



**water affairs**

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Department:  
Water Affairs  
**REPUBLIC OF SOUTH AFRICA**



# Report on findings of Hydrocensus in Tesselaarsdal

2013 November 15

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## **Introduction**

The purpose of the report is to understand the status of the groundwater in Tesselaarsdal. A hydrocensus was conducted in Tesselaarsdal within a 5km radius from a DWA monitoring borehole from the 27-28 August 2013. This hydrocensus was prepared as an aid of getting an understanding of the impacts in the area, so that sense can be made of the monitoring data. Significantly it is also needed to consider whether there is any value in continuing to monitor the site.

Groundwater monitoring in Tesselaarsdal commenced in March 1996. The borehole of interest is drilled in an area surrounded by indigenous vegetation, and according to the Departments' knowledge this borehole is only used for monitoring purposes. Occasional past measurements indicate a noticeable long term groundwater level decline of approximately 15 meters between 1996 and 2012. A better understanding is needed of the situation, and whether overexploitation of this aquifer is taking place.

## **2. Methodology**

The following method was used to conduct the study:

### **2.1 DESKTOP STUDY:**

- A desk top study, to find out about the area, as well as find out what information is available that could add to an understanding of the area, to determine the characteristics of the geology.
- Read previous reports written on the area if any are available.
- Get GPS coordinates of the boreholes, to plot on Geological and Geohydrology maps
- Locate the area of interest on satellite maps to analyse and compare the surroundings.
- Identify on the maps possible locations where groundwater occurs
- Locate possible water users that could impact the water level of the borehole.

### **2.2 FIELD HYDROCENSUS**

- Visit properties within a 5km radius of monitoring borehole
- Identify the various groundwater uses in the vicinity.
- Take field measurements of groundwater level, Ec, pH, and temp.

### **2.3 DATA ANALYSIS AND REPORT WRITING**

- The data gained from the hydrocensus is interpreted to better understand hydrology of the area.

