



# **SWELLENDAM MUNICIPALITY**

## **DRAFT SERVICES REPORT FOR CIVIL ENGINEERING SERVICES FOR THE REMAINDER OF ERF 1, RAILTON FOR SWELLENDAM MUNICIPALITY**

**HESRIV-470**

**Revision 0.0**

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## ABBREVIATIONS

AADD	:	Annual Average Daily Demand (water)
ACCE	:	Afri-Coast Consulting Engineers
CES	:	Community Engineering Services
DCE	:	Deca Consulting Engineers (Transport Impact Assessment)
GLS	:	GSL Consulting Engineers
ha	:	hectare
HCE	:	Hessequa Consulting Engineers CC
kℓ	:	kilolitre
kℓ/d	:	kilolitre per day
ℓ/c/d	:	kilolitre per capita per day
m	:	metres
masl	:	metres above mean sea level
MIG	:	Municipal Infrastructure Grant
Mℓ	:	mega litre
m <sup>3</sup>	:	cubic metre, i.e. one kilolitre
mm	:	millimetre
SM	:	Swellendam Municipality
TWL	:	Top of Water Level (Dam or Reservoir)
VAT	:	Value added tax
WTW	:	Water Treatment Works
WWTW	:	Waste Water Treatment Works

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## INTRODUCTION

Hessequa Consulting Engineers have been appointed by ASLA Devco for the planning and design of civil engineering services for the Low Cost Housing project in Railton, Swellendam the Western Cape. This report is based on various desk top studies and assessments and is compiled on behalf of the Swellendam Municipality for submission to the Department of Human Settlements as part of the project application for conditional approval of the housing development.

The report will discuss the design criteria and specifications which will be applied to civil engineering services required for the development.

## LOCATION AND ACCESS

Railton falls within the demarcated boundaries of the Swellendam Municipality in the Western Cape and is located south of the National Road (N2). The proposed development area is situated to the East of the existing Rondomskrik development. The Northern and Eastern boundaries of the proposed development area are limited by the existing railway line.

There is currently only one access road linking Railton to the rest of Swellendam and the N2. (Station Street)

## CIVIL ENGINEERING SERVICES

Proposed designs are based on the design standards of the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* as published by the CSIR as well as the minimum requirements of Swellendam Municipality.

### 3.1 MASS EARTHWORKS

No mass earthworks are foreseen at preliminary stage.

### 3.2 EXTERNAL ROAD NETWORK UPGRADINGS

Deca Consulting Engineers (DCE) was contracted to conduct a Transport Impact Assessment to determine what the effect of the proposed development will be on the existing road network and to recommend upgrading to mitigate the short comings. The complete report is attached under Annexure A of this report.

The following recommendations, with regard to the external road network, are proposed to accommodate the proposed development:

- The Station Street/Industries/SWD Tyre inter-section has to be upgraded to improve safety.
- The surface of Station Street, between the N2 underpass and the railway crossing, requires repair/maintenance.
- The four-way stop at the Soufietjie Street/Ellis Street intersection should be changed so that traffic on Soufietjie Street has free flow and only traffic on Ellis Street has to stop.
- Swellendam Municipality should reserve space along the proposed alignments of the three routes that may serve as links between Railton and the external road network (N2 and DR 1321).
- Space should also be reserved for the proposed new internal Railton roads so that these roads can be provided if required in future.
- Minibus taxi route descriptions should be amended to include a route through the new development, once fully occupied.
- Streets along the school bus routes (probably Theunissen Street, May Street, Soufietjie Street, Aster Avenue, Boslelie Street and Madeliefie Street) may have to be widened to accommodate regular bus traffic.
- Sidewalks to be provided along Theunissen Street and other roads leading up to the schools to encourage/safeguard pedestrian movement.

The recommendations with short term cost implications will be listed in the costing schedule.

### 3.3 ROADS

The Minimum Design and Construction Standards for Internal A Grade Engineering Services, as approved by the Chief Director : Human Settlements, will be applicable for this project. The circular rout between Theunissen Street and Aster Street (Class 4) will consist of a 6,0m wide road within an 18m road reserve.

