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Our Ref: 505510/20.1/MB/sj

29 May 2020

The Municipal Manager
Beaufort West Municipality
Private Bag 582
BEAUFORT WEST
6970

Attention: Mr. Christopher Wright

Dear Sir,

**BEAUFORT WEST MUNICIPALITY: "GOUE AKKER" CEMETERY: BEAUFORT WEST:
ENGINEERING SERVICES REPORT**

Below please find the Engineering Services Report for the proposed expansion of the "Goue Akker" Cemetery, based on the latest layout drawing. Refer to enclosed Drawing no. 505510 GE 201 - REV D – Layout Plan.

1. **INTRODUCTION**

1.1 **Brief**

The Beaufort West Municipal area currently has five (5) existing cemetery sites, namely the Beaufort West Eastern Cemetery, Beaufort West Central Cemetery, Botha Street Cemetery, "Goue Akker" North Cemetery and the "Goue Akker" Cemetery. The Municipality has identified the need to expand the existing "Goue Akker" cemetery due to an imminent shortage in future available burial space and that the existing five (5) cemeteries are running out of burial space. Based on the Technical Report and Motivation for the Expansion of the Existing "Goue Akker" Cemetery in Beaufort West compiled by Aurecon (dated 23 October 2019) it was estimated at the time that the "Goue Akker" cemetery had a capacity of approximately 691 burial spaces. The average monthly funerals are 41, leaving the "Goue Akker" cemetery with a capacity of approximately 16 months at the time before reaching capacity, hence the urgency to expand the cemetery.

The Beaufort West Municipality appointed Aurecon to conduct the planning and design for the proposed cemetery expansion.

1.2 **General**

The proposed cemetery is located within the Beaufort West Municipal Area. Beaufort West is situated in the Great Karoo. The town is located at the junction of two National roads, the N12 and the N1. The Locality Plan is shown on Figure 1.

Beaufort West lies 850m above sea level. The region is characterized as desert due to its climatic conditions. The average temperature in Beaufort West is 18.0 °C and precipitation around the area is about 199 mm per year.



Figure 1: Locality Plan

The proposed number of facilities as shown on the layout drawing, is as follows:

Land – Use	No. of facilities	Extent (±m ²)	% of Total
Caretaker & Ablution facility	1	69	0.08
Outdoor Cemetery	1	82 500	99.92
TOTAL		82 569 m²	100

2. BULK WATER SUPPLY SYSTEM

2.1 General Description

The Greater Beaufort West Municipality incorporates four (4) towns within its municipal area, namely, Beaufort West, Merweville, Murraysburg as well as Nelspoort.

The Beaufort West Municipal area is supplied with water from the Gamka Dam, ground water from the Lemoenfontein, Gamka, Springfontein, Tweeling, Walker Dam and Brandwacht aquifers via 17 boreholes, two fountains as well as a Wastewater Recycling Plant. The water is purified at the Beaufort West Water Treatment Plant.

2.2. Proposed Water Demand for proposed cemetery

Our calculations are based on the “Guidelines for Human Settlement Planning and Design” as well as other assumptions made regarding the facilities to be implemented for the proposed cemetery development.

CES Consulting Engineers was appointed by the Beaufort West Municipality to draw up the Water Master Plan for the Municipal area and to determine the effect of any form of developments in the Municipal area on the Water Master Plan.

According to Table 9.14: Water Demand from “Guidelines for Human Settlement Planning and Design”, the following calculations were done to determine the Annual Average Daily Demand (AADD) for the various Land Uses:

The proposed number of developed facilities are as follows:

Description	Calculations	Annual Average Daily Demand (AADD)
Caretaker & Ablution facility	See calculation below	1 460 ℓ/day
TOTAL AADD		1 460 ℓ/day

The following calculations are based on the assumption that the proposed cemetery will most likely be used for a maximum of 2 hours per day. If the Ablution facility consists of 9 toilets, the water demand can be calculated as follows:

$$\begin{aligned} \text{AADD} &= 9 \text{ toilets} \times 7 \text{ ℓ/flush/toilet} \times 10 \text{ flushes/hr} \\ &= 630 \text{ ℓ/hr} \times 2\text{hrs/day} \\ &= 1\,260 \text{ ℓ/day} \end{aligned}$$

$$\begin{aligned} &= 10 \text{ basins} \times 1 \text{ ℓ/use/basin} \times 10 \text{ uses/hr} \\ &= 100 \text{ ℓ/hr} \times 2\text{hrs/day} \\ &= 200 \text{ ℓ/day} \end{aligned}$$

Thus, a combined maximum water demand of 1 460 ℓ/day is calculated for the ablution/caretaker facilities.

Therefore the combined water demand equates to two (2) equivalent erven and from the design codes, Figure 9.11, we expect to design for a peak factor of 30.

$$\begin{aligned} \text{Peak Domestic Demand} &= 1\,460 \text{ ℓ/d} \times 30 \\ &= 43\,800 \text{ ℓ/d} \\ &= 0.507 \text{ ℓ/s} \end{aligned}$$

Fireflow:

Such a development would fall into a low risk-group 1 category and as such, the following would apply:

- 900 ℓ/min
- 2 hour design fire flow

The Beaufort West Municipality has confirmed that should the proposed development take place on the proposed site, bulk services will be able to accommodate the additional water and sanitation services required by the Beaufort West "Goue Akker" Cemetery project (See attached letter from the municipality dated 27 May 2020).

2.3 Proposed Services

Currently, the proposed cemetery site is not connected to any water reticulation network of the Beaufort West Municipality. However, there is an existing water reticulation network in the vicinity of the site for the proposed development to connect to.

The facility will connect to an existing watermain running next to the existing road on the Western side of the proposed development.

Based on the above, there is sufficient capacity to accommodate the proposed development.

3. **BULK SEWAGE SYSTEM**

3.1 **Wastewater Treatment Works**

Beaufort West Municipality has 4 Drainage areas. Each town has one (1) Wastewater Treatment Plant. The drainage areas are Beaufort West, Nelspoort, Murraysburg and Merweville.

According to Beaufort West Municipality Sewer Master Plan, the Beaufort West WWTP a maximum capacity of ± 6.787 M ℓ /d which include unaccounted-for-water (UAW).

Wastewater generated from each town is treated in each town's WWTP. Therefore, wastewater generated from the proposed site will gravitate to the Beaufort West WWTP, where it will be treated.

3.2 **Wastewater Reticulation System**

There is currently no sewer infrastructure on site at the proposed development, however there is a 375mm \emptyset gravity sewer mainline adjacent to the road on the Western Side of the proposed site which gravitates to the nearest WWTW.