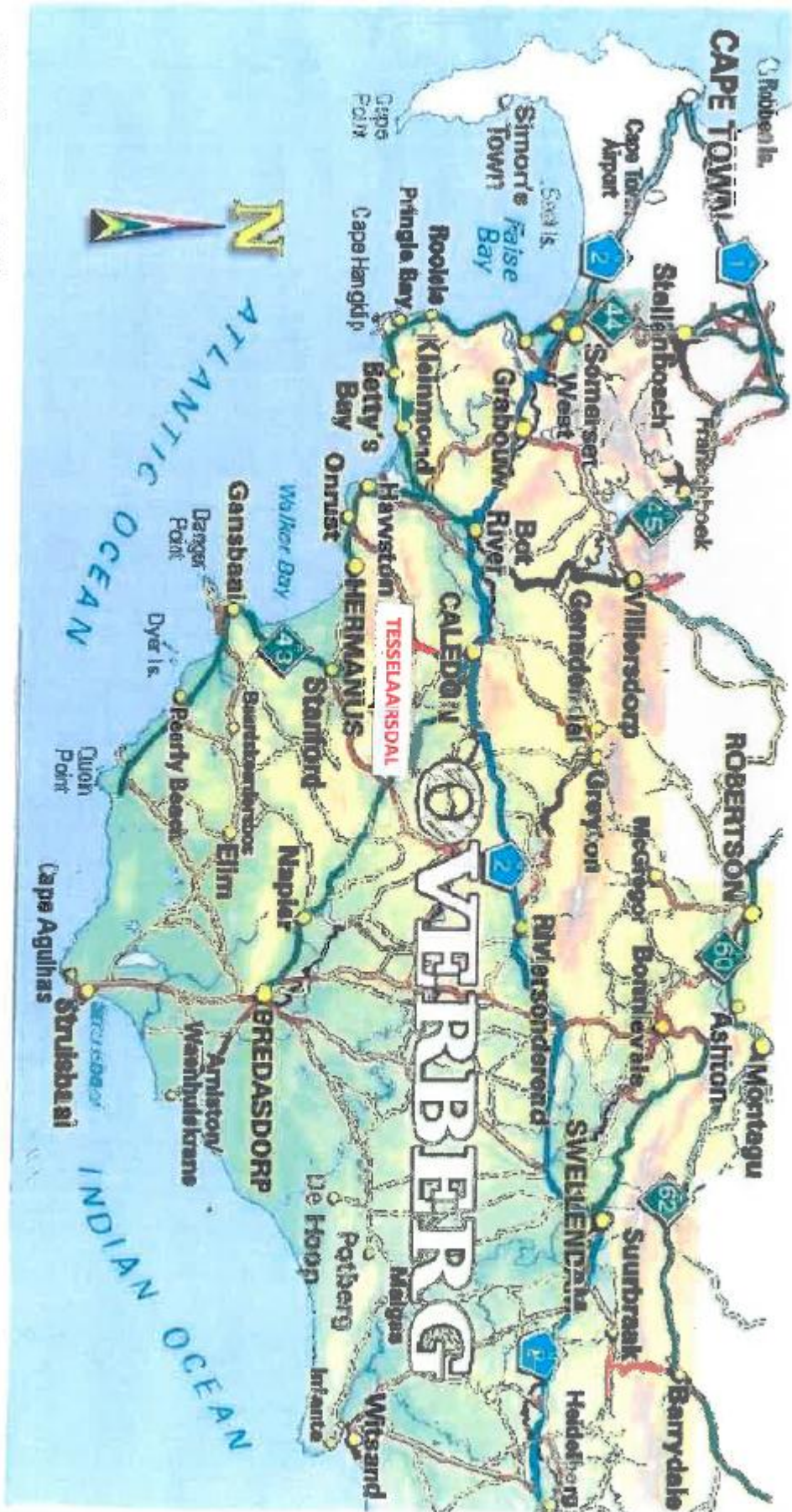


Fig 1: locality map of Tessellaarsdal

### **3. Study area**

Tesselaarsdal is situated in the Cape Overberg, roughly 21 kilometers from Caledon and the N2. The small virtually unheard of village of Tesselaarsdal, a quiet community with a population of approximately 3000 people, high in the mountains of the Western Cape's Overberg region, and is only barely on the map. It is positioned within the Breede Water Management Area (WMA) which is located in the south-west corner of South Africa, situated in the G40K quaternary catchment. It derives its name from the largest river within its boundaries, namely the Breede River.

#### **3.1 Topography**

The landscape of the Overberg area is dominated by gently to moderately rippling hills enclosed by mountains and the ocean. The topography of the Tesselaarsdal area varies considerably from east to west, with low lying areas evident more to the north east. This has a significant impact on the groundwater of the region. Rainfall is highest in the mountainous regions in the southwest.

#### **3.2 Climate**

The area has a predominantly Mediterranean climate with the majority of the rainfall occurring in the winter months. It has an average annual temperature of 16.5°C and a mean annual rainfall of 650mm (Septon, 1995).

#### **3.3 Geology**

The geology of the study area is outlined on the 1: 250 000 geology map 3319 Worcester (Council for Geoscience). This area lies within the northern margins of the Cape Fold Belt and is largely underlain by shallow marine sedimentary rocks of the Lower Bokkeveld Group (Ceres Subgroup) and upper Table Mountain Group (Nardouw Subgroup). DWA monitoring borehole G40115 is situated directly on the contact between the Bokkeveld shale (Gydo formation) and TMG sandstone (Rietvlei formation) of the Nardouw Subgroup.

The Rietvlei formation consists of alternating light-grey quartzose sandstone, feldspathic sandstone and some shale. Bedding thickness varies, ranging from 20-30cm, but is generally considerably less than that of the Skuweberg formation.

