS) in 2008.

Working Experience:

- Worked part time at Eco-Consult – 1988-1990;
- Worked part time at **Plan Associates as Landscape Architect in training** – 1990-1991;
- Worked as Landscape Architect at **Environmental Design Partnership (EDP)** from 1992 - 1994
- Practised under **Lizelle Gregory Landscape Architects** from 1994 until 1999;
- Lectured** at Part-Time at **UP (1999)** – Landscape Architecture and **TUT (1998- 1999)**- Environmental Planning and Plant Material Studies;
- Worked as **part time Landscape Architect and Environmental Consultant at Plan Associates** and **managed their environmental division for more than 10 years** – 1993 – 2008 (assisted the **PWV Consortium** with various road planning matters which amongst others included environmental Scans, EIA's, Scoping reports etc.)
- Renamed business as **Bokamoso in 2000** and is the only member of Bokamoso Landscape Architects and Environmental Consultants CC;
- More than 20 years experience in the compilation of Environmental Reports**, which amongst others included the compilation of various **DFA Regulation 31 Scoping Reports**, EIA's for EIA applications in terms of the applicable environmental legislation, Environmental Management Plans, Inputs for Spatial Development Frameworks, DP's, EMF's etc. Also included EIA Application on and adjacent to mining land and slimes dams (i.e. Brahm Fisherville, Doornkop)

Qualifications And Experience In The Field Of Landscape Architecture (Lizelle Gregory (Member Bokamoso)):

Landscape Architecture:

-Compiled landscape and rehabilitation plans for more than 22 years.

The most significant landscaping projects are as follows:

-Designed the Gardens of the Witbank Technicon (a branch of TUT). Also supervised the implementation of the campus gardens (2004);

-Lizelle Gregory was the Landscape Architect responsible for the paving and landscape design at the UNISA Sunnyside Campus and received a Corobrick Golden Award for the paving design at the campus (1998-2004);

-Bokamoso assisted with the design and implementation of a park for the City of Johannesburg in Tembisa (2010);

-The design and implementation of the landscape gardens (indigenous garden) at the new Coca-Cola Valpre Plant (2012-2013);

-Responsible for the rehabilitation and landscaping of Juksei River area at the Norwood Shopping Mall (Johannesburg) (2012-2013);

-Designed and implemented a garden of more than 3,5ha in Randburg (Mc Arthurpark). Bokamoso also seeded the lawn for the project (more than 2,5 ha of lawn successfully seeded) (1999);

-Bokamoso designed and implemented more than 800 townhouse complex gardens and submitted more than 500 Landscape Development Plans to CTMM for approval (1995 – 2013);

-Assisted with Landscape Designs and the Masterplan at Eco-Park (M&T Developments) (2005-2011);

-Bokamoso designed and implemented an indigenous garden at an office park adjacent to the Bronberg. In this garden it was also necessary to establish a special garden for the Juliana Golden Mole. During a recent site visit it was established that the moles are thriving in this garden. Special sandy soils had to be imported and special indigenous plants had to be established in the natural section of the garden.

-Lizelle Gregory also owns her own landscape contracting business. **For the past 20 years she trained more than 40 PDI jobless people (sourced from a church in Mamelodi)** to become landscape contracting workers. All the workers are (on a continuous basis) placed out to work at nurseries and other associated industries;

-Over the past 20 years the Bokamoso team compiled more than 800 landscape development plans and also implemented most of the gardens. Bokamoso also designed and implemented the irrigation for the gardens (in cases where irrigation was required). Lizelle regarded it as important to also obtain practical experience in the field of landscape implementation.

