



**PROPOSED DEVELOPMENT APPROVAL OF THE FARM
SWEETVALE NO. 15257
(PREVIOUSLY SWEETDALE NO. 14176)
MARGATE
ENGINEERING SERVICES REPORT**

OUR REF		6302
DATE		18 October 2019
REVISION		00

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BRIEF

Bragge & Francis Consulting Engineers was appointed by Hills and Dales Farm cc. to investigate and report on the availability of engineering services (roads, water, sanitation, stormwater management and solid waste disposal) for the proposed development on the above property. This study commenced with the provision of the requisite reference data indicated below.

REFERENCE DATA

Although every effort was made to request and obtain all pertinent information for this assessment, Bragge & Francis Consulting Engineers cannot be held accountable or accept responsibility for any discrepancies in this information or for the disclosure or review of information which has not been presented to the consultant. All reports presented to the consultant for review have been referenced below.

The following has been used as the data platform from which the calculations and findings listed in this report have been derived:

- A Site & Concept Development Plan produced by Plankonsult Town and Regional Planners (Drawing No. 01, dated 22/08/2019);
- A Preliminary Geotechnical Investigation Report produced by Drennan Maud (ref. no. 32533) and a further elaboration of the nature of the fault line referred to in this report;
- A site contour plan by HNK Geomatics Professional Land Surveyors, June 2019, Plan No. 6168;
- The CSIR 'Red Book' – Guidelines for Human Settlement Planning and Design, 2000.

In addition, an informal indication of intended design directions has been communicated by the developer.

PROPERTY DESCRIPTION

The property is located inland of Margate within the Ray Nkonyeni (local) and Ugu (district) Municipalities, and is skirted on the east by the P200 Gamalakhe Road.