The Gydo Formation is a dark-grey to black shale, mudstone and siltstone unit, which forms the base of the Bokkeveld Group. The Bokkeveld Group rocks range in age from 410-390 million years old, *i.e.* the Early to Middle Devonian Period. The Bokkeveld Group, the middle unit of the Cape Supergroup, is a thick (approximately 1.5 to 3.5km) succession of fossiliferous sedimentary rocks which was deposited in shallow marine to coastal settings during the Early to Middle Devonian Period, about 410 to 375 million years ago (Theron 1972).

The rock formations in the area are dipping towards the SW direction at an angle of 10 degrees, anticline plunge direction is also SW.

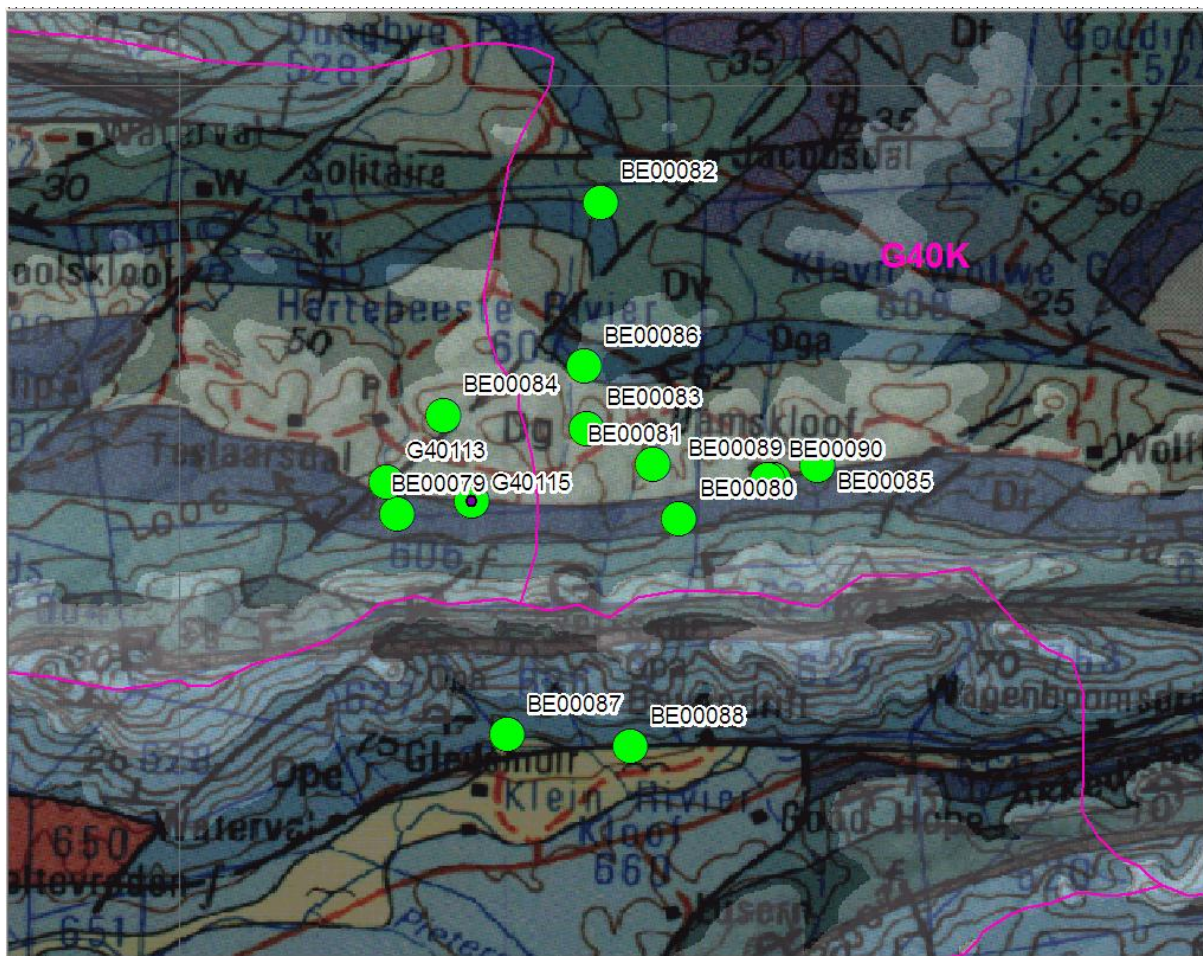


Fig 2. Extract from 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) displaying the extent and location of the hydrocensus boreholes

