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BOSCHENDAL VILLAGE DEVELOPMENT

STORMWATER MANAGEMENT REPORT

25 January 2016

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1 INTRODUCTION

This development is situated at the intersection of the R45 and Helshoogte Road, between Stellenbosch, Franschhoek and Paarl. It consists of mainly residential precincts and some business and hotel usage, all as shown on the land-use concept diagram of the Urban Designers attached. Presently the area is part of the greater Boschendal farm, and consists mainly of open uncultivated areas, interspersed with various buildings.

This report addresses the stormwater management aspects, and is divided into three parts as follows:

- Floodlines of the adjacent Dwars River
- Quantity aspects (flow and attenuation)
- Quality aspects (environmental measures)

The various designs and measures relating to the above, result in the Stormwater Management Plan on the attached drawing TC02339-SMP. Detailed design will follow at a later stage, and will follow these same principles.

2 FLOODLINES

The development is affected by the floodline of the adjacent Dwars River to the east. A previous floodline analysis and determination was carried out by V3 Consulting Engineers, for the portion from the R45 bridge up to the Lanquedoc Bridge. This development is situated at the bottom end thereof, against the R45.

Because this development is at a localised point relative to the entire reach analysed in the V3 calculation, and because the exact floodlines at this localised position are highly sensitive to the actual contours, the floodline was recalculated here, based on the actual more recently surveyed and more detailed contours.

The hydrology parameters for the catchment area were checked, and it was found that those in the V3 report could be used. The following flows were therefore used in the analysis:

1 in 50 year:	520 m3/s
1 in 100 year	641 m3/s

The flood levels were then analysed using the Hec-Ras programme, and the detailed surveys referred to above. The 1 in 50 and 1 in 100 year floodlines were then plotted, and these are shown on the attached drawing.

In terms of accepted practice, development should not take place within the 1 in 50 year floodline, and where it falls between the 1 in 50 and 1 in 100 year floodlines, all floor levels of buildings should be set above the 1 in 100 year flood level.

The preferred urban design alternative along the eastern edge of the development, entails moving the floodline slightly eastwards. This will require filling in a small strip of about 30m wide below the calculated floodline, by an amount of between 0,5m and 1,5m.

From an engineering point of view, the effects of this on the hydraulics, river-flow and flood-levels have been calculated to be negligible. This can be explained firstly in that this width is extremely narrow relative to the entire floodline width here of 460m. Secondly the area is at the outside extreme of a secondary valley, far outside the main river channel. Only at a high return period will the immediate western bank of the main river channel be breached, and the floodwaters spread out across this secondary valley. Due to the railway and R45 road forming a barrier across the valley, the water that does reach this point will be standing water, well outside the main flow-stream that flows under the rail/road bridges. Had the immediate western bank been slightly higher, the flood flows would quite easily have been contained close to the river and at approximately the same levels.

It should further be noted that should any portions of erven protrude below the 1 in 50 year floodline, no buildings will be allowed below that floodline, and activities/usage there will be restricted.

3 QUANTITY ASPECTS

The site can be divided into two definite portions, being that to the west of Helshoogte Road and that to the east thereof. The natural fall of both portions is mainly from the south-west to the north-east, eventually to the Dwars River to the east. Only a small section of the western portion drains eastwards, to an existing open channel which then runs towards the Berg River to the north.

For the stormwater management, the land-use concept diagram has been used, catchments identified, and the main stormwater routes planned. This includes some catchment areas from upstream that flow

through the development. These are all shown on drawing TC02339-SMP. A computer model was drawn up, and analysed using the PCSWWM programme, for various storm occurrences.

The prime objective of the Stormwater Management Plan in respect of the flow and attenuation aspects, is that the post-development flow from the outlet from the development must not exceed the pre-development flow for a 1 in 50 year storm event.

Various options were investigated, (taking into account environmental measures as covered below), and ultimately the attached Stormwater Management Plan arrived at. It shows one attenuation pond at the low end of the western portion, and one at the low end at the eastern portion. Each will have a restricted outlet, and flow from the western pond is also routed via the eastern pond. The bottom level of the eastern pond will be above the 1 in 50 year flood level of the Dwars River.

The results of the 1 in 50 year pre-development analysis, and that of the 1 in 50 year post-development analysis for this model, are attached in graphical form showing flows and attenuation volumes. The latter shows a western pond with a volume of approximately 1100m3, an eastern pond of 2100m3, and an outflow from the development of 1.35m3/s. This run-off will then run from the outlet of the eastern pond into an unlined channel and then 900dia pipe, both running along and just inside the Boschendal farm boundary in a servitude to be registered, and then discharge into the Dwars River just upstream from the railway bridge. Gabion drop-structures will be constructed at the outlet from the pond, and at the outlet to the river. This is also shown on drawing TC02339-SMP.

