- Approximately $^{2}/_{3}$ of households have water inside their yards;
- About 75% of the population in the ward has flush toilets;
- 80% of the population have electricity for lighting; and
- The water demand exceeds capacity.

3.2.4. Heritage

- Stone Age

No information about Stone Age habitation of the area is available. There might be two reasons for this. Firstly, it is unlikely that Stone Age people would have occupied the area, as it would have been too cold and no shelters or caves are known to exist in the area. Secondly, no systematic survey of the area has been done and, as a result, no sites have been reported. However, it is quite likely that a detailed survey would reveal traces of these early people's occupation of the area.

- Iron Age

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Silver Leaves, south east of Tzaneen dating to AD 270. However, Iron Age occupation of the eastern highveld area (including the study area) did not start much before the 1500s. Occupation of these areas became possible due to wide-scale climatic changes, as well as the introduction, from the east coast, of cereal crops such as mealies. Some sites dating to the Late Iron Age are know to exist to the north-west of the study area, as well as approximately 15 km due south. These are typically stone walled sites. They were occupied by a number of related people, varying in size from twenty to as many as a few hundred individuals. The people cultivated various crops and kept large herds of cattle.

- Historic period

The historical period in this area started with the arrival of early explorers, hunters and traders, followed later by the Voortrekkers, who settled permanently and started to farm in the area and developed a number of towns. During the Anglo Boer War (1899-1902), some skirmishes took place in the region.

Apart form urban areas, such as Amersfoort, which have origin dates to the late 1880s, most heritage resources in this part of the world would be related to farming and infra-structural development. Most farmsteads were burned down by the British during the Anglo-Boer War, but were later rebuilt. Typically, these consist of the main house, outbuildings, stock enclosures and cemeteries. The housing of labourers were much more informal and once abandoned, quickly disintegrated.

3.2.5. Risk

The main hazards of the project would be exposure to toxic fumes of carbon monoxide and the thermal radiation of the fuel containing carbon monoxide and hydrogen. Carbon monoxide is an odourless and colourless gas having the same density of air. It is extremely flammable and mixes well with air easily forming an explosion hazard. When burnt, carbon monoxide produces carbon dioxide a less toxic material that is considered a simple asphyxiant.
In the presence of finely dispersed metal powders the substance forms toxic and flammable carbonyls. Carbon monoxide may react vigorously with oxygen, acetylene, chlorine, fluorine, nitrous oxide. In the presence of finely dispersed metal powders the substance forms toxic and flammable carbonyls. Carbon monoxide is absorbed into the body by inhalation and acts a chemical asphyxiant by combining with the haemoglobin in the blood displacing the oxygen. Short-term exposure may cause effects on the blood, cardiovascular system and central nervous system. Exposure to concentrations of over 1.3% may result in lowering of consciousness and death. Long-term exposure may have effects on the nervous system and the cardiovascular system, resulting in neurological and cardiac disorders.

Hydrogen is a colourless, odourless gas that is flammable over a wide range of vapour/air concentrations. Hydrogen vapour forms an explosive mixture with air. Vapours or gases may travel considerable distances to ignition source and flash back. Leaking hydrogen may ignite in the absence of any normally apparent source of ignition and if so, burns with a practically invisible flame that can instantly injure anyone coming in contact with it. Hydrogen gas is very light and rises rapidly in the air; concentrations may collect in the upper portions of buildings. Liquid hydrogen can solidify air and may create an explosion hazard.

3.2.6. Visual

The study area for the placement of the CCGT is located in the Amersfoort region of the Mpumalanga province and encompasses the town of Amersfoort, the Majuba coal fired power station and two other predominantly agricultural settlements, namely Vlakplaats and Daggakraal.

The study area has a rural character with dry-land agriculture and cattle and game farming as primary economic activities. It is situated within the grassland biome and the terrain morphological description is strongly undulating plains and hills and lowlands with mountains towards the south-west of the study area. The population density is roughly 30 people per square kilometer, and is primarily concentrated within the town of Amersfoort and the other two main settlements.