**KEY TO MAIN GEOLOGICAL UNITS ON THE MAP:**

- Nardouw Subgroup= upper TMG

Dr (powder blue) =Rietvlei Formation (grey quartzose sandstone/ feldspathic sandstone)

- Ceres Subgroup = Lower Bokkeveld Group

Dg (pale blue green) = Gydo (mudstone and siltstone)

Dga (blue) = Gamka Formation (mainly sandstones / wackes)

Dv (blue-green) = Voorstehoek Formation (mudrock-dominated)

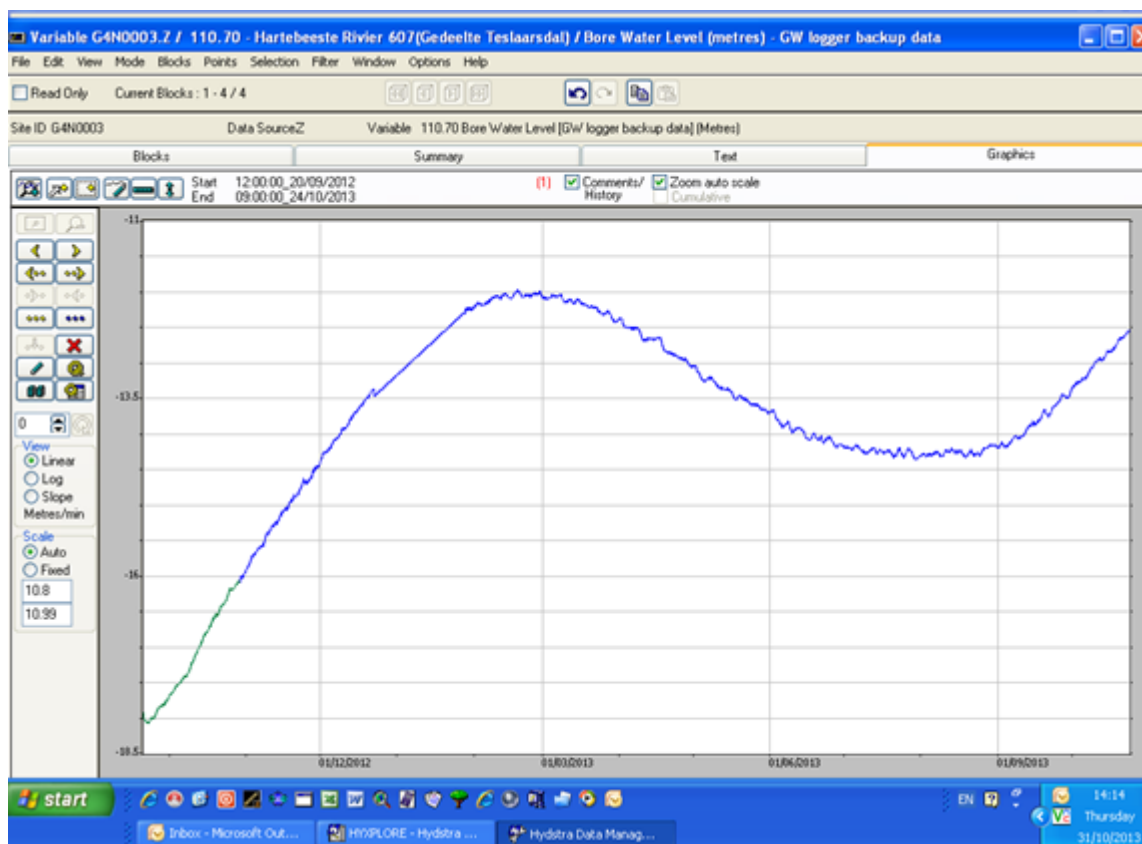
Dh (purple) = Hexrivier Formation (mainly sandstones / wackes)