There are some existing channels from the farming areas outside the development here, which join up with an existing channel along the railway outside the boundary here, and discharge through a culvert under the railway and road into another channel on the other side, eventually

discharging into the Dwars River just downstream from the road bridge. The above-mentioned new system from the development will be kept separate from this system which therefore remains unchanged and does not require any upgrading.

4 QUALITY ASPECTS

It is the intention of the Developer to implement this development in as environmentally friendly a manner as possible.

Therefore, although there are no specific municipal requirements with regard to designing for stormwater quality, the general principles of sustainable urban drainage systems (SUDS) will be followed, as covered below:

- The receiving waters, being that of the Dwars River to the east, will be protected by disconnecting this development's system from the river until the final outflow from the development, by which time the various treatment measures will have taken effect.
- Identified wetlands are incorporated in the urban design layout and the Stormwater Management Plan, by routes being planned so as to coincide with wetlands, as well as ponds being designed around the wetlands and their buffer zones.
- Infiltration and bio-retention of stormwater will be promoted as far as possible. Run-off will be conveyed in open unlined channels, or along existing wetlands or green-belts as far as possible along all the routes. Open channels such as this also result in attenuation along the routes, enabling smaller main ponds at the end. Where open channels need to be lined for erosion protection reasons, this will be done by means of environmentally friendly measures such as vegetation, ungrouted stone-pitching, grass blocks, gabions and reno-mattresses etc. Design of the open

channels and areas will be done in close conjunction with the landscaping architects and wetland specialists. Underground conduits will be limited to road crossings, and where there are space limitations for open channels and areas.

- When the internal precincts proceed, stormwater design guidelines will be drawn up for those developments to follow the same principles as these. Such guidelines will include grassed swales, maximising grassed/planted areas, discharging of downpipes onto these areas, infiltration/bioretention ponds etc. Run-off from hard areas will be routed to permeable areas as far as possible, before entering the main system.

4 SUMMARY

The attached Stormwater Management Plan TC02339-SMP incorporates all of the above aspects i.e. the floodline, and the quantity and quality aspects. At the next planning stage, the channels, conduits and ponds for the various bulk routes will be designed in more detail in conjunction with the urban design inside the devlopment, and when individual precincts proceed those internal systems will be designed with outlets to this bulk system, all in accordance with the same principles contained in this report.

Dave Edwards Pr Eng & Malcolm Cerfonteyn Pr Eng
iCE Group (Pty) Ltd

Attached:

TC02339-SMP- revB: Stormwater Management Plan
Results of 1 in 50 year Analysis
Land-Use Concept Diagram

Legend:

- New Stormwater Routes from development
- New Stormwater Ponds for development
- Existing Stormwater Routes from farm
- Wetlands & Buffer Zones

N

R45 Road

Helshoogte Road

Dwars River

Pond Alternative Without Fill

Pond Alternative With Fill

New unlined open channel for run-off from development

Existing culverts under railway & road and existing channel, receiving run-off from farm, as before

Existing Floodlines

Development alternative with fill in shaded area, moving floodlines to this new position

New 900 dia pipe for run-off from development, discharging to river with double gabion drop-structure