GDRT Approval Letter





GAUTENG PROVINCE

Department: Roads and Transport
REPUBLIC OF SOUTH AFRICA

Infrastructure Protection, Koedoespoort 1215 Nico Smit Street, Private Bag X1, TOTIUSDAL, 0134
Tel No: (012) 310 2405

Enq: / Navr: Ms. D. Dahlberg / Ms. E. Iding
Ref: / Verw: 2/2/4/P66-1/SEW/202
2D-2/2/4/1-P66-1 (K71)



Messrs. Innovisi Consulting (Pty) Ltd.
1 Marais St Bailey's
MUCKLENEUK
0181

Tel: (012) 346 6542

Sir/Madam

Attention: C. Joubert

WAYLEAVE APPROVAL: 2D-2015/7132

UNDERGROUND WAYLEAVE:

<u>ROAD NO:</u>	Road P66-1 (K71)
<u>KILOMETRE SIGNPOST/S:</u>	km 5.8
<u>SERVICE DESCRIPTION:</u>	Bulk Sewer Road Crossing.
<u>PROPERTY DESCRIPTION:</u>	Pretoria
<u>DISTRICT:</u>	Sunderland Ridge AH
<u>APPROVED PLAN/S:</u>	8292-300-01-R55 Rev A

With reference to your application 903312 dated 19 March 2015 in connection with the above mentioned, you are hereby informed that your application has been approved, as set out below subject to the following conditions:

NB: This wayleave is granted in favour of **Tshwane Municipality** and their successor(s) in title.

1. **The District Manager, Mr. J. Mabelane**, Private Bag X1 Totiusdal, 0134, telephone (012)808 0333 cell, 082 906 0821, must be informed at least seven days before commencement of any work and shortly before completion thereof in order to make the necessary arrangements for inspection.

The Inspection and Completion certificate must be completed during the inspection and handed to the District Manager, Mr. J. Mabelane. (The certificate is attached as Addendum A).

2. The necessary and prescribed road traffic signs (road signs and markings) for the proposed work must conform to the S A Manual for Road Traffic Signs. You must provide the signs and erect them to the satisfaction of the **District Manager, Mr. J. Mabelane, Cell: 082 906 0821** before commencing with the work. The minimum lay-out of the road signs is shown on the sketches included in the attached Addendum.

3. The necessary precautions are to be taken at all times to safeguard traffic while installation operations are in progress within the road reserve. Any accidents during installation operations due to negligence on the part of your own employees or contractors will be your responsibility.
4. Any damage to existing wayleaves or to the rights of other people as a result of your installation operations will be your responsibility. If you are not the owner of the relevant property, this wayleave is granted to you without prejudice to the rights of the ownership of the owner or any other parties concerned.

When the road servitude ceases to exist, either by the closing or deviation of the relevant road, the full authority and control of the land taken up by the road reserve, will revert to the owner or other parties concerned and removal of your service may be demanded. It will thus be necessary to obtain the consent to this wayleave from the owners of the land in question and/or other parties concerned in order to protect your interests.

5. **The Department of Roads and Transport will not be liable for any costs related to the laying, erection, installation or maintenance of your services. Should it become necessary for the relocation of any of these services as a result of any road works, road maintenance or road surfacing, it would be executed at your own expense on having been given notice by the department to this effect.**

This includes everything related to the service(s) such as meter boxes, meters, transformers, poles, street distribution cabinets, anchors, stays, manholes or any other fittings or parts thereof. Where special conditions were allowed, you will still be held responsible for all costs incurred should your service(s) and all appurtenant items have to be relocated.

This approval is given without prejudice to any of the rights that the department may have and on the express understanding that you will remain liable for any relocation costs as aforementioned until such time as the issue of relocation costs has been changed by either a ruling of a competent Court or an agreement reached by both parties hereto.

6. NB: This permission with regard to parallel services and services within the existing road reserve can expire later when you are instructed to shift/remove your services and can, therefore, mean that your service will not automatically be allowed within the future/new road reserve. Your service will then have to be placed outside the road reserve and the building line.
7. You will be held responsible for any damage suffered by the Department of Roads and Transport as a result of your negligence to shift the service(s) within the prescribed period(s).
8. If it is deemed necessary in the future by the Department of Roads and Transport to repair, resurface or do repair work directly as a result of the presence of your service (in spite of the duration of when the service was installed), you will have to accept full responsibility for the extra costs (that is those repair costs directly attached to the presence of your service within the road reserve) incurred by the Department of Roads and Transport. You will have to pay the full amount, within three months from date of the written notice, to the abovementioned District Manager.