Dt (blue) = Tra Tra Formation (mainly mudrocks with minor sandstones)

### **3.4 Geohydrology**

Most boreholes in the area are drilled into the TMG or the Bokkeveld Group rocks. The vicinity of Tesselaaarsdal is over fractured rock aquifers, groundwater is stored in the fractures, joints, bedding planes and cavities of the rock mass. Water availability is largely dependent on the nature of the fractures and their interconnection. Fractured aquifers are less prominent towards the south east relating to the change in predominant geology from the sandstone rich TMG to the more shale rich Bokkeveld and younger groups. TMG has a brittle arenaceous nature and therefore faulting and fracturing is common. The Bokkeveld and younger groups are generally more argillaceous and therefore less susceptible to brittle deformation.

## 4. Results



**Fig 3: graph depicting logger data from monitoring borehole G40115**

Prior to the hydrocensus, it was observed that the monitoring borehole groundwater level declined of approx. 15 meters between 1996 and 2012. A better understanding was needed of the situation, and whether overexploitation of this aquifer is taking place.

From the hydrocensus it was in fact discovered that the water level is currently rising again. According to the logger data graph the water level at borehole G401154 illustrates how the groundwater level shows an upward trend from the period 01/12/2012 till 01/01/2013, with a gradual decrease again. The general water level of the area is fairly deep fluctuating between 20-30m.

The initial dropping of the water level could have been as a result of over abstraction of the surrounding municipal production boreholes (G40113 and BE00079) that are situated approximately 25m away from borehole G40115. When water is pumped from a certain point, the cone of

depression affects the water table and surrounding borehole water levels can be affected. Both the Municipal production boreholes of Tesselaarsdal are at a radius of less than 50 meters away from the DWA monitoring borehole, and this could be one of the reasons there was a noticeable decrease in the water level over the past few years. There is no record of how much water is pumped by the two production boreholes (G40113 and BE00079).

Another possible influence on the water level decrease could result from the indigenous vegetation in the vicinity, this is not conclusive. Portion of the vegetation that was surrounding the DWA monitoring borehole has since been cut down (indicated with red block). According to indication, the water level has since shown a slight rise.