Existing stormwater routes for run-off from farm, to be retained

Updated existing 1 in 50 year floodline

Updated existing 1 in 100 year floodline

Calculated existing 1 in 50 year floodline

Calculated existing 1 in 100 year floodline

Notes

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Client/Kliënt

Boschendal (Pty) Ltd

Project/Projek

Boschendal Village

Draw. Description/Tek. Beskrywing

Stormwater Management Plan

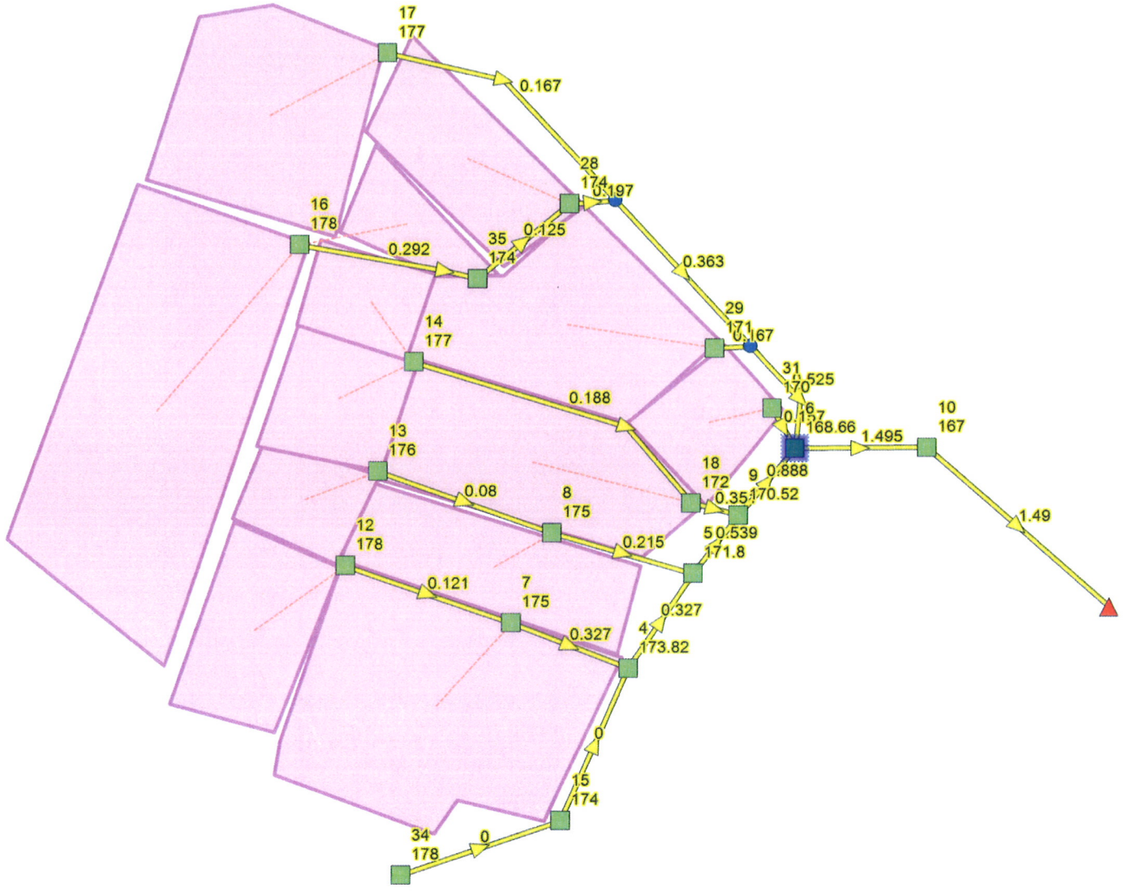
Drawing No
Tekening Nr.