3.3 **Wastewater Flow Demand**

3.3.1 It is assumed that 85% of the Water demand of the Caretaker & Ablution facility will enter the sewer system.

Based on the above, the Average Dry Weather Flow (ADWF) for the proposed development would therefore be:

$$\begin{aligned} Q &= 1\,460 \times 85\% \\ &= 1\,241 \ell/d \\ &= 1.241 \text{ k}\ell/d \\ \text{ADWF} &= 1.241 \times 10^{-3} \text{ M}\ell/d \end{aligned}$$

3.3.2 A peak factor of 3.5 will be used.

This would lead to an expected Peak Dry Weather Flow (PDWF) as follows:

$$\begin{aligned} Q &= 1\,241 \times 3.5 \\ &= 4\,344 \ell/d \\ &= 4.344 \times 10^{-3} \text{ M}\ell/d \\ \text{PDWF} &= 0.05 \ell/s \end{aligned}$$

If an infiltration rate of 15% is used for the ingress of stormwater into the system, the Peak Wet Weather Flow (PWWF) is calculated as follows:

$$\begin{aligned} Q &= 4\,344 \times 1.15 \\ &= 4\,996 \ell/d \\ &= 4.996 \times 10^{-3} \text{ M}\ell/d \\ \text{PWWF} &= 0.058 \ell/s \end{aligned}$$

3.4 **Proposed Services**

Currently, the proposed cemetery site is not connected to any sewer reticulation network of the Beaufort West Municipality. However, there is an existing 375 mm \emptyset gravity sewer mainline adjacent to the road on the Western Side of the proposed development to connect to. The existing pipeline gravitates to the WWTW as shown on

the enclosed Beaufort West Sewer Distribution System BWS-D5C, BWS-D6A and BWS-D6C.

Based on the above, there is sufficient capacity to accommodate the proposed development.

4. **STORMWATER**

No bulk stormwater systems are required as the stormwater will be collected and dispersed by means of a proposed stormwater berm towards the East of the site channeling run-off to an existing low-lying disturbed area which we propose to be formalized into a stormwater detention area as shown on Drawing no. 505510 GE 201 - REV D – Layout Plan. Accumulated stormwater will be dispersed by means of an overflow channel to minimize the effect of peak runoff downstream. The proposed detention pond will act as energy dissipater.

Currently, no formal stormwater exists within the proposed development. The greater total actual drainage area is subject to confirmation during the detailed design phase.

4.1 **Runoff**

The proposed site is currently undeveloped with sparse vegetation and can be categorised as a “Greenfield Development”. Therefore, the proposed development is expected to increase the amount of stormwater runoff marginally due to additional hard surfaces being constructed. No treatment of stormwater is envisaged on site.

4.2 **Stormwater Management Techniques: During Construction**

The stormwater surface run-off water will be managed carefully during construction.

The following management techniques will be implemented:

- Temporary cut-off channels and berms;
- Routing of run-off towards the existing watercourse and drainage routes;
- Erosion protection by means of Silt fences, Geofabric, Sand Bags and/or any combination thereof;
- Compliance with a site-specific Environmental Management Plan; and
- Provision for dealing with water, in accordance with SABS 1200, will be stipulated in the Project Specification and Contract Documents. Of specific importance will be the following clauses:
 - i. Clause 5.5 in SABS 1200 A;
 - ii. Clause 5.3 in SABS 1200 AA;
 - iii. Clause 5.1.3 in SABS 1200 D; and
 - iv. Clause 5.1.2 in SABS 1200 DB.

4.3 **Stormwater Management Techniques: Post Construction**

The factors to consider in Stormwater Management falls broadly into two main categories, namely those related to quantity and those related to quality.

Any development brings about changes to the natural environment of a site, which in turn has an effect or disrupts the natural hydrological cycle. Changes include, among other:

- Increase in impermeable surfaces (roads, roofs etc.) resulting in lower infiltration, higher run-off volumes and velocities;

- Changes to natural flow routes through earthworks, infrastructure and shaping of terrain; and
- Changes to local water course environment and ecology.

The management of the increased run-off volumes and velocities is important as it can be detrimental to the receiving drainage system and communities downstream of the site, as it could cause severe erosion, property damage and even loss of life.

By restricting peak flows to pre-development levels, the status quo of the catchment is maintained. This could be achieved through the implementation of the following recommended practices, as described below.

4.3.1 **Proposed Stormwater Control Measures**

According to the CoCT's "Management of Urban Stormwater Impacts Policy" all stormwater management systems shall be planned and designed in accordance with best practice criteria and guidelines laid down by Council, to support Water Sensitive Urban Design principles and the following specific sustainable urban drainage system objectives:

- Improve quality of stormwater runoff;
- Control quantity and rate of stormwater runoff; and
- Encourage natural groundwater recharge through infiltration.

4.3.2 **Infiltration**

By dispersing the run-off to numerous outfalls spread across the proposed site into the proposed cut-off berm, the recharge of the underground water table is promoted thus reducing the risk of localised erosion.

As mentioned above, an open cut-off berm will be used. Channels with longitudinal slopes flatter than 4% will be earth channels. The topography of the site is relatively flat and no slopes steeper than 4% are expected.

4.3.3 **Attenuation**

Attenuation functions by the principle of allowing large flows of water to enter a facility but limiting the outflow by having a small opening/overflow at the low point in the facility. The difference between in- and outflows is directed to a catchment area where the water is flowing towards the river.

Attenuation are already available on site in the form of the disturbed area adjacent to the proposed site.

5. **ACCESS ROADS**

Based on the enclosed Drawing no. 505510 GE 201 - REV D – Layout Plan, it is recommended that existing Access Road be maintained as the best suited option to provide access to the proposed Cemetery site.

It must be noted that the existing gravel surfaced road will require the re-working of the in-situ material to the required compaction.

6. **SOLID WASTE**

Refuse removal will be dealt with once a week as applicable to all the current residential areas in the Beaufort Municipal area.

We will regard the caretaker/ablution facility as the only property in determining the solid waste generated.

Commercial properties generate approximately 12kg/100m² of Solid Waste per day.

Therefore: (12kg/100m² x 69m² x 0.6 GLA)
 = 4.968 kg/day
 = 0.005 tons/day

Volume = 0.005 t/d x 0.75
 = 0.004 m³/d
 = 0.12 m³/month

7. **FLOODLINES**

The proposed cemetery development is affected by a floodline at the Eastern side of the development where the Kuils River flows past the site. A 100-year floodline analysis has been conducted.

Refer to the enclosed Drawing: 100 Year Floodline Layout by Fraser Consulting Civil Engineers for details regarding the 1:100-year floodline affecting the development area.

8. **INTERNAL SERVICES**

The proposed internal civil services are indicated on enclosed drawings. Below is a brief description of the services to be provided for the area.

8.1. **Sewage**

±100 m of 160mm dia PVC-u heavy duty sewer pipe; and

2 No. Manholes.

8.2 **Water**

±100 m of 90mm dia HDPE Class 12 water pipe;

1 No. Gate valves;

1 No. Fire hydrants; and

32 mm dia HDPE Class 12 water pipe connections.