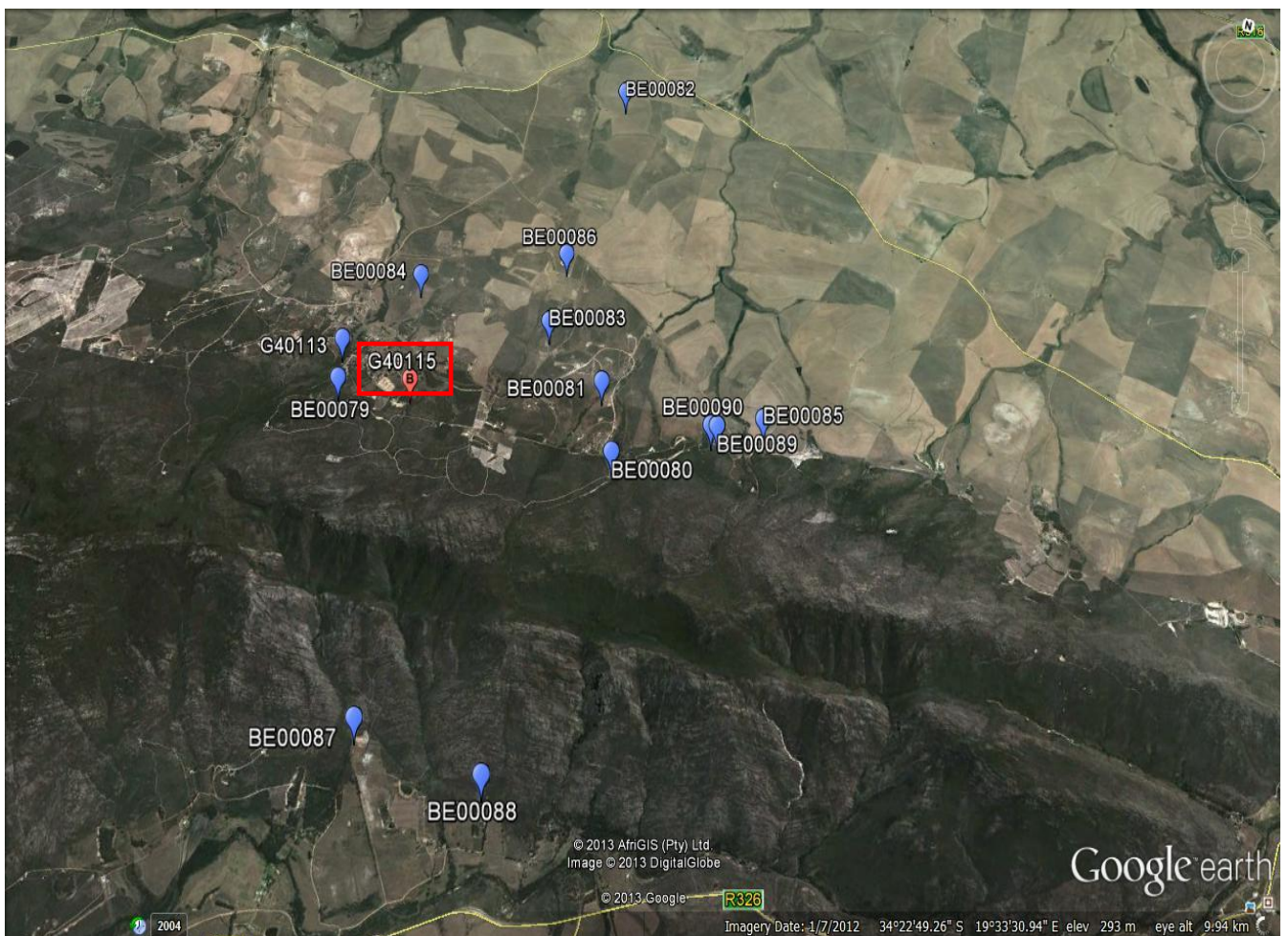


Fig 4: Satellite image showing the extent of the hydrocensus. The Red dot is the DWA monitoring borehole

## 5. Discussion

Dropping water levels are potentially related to forestry activity/alien invasion in the area, groundwater use by the surrounding community and the municipal groundwater supply.

A total of 15 boreholes were recorded during the hydrocensus, excluding the DWA monitoring borehole G40115. Two of the recorded boreholes, are the production boreholes for the Tesselaarsdal municipality, and the rest are private owned boreholes used for domestic use buy the water users in the area.

The hydrogeology of the area is relatively complex, as a result of the topography of the area. At areas of high altitude the water level is deep and where the altitude is low the water level is shallow. Therefore it is safe to say the topography plays a role on the height of the water table.

Even though there is no conclusive evidence that the water level is dropping as a result of over abstraction, the idea of the surrounding indigenou vegetation may also result in the drastic water level drop. It is complicated to establish the groundwater level signature at the moment. More intensive analysis is required, as a result of the noticeable fluctuating water level with random rises again. A sharp four meter rise in groundwater level has occurred since a data logger was installed in late 2012.

## **6. Conclusion and recommendations**

The existing monitoring route should be continued and expanded, to get a more general idea of the groundwater of the area.

## References

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**Figure 1: Locality map of Tesselaarsdal**