TC02339-SMP

B

Scale :
Skaal :
1:4000

Date :
Datum :
May 2015



Legend

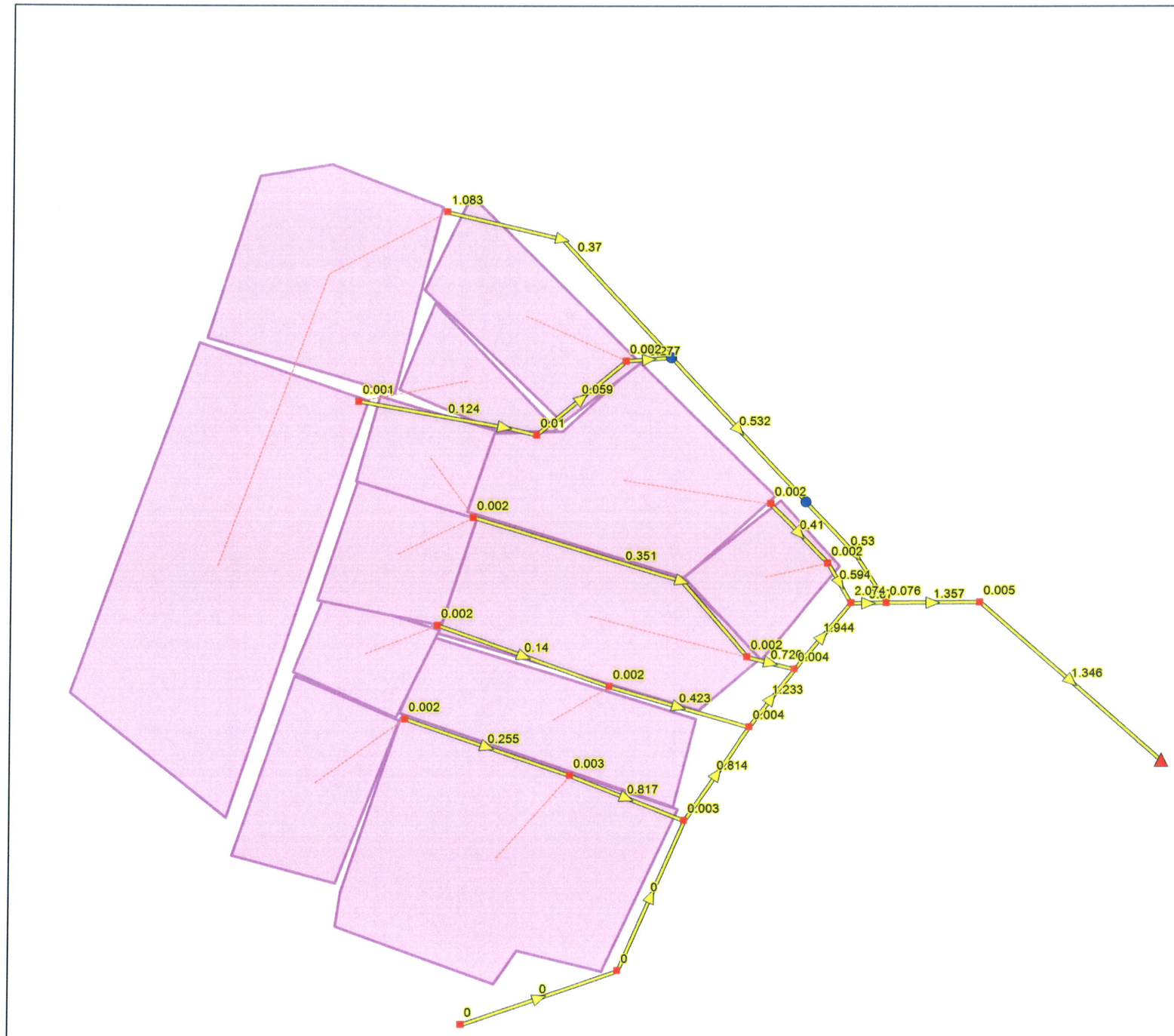
- Junctions
- Outfalls
- Storages
- Conduits
- Subcatchments

1 in 50 year

PRE-DEVELOPMENT

N

5 cm



Legend

- Junctions
- Outfalls
- Conduits
- Subcatchments

1 in 50 year

POST-DEVELOPMENT

N

5 cm

3.13 PROPOSED LAND USE CONCEPT

The land use mix on the property is illustrated in the land use table (Fig.6.1) and furthermore illustrated on the land use concept plan in Figure 81.

The core of the development will comprise mixed use development which includes a farmers market, shops, and restaurants, places of entertainment, offices and other related businesses as well as apartments on the upper levels.

The mixed use core of the village will be surrounded with residential development of varying densities and unit sizes, ranging from 3 storey residential buildings near the core which contain medium to high density flats, double storeyed town & row houses to one and two storey free standing residential units. In line with provincial guidelines, the highest densities of the village will be located at the centre of the village, whilst the lower densities will be located around the edges.

Maximum 450 residential units are proposed in this development of which at least 5% of the accommodation will be housing for key workers such as teachers, policemen, nurses etc (accommodation for household income levels R 300 000.00 (at 2015 levels)) A hotel or guest accommodation of approximately 100 rooms is also proposed.

Controls: The final land use mix in the development shall be generally in accordance with the land uses illustrated in Figure 81 and table 6.1. The maximum development extent which may not be exceeded is summarised as follows:

- Residential: 450 dwelling units
- General Business GLA: 14 500m2
- Hotel/Guest accommodation: 100 bedrooms
- Community facilities GLA: 3000 m2 GLA

A minimum of 22 affordable housing dwelling units shall be provided by the developer for key workers with household income levels of +/- R300 000. This will be done in the form of rental housing or a rent-to-buy scheme set up by the developer.

Restricted maximum retail of 500m^2 floor area per franchise as principle to establish a balanced competitive market between local and national retailers. Preferable average size of retailers +/- 150m^2.

The final land use mix for each superblock will be indicated on the subdivision plan for that superblock.