Figure 1 – Sweetvale Farm location

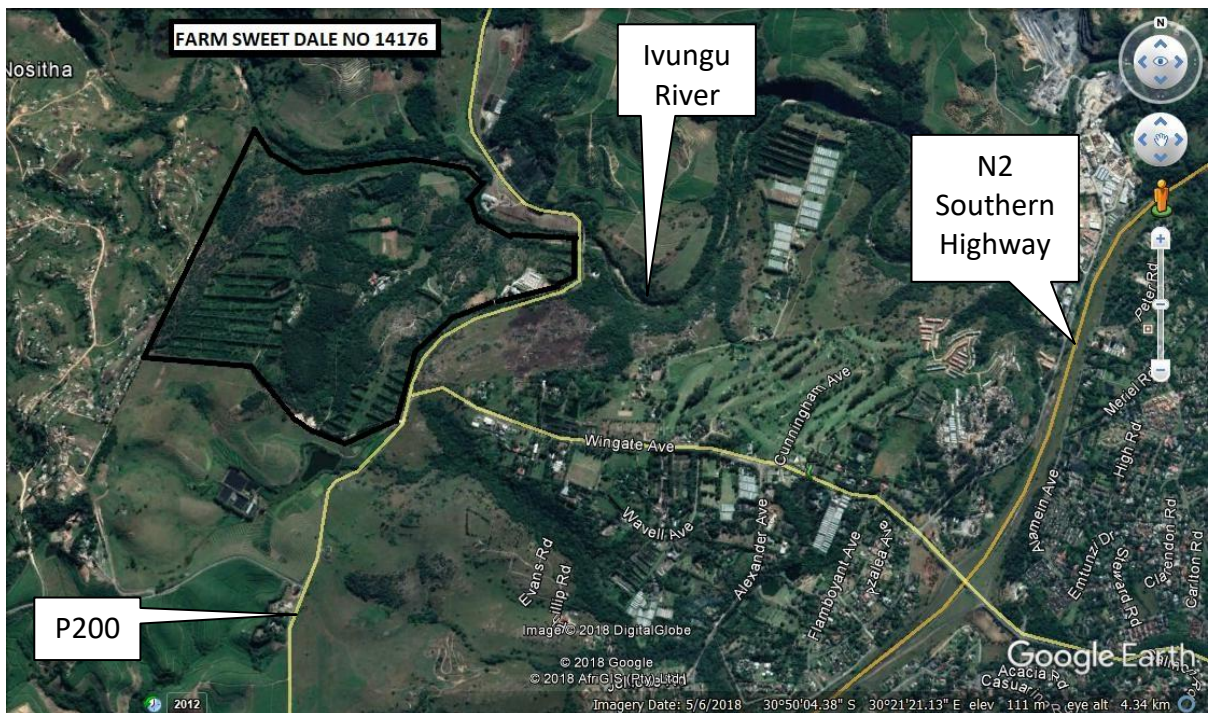


Figure 2 – Sweetvale Farm outlined

The property covers some 121.5 ha.

The site comprises an elevated southern component with moderate to steep slopes forming valley lines falling north towards the Ivungu River which forms the northern boundary of the site. Existing development on the site comprises a farmstead complex associated with the historical usage of the site, and a skills centre and a restaurant forming the more recent components of development. The bulk of the remainder comprises former grazing/paddock lands and crop lands that are separated by defining hedges and trees.

The steeper areas have slopes steeper than 1:3, requiring careful consideration and special attention when designing development and developing the site. Typically, these gradients are considered uneconomical for development.

The low lying areas display signs of groundwater seepage and other characteristics of wetlands. The geotechnical investigation and the wetland delineation study define these areas in more detail.

Rocky outcrops across the site indicate shallow soils overlying both boulders and bedrock of Natal Group Sandstone. This was confirmed during the geotechnical investigation by augers and DCP results, with soil mantles of less than 2 metres over inferred rock (either bedrock or loose boulders) being recorded in all cases. The geotechnical report indicated the possible presence of a geotechnical fault line running roughly north-south across the site. However, the scale, orientation, location and indeed presence require detailed investigation to confirm. A further clarification document issued by Drennan Maud (dated 23 August 2019) indicates, however, that the engineering implications of the fault are not prohibitive to development. The qualities of good road-building material were noted in the colluvium and the sandstone. The shallow rock depths were noted as a potential challenge for the installation of underground services, potentially requiring ripping and/or blasting. There is limited scope for the latter in the immediate vicinity of the existing overhead electrical infrastructure. Cautions were also expressed concerning the establishment of platforms and the impact thereof on slope stability. Additional geotechnical guidance will be necessary at final design and construction stage to maintain slope stability.

The site has been vegetated by both indigenous and alien vegetation. A detailed delineation of the various types of indigenous vegetation has been undertaken by Terratest and integrated into the Site Development & Concept Plan produced by Plankonsult.

A 1:100 year floodline study has been calculated for this property by Bragge & Francis Consulting Engineers, which has been incorporated into the Site Development & Concept Plan produced by Plankonsult and the various engineering layouts produced by Bragge & Francis Consulting Engineers.

NATURE OF THE DEVELOPMENT

The developer proposes development of a Retirement Village with the following distinct structures:

Section	No. of Units	Area per unit (m ²)
HIGH END UNITS	129	150-180
MIDDLE CLASS UNITS	285	90-110
APARTMENTS	132	70-85
SERVICE APARTMENTS	16	55-65
(Existing)		Occupancy
OFFICES & SKILLS CENTRE		60 staff
RESTAURANT & FARM STALL		100 patrons

Table 1: Development Breakdown

These structures would be accessed via roads constructed as per the proposed road layout indicated on the SDP. These roads would also largely form the corridors by which water and sewerage lines would link with the proposed bulk connection (in the case of water) and de-centralised treatment works (in the case of sewage).

The existing restaurant and skills centre located on the east of the property would remain and would be supplemented by a farm stall/tourist centre facility along the P200. These three facilities (skills centre, restaurant and farm stall) would comprise, for the purpose of engineering services, a single node.

A second node would comprise units on the south-eastern, high-lying area of the property. A third node would comprise residential and service units on the lower-lying central and northern are of the property. The fourth node would comprise the majority of the residential units and would be located along the western, high-lying areas of the site.