Road finishing will consist of Double and Single surface treatments with formal stormwater pipework and inlet- and outlet structures. Roads with longitudinal grades steeper that 10% will be constructed with 80mm interlocking segmented paving.

The basis of the road and pavement design for the proposed development is set out in the table below:

**Table 1 Road Design Criteria**

Parameter	Local Distributor (Class 4)	Residential Access Loop (Class 5b)	Residential Access way (Class 5d)
Category	UB	UC	UC
Traffic Class	E1	E0	E0
Structural Design Traffic	0.05 - 3 x 10 <sup>6</sup>	< 0.2 x 10 <sup>6</sup>	< 0.2 x 10 <sup>6</sup>
Surface Treatment	Double surface treatment with 13,2 & 6,7mm aggregate and single slurry seal or 80mm segmented paving	Single surface treatment with 13mm aggregate and two slurry seals or 80mm segmented paving	Single surface treatment with 13mm aggregate and two slurry seals or 80mm segmented paving
Base, Sub-base and Upper Selected from commercial sources	150mm G2 (98% MAASHTO) on 150mm G4 (95% MAASHTO) on 150mm G7 Upper Selected (93% MAASHTO) on 150mm Roadbed prep in-situ Material (90% MAASHTO)	100mm G4 (98% MAASHTO) on 125mm G6 (95% MAASHTO) on 150mm G7 Upper Selected (93% MAASHTO) on 150mm Roadbed prep in-situ Material (90% MAASHTO)	100mm G4 (98% MAASHTO) on 125mm G6 (95% MAASHTO) on 150mm G7 Upper Selected (93% MAASHTO) on 150mm Roadbed prep in-situ Material (90% MAASHTO)
Sub-grade (No geotechnical information with regard to the specific development area is available. Previous test holes in the adjacent Rondonskrik development confirms that the in-situ soil quality varying between G9 to G10 materials. The presence of ground water is also expected and sub-soil drains will have to be installed in specific roads.	-	-	-
Carriage Way Width	6.0m	4.5m	4.5m
Design Speed	50 km/h	40 km/h	30 km/h
Maximum Gradient	10% over 100m max	16% over 50m max	16% over 30m max
Minimum Gradient	0.5%	0.5%	0.5%
Cross Fall	2%	2%	2%
Bellmouths	8m Radius	8m Radius	8m Radius



### 3.4 STORMWATER

#### 3.4.1 Major Systems

A complete Stormwater Management Plan was completed by Hessequa Consulting Engineers for the Overberg PRT. Swellendam Municipality started with the upgrading of Bulk Stormwater Infrastructure in Railton, mainly within Catchment D. The complete Stormwater Management Plan is included under Annexure B of this Report. The bulk stormwater upgrading related to the specific development is indicated on Drawing HESRIV-480-BSW1 also under Annexure B.

The proposed development area drains mainly away from the existing township in an easterly to north easterly direction. Stormwater from the proposed development has no or very little influence on the existing attenuation dams 1, 2 & 3. Attenuation dams 4 and 5 will have to be upgraded as the proposed development's runoff will have a direct influence on the capacity.

**TABLE 2: PROPOSED DAMS UNDER FLOOD CONDITIONS**

DAM	PROPOSED DAM CONSTRUCTION	1:50 YEAR			1:100 YEAR		
		IN-FLOW (m <sup>3</sup> /s)	OUT-FLOW (m <sup>3</sup> /s)	DOWN-STREAM ROAD/RAIL	IN-FLOW (m <sup>3</sup> /s)	OUT-FLOW (m <sup>3</sup> /s)	DOWN-STREAM ROAD/RAIL
4	No significant change	6.7	4.9	Rail over-topped to lesser extent	8.7	7.6	Rail overtopped to lesser extent
5	New outlet with increased basin	10.0	8.6	N2 culvert OK; Station St channel slightly surcharged	15.2	12.1	N2 culvert OK; Station St channel flooded to lesser degree
NOTES:							
[1] At the N2 culvert the basin will be enlarged and a new outlet structure provided.							
[2] The Station St concrete channel has a capacity of 8 m <sup>3</sup> /s.							