9. You will be responsible for all liaison and co-ordination work including any and all correspondence between your commission/department and any private property owners. The Department of Roads and Transport will not be involved with any individual property owners with regard to the service, as this is then still your responsibility. See also clauses 4 and 5 of this wayleave.
10. You indemnify the Premier of Gauteng Province and exempt him from any claim or damage which may be instituted or suffered by any person, including legal costs, as a result of the laying or erection of any service or any other works caused or erected by you, or as a result of negligence on your part to protect or maintain the service or other works caused by any other person unless you can prove negligence on the part of the Department of Roads and Transport or its officials.
11. The Department of Roads and Transport will not be liable for any damage suffered by the applicant as a result of operations carried out on road construction or road maintenance or any other operations whatsoever, unless negligence on the part of the Department of Roads and Transport or its officials can be proved.
12. The work must be carried out to the entire satisfaction of the abovementioned District Manager. No trees, shrubs, cultivated grass or fencing must be removed or damaged. If such plants or fences were removed or damaged you will have to replace it to the entire satisfaction of the said District Manager involved.
13. Permission must be obtained from the District Manager before any trees or shrubs can be pruned or removed for erection/installation or maintenance purposes. All branches and tree trunks or other waste must be removed and the road reserve must be cleaned up before the final inspection takes place. The service(s) must be erected in such a manner that no trees are affected or will fall within the safe area of the service(s).
14. Drainage systems (surface and sub-surface) must not be interfered with or damaged in any way. The road reserve must be left clean and all waste be removed.
15. No permanent access to and from the road to the service will be allowed. Temporary access points must be approved by the District Manager.
16. The work must be done within **twelve months** from the date of this letter. If for any reason at all, the work is delayed for a longer period, extension of time must be requested in writing or a new application will have to be submitted.
17. The official in charge of the construction or maintenance work on the site must, at all times, be in possession of a complete copy of the letter of approval, including the general conditions, special conditions and specific conditions where applicable to the service concerned, as well as all plans that are required and are referred to in the correspondence, so that during an inspection the official can submit it to the official(s) of the controlling authority when requested to do so. If no approval can be submitted the official of the controlling authority then can order that the road be secured and the work immediately ceased. Any cost incurred by the Department of Roads and Transport to secure the road, will be for your account.
18. The conditions of this wayleave are applicable to you as well as your successor-in-title (where applicable). If property rights of your service be transferred to any other person or institution, it will be your responsibility to bring the contents of this wayleave to the attention of your successor-in-title as the conditions of this wayleave together with your property rights will be transferred to your successor-in-title and will still be applicable.

19. The Postal Act No 44 of 1958 (as amended) and any further amendments on new act, **Electronic Communications Act, 2005** will not be applicable with regard to this application and approval. Only the conditions laid down in this wayleave will be considered as legal and binding! Therefore, any claims that may arise as a result of the presence of your service will be treated strictly according to the conditions laid down in this wayleave. Therefore, section 108 of the new Act 44 of 1958 or section 50 of the Postal Amendment Act No 113 of 1976 or any other sections of any Postal Act, will not be applicable to the Department of Roads and Transport.

Upon non-acceptance of this condition, this approval is withdrawn and your application is not approved. Application must then be re-submitted.

20. If you fail to comply with any of the general, specific and special conditions of this wayleave during the laying/installation/erection or maintenance of the concerned service, the Premier of Gauteng Province reserves the right to withdraw this wayleave and you will be obliged to cease all work immediately or to rectify the situation or in failure of the latter you can be ordered (Act No. 8 of 2001), to remove the service from the road reserve and/or building restriction area.
21. Any damage to infrastructure already existing in the road reserve shall be compensated by you in full. This Department shall not be held liable for such loss.