The sum of proposed development areas is significantly less than the total property area, limited in part by steep slopes, wetlands, and other environmentally-sensitive features.

ROADS

Current access to the properties is directly off the P200 Gamalakhe Road. The two existing entrances would remain, with the eastern-most, lower access point possibly serving the restaurant and skills centre more directly.

The proposed internal roads would consist of formal asphalt or brick-paved, kerbed roads constructed as indicated in the SDP and in the Preliminary Engineering Services Layout (drawing number 6302/19/C03).

Development of the proposed internal roads will be hindered by shallow rock depths and steep slopes. Attempts to mitigate excessive rock excavation, by raising the road carriageway, will result in significant fill embankments on these steep slopes. Where these run over onto lower platforms/roads, or are simply too costly, retaining structures will become necessary. An optimization exercise will necessarily run the full course of construction to limit the cost of these structures.

The Developer has indicated the intention to develop split level residential units (accommodating vehicular access to either the upper or lower level), which will go a significant way to minimizing the need for extensive platforms on the steeper slopes.

Notably, the internal arterial roads necessarily cross wetlands. Where possible, existing road alignments have been chosen in order to limit the impact of roadworks on these areas. However, in some cases the

The existing external road infrastructure serving the site is in a fair condition, but care must be taken during construction that earth moving equipment does not unnecessarily damage the existing infrastructure. Comment from the KZN Department of Transport must be obtained to confirm the acceptability of the proposed (existing) entrances.

STORMWATER MANAGEMENT

The site presently contains little in the way of formal stormwater structures or any other controls. Drainage occurs naturally from the elevated ground to the south and west of the site into the drainage paths on the lowest reaches of the site, which in turn drain into the Ivungu River. What minimal measures have been taken on the site amount to current farming practice in areas of elevated groundwater; that of surface furrows by which the most elevated of groundwater may be relieved and the planting of hydrophilic trees to create passable surfaces for circulation about the property and for other farming activities.

The prevailing soils, being colluvium, are erodible and prone to sloughing under concentrated stormwater flows. Therefore, all hardened, impervious surfaces are to be treated in accordance with recommendations that stormwater runoff be collected and attenuated prior to discharge into the natural drainage system. It is noted that percolation of stormwater is not generally feasible for this site, although localised, small-scale groundwater recharging may be possible.

Reference is also made to the Storm Water Management Plan (policy document) and the Preliminary Civil Engineering Services Layout (drawing no. 6302/19/C03) by Bragge & Francis Consulting Engineers wherein a higher level of detail is offered.

In the main, the stormwater flows generated from the site should, where feasible, pass through attenuation structures associated with each structure before being conveyed to discharge points within drainage lines. Where practical, this also applies to the road run-off. Consideration must be made of sections of the roadways (parking areas in particular) being constructed of appropriately designed permeable paving (such as grass blocks) to allow ingress of water directly into the subsoils at locations where the groundwater will pose no threat to downstream structures. This may, however, not be possible where depths above bedrock are prohibitive.

In general, although the proposed development is extensive, the philosophy behind stormwater management on this project is to limit the risk of erosion of the erodible soils on the site and to attenuate the increased run-off resultant from increased hardened surfaces. The controls will need to be configured in such a way as to limit litter and silt transportation into and along the water courses, reduce the need for additional attenuation structures, and mitigate the redirection of stormwater and groundwater from their natural directions.

Stormwater management during construction is to make use of temporary stormwater controls in the form of swales, berms, erosion fences, and the like. Where possible, integration with final landscaping is to be leveraged for the sake of cost saving and the early establishment of protective vegetation.

SANITATION

No water-borne municipal sewerage service is available on the property. Furthermore, no municipal service is planned for this area in the foreseeable future.

The Skills Centre and Restaurant are currently serviced by a septic tank and French drain. However, this is regularly serviced by vacuum tanker.