The N11 national road and the R23 arterial road affords access to the study area. Standerton and Volksrust are the two major towns in closest proximity to Amersfoort
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4. SENSITIVITY ANALYSIS

4.1 Biophysical Impacts

4.1.1 Hydrogeology

Figure 4.1 shows the areas that are ideal, acceptable, and sensitive from a preliminary hydrogeological perspective. The data conveyed in the figure must be considered preliminary and based on average data and regional information rather than site specific data. It does, however, highlight areas which could be considered more favourable from a hydrogeological point of view.

Areas shown as red in Figure 4.1 should be considered sensitive and of least suitability for development. The red areas to the north have shallow groundwater levels, which are recognised as more vulnerable to potential surface contamination sources. This is due to the limited barrier potential of the unsaturated (vadose[1]) zone, where attenuation of poor quality seep / infiltration can occur.

The available hydrogeological data indicates that groundwater levels to the north of study area are shallow and are thus envisaged to be more vulnerable to potential contamination. The central portion of the study area is underlain by Vryheid Formation geology and thus is recognised to have lower groundwater potential and deep groundwater levels. The southern portion of the study area is underlain by Volksrust Formation rocks, which have greater groundwater potential (when compared to the Vryheid Formation sediments) and moderate groundwater levels.

The central portion of the study area (as envisaged in Figure 4.1, a 3 km radius around the existing Majuba Power Station) including the Farm Roodekopjes, is therefore recognised to be more favourable for the CCGT plant, due to deeper groundwater levels and lower groundwater potential within the Vryheid Formation geology from a hydrogeological perspective.

The yellow zone to the south is recognised as acceptable as the average groundwater levels are between 8 and 15 m below surface but the groundwater potential (average yields 0.5 to 2 l/s) is enhanced within the Volksrust Formation.

The resultant figure (Figure 4.1) reflects the general hydrogeology across the study area, indicating vulnerable more sensitive areas to the north, ideal areas in the center, and acceptable areas to the south. Farms where site specific data was obtained are indicated on the map, thus providing variations to the general trend across the study area. Farms Mezig and Bergvliet have groundwater records which indicate shallow groundwater conditions, thus making these farms more sensitive. It must be noted that this approach assumes the entire

[1] The portion of Earth between the land surface and zone of saturation. It extends from the top of the ground surface to the water table.

farm to be underlain by shallow groundwater, when in reality areas of these farms may still be suitable for the proposed CCGT plant.