8.3 **Roads**

Approximately 15 730m² gravel wearing course surfaced roads. Road width is proposed to be 4.5m wide.

8.4 Stormwater

640m of In-situ Stormwater berm;
Stormwater detention pond; and

1 No. In-situ Stormwater Outlet/Overflow.

9. **STANDARD OF ENGINEERING SERVICES TO BE PROVIDED**

Levels of services are as follows:

9.1 **Sewer**

- Pipe diameter: 160mm dia solid wall for main lines and 110mm solid wall for house connections;
- UPVC Class 34 or Ultracor Class 400 Heavy Duty (400 kPa); and
- Precast concrete/prefabricated fiber cement rings to be used for manholes.

9.2 **Water**

- Pipe diameter of 90 mm dia MPVC Class 9/12 pipes depending on residual pressure;
- The facility will be serviced with a 32mm diameter connection and an Elster Kent/Honeywell plastic water meter in a plastic meter box or similar approved meter by the Technical Services Directorate;
- Provision is made for one (1) fire hydrant according to "Red Book" guidelines;
- All fire hydrants shall be 65mm dia (internal);
- All fire hydrant outlet shall be of bayonet coupling type; and
- All valves shall be AVK type valves – left hand/closing or similar approved.

9.3 **Roads and stormwater**

- The road width will be 4.5m;
- All road surfaces will be gravel wearing course;
- Sub-base and base materials will be imported;
- Sub-surface drainage, where applicable, will be installed; and
- In-situ stormwater channels will be provided on the low side of the road draining to the proposed stormwater berm on the Eastern side of the site.

9.4.1 Design criteria

The following documents will serve as a base for the detail design criteria and standards:

- Guidelines for Human Settlement Planning and Design ("Red Book"); and
- City of Cape Town Management of Urban Stormwater Impacts Policy – Version 1.1, 2009.

9.4.2 Construction specifications

All materials and workmanship shall comply with the specifications as set out in the South African National Standards for Civil Engineering (SANS).

9.4.3 Roads

The road system forms an integral part of the local area plan.

9.4.3.1 *Design Criteria*

The design criterion for roads is as follows:

- Design life of the roads is 20 years;
- Sub-grade CBR – 15 to 20;
- Sub-base CBR – 45min (processed crushed stone);
- Base course CBR – 80min (processed crushed stone);
- Surfacing – minimum gravel wearing course on all roads;
- Minimum road grade 0.45%; and
- Minimum road crossfall 2%

9.4.4 Stormwater

The storm water system forms an integral part of the road and urban planning layout. The system rests on three legs, the minor system, the major system and an emergency system. Normally minor storms are catered for in the pipe system while the major storms are routed through a linked system of roads and public open spaces using attenuation techniques. The emergency system recognizes failure of the minor and major system by storms greater than provided for in major system or in the event of malfunction of the minor system by providing continuous overland flow routes to minimize flooding of residential areas. In this instance all stormwater will be dealt with as surface run-off channeled to the low side of the site and conveyed to the detention pond where it will be dispersed safely into the adjacent Kuils River.

9.4.4.1 *Minimum design criteria for storm water system*

The data to be used for the design of the system is as follows:

- Minor system : 2-year return period conveyed in an underground pipe system. Preferably the overland flow shall not exceed 200m;
- Major system : 50-year return period. The difference between the 2-year and 50-year to be conveyed in the road prism with depth not exceeding 150mm within the road reserve width;
- The minimum gradients for pipelines are designed to give a minimum velocity of 0.7m per second with the pipe flowing full;
- The maximum velocity used is 3.5m per second;
- Major storm water overflows are to be provided to convey the excess storm water from the streets into designated public open spaces;
- Storm water flow velocities in road ways will be kept as low as possible and related to the surface finish to prevent scour and erosion; and
- Roads are to be graded to ensure free and continuous flow to the main storm water system and to prevent local ponds at intersections.

9.4.5 Sewers

The sewer drainage system forms an integral part of the sewage system. The drainage for the site is in different directions due to the topography of the site, however the proposed facilities will gravitate towards the future sewage pump station KKS 8.2 as shown the Sewer Master Plan.

9.4.6.1 Minimum design criteria

- A conventional waterborne sewerage system is provided with single connections to individual erven. The main sewer line will be constructed within roads reserves or midblock sewers on the site topography depending;
- Design parameters : Average daily flow - 500ℓ / erf / day
: Peak factor – Harmon formula
: Extraneous flow – 15 %
: Minimum velocity – 0.7m per second;
- Minimum cover to pipes : 0.80m;
- Minimum pipe size : 110mm diameter for house connections
: 160mm diameter for sewer mains;
- Minimum gradients : 110mm diameter house connection 1:60
: main lines at 80% capacity as follows:

“Dwelling” units	Grade
Less than 6	1:80
6 to 10	1:100
11 to 80	1:120
81 to 110	1:150
111 to 130	1:180

- House connection depth shall generally be 1.0m but at least be able to drain 80% of an erf; and
- Maximum manhole spacing of 80m.

9.4.6.2 Pipelines

- Pipeline material for pipe sizes up to 160mm diameter;
- uPVC Class 34 Ultracor Class 400 Heavy Duty (400 kPa) complying with SABS; and
- Pipes are generally laid on Class C bedding.

9.4.6.3 Manholes

- Dolomite aggregate and low alkali sulphate resistant cement to SABS 471 shall be used for all concrete, mortar or screed;
- Manhole cover to be central over main pipe on downstream side; and
- Manhole covers and frames to be Polymer-concrete.

9.4.7 Water

The water reticulation network forms an integral part of the water distribution system.

9.4.7.1 Minimum design criteria

The design criteria generally as per the “Red Book” guidelines and specifically as follows:

- Peak factors for the development will be calculated in accordance with Figure 9.11 of the “Red Book”;

- Minimum pressures for the network are calculated for the fire flows of 30ℓ per second and peak demand at the point of lowest pressure under peak flow conditions;
- Valves to be placed such that a maximum of 4 valves need to be closed to isolate a section of pipeline;
- Valves to be spaced so that the length of main included in an isolated section does not exceed 600m;
- All valves to be installed at T-pieces where applicable and not within the road surface; and
- Minimum cover to pipe to be 0.8m.

9.4.7.2 Pipeline materials

- Network – uPVC Class 9/12, dia 90mm complying to SABS 966; and
- Erf connections – HDPE Class 12, JASWIC.

We trust that we have provided sufficient information for your purposes and look forward to hearing from you shortly. Please do not hesitate to contact us if you should require any further information.