CONDITIONS FOR UNDERGROUND PIPES/CABLES:

22. Except where the service crosses the road it may in terms of section 46 of the Gauteng Transport Infrastructure Act (Act no. 8 of 2001) not be laid nearer than 95 metres from the centre line of the road or within a 500 metre radius measured from the centre line of the junction of a building restriction road and the centre line of any other road (except a national road), without the specific permission of the Department of Roads and Transport.
23. The service must be laid in a sleeve pipe over the full width of the road reserve. The top of the sleeve pipe must be laid at least 1,5 metres under the lowest point of the road or road reserve and follow a straight line. The cable must cross the road perpendicular as far as possible and no manholes/distribution cabinets, access chambers, etc., must be erected within the road reserve. Manholes, access/valve chambers, air valves, etc., may only be erected on one side of the road and outside the road reserve. Should permission be given to allow one or more of the foregoing structures within the road reserve, it shall not protrude above the surrounding surface and the structure must be of sufficient strength to withstand and carry axle loading as prescribed by the Department of Roads and Transport.

The sleeve pipe or duct must be acceptable and comply with the standard types approved by the Department of Roads and Transport. A list of standard types is available on written request. In the event of the sleeve/pipe being larger than 150 mm (inside diameter) a note on the detail plans is to be added confirming that the sleeve/pipe is strong enough for the required purpose. (Detail plans will normally encompass a lay-out plan, locality plan, longitudinal and cross sections to a suitable scale signed by a professional Engineer).

24. A bright weather-proof plastic tape must be laid, where applicable, \pm 300 mm above the sleeve to act as a warning.

25. The material that is used must be of such quality that during the expected life of the road it will not be necessary to disturb the road surface to do repairs to the service.
26. If the open trench method is used the sleeve pipe must be laid in two sections across the roadway to obviate interruption to the flow of traffic; only one lane may be closed to the public at a time. A deviation to make the crossing of the road easier, can be considered but it must be shown on a fully detailed plan and approved by the District Manager before commencement of the work.
27. **Care must be taken that existing stormwater drains or subsurface drainage systems or survey beacons/pegs are not damaged or interfered with by excavations. Excavation within the road reserve must be fenced and secured.**
28.
 - a) Any survey pegs/beacons that are damaged as a result of your activities must be replaced at your own cost by a surveyor who is on an approved panel of surveyors appointed by the Department of Roads and Transport.
 - b) Cadastral beacons, however, must be replaced by a registered Surveyor.
 - c) After the beacons have been replaced a Completion Certificate, marked for the specific attention of the Principal Industrial Technician: Survey, must be handed in at the office of the Director: Design for approval.
 - d) All arrangements for the implementation of the abovementioned procedures will be arranged by the service owner/applicant and will they accept full responsibility thereof.
29. Treatment of the layers for service excavations must conform to the Standard Specifications for Road and Bridge Works as well as the Material and Pavement Design Manual (L1/78, as amended) issued by the Head: Department of Roads and Transport, Gauteng Provincial Administration, Johannesburg. Should these specifications in any instance be less stringent and/or a lesser standard than the general specifications as given below, these will apply:

Backfilling alongside and over all sleeve pipes must be placed and compacted in layers of at most 100 mm after compaction to a density required for the material in adjacent fill, subgrade or subbase layer. The density of the backfill in excavations in natural ground must be at least 90% of modified AASHTO density.

You will be held responsible for any subsidence in the backfill or accidents due to such subsidence.
30. You agree to maintain at all times underground services and appurtenant items including repair work to the surface of the road if requested and to take the necessary precautions to safeguard the travelling public.
31. No excavation in the roadway may be left open overnight.
32. **Service markers** as specified on attached plan W93 indicating the nature, position and depth of the service will have to be erected on both sides at crossings, by the service owner. For parallel services within the road reserve the markers must be erected at least at every 100 metres alongside the underground service. The markers must be at least 200 mm high and also be clearly visible.