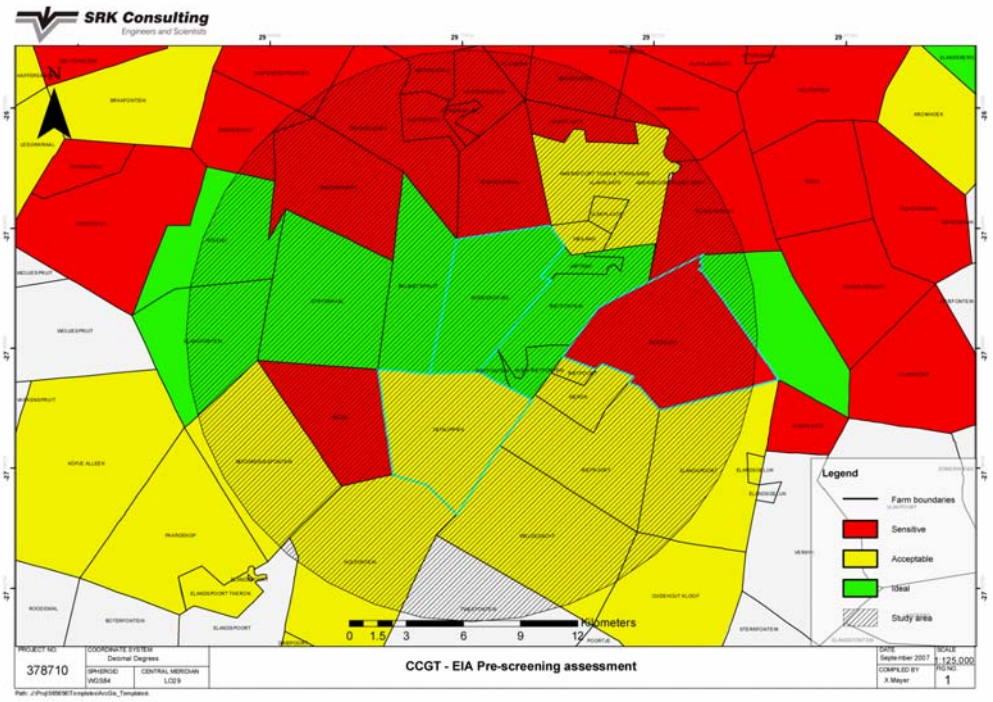

Figure 4.1 Sensitivity map showing areas that are ideal, acceptable and sensitive in terms of hydrogeological impacts.

4.1.2 Hydrology

Figure 4.2 shows the areas that are ideal, acceptable and sensitive from a hydrological point of view. Areas shown as red should be considered sensitive and of least suitability for development. In many cases these areas will require river diversions and water use license applications to DWAF as they likely to be in the floodline. Where the sensitive areas are not near a river they are due to steep slopes that will make stormwater control difficult.

Areas shown as yellow are acceptable but not ideal and from a hydrological point can be developed. Areas shown as green are the most ideal and these areas can be developed with little impact on surface water.

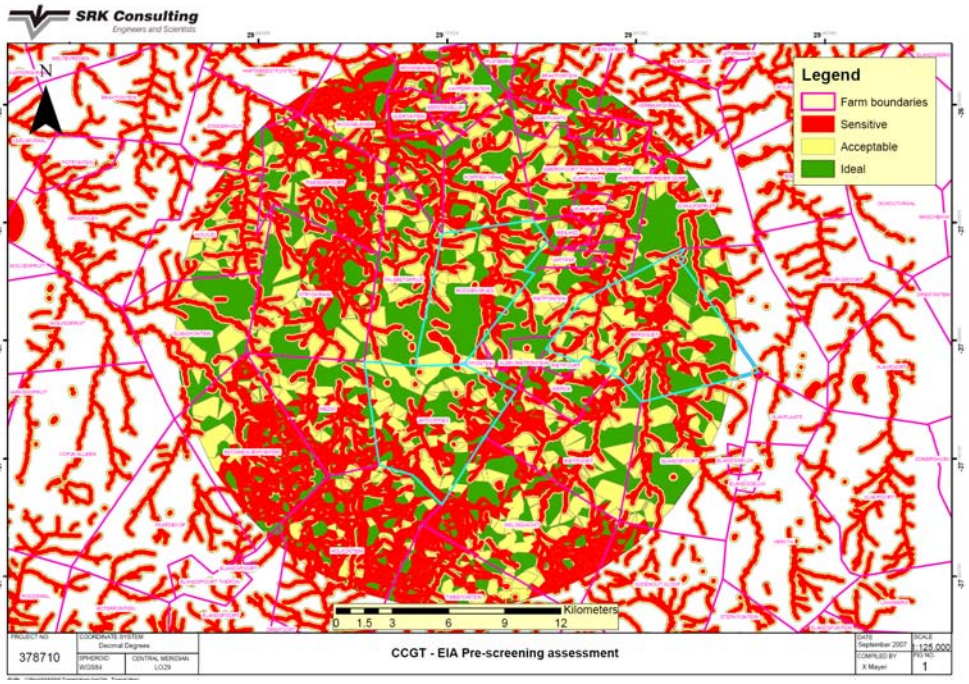

Figure 4.2 Sensitivity map showing areas that are ideal, acceptable and sensitive in terms of hydrological impacts.

4.1.3 Biodiversity

Grassland areas constitute important and sensitive ecological habitats, providing important refuge areas for a high diversity of animals, some of which may be endemic or regionally sensitive. The status of grasslands in the region presents the main problem of this particular assessment as available aerial photography does not accurately reflect the status of grassland regions. This aspect will enjoy particular attention in the Scoping and EIA phases of this particular project. For the moment it was accepted that all areas that could be identified as grassland, are pristine.