Yours faithfully

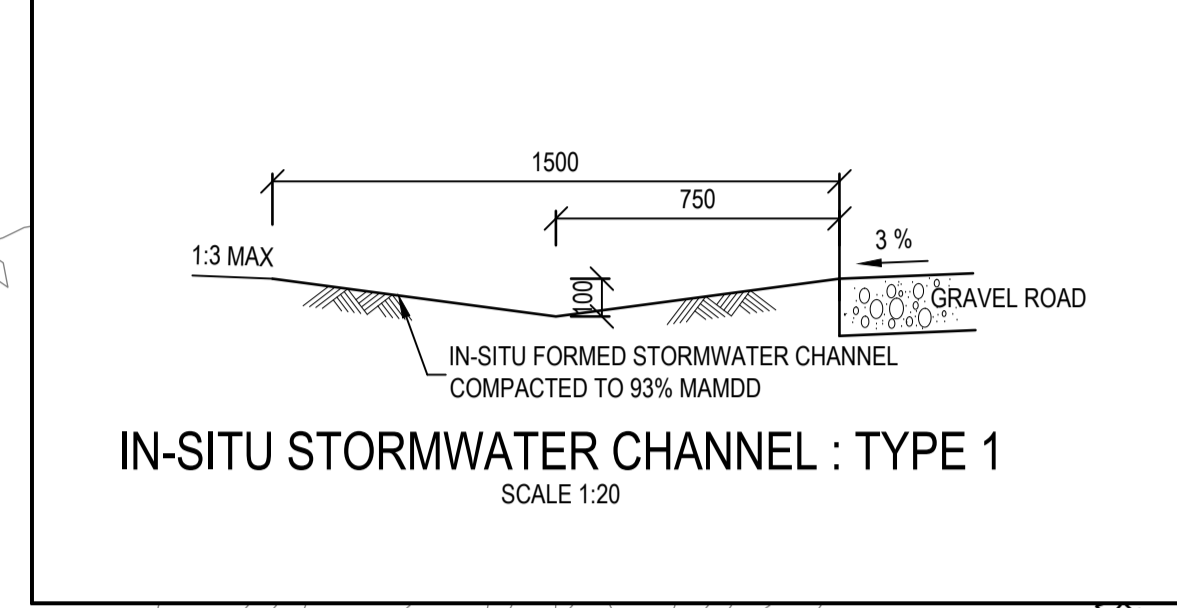
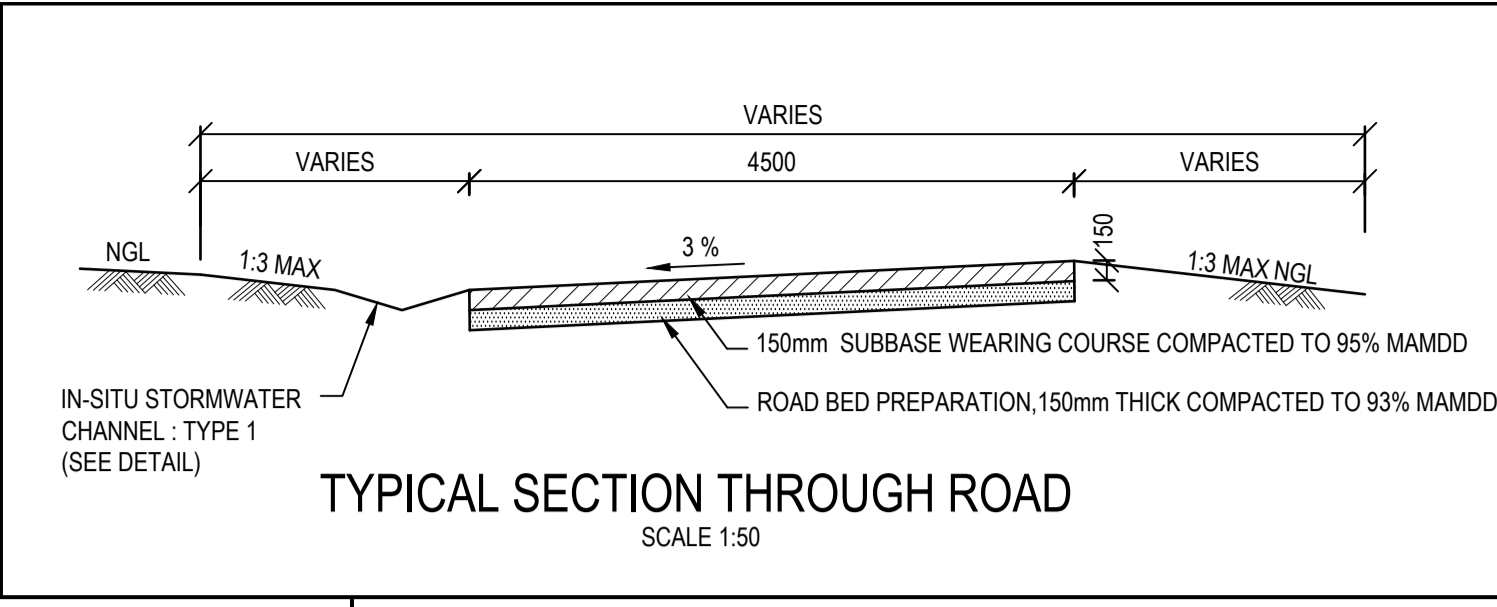
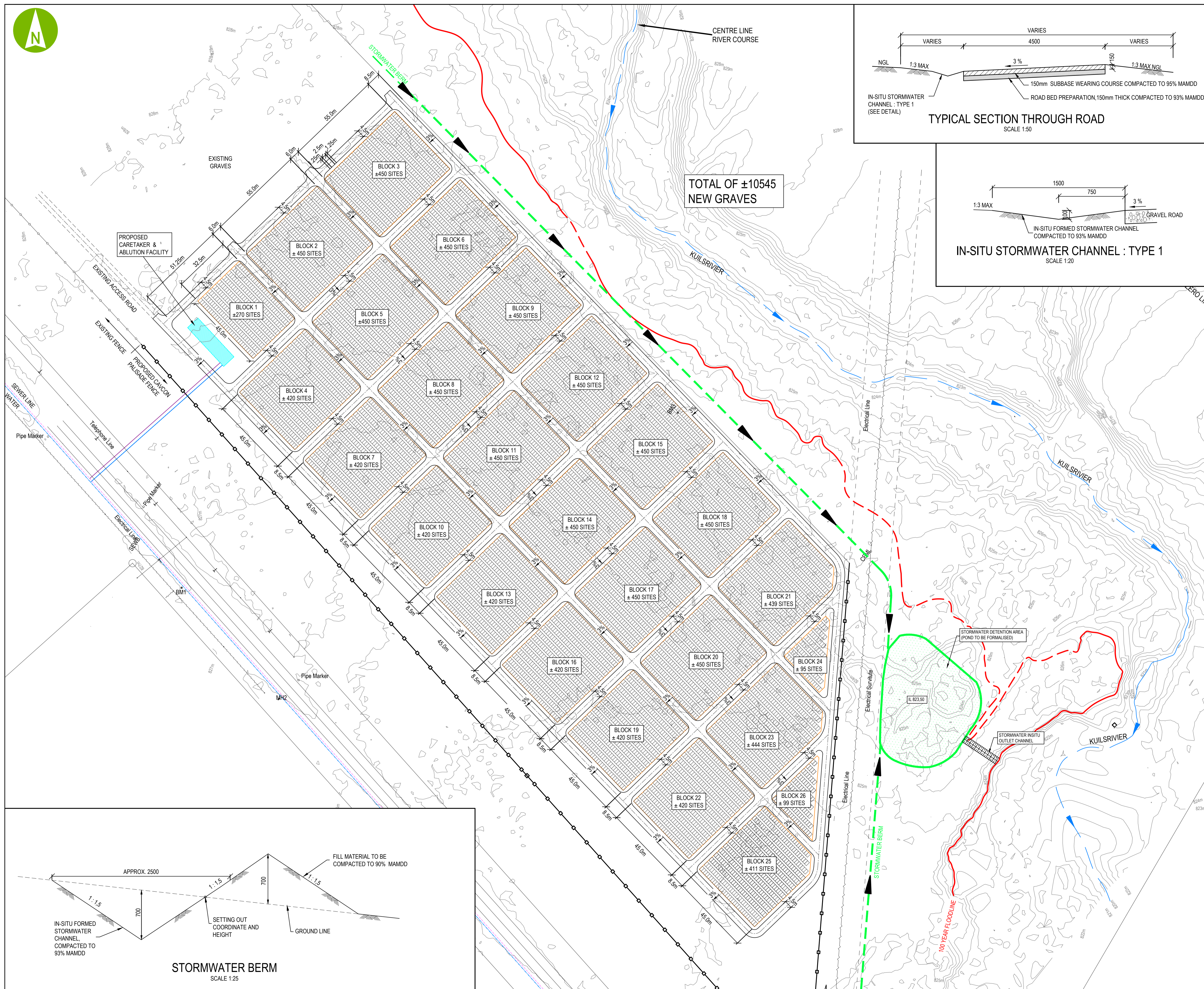