33. You will not be allowed to excavate at any time to effect repairs to the service. If a defect occurs you will have to apply for a new wayleave before the service may be repaired.
34. Arrangements must be made with the Provincial Inspection Services or local traffic department to be present while work is in progress on the road. This clause may be ignored if you make use of the method where the pipe is pushed underneath the road, but clause 3 will still apply.
35. The joints of the pipes beneath the road must be watertight and you will be responsible for any damage to the road and road reserve because of leakage's. (Not applicable in the case of power line cables).
36. You must reinstate the road surface to the entire satisfaction of the abovementioned District Manager and it must be to the specifications of the Department of Roads and Transport.
37. **Work must be carried out in accordance with the Occupational Health and Safety & Welfare Act 2005 or amendments thereafter.**
38. Commencement of any work in respect of which this wayleave is granted will be regarded as acceptance of the **GENERAL, SPECIFIC AND SPECIAL CONDITIONS.**

SPECIAL CONDITION/S:

1. The absolute minimum distance between the face of an excavation or pits and the road shoulder break point is 4,5 metres or 2, 0 metres from the toe of an embankment, whichever is the greater.
2. Upon completion of the work all pits and excavations shall be backfilled with suitable material compacted to at least the same density as the undisturbed adjoining material. It is the responsibility of the holder of the wayleave to prevent any subsidence in the soil due to inadequate compaction and/or consolidation of the backfill material and reinstate settled areas.
3. Voids around jacked/drilled culvert are to be filled with cement grout pumped through holes made in the wall of the culvert. Such holes shall be filled and sealed with non-shrink cementitious grout.
4. All joints between culvert sections shall be caulked with non-shrink cementitious mortar to ensure water tightness. The surface shall be finished off flush with the exposed wall face.
5. After completion of the works the cross-section of the road profile shall be resurveyed. There shall be no change from the original road levels due to subsidence on the position of the jacking.
6. All excavations must be fully fenced off and the necessary safety precautions implemented and maintained throughout the work.
7. Excavation at the advancing face may not be by means of water jetting and permission must be obtained from the Department if blasting is required.

8. The method of drilling beneath road must be used without disturbing the traffic, the road surface or road pavement. The openings, after completion of the work must be sealed and backfilled to the satisfaction of our District Manager.

Access pits and work areas for this method (on both sides of the road) may not be closer than 3 metres to the "edge of tar" provided that no excavations be left open overnight otherwise a distance of 10 metres will apply.

You may not use the open trench method, crossing the road, and clause 26 will not be applicable.

If the above-mentioned method is unsuccessful a **new application** for an alternative method/position must be submitted.

9. Your service shall be installed in a sleeve pipe over the full width of the existing road reserve with a minimum cover of **1, 5 metres** at the lowest point in the road reserve.
10. Manholes must not protrude above the natural ground level.
11. No manholes will be allowed inside the road reserve boundary.

NOTE/S:

1. **Future Road K71** may be affected by your service. If it becomes necessary to remove or relocate your service during the construction of this road, it will be at your cost without any compensation from this Department.
2. The road reserve boundaries shall be set out by a professional land surveyor with information (co-ordinates) obtainable from this Department.

Commencement of any work in respect of which this wayleave is granted will be regarded as acceptance of the above-mentioned GENERAL, SPECIFIC AND SPECIAL CONDITIONS.

If you fail to comply with any of the general, specific and special conditions of this wayleave during work activities within the road reserve, the Head of the Department reserves the right to withdraw this wayleave and you will be obliged to rectify the situation or in failure of the latter you can be ordered (Act No. 8 of 2001), to cease all work immediately.

This wayleave is granted in terms of the Gauteng Transport Infrastructure Act 2001 (Act No. 12 of 2001) and the Regulations to the Act and does not exempt you from the provisions of any other law.