The identification of wetlands, rivers, streams and marshes also proved problematic at this stage. Available information will be sourced and the level of detail will be updated.

It is recommended, with a relative high degree of certainty that all areas that constitute wetland or pristine grassland habitat is regarded sensitive and should ideally be excluded from the proposed development.

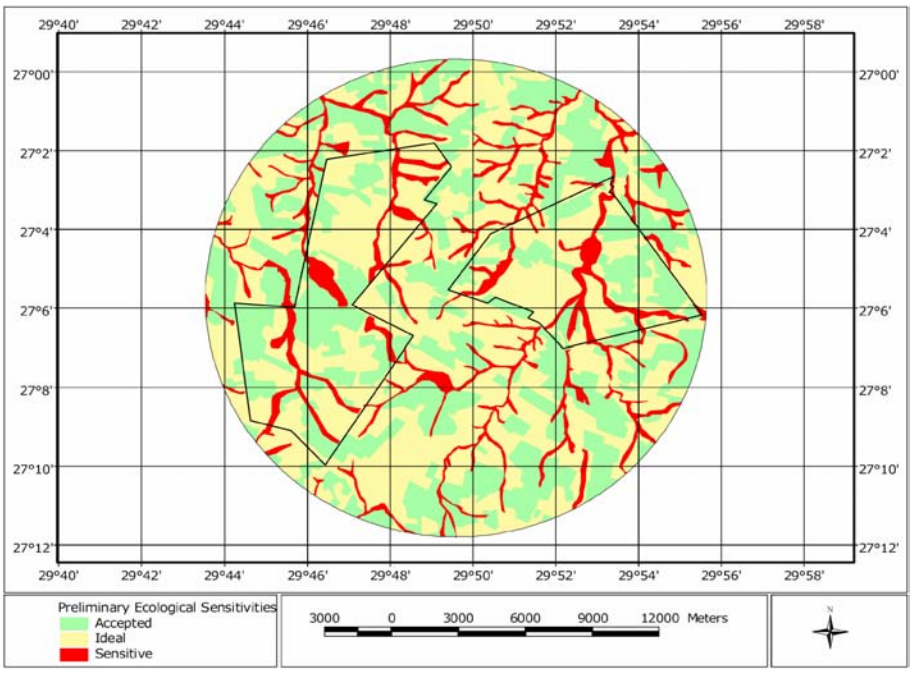

Figure 4.3 Sensitivity map showing areas that are ideal, acceptable and sensitive in terms of biodiversity impacts.

4.2 Social Impacts

4.2.1 Air Quality

The wind field is predominantly west to east although there are periods of significant east to west movements as well. Taking the perimeter of the existing Majuba power station as the point of reference, the sensitive receptors span the eastern to northern segment around the existing power station. There are no sensitive receptors that are apparent around the southern segment of the Majuba power station. The EIA phase will further evaluate the impacts of the aforementioned phenomenon during the modeling exercise to be conducted. This will evaluate amongs other things the effect source characteristics and dispersion potential on pollution movements.

Based on the preliminary assessment results, three bands of varying sensitivity have been identified. These are the ideal blue zone to the south of the Majuba power station, the yellow zone in the center and the red zone to the north of the Majuba power station (Figure 4.4). This assessment has been based primarily on the presence of sensitive receptors and the dominant wind field in the area and has not taken into account the type of emissions which would be released from the proposed CCGT power plant and associated infrastructure. At this stage of the investigation not enough is known about the potential emissions which could be released during the process to be included into this assessment.