M Botha Pr Tech Eng
Associate
pp Aurecon



AC KEYSER Pr Tech Eng
Office Manager
pp Aurecon

Encl: *Drawing no. 505510 GE 201 - REV D – Layout Plan*
Drawing no. 505510 GE 202 – Ablution/ Caretaker Facility
100 Year Floodline Layout
CES Figure BWW 2.1a Beaufort West Existing waster system layout
Beaufort West Sewer Distribution System BWS-D5C
Beaufort West Sewer Distribution System BWS-D6A
Beaufort West Sewer Distribution System BWS-D6C
Figure BWS 2.1a Existing Sewer System layout
Bulk Water and Sanitation Services for The Extension of the "Goue Akker" Cemetery



- LEGEND:**
- ▬ PROPOSED ABLUTION FACILITY
 - ▬ PROPOSED CAVCON FENCE
 - ▬ PROPOSED WATER CONNECTION
 - ▬ PROPOSED SEWER CONNECTION
 - ▬ 100 YEAR FLOODLINE (DISTURBED TERRAIN)
 - - - 100 YEAR FLOODLINE (UNDISTURBED TERRAIN)
 - ▬ CENTRE OF WATERCOURSE
 - ▬ STORMWATER BERM

- EXISTING:**
- ▬ WATER
 - ▬ SEWER
 - ▬ PALISADE FENCE

RESPONSIBLE PERSONS		
	SIGNATURE	DATE
DRAWN		
DESIGNED		
CHECKED		

THE MASTER HELD AT THE AURECON GEORGE OFFICE BEARS THE SIGNATURE OF APPROVAL



CLIENT

BEAUFORT WEST MUNICIPALITY

REV	DATE	REVISION DETAILS	APPROVED
A	24/4/2019	FOR DISCUSSION PURPOSES ONLY	AC KEYSER
B	5/6/2019	AMOUNT OF GRAVES SITES ADDED	AC KEYSER
C	7/4/2020		AC KEYSER
D	24/4/2020	LAYOUT AMENDED	AC KEYSER

