REVIEW OF THE WATER USE LICENSING APPLICATION for a RESIDENTIAL DEVELOPMENT IN KEURBOOMSTRAND, PLETTENBERG BAY. Dated September 2024

This Review has been Prepared by:

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For:

Cullinan and Associates Incorporated (2001/001024/21)
Cape Town

Date of Review: 5 November 2024

1. INTRODUCTION

The main objective of this review is to comment on the contents of the Water Use Licence Application (WULA: including the supporting information contained within the 10 Appendices) for the proposed housing development on Portion 91 of the farm Matjesfontein 304, in Keurboomstrand, Plettenberg Bay.

Additional information that was provide to the reviewer included documentation of a number of comments on the draft basic assessment report for the proposed development, as well as several maps and diagrams that highlight the topographic characteristics of the area.

The objectives of this review are:

- To review the main contents of the WULA.
- To comment on the key conclusions of the WULA.
- To review any additional evidence provided that pertain to water resources, flooding or other issues that fall within this reviewer's area of expertise (i.e. hydrology).
- To assess the impact of the proposed development on other existing residential properties in the area with respect to flooding or other issues relating to water resources, water supply and wastewater disposal.
- To make any additional comments that might be relevant to the feasibility of the development.

This review will not address any issues pertaining to socio-economic or non-water related infrastructure (e.g. roads and traffic) impacts of the development, nor is the reviewer qualified to address issues related to biodiversity or other ecological impacts.

2. GENERAL OBSERVATIONS ABOUT THE DEVELOPMENT SITE

The proposed development is situated some 5.8km along the shoreline from the main part of the Keurbooms Estuary mouth. It is therefore initially surprising that part of the area is included in the Estuarine Functional Zone (EFZ) of the Keurbooms Estuary. However, a more detailed examination of the topography to the east of the Keurbooms Estuary indicates that there are low-lying areas on the inland side of the coastal dunes (Figure 1). Although quite detailed 2m contour maps were provided, they do not extend all the way to the estuary and it is difficult to definitively conclude that the development site is directly hydraulically connected to the estuary during high floods. However, all the evidence points to the fact that it is connected and will form an inundated backwater area when the estuary is subjected to flooding. This is supported by the cross-section data (approximately north-south through the proposed development property) that indicates that most of the area to be developed is below 5m above mean sea level.

Figure 1 Location map showing the mapped extent of the Keurbooms EFZ.

A further characteristic of the site is the existence of a spring (reportedly perennial) and a pond situated at the base of the steep inland slopes to the north. The protection of this spring appears to be a major component of the WULA.

3. OBSERVATIONS ABOUT THE KEY COMPONENTS OF THE WULA

There is a great deal of discussion in the WULA about the likely impacts of the development on the spring and all the regulations pertaining to developments close to a watercourse. However, these seem to be largely irrelevant because there is no drainage line away from the pond that is supplied by the spring and I am doubtful if this spring would be classified as a significant water resource.

A further key component of the report relates to the proposed waste-water disposal system which consists of an underground anaerobic storage tank, a containerised bioreactor plant and an elevated storage tank located in the northwest of the property. Some of the treated waste-water will be used for irrigation of the property but the area close to the spring will not be irrigated. The proposals for the waste-water treatment system seem to be appropriate. However, this also seems to be a temporary measure as the report suggests that the waste-water will eventually be directed to the municipal sewer system when the existing capacity has been increased.

The WULA report includes a stormwater management plan that includes the construction of three stormwater retention ponds and concludes that the total volume of 2 840 m^2 is sufficient to store the runoff that might occur during a 1:50 year rainfall. The 24 hour rainfall depth used in the calculations is about 77mm, and the report appears to assume that a large proportion of the runoff will infiltrate during the 24 hours such that the available storage will be sufficient. However, my experience suggests that flooding events in this region of the Southern Cape coast are typically a result of rainfalls with a longer duration than 24 hours and therefore only focussing on the rainfall depth in a 24 hour period is unlikely to provide an accurate value for the storage required. The effects of antecedent wetness conditions have been ignored and could be very significant. The report also assumes a quite high rate of natural drainage from the ponds. However, the ground is very flat and sea level is not far below, suggesting that drainage gradients will be very low and that the capacity of the soil material immediately beneath the ponds will also be very low. The stormwater management plan also appears to ignore the possibility of runoff and near surface drainage from the forested slopes to the north of the property. The Geotechnical Report (compiled by Outeniqua Geotechnical Services, Knysna) noted that groundwater was identified in test pits at an average depth of 2 m (see also the photographs in Annexure C of this report), supporting the suggestion that there is limited storage capacity for drainage into the soils underlying the property, although this will clearly vary over time depending on the antecedent rainfall conditions. My conclusion is that the potential benefits of the proposed stormwater retention ponds for reducing the flooding impacts of surface water runoff during high rainfalls have been quite substantially over-estimated.