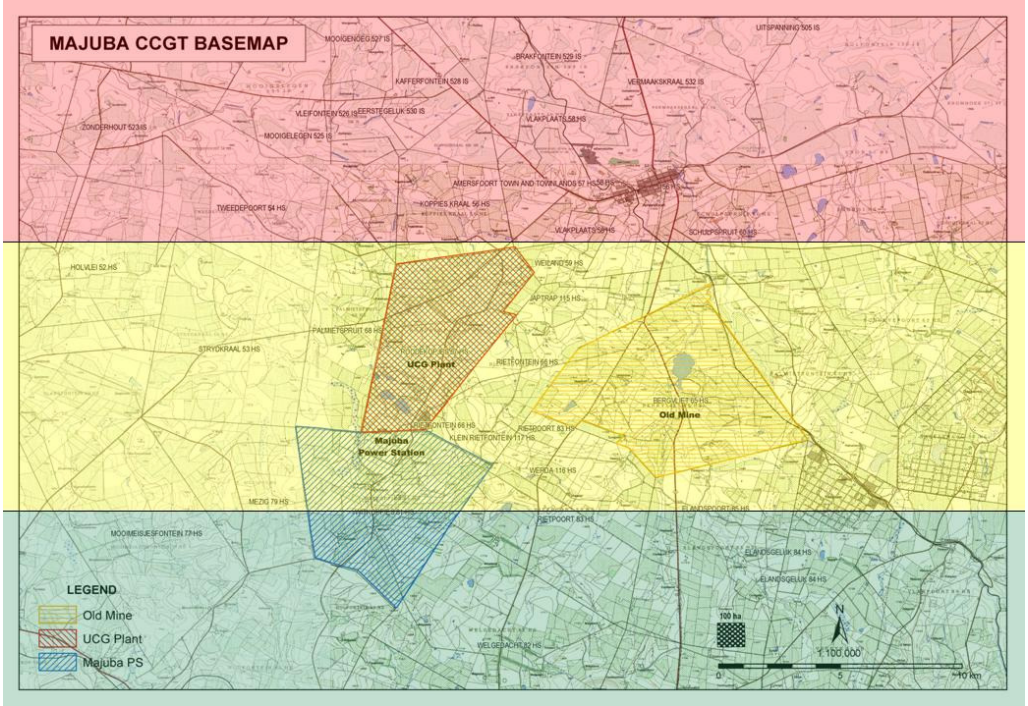

Figure 4.4 Sensitivity map showing areas that are ideal (green), acceptable (yellow) and sensitive (red) in terms of air quality impacts.

4.2.2 Noise

The area within a 10 km radius of the Majuba Power Station was analysed in detail. There were also several sectors where there were noise sensitive sites just outside the 10 km limit that could potentially be impacted, and in these cases a 12 km radius was used. National Road N11 was used as an expansion limit in the east, and sections of the Perdekop Road as a desirable expansion limit in the north-west.

The noise sensitive sites/areas are Amersfoort Town and various farm houses and farm labourer residences in the surrounding area. These are relative evenly spread out throughout the area. An analysis of the area within a 10 - 12 km radius of the Majuba Power Station (but maintaining the National Road N11 as an eastern limit) indicated that there was approximately the following number of noise sensitive sites (farmhouse and farm labourer homes) in the given quadrants of the 12 km circle:

Quadrant	**No. of Noise Sensitive Sites**
North-west	20
North-east	10
South-east	19
South-west	23

It should be noted that there are topographical restraints approximately 7.5 km to the south and south-west of the power station. Although the new facility cannot be built in these areas,

some of the noise sensitive sites are located in this far-distance sector and could still be impacted by noise from the new facility.

Figure 4.5 indicates the zones (I, II and III) that are acceptable (ideal), less acceptable (acceptable) and sensitive for the construction of the CCGT and associated infrastructure. The characteristic of each zone is described below, where

Zone 1 (Green): This zone is continuous and incorporates the area at the Majuba power station, the area north of the power station up to the Perdekop Road, the area between the existing power station, the UCG facility and the old mine (north-eastern quadrant), the area to the south-east of the power station (inner portion of the south eastern quadrant), and small areas to the south-west and west of the power station. The existing power station is already a source of noise. Locating the new facility at or too close to the existing power station will have cumulative effects, but because it is the centre of an existing noise degraded area, there are advantages to locating the new facility reasonably close to Majuba Power Station. If the CCGT plant is located at or within 3 km of Majuba Power Station (see circle around the power station), special consideration will need to be given to the acceptability of the cumulative effects at affected noise sensitive sites.