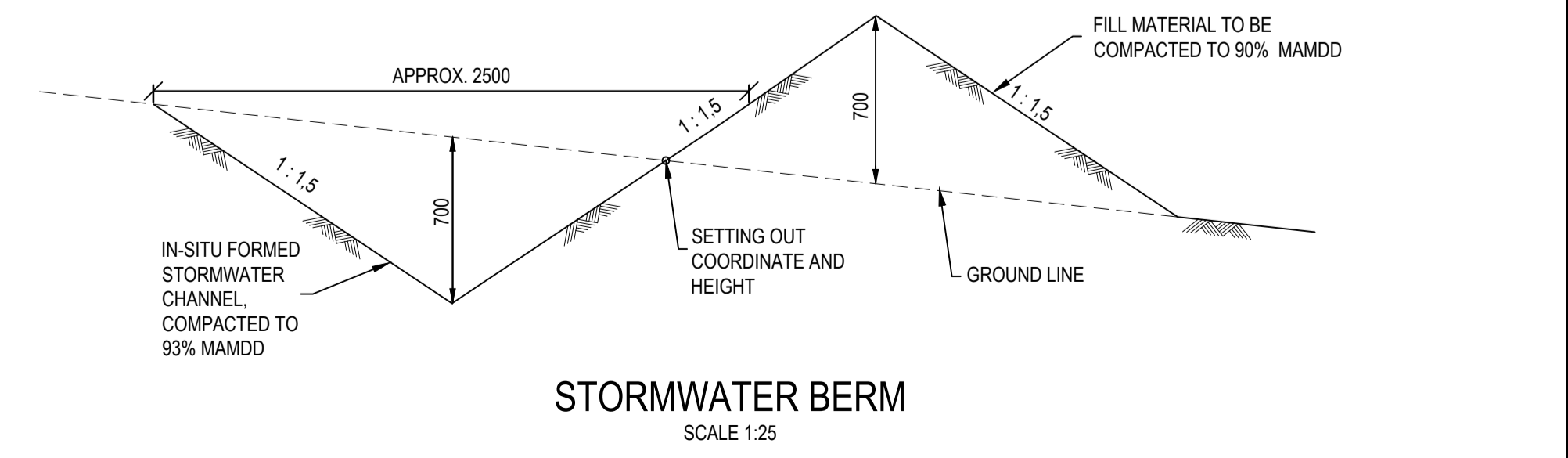
PROJECT

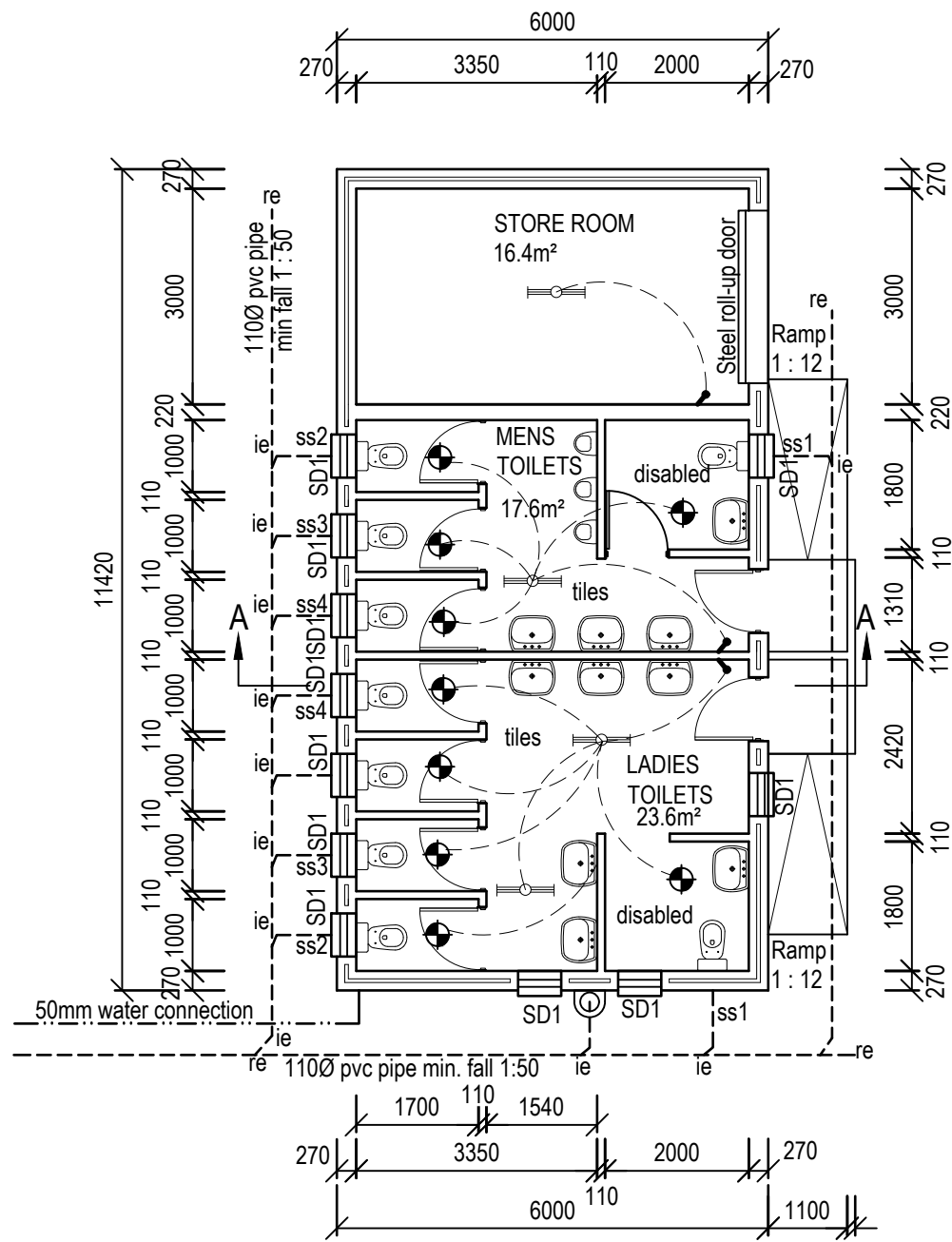
EXPANSION OF "GOUE AKKER" CEMETERY

TITLE

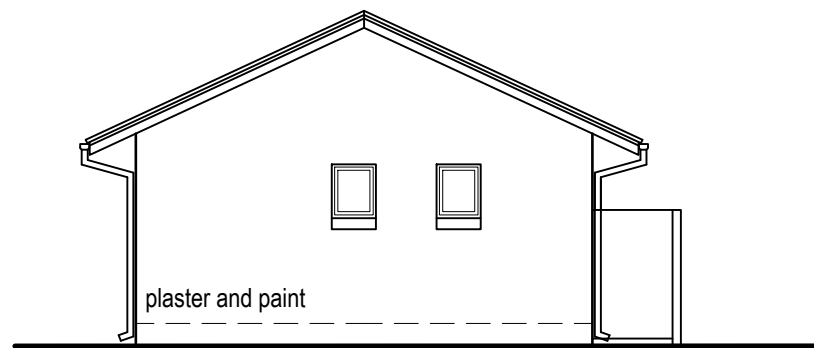
LAYOUT PLAN

DRAWN	DESIGNED	FOR DISCUSSION NOT FOR CONSTRUCTION	
A VAN WYK		PROJECT No. 505510	
CHECKED		SCALE	SIZE
M BOTHA		1 : 1000	A1
APPROVED		DRAWING No.	REV
AC KEYSER		505510 GE 201	D
ECSA - 200670188	DATE		