The WULA report does not make any mention of the flooding risk from the Keurbooms River estuary and only focuses on the risks of localised flooding from stormwater.

The Geotechnical Report also suggests that 'Stormwater from roofs can generally be handled in gutters, downpipes and open channels or underground pipes, with suitable discharge locations on the southern side of the site'. However, the cross-section and contour data suggests that there is no drainage route to the south due to the existence of the coastal dune.

It is noted that upgrades to the existing bulk water supply system will be required to accommodate the potable water supplies to the new development. It was not clear to me what the time frame of these planned upgrades is and therefore it is difficult to comment on the likely impact of the proposed development on the assurance of water supply to existing users.

4. REVIEW OF PHOTOGRAPHIC EVIDENCE AND CROSS-SECTIONAL DATA PROVIDED

A number of maps, topographic cross-sections and photographs of inundation during the November 2007 floods were also provided to the reviewer and these are added as annexures at the end of this report. Annexures A and B show that the 1:100 year flood line (based on the Keurbooms and Environs Local Area Spatial Plan) reaches almost to the development site but is confined to the south of the road. At Portion 91/304 the 394 road itself does not appear to be elevated above the surrounding ground (see the cross-section in Figure 2) and therefore does not act as a barrier to flooding. It is therefore possible that the actual extent of a 1:100 year flood could continue to the north of the road. The extent to which the property currently plays a role in flood attenuation, would also depend on whether or not the property would be locally saturated from local runoff from the slopes to the north.

Annexure C shows some photographs taken during the November 2007 flood when the Keurbooms Road (394) was reported to be impassable and the Dunes Resort (about 1 400 m to the west of the proposed development) was 1.5 m under water. Fortunately, vacant land on both sides of the road were not saturated before the heavy rainfall and floods of 2007 and acted as important areas for floodwater drainage. I assume that this also means that the existing properties to the south of the road, adjacent to the development site and constructed below the slopes of the coastal dune, were also under water.

The cross-section data suggests that almost all parts of the development will be below 5m above mean sea level (the black dashed line in Figure 2). There seems to be little doubt that the site does play a role in providing some flood storage, as well as the fact that the site is highly likely to be flooded during heavy and prolonged rainfall events.

While there is little real evidence to suggest that the frequency of high, flood producing, rainfalls are increasing in this part of South Africa due to climate change, there remains a great deal of uncertainty surrounding the likely effects of climate change. However, there does seem to be some evidence that sea tidal/storm surges are becoming more frequent (note the flooding of the N2 entering Port Elizabeth due to several storm surges during 2024). To suggest that storm surges are likely to impact on flooding in the Keurbooms Estuary EFZ would be very speculative in the absence of further information, however, the possibility should not be entirely discounted.