Based on the current service quota tables published by the Ugu District Municipality, the proposed development would produce the following estimated daily sewage flows:

Section	No. of Units	Area per unit (m ²)	Estimated Daily Sanitation Volumes (m ³)	
			Quota per unit	Total Volume (m ³)
HIGH END	129	150 - 180	1	129
MIDDLE CLASS	285	90 - 110	0.65	185.25
APARTMENTS	132	70 - 85	0.5	66
SERVICE APARTMENTS	16	55 - 65	0.35	5.6
SKILLS CENTRE	60 PERSONS		90 LT/PERSON	5.4
RESTAURANT	100 PATRONS		90 LT/PATRON	9
Daily Total (m³)				400.25

Table 2: Estimated Daily Sewage Volumes

Both the soil depths, as outlined in the geotechnical report, and the intensity of the development do not support the use of on-site septic tanks and French drains. This is supported by the regularity of vacuum tanker servicing of the current restaurant/skills centre septic tank and French drain.

The remaining options amount to either conservancy tanks or on-site waste water treatment works (WWTW).

Conservancy Tanks

While this means of disposal requires the lowest capital outlay, the operational costs are the highest of the available options, requiring regular servicing by tankers. A limited number of service providers make this option unfeasible if serviced by external contractors and/or the municipality. The option of the Development purchasing a tanker and operating it privately instantly increases the capital costs, and would not mitigate the operational costs other than to save the profit that a contractor would charge.

In addition, the extensive nature of the site would demand of the order of 1,592.5 trips daily for a standard 7m³ tanker under full occupancy.

It is our opinion that this is not sustainable for any length of time.

Waste Water Treatment Works (WWTW)

Numerous proprietary plants are available locally, all claiming compliance with the required water quality standard. In practice, however, all of these plants will have been designed to handle effluent that falls within certain parameters. When the incoming effluent falls outside of these parameters, the recovery (or otherwise) of the plants differ widely.

However, of the more common systems that exist, the Return Activated Sludge process has produced the most consistent results on record locally. This process lends itself to compact design of the works, and is widely used by both municipalities and private developers. A proposal from a local supplier of this process has been sought and is included as an appendix to this report for illustrative purposes.

It is proposed that four separate plants be established to accommodate the distinct geographical nodes of development and to mitigate the costs and inherent risks of reticulation of sewage about the site. The locations of these plants have been indicated in the Sewage Management Schematic Layout (drawing no. 6302/19/C02) produced by Bragge & Francis Consulting Engineers. These plants are suitable for underground construction, typically beneath parking areas, to allow for ease of access and to economise on the use of developable space.

Reticulation

The aforementioned layout also indicates the positions of pumpstations, necessarily located at localised low points, from whence waste water is to be boosted to discharge points within the gravity mains networks, or to the WWTWs themselves.

The proposed locations of the WWTWs will allow direct discharge of the treated effluent into the stormwater system or directly into the drainage lines, reducing the risk of exposure by occupants of the development. Additional polishing will be required for this means of disposal. The risk of spills and leaks must be mitigated to prevent groundwater and surface water contamination.

The WWTW will require an emergency overflow soakaway to contain flow during extended power outages, breakdowns or servicing, as part of the Ugu District Municipality's requirements. This need not necessarily be seen in the same light as a French drain; it amounts to holding capacity that may be aided by any possible percolation but which could foreseeably also be serviced by a tanker and would be used sporadically, if ever, when the WWTW is operating correctly. This is ideally located below the WWTW, but in the instance in which this is not achievable, it would have to be located above the installation, requiring that it is within reach of a mobile pump and lay-flat hose. Some degree of noise and odour accompanies this mode of servicing the emergency overflow soakaways but the discomfort of this exercise goes a long way towards not allowing a sub-standard operation of either the WWTWs or pumpstations to continue for protracted periods.

The use of WWTWs requires a contract with independent, registered testing facility for test logging and submission to the authorities. Service contracts are also available to monitor and service the WWTW.