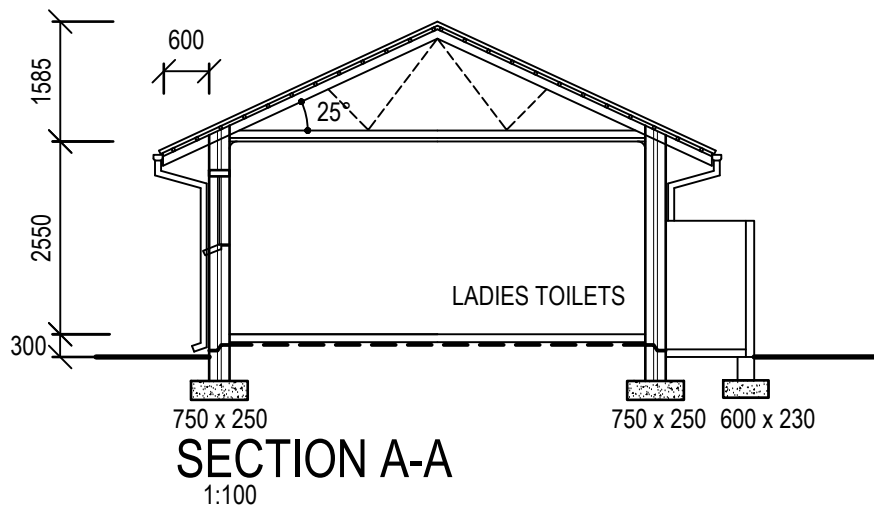




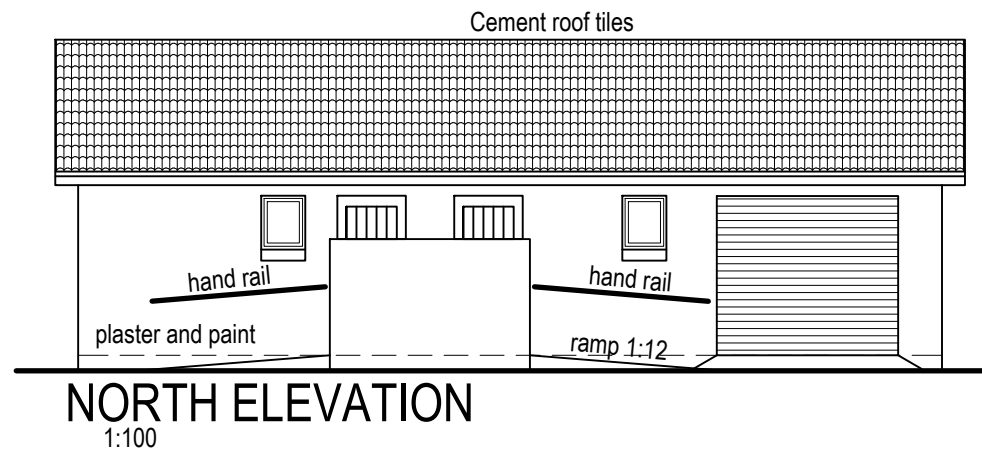
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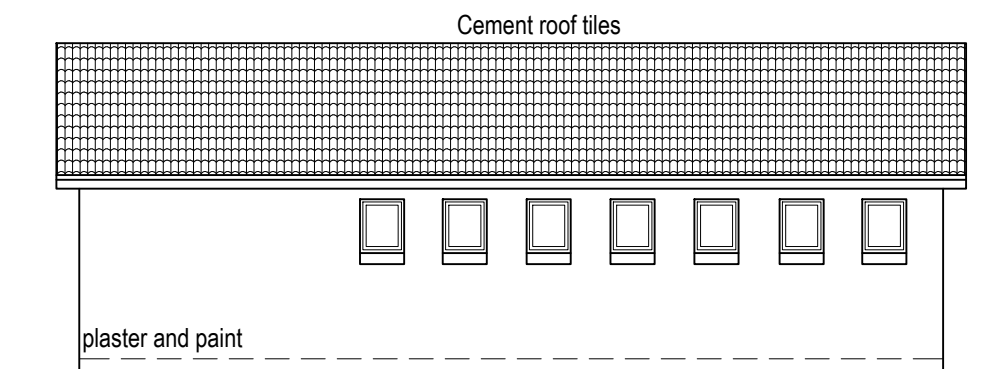
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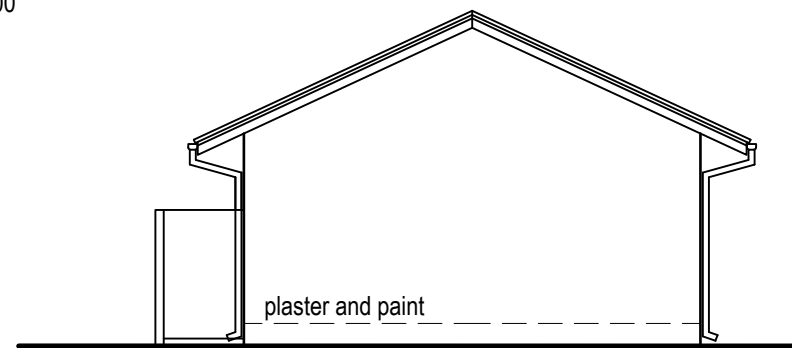
SECTION A-A
1:100



NORTH ELEVATION
1:100



SOUTH ELEVATION
1:100



EAST ELEVATION
1:100

SPECIFICATIONS:
Walls:
 375 micron brickgrip under all walls. Internal and External bricks to owners specifications. Brickforce every five layers up to wallplate, thereafter every second layer. Provide weepholes @ 1000 c/c. Plaster and paint outside and inside.
 Outside: Base coat and 2 layers PVA. Paint to match existing colour scheme as indicated onelevations.
 Inside: Basecoat and 2 layers PVA. Windows and doors to schedule. Damp proof course around all windows. Precast concrete lintols above all windows and doors.

Floor:
 Tile flooring with suitable skirting, on 25 mm cement screed on 85mm concrete slab on 250Micron gunplus on 50mm sandbed on approved filling, compacted in layers of maximum 150mm.

Windows and Doors:
 Windows and doors (Swartland) to codes on plan.

Ceilings:
 6,5mm Rhinoboard ceiling to 38 x 38 branding @ 400mm c/c. Finish with cretestone, rhino cornices. Base coat and two layers PVA.

Doors:
 Internal: Hollow-core with print & 3-lever locks.
 External: Timberframe door as per Swartland catalogue SD2 with 3-lever lock.




Foundation:
 20Mpa concrete (Ready Mix)
 Depth min 850mm
 Brickforce every 2nd layer up to floor level

PITCH ROOF: 25°
 Cement roof tiles on 38 x 38 battens @345mm c/c on Gundle undertile yellow dpc on Gangnail rooftrusses @ 800 c/c on 114 x 38 wall plates tied down with galvanized hoop iron. Facia's to match existing, prepared and painted.

Gutters:
 Seamless aluminium gutters with downpipes to match existing.

AREA = 69m²

ELECTRICITY LEGEND:

-  CEILING LIGHT
-  LIGHT SWITCH
-  FLOURES. LIGHT

NOTES:
 ALL WORK AND MATERIALS USED MUST COMPLY WITH ALL THE RELEVANT SANS 10400 AND BUILDING REGULATIONS. DRAWING MUST NOT BE SCALED AND ONLY DIMENSIONS GIVEN MUST BE USED. BEFORE COMMENCING WORK, ALL DIMENSIONS MUST BE VERIFIED ON SITE. CONTRACTOR MUST IMMEDIATELY BRING ANY DISCREPANCIES UNDER THE ATTENTION OF THE DESIGNER.



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BEAUFORT WEST MUNICIPALITY

REV	DATE	REVISION DETAILS	APPROVED	DRAWN	DESIGNED

PROJECT		FOR DISCUSSION PURPOSES ONLY	
BEAUFORT WEST CEMETERY		PROJECT No.	
TITLE		50550	
ABLUTION/CARETAKER FACILITY		SCALE	SIZE
		NTS	A3
		DRAWING No.	REV
		505510 GE 202	A

AC KEYSER
ECSA -200670188

DATE

- LEGEND:**
- RS 90
 - RIVER STATION 90
 - 100 YEAR FLOODLINE
 - 100 YEAR FLOODLINE (DISTURBED TERRAIN)
 - CENTRE OF WATERCOURSE
 - CONTOUR LEVEL