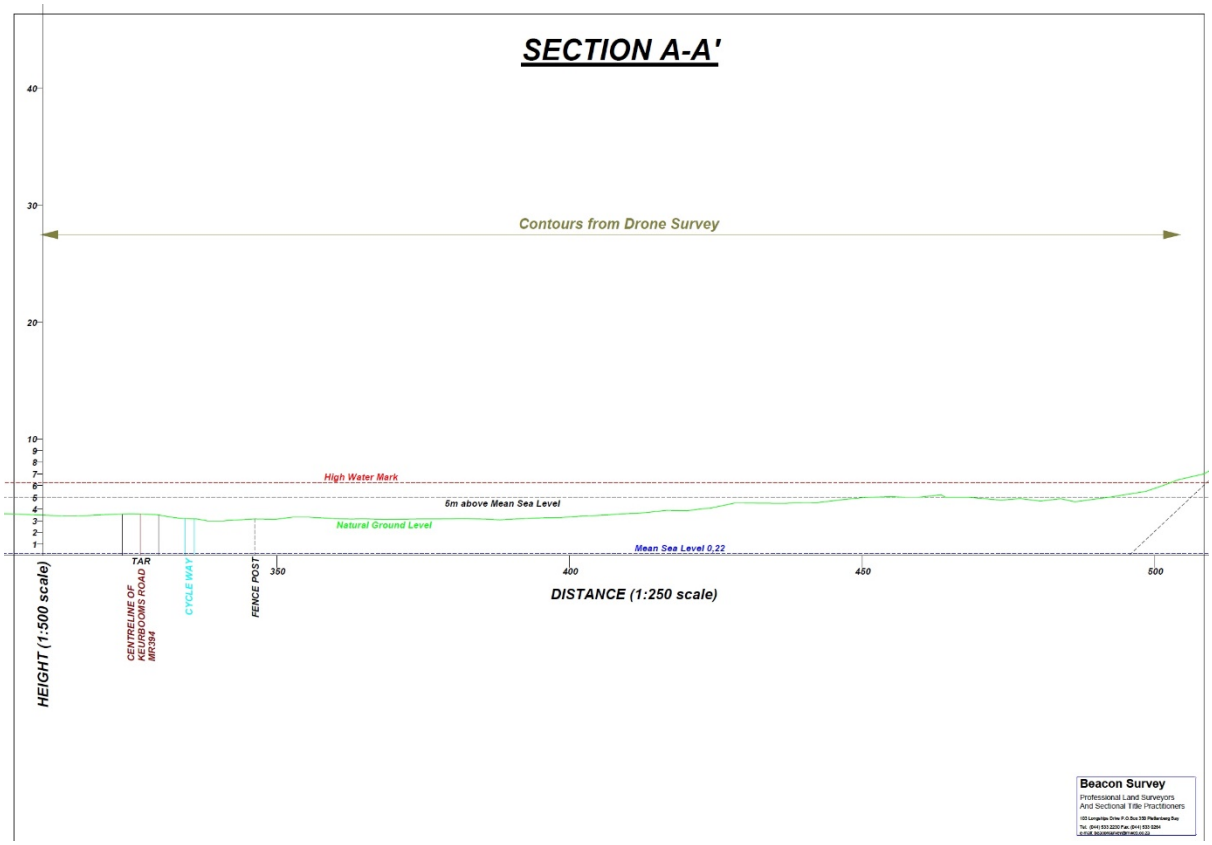


Figure 2 Cross-section through part of the proposed development site (south is on the left, north on the right).

Although the WULA does consider cumulative impacts related to bulk water infrastructure, the resolution of those concerns appears to depend upon upgrades to these services and it seems as if no timeframe can be guaranteed for the implementation of these upgrades. It is noted that the development plans do include an interim solution for waste-water treatment that appears to be appropriate.

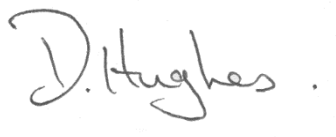
5. OVERALL CONCLUSIONS ABOUT THE IMPACT OF THE PROPOSED DEVELOPMENT

The main conclusion relates to the impacts of flooding on the development itself, as well as on adjacent existing property developments. I reached the conclusion that the development plans and proposals generally fail to give due consideration to potential future flooding risks associated with development. My evaluation of the available information suggests that the risks to flooding on the development site itself have been quite seriously under-estimated. This includes the risks associated with large scale flooding from the Keurbooms Estuary, as well as those associated with more localised flooding. The extent to which these flood risks are likely to be extended to adjacent properties is somewhat more difficult to be sure about, but there seems to be little doubt that the development will remove at least some existing flood retention storage and could therefore impact on existing developments, notably those in the relatively low lying areas to the south of the road.

It is assumed that under existing conditions any flood waters that inundate the property will gradually decrease through either evaporation or drainage through the soils towards the south (underneath the coastal dune and eventually seeping out through the beach sands). This drainage is expected to be relatively slow due to the low gradients involved. Apart from the potential for increased localised flooding due to the increase in impervious areas (roofs, roads, pathways, etc.) there is also the potential for the compacted foundations to restrict the rate of sub-surface drainage after flooding and therefore prolong the period of inundation. This is based on the assumption that the compacted foundations (which will reduce the permeability of the soils underneath each building) will reduce the area of the seepage face along the southern boundary of the property. Whether or not this would constitute a significant impact is difficult to say in the absence of more quantitative data, but if there are doubts about the validity of this assumption, it would be appropriate to set up a groundwater flow model to assess the impacts of the reduced permeability on the duration of inundation. This was beyond the scope of this short review. Many of the issues discussed above are also raised in an untitled report by Nick Frootko that was made available to this reviewer.

The impacts on bulk water and sewerage services will be largely determined by the timeframes of proposed upgrades to these services by the relevant local authorities. It is therefore difficult to make any definitive comments about such impacts without further information about the implementation of the upgrades. It is clear, however, that without the upgrades the impacts (particularly on bulk water supplies) will be significant.