Zone 2 (Yellow): The CCGT plant can be introduced to almost any new area, but it is desirable not to move a new major noise source into areas too far away from the existing power station as this has the potential to introduce new impact situations. These zones are generally outside Zone 1. Four areas have been categorised as Zone 2 areas, namely one to the north, two to the south-east and one to the west of the existing power station.

Zone 3 (Red): The main no-go areas are those in close proximity to urban areas and informal settlements. In order to limit the night time noise impact on the Amersfoort Town, the new facility should not be closer than 4 km to the town (SANS 10103 night time standard for urban areas). Areas east of National Road N11 should be avoided, particularly areas that get close to Vlakplaats and Daggakraal.

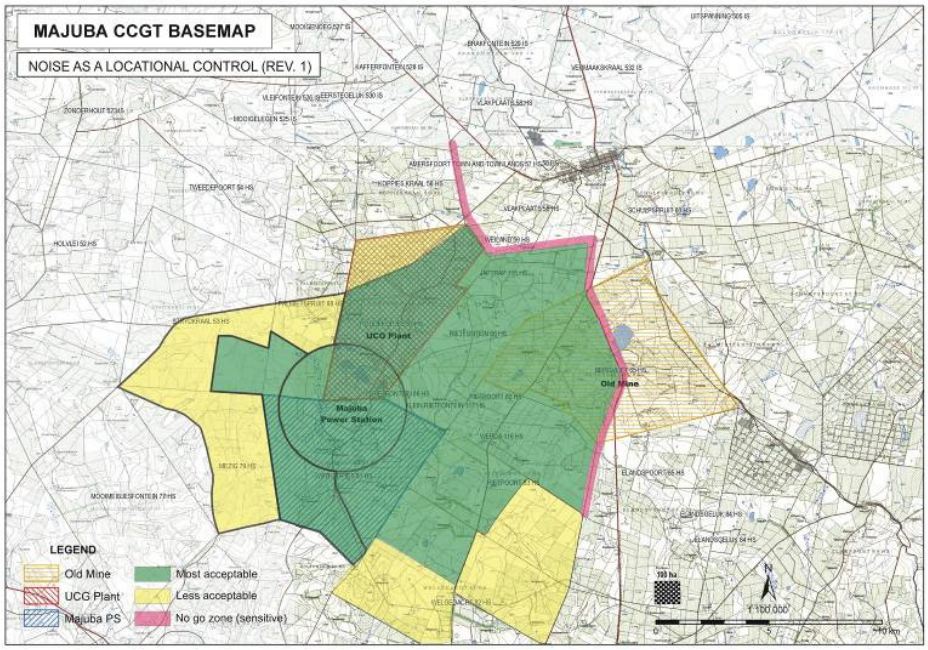

Figure 4.5 Sensitivity map showing areas that are acceptable, less acceptable and sensitive in terms of noise impacts.

4.2.3 Social

- *Demographic Processes*

The study area is sparsely populated. The closest town is Amersfoort on the northern border of the study area. The informal settlement to the west of the town, north of the N11, is growing. It does not appear as if formal structures in the town are on the increase. Isolated farm houses occur in the study area, and these are depicted on the sensitivity map. The total number of farm houses observed in the study area was approximately eight (8) and four (4) clusters of traditional huts / workers' huts were observed. There are on average 4-5 houses/huts in these clusters.