Work at Attenuation Dam 5 will mainly consist of the following:

- Clear and grub of wall embankments.
- Clear and grub for basin extensions. (10,000m<sup>2</sup>)
- Cut to spoil for basin enlargements. (7,100m<sup>3</sup>)
- Cut to fill wall embankment from selected excavated/imported material. (1,000m<sup>3</sup>)
- Cut to fill berm from selected excavated/imported material. (144m<sup>3</sup>)
- Construction of gabion lined spillway.
- Concrete outlet structure. (25m<sup>3</sup>)

Work at Attenuation Dam 4 will consist of the upgrading of the outlet works. The estimated costing for the proposed external stormwater upgrading will be listed in the costing schedule.

### 3.4.2 *Minor Systems and Stormwater Design*

Stormwater infrastructure will be constructed in accordance with the standard requirements and specifications as agreed with the Swellendam Municipality.

Stormwater runoff from the erven will gravitate towards the internal road network. Surface runoff from roadways will be collected via kerb inlets into a piped stormwater system which will discharge into the new major stormwater system (1:20 year). Servitudes will be provided for stormwater reticulation as required.

Design criteria adopted for the development with regard to stormwater infrastructure is summarised as follows:

Runoff rates will be determined according to the Rational Method.

Flood recurrence interval	:	2 years
Pipe material	:	Concrete
Pipe class	:	75D / 100D
Pipe diameters	:	min 375mm Ø up to diameter as required
Bedding	:	Class C
Inlets	:	Kerb and drop inlets as required
Manholes	:	Point of deflections on pipes

## 3.5 WATER

### 3.5.1 WATER SOURCE & WTW

Swellendam receives raw water from the Klip River via the Grootkloof Dams. In accordance with the Comprehensive Bulk Infrastructure Master Plan (BIMP) the average yields available from the Klip River are sufficient to provide in Swellendam's bulk water needs until well past 2035 (Considering a 1:20 year draught factor.).

Afri-Coast Consulting Engineers prepared a Technical Report, as support to a MIG Application for the Extension and Upgrading of the Swellendam Water Treatment Works, in 2012. The WTW capacity required up to 2030 is 10,596 Kl/day. Afri-Coast Consulting Engineers completed Phase 1 of the required upgrading, at a growth rate of 2%, to ensure sufficient capacity in Swellendam's current up to 2030 demands.

### 3.5.2 WATER DEMAND

For this preliminary capacity analysis of the Railton water system, the total annual average daily demand (AADD) and fire flows for the proposed development was calculated as follows:

- Single Residential : 941 Affordable Housing units @ 450 l/d/unit= 423,45 kℓ/d
- Fire flow criteria (Low risk) = 15 ℓ/s @ 10 m

### 3.5.3 STORAGE CAPACITY

The master planning indicated that the proposed development should be accommodated in the existing Railton reservoir water distribution zone. There is sufficient reservoir capacity in the existing Railton reservoirs to accommodate the proposed development.

### 3.5.4 BULK WATER DISTRIBUTION

GLS Consulting Engineers prepared a complete capacity analysis of the bulk water and sewer services. There is insufficient capacity in the existing water network to accommodate the proposed development. The following network reinforcements will be required to improve the network conveyance capacity, of the existing Railway reservoir network, in order to accommodate the proposed development (Annexure C, GLS Figure 1):

- SSW4.1 : 94 m x 160 mm Ø parallel reinforcement of main pipe
- SSW4.6 : 282 m x 160 mm Ø parallel reinforcement of main pipe
- SSW4.10 : 77 m x 160 mm Ø inter-connection pipe
- SSW4.11 : 352 m x 160 mm Ø parallel reinforcement of main pipe
- SSW4.17 : 300 m x 160 mm Ø parallel reinforcement of main pipe
- SSW4.18 : 263 m x 110 mm Ø new supply pipe & connections
- SSW5.2 : 140 m x 160 mm Ø new supply pipe & connections
- SSW5.3 : 107 m x 110 mm Ø new supply pipe & connections