Capital Contributions

The use of privately owned plants will not attract capital contributions for this service. However, the district municipality bylaws state that a deposit equal in value to the cost of the plant is payable to the district municipality (as the service authority, although in this case not also the service provider) against failures of the plant. However, to our knowledge this has never been enforced.

WATER

According to the Ugu Water Services GIS database, the area is currently serviced with a potable water supply. Records indicate that the site would be fed off a 250mm Ø F.C. man running along the P200. The supply in this length is from the Old Kaiser Reservoir located near the Oatlands Landfill Site turn-off.

The elevation of this reservoir is approximately 163m above M.S.L., whereas the elevation at the Sweetdale Farm entrance is approximately 143m above M.S.L., which produces a static head of 20 metres (or 2 bars) excluding friction losses.

The highest point of the farm, as per Google Earth, is approximately 204m above M.S.L., resulting in a need to pump to these levels. However, since on-site storage will be a requirement of the District Municipality, this break in pressure at on-site reservoirs renders the re-energizing of the supply inevitable.

It is worth noting, however, that an additional reservoir is located inland of the property (to the south-west) in a rural residential node. The elevation thereof is roughly 208m above M.S.L., allowing even the highest points of the site a gravity supply. However, records do not indicate an existing connection between this reservoir and the farm.



Figure 3 – Sweetdale Farm (highlighted) in relation to municipal reservoirs

A preliminary design of the internal reticulation will be indicated on the Preliminary Engineering Services Layout (drawing number 6302/19/C03).

The fire department may require the addition of a booster connection at the entrance to the development and, in all likelihood, additional internal boosting means. This and other requirements of the fire department will be the subject of later negotiation at detailed design stage.

Water Storage

The District Municipality requires that 24 hours of water storage for domestic use be provided. However, due to the prevalence of interruptions to the water service, we believe it would be necessary to make provision for as much as 72 hours of water storage for this usage. This requirement, in its simplest form, implies the breaking of municipal pressure at the storage tanks. In order to re-pressurise the internal network, either elevated tanks or pumps will be required.

We point out that fire-fighting requirements are likely to place additional storage demands on the development. These demands may not be deducted from that of domestic storage, and would be calculated in accordance with the recommendations of a fire engineering practitioner in consultation with the local fire department. Alternatives to the use of water for fire-fighting exist but these can only be designed once the development has moved beyond a preliminary design stage.

Connection into the Ugu water service would attract capital contributions.

Based on the current service quota tables published by the Ugu District Municipality, the proposed development would produce the following estimated daily domestic water demands:

Section	No. of Units	Area per unit (m ²)	Estimated Daily Water Demand (m ³)	
			Quota per unit	Total Volume (m ³)
HIGH END	129	150 - 180	1	129
MIDDLE CLASS	285	90 - 110	0.8	228
APARTMENTS	132	70 - 85	0.6	79.2
SERVICE APARTMENTS	16	55 - 65	0.35	5.6
SKILLS CENTRE	60 PERSONS		90 LT/PERSON	5.4
RESTAURANT	100 PATRONS		90 LT/PATRON	9
Daily Total (m³)				456.2

Table 3: Estimated Daily Domestic Water Consumption

SOLID WASTE DISPOSAL

All internal domestic solid waste is to be collected weekly by the local municipality and transported to a licensed landfill site. A central collection point will need to be agreed upon with the Maintenance and Cleansing Department of the local municipality. The Ray Nkonyeni Local Municipality landfill site is Oatlands, located inland of the Margate Airport.

All non-domestic waste associated with, for instance, workshop activities and builders rubble, is to be handled as is appropriate to the waste category, in accordance with relevant national and local legislation.

CONCLUSION

From a civil engineering point of view, the proposed development is considered feasible within the known parameters thereof. However, considerable design input is still required before a final design is complete.

Compiled for HILLS AND DALES FARMS CC by
BRAGGE & FRANCIS CONSULTING ENGINEERS

A handwritten signature in black ink, appearing to read 'R. R. BRAGGE', written in a cursive style.

R. R. BRAGGE, PR. ENG. 20150472
(Partner)