D A Hughes

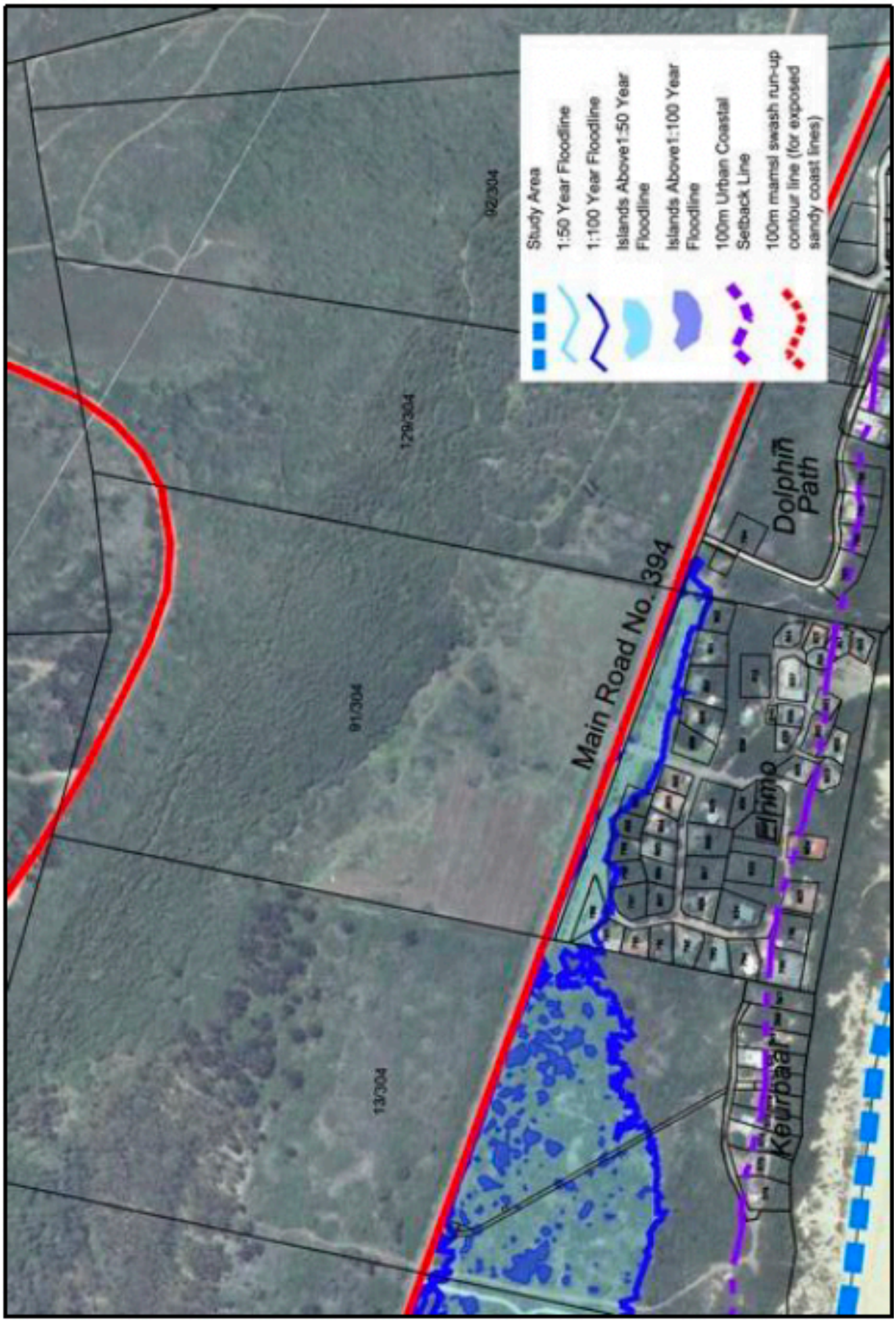


5 November 2024

ANNEXURE A


Keurbooms & Environs Local Area
Spatial Plan
Notation
1:50 Year Floodline
1:100 Year Floodline
Fynbos Corridor
Forrial/Thicket Corridor
Wetland Corridor
Dune Corridor
Slopes steeper than 1 in 4
100m miamsl swash run up contour line (for exposed sandy coast lines)
Study Area
0 250m 500m 750m 1km
N2
The Dunes
Dolphin Waves
Silver Ridge
Silver Streams
Silver Glades
Blue Chalets
San Marino
Keurbooms River
Steytlerville
PROPOSED SPATIAL PLANNING CATEGORIES
ARCHITECTS AND TOWN PLANNERS
First Floor • La Gratitude Office Building
97 Dorp Street • Stellenbosch 7600
tel (021) 861 3800
fax (021) 882 8025
e-mail: stel@tv3.co.za
web: www.tv3.co.za