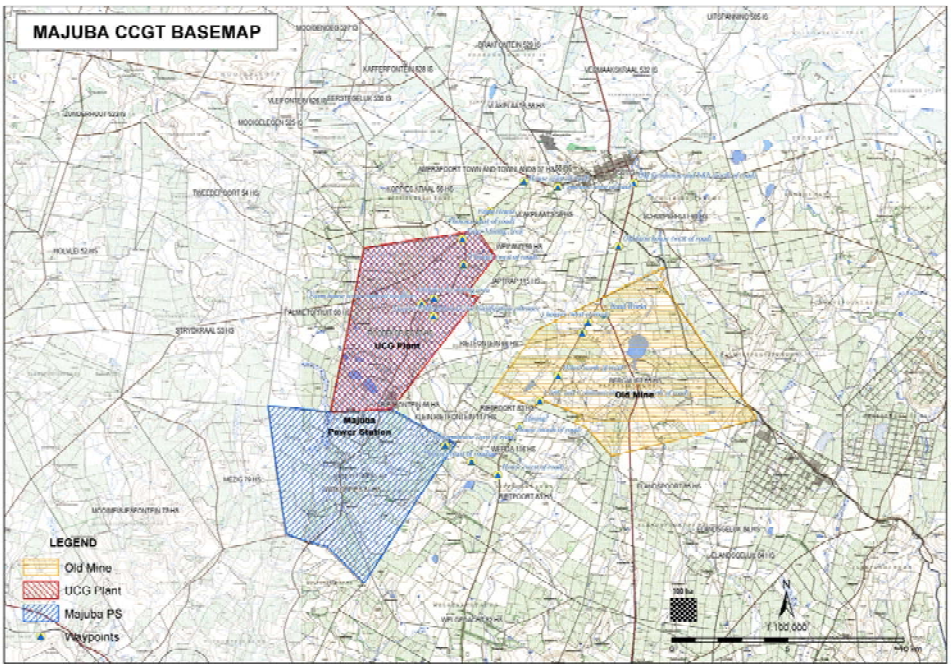

Figure 4.6 Map indicating the location of farmhouses in the study area.

- ***Economic and Land Use Processes***

The UCG pilot plant, Majuba power station and an old mine are located in the study area. Farming activities consist of the grazing of cattle and cultivation of mealies. The Department of Land Affairs plans to purchase grazing land in the area. The IDP lists the Majuba Mining Complex as an opportunity for growth, as well as the availability of agricultural land. This gives an indication that the agricultural activities are important for the economic development of the area.

- ***Socio-Cultural Processes***

There are plans to develop the Amersfoort Dam to the north of the study area into a recreational area. A private developer has plans to develop an exclusive residential development for city dwellers to the north of Amersfoort. At this stage, more information on planned tourism and residential development in the area is not available. Not enough information about the cultural landscape is available at this stage, as this will have to be informed by the affected parties. Therefore at this stage, the results of the Visual Assessment are considered sufficient to address potentially sensitive areas.

- ***Institutional Processes***

The local municipality will have to extend existing infrastructure (water and electricity) to service the CCGT. If construction workers and permanent workers are housed on site, this may necessitate the development of infrastructure for the provision of services. The municipality already lacks capacity and finance to provide services to its current inhabitants.

The sensitivity map for social impacts is largely informed by the visual sensitivity map (see Section 4.2.6, Figure 4.7) for this screening exercise. The visual sensitivity map can therefore be used as a reference.

4.2.4 Heritage

Without a detailed survey, it is difficult to describe specific issues with regard to sensitivity. However, based on experience, some generalised sensitivities can be identified:

- In the past, people used to settle near water sources. Therefore, riverbanks, rims of pans and smaller watercourses should be avoided as far as possible.
- In this particular part of the country, Iron Age people also preferred to settle on the saddle (or neck) between mountains (hills/outcrops), outcrops and the foot of hills. These areas should also be avoided.
- Avoid all patches bare of vegetation unless previously inspected by an archaeologist. These might be old settlement sites.
- Rock outcrops might contain rock shelters, engravings or stone walled settlements, and should therefore be avoided unless previously inspected by an archaeologist.
- Communities living close to the proposed corridor should be consulted as to the existence of sites of cultural significance, e.g. graves, as well as sites that do not show any structures but have emotional significance, such as battlefields, etc.
- All graves or cemeteries should be avoided, where practically possible. The correct procedure, i.e. notification of intent to relocate them, consultation with descendants and permit application, should then be followed in relocating the graves. If any of the graves are older than 60 years, they can only be exhumed by an archaeologist. Graves of victims of conflict require additional permits from SAHRA before they can be relocated.

4.2.5 Risk

The sensitivity analysis was based on the catastrophic failure of a single 1.8 diameter pipeline from the gas cleaning unit to the CCGT plant. The process conditions of the pipeline used in the study were:

- Pressure: 15 bar (g)
- Temperature: 40 ºC