Low water pressure will be experienced at the higher lying erven, of the existing Railton reservoir zone, and the higher lying erven of the proposed development area and it is proposed a new booster zone be implemented in order to alleviate the low water pressures in the area:

Implementation of booster zone

- SSW4.7a : New 110 mm Ø zone valve
- SSW4.7b : New 75 mm Ø zone valve
- SSW5.1 : New 15 ℓ/s @ 20 m booster pump station

GLS Figure 1 illustrates the position of the reservoirs and the water main reinforcements in Railton.

### 3.5.5 INTERNAL WATER RETICULATION

New 160/110/75mm class 9 uPVC water mains complete with isolating valves, fire hydrants and erf connections will be provided. Erf connections will be made with HDPE PE80 PN12,5 pipes and terminate at an Elster Kent (or similar) water meter. Typical details are shown on drawing HESRIV-470-W1.

The basis of the water reticulation design for the proposed development is summarised in the table below:

<b>Table 3 Water Reticulation Design Criteria</b>	
<b>PARAMETER</b>	<b>GUIDELINE</b>
Pipe materials for erf connections	HDPE PE80 PN12,5
Pipe materials for reticulation mains	uPVC (Class 12)
Minimum diameter for reticulation mains	75mm
Minimum diameter for erf connections serving two erven	25mm branching to 2 x 20mm
Minimum diameter for erf connections serving one erf	20mm Polycop
Valves	AVK (open clockwise)
Fire Hydrants	AVK London Round
Water meters	Elster Kent or similar

## 3.6 SEWAGE TREATMENT AND SEWER MAINS

### 3.6.1 WWTW

The new Waste Water Treatment Works was completed in 2015 and consists over a treatment capacity of 4 Ml/day. The WWTW allows for a growth rate of 2% per annum and will supply sufficient treatment capacity till 2035. The new WWTW consist of an activated sludge plant which produces effluent that complies with the General Limit required in terms of the National Water Act. Sufficient treatment capacity exists within the existing WWTW for the proposed development.

### 3.6.2 SEWER MAINS

There is insufficient capacity in the existing sewer reticulation system to accommodate the proposed development. The following master plan items will be required to reinforce the existing Swellendam sewer system in order to accommodate the proposed development together with other future development areas. (Annexure C, GLS Figure 3):

- SSS1.2 : 250 mm Ø New flow diversion
- SSS1.3 : 84 m x 250 mm Ø New outfall sewer
- SSS1.6 : 315 mm Ø New flow diversion
- SSS1.7 : 100 m x 315 mm Ø New outfall sewer
- SSS1.8 : 229 m x 315 mm Ø Re-align existing bulk sewer
- SSS1.9 : 304 m x 315 mm Ø Re-align existing bulk sewer

For this preliminary capacity analysis of the Railton sewer system, the peak day dry weather flow (PDDWF) for the proposed development was calculated as follows:

- Single Residential : 941 Housing units @ 450 l/d/unit = 423,45 kℓ/d  
70% of 423.45kℓ/d = 296,42 kℓ/d

### 3.6.3 SEWER RETICULATION

A waterborne sewer reticulation system comprising of 160mm class 34 PVC sewer mains with solid shaft fibre cement manholes, complete with lockable ductile iron double lipped manhole covers, is proposed.

Each new erf will be provided with a 110mm Ø Class 34 uPVC connection with rodding eye and end cap terminating one meter inside the erf boundary. Typical details are shown on drawing HESRIV-470-S1.

### 3.7 ELECTRICAL SLEEVES

The position of electrical sleeves (110/160mm Class 34 PVC) will be determined in consultation with the Electrical Engineer.

### 3.8 LAND FILL SITE

The existing land fill site in Swellendam is an unlicensed facility with limited air space capacity. Mott MacDonald Consulting Engineers completed, in January 2016, a comprehensive 2nd Generation Integrated Waste Management Plan. A private initiative started in 2015 with a recycling facility which will have a significant influence on future demands for air space.