Fig. 6.1 LAND USE TABLE		
Residenal (Low Density)	One storey: Free standing dwelling and Row Houses	83 Dwelling Units
Residenal (Medium Density)	Two storeys: Row Houses & duplexes	135 Dwelling Units
Residenal (High Density)	Three storeys: Flats & row houses	232 Dwelling Units
Residenal (Hospitality)	Two Storeys (Hotel and self catering apartments)	50 Bedrooms (hotel) + 10 apartments (2 rooms each)
Guestcoages	One storey (Exisng coages retained)	30 Bedrooms
Residenal Total	**dwelling units:** **bedrooms hotel/guests:**	**450 Dwelling Units** **100 bedrooms**
Business (Low density)	Single storey Retail on Ground	Retail: 3 000m^2 GLA
Business (Medium density)	Two storey Retail on Ground; General Business/Res on 1st floor	Retail: 500m^2 GLA Gen Business: 3 000m^2 GLA
Business (High density)	Three storey Retail on Ground; General Business/Res on 1st + 2nd floor	Retail: 1 000m^2 GLA Gen Business: 6 000m^2 GLA
Business (Market)	Single storey Retail on Ground	Retail: 1 000m^2 GLA
Business Total	**Retail:** **General Business (incl. office):** **GRAND TOTAL BUSINESS:**	**5 500m^2 GLA** **9 000m^2 GLA** **14 500m^2 GLA**
Civic/Community Buildings		500m^2
Clinic (to be developed)		2 Consulng rooms
Ulity	Recycling and Maintenance	500m^2

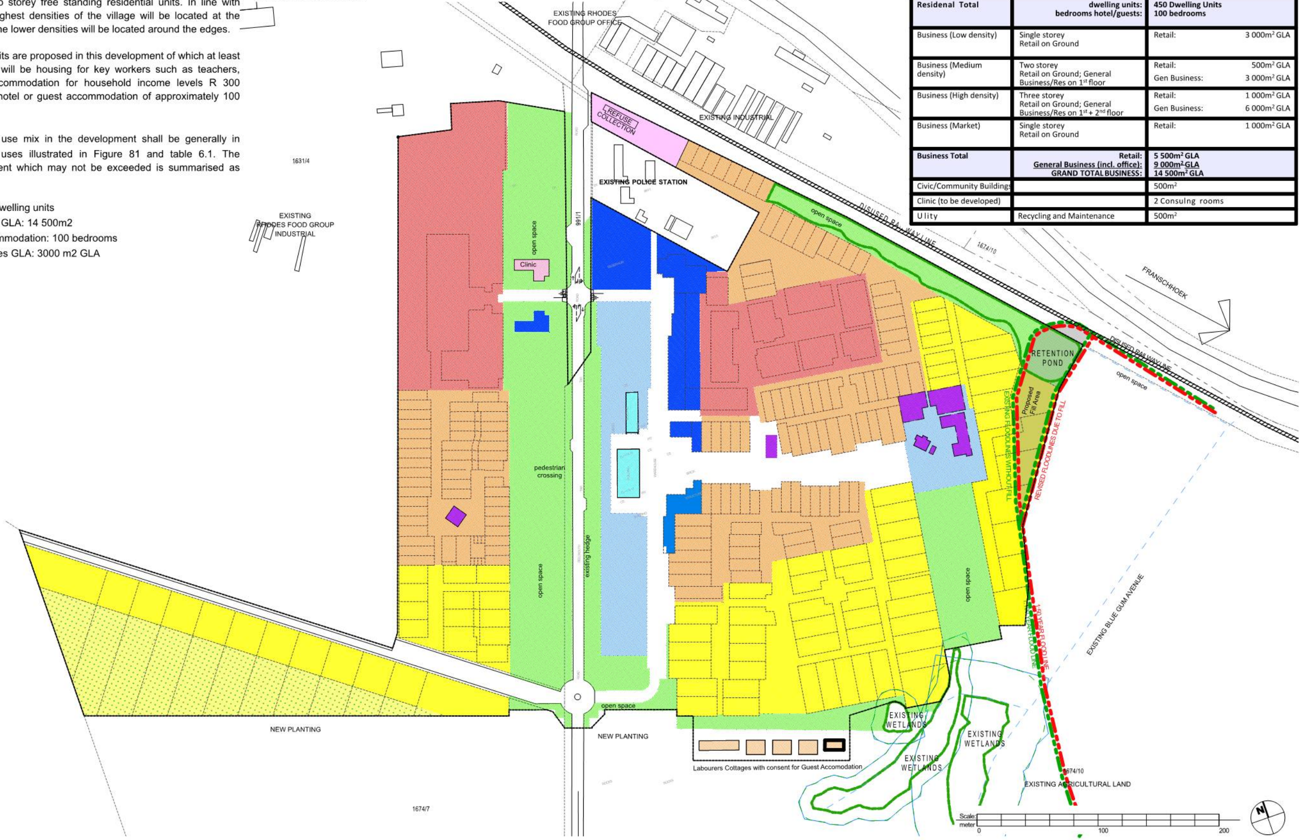


Fig. 81 Proposed land use | scale 1:3000 @ A3