ANNEXURE B


Study Area
1:50 Year Floodline
1:100 Year Floodline
Islands Above1:50 Year Floodline
Islands Above1:100 Year Floodline
100m Urban Coastal Setback Line
100m marrisl swash run-up contour line (for exposed sandy coast lines)
92/304
129/304
91/304
13/304
Main Road No. 394
Dolphin Path
Elmo
Keurbaai

ANNEXURE C

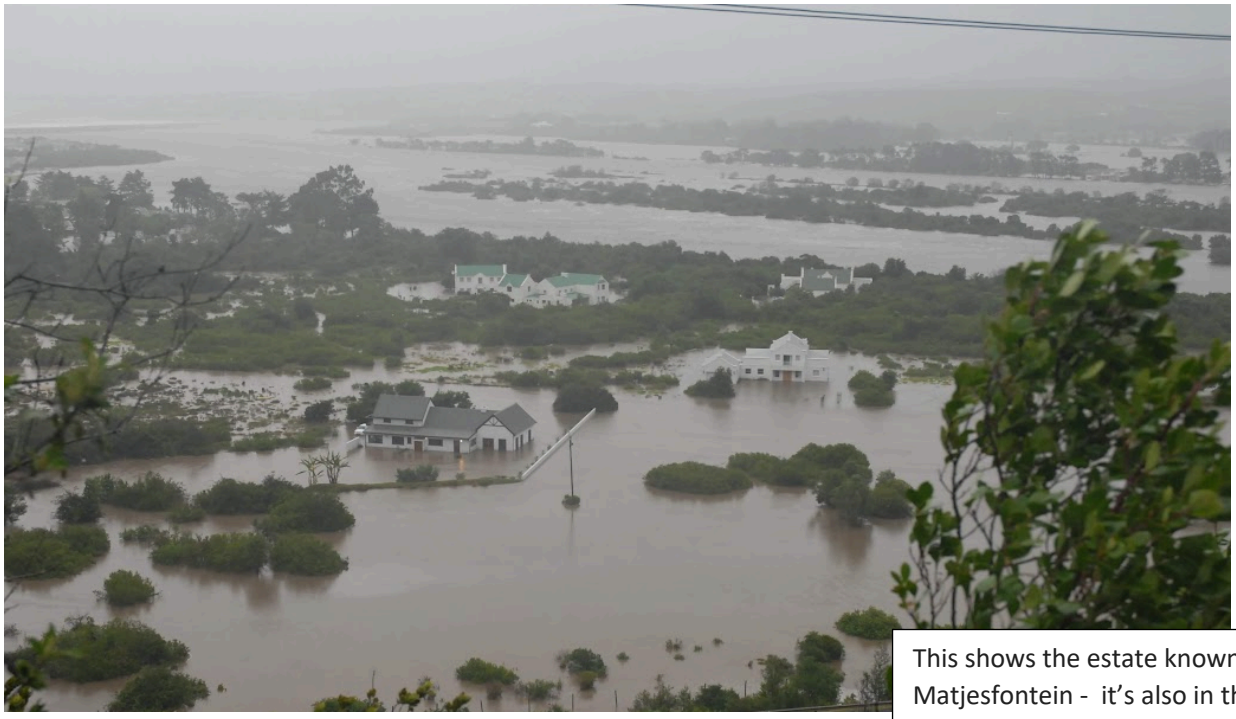
These three pictures above were taken on Portion 9 of Matjesfontein 304, November 2007, known as The Dunes Resort. These photos were taken a day after the flood and show the high-water mark on the buildings above the level of the ground floor windowsills.

The Dunes Resort is on the south side of the PO394 Road, Keurboomstrand, and is 1 km from Erf 91 of 304 and part of the same water-course.

In the flood, the fields opposite The Dunes, on the north side of the PO394, were also flooded (the entire Keurbooms Valley Water Course also became a swamp, including the proposed development site).

Flood damage to a house in the Silver Stream Resort on the Keurboomsrivier Road. Most of the houses in the estates along this road were flooded, November 2007.

November 2007, Twin Rivers Lodge between the Keurbooms and the Bitou Rivers.



This shows the estate known as Matjesfontein - it's also in the old Keurbooms River flood plain and water course

Water measured at between 1.5m and 1.8m below ground level on property opposite site of proposed development.