Waste services are provided via road collections. Swellendam Municipality consist over sufficient collector trucks for road collections.

## COST ESTIMATE

The preliminary estimated cost for the provision of bulk/external services for the proposed development of 941 Low Cost erven is set out in the table below, viz.

<b>TABLE 4 : COST ESTIMATE</b>	
<b>Description</b>	<b>Costs</b>
<b>Costs associated with the provision of Bulk/external services</b>	
<b>Road Network</b>	
Upgrading of Station/Industries/SWD Tyre intersection	R 550,000.00
Upgrade surface of Station Street between the N2 underpass and the railway crossing (670m x 7.4m wide)	R 915,000.00
<b>Subtotal A</b>	<b>R 1,465,000.00</b>
<b>Stormwater</b>	
Upgrading of existing Attenuation dam 4	R 66,500.00
Upgrading of existing Attenuation dam 5	R 980,000.00
<b>Subtotal B</b>	<b>R 1,046,500.00</b>
<b>Water Network</b>	
SSW4.1 : 94 m x 160 mm Ø parallel reinforcement of main pipe	R 105,000.00
SSW4.6 : 282 m x 160 mm Ø parallel reinforcement of main pipe	R 259,000.00
SSW4.10 : 77 m x 160 mm Ø inter-connection pipe	R 88 500.00
SSW4.11 : 352 m x 160 mm Ø parallel reinforcement of main pipe	R 318,000.00
SSW4.17 : 300 m x 160 mm Ø parallel reinforcement of main pipe	R 261,500.00
SSW4.18 : 263 m x 110 mm Ø new supply pipe & connections	R 171,500.00
SSW5.2 : 140 m x 160 mm Ø new supply pipe & connections	R 129,500.00
SSW5.3 : 1073 m x 110 mm Ø new supply pipe & connections	R 76,000.00
SSW4.7a : New 110 mm Ø zone valve	R 69,000.00
SSW4.7b : New 75 mm Ø zone valve	R 66,000.00
SSW5.1 : New 15 l/s @ 20 m booster pump station	R 1,264,000.00
<b>Subtotal C</b>	<b>R 2,808,000.00</b>
<b>Sewer</b>	
SSS1.2 : 250 mm Ø New flow diversion	R 185,500.00
SSS1.3 : 84 m x 250 mm Ø New outfall sewer	R 276,500.00
SSS1.6 : 315 mm Ø New flow diversion	R 202,000.00
SSS1.7 : 100 m x 315 mm Ø New outfall sewer	R 355,000.00
SSS1.8 : 229 m x 315 mm Ø Re-align existing bulk sewer	R 706,500.00
SSS1.9 : 304 m x 315 mm Ø Re-align existing bulk sewer	R 912,000.00
<b>Subtotal D</b>	<b>R 2,637,500.00</b>
<b>Total (A+B+C+D) (Carried over)</b>	<b>R 7,957,000.00</b>

<b>Total (A+B+C+D) (Brought forward)</b>	<b>R 7,957,000.00</b>
Plus : Preliminary & General @ 15%	R 1,193,550.00
Plus : 10% Contingencies	R 915,055.00
Plus : Engineering Fees @ 11%	R 1,107,216.00
<b>SUB-TOTAL</b>	<b>R11,172,821.00</b>
Plus 15% VAT	R 1,675,923.15
<b>TOTAL</b>	<b>R12,848,744.15</b>

## CONCLUSION

We trust that the information provided in this report will provide an understanding with regard to the required bulk infrastructure for the development of 941 low cost housing erven on the Remainder of Erf 1, Railton, Swellendam.

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3 April 2018



## ANNEXURE A

### Transport Impact Assessment

## ANNEXURE B

HESRIV-470-BSW1 – Bulk Stormwater  
Stormwater Management Plan for Railton

## ANNEXURE C

GLS Figure 1

GLS Figure 3

HESRIV-470-W1 : WATER RETICULATION TYPICAL DETAILS

HESRIV-470-S1 : SEWER RETICULATION TYPICAL DETAILS