Yours faithfully

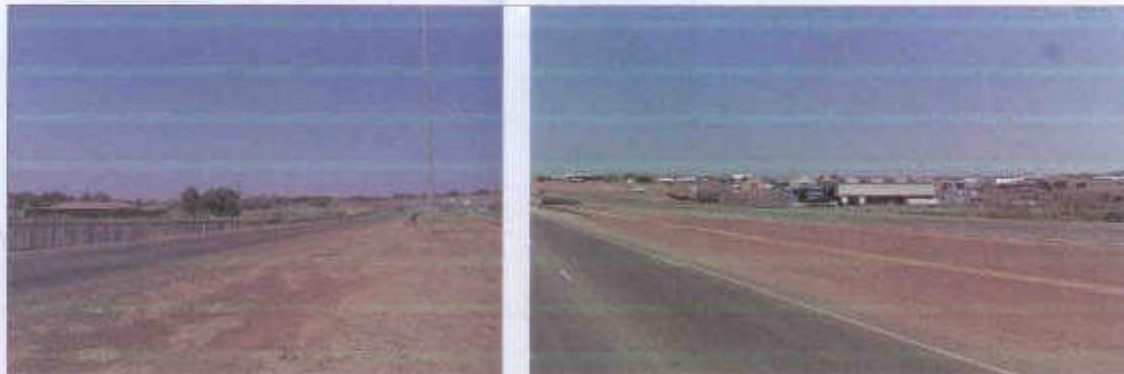
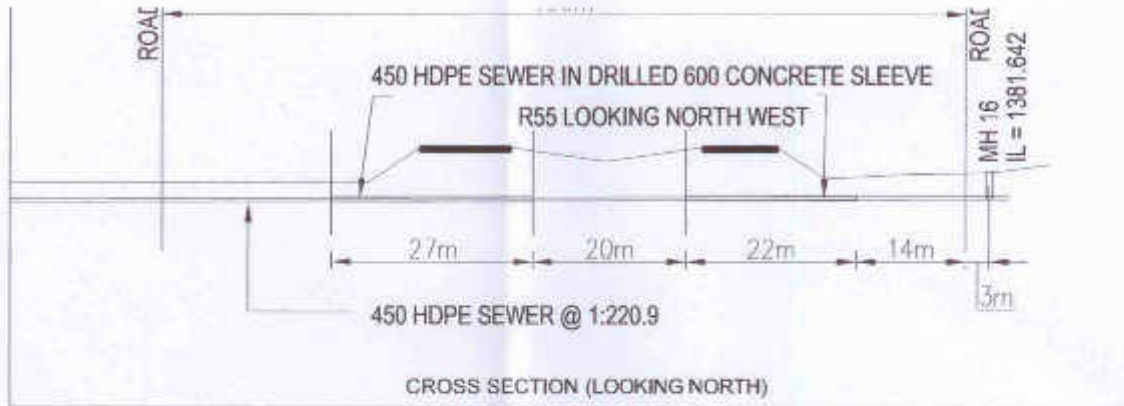

HEAD OF DEPARTMENT

DATE:

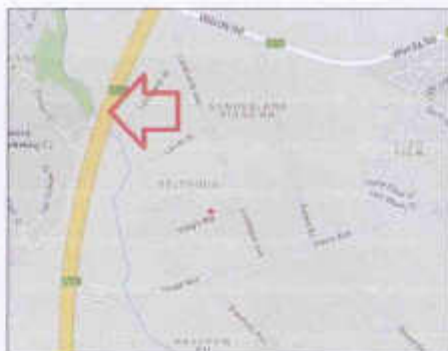
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28/04/2015 -
2D-2015-7132

ATTACHED: (a) Addendum A (b) Layout plan of road signs for work within the road reserve
(c) Approved plan/s



SITE PHOTOS AT ROAD CROSSING



LOCALITY PLAN



APPROVED

WAYLEAVE No: 2D- 2015/7132
 PROJECT No: 2/2/4/1- P66-1/SEW/202
 FILE No: 2D-2/2/4/1 - P66-1 (K71)
 SIGNATURE: *[Signature]*
 By Delegated Authority From
 HEAD OF DEPARTMENT
 DEPT. OF ROADS AND TRANSPORT
 GAUTENG PROVINCIAL GOVERNMENT

**INNOVISI CONSULT
 CW JOUBERT PR ENG
 REG NO. 900008**

[Signature]
19 MAR 2014

RASLOUW OUTFALL SEWER		
PROPOSED SEWER R55 ROAD CROSSING		
8292	FIGURE No 8292-300-01-R55	REV A