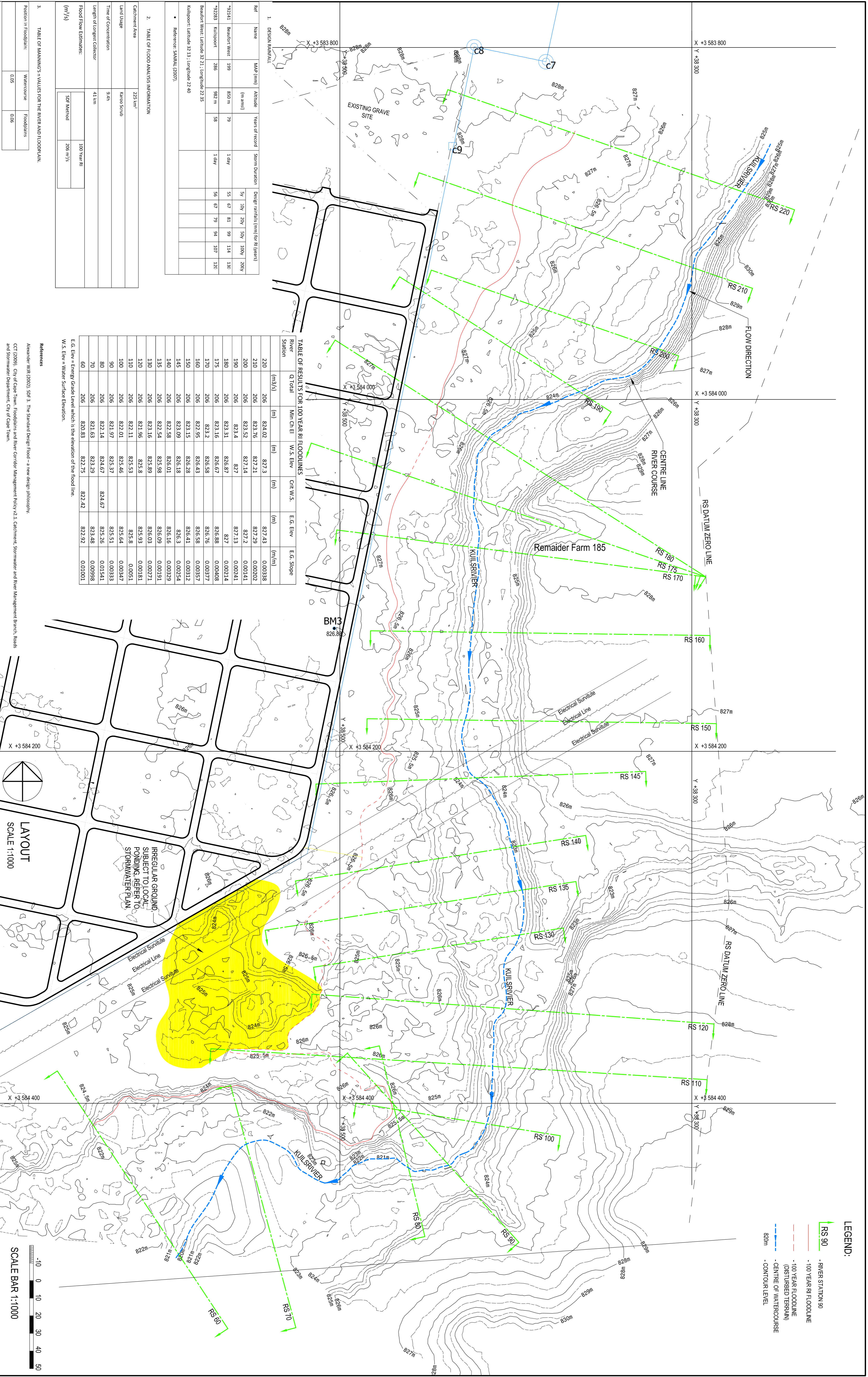


TABLE OF RESULTS FOR 100 YEAR RI FLOODLINES

River Station	Q Total (m ³ /s)	Min Ch El (m)	W.S. Elev (m)	Ch El W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)
220	206	824.02	827.3	827.43	827.43	0.00338
210	206	823.76	827.21	827.29	827.29	0.00202
200	206	823.52	827.14	827.2	827.2	0.00141
190	206	823.4	827	827.13	827.13	0.00241
180	206	823.31	826.87	827	827	0.00214
175	206	823.16	826.67	826.88	826.88	0.00408
170	206	823.2	826.58	826.76	826.76	0.00377
160	206	822.95	826.43	826.58	826.58	0.00357
150	206	823.15	826.28	826.41	826.41	0.00312
145	206	823.09	826.18	826.3	826.3	0.00254
140	206	822.58	826.01	826.16	826.16	0.00219
135	206	822.54	825.98	826.09	826.09	0.00191
130	206	823.16	825.89	826.03	826.03	0.00271
120	206	821.96	825.8	825.93	825.93	0.00181
110	206	822.11	825.53	825.8	825.8	0.0051
100	206	822.01	825.46	825.64	825.64	0.00347
90	206	821.97	825.37	825.51	825.51	0.00333
80	206	822.14	824.67	824.67	824.67	0.01541
70	206	821.63	823.29	823.48	823.48	0.00998
60	206	820.83	822.75	822.42	822.42	0.01001

E.G. Elev = Energy Grade Level which is the elevation of the flood line.
W.S. Elev = Water Surface Elevation.

References

- Alexander WIR (2003), SDR 3, The Standard Design Flood – a new design philosophy.
- CCT (2009), City of Cape Town, Floodplains and River Corridor Management Policy v1.1, Catchment, Stormwater and River Management Branch, Roads and Stormwater Department, City of Cape Town.
- SANRAL (2007), Drainage Manual, Published by the South African National Road Agency Limited, PO Box 415, Pretoria, 0001, www.nra.co.za; ISBN 1-86844-328-0
- US Army (2016), HEC-RAS River Analysis System, User's Manual (5.0), www.hec.usace.army.mil/.

3. TABLE OF MANNINGS' n VALUES FOR THE RIVER AND FLOODPLAIN

Position in Floodplain:	Watercourse	Floodplains
	0.05	0.06

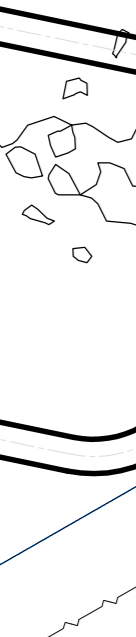
4. Consideration from the City of Cape Town Floodplain and River Management Policy (2009):

- a. It is far more cost effective in the long term to develop in areas where the threat of flooding is infrequent and the severity of flooding is minimal as opposed to the retrospective implementation of flood mitigation works which would generally be very costly and sometimes prove to be catastrophic failure when flood flows exceed the design flow of infrastructure.
- b. The flood levels must be based upon theoretical energy levels as opposed to water surface levels.

5. Note that the 100 year flood line is likely to be exceeded during the lifetime course of time.

6. The position of the floodline on the ground should be based upon elevation data rather than the approximate position indicated on the drawing.

LAYOUT SCALE 1:1000



SCALE BAR 1:1000

0 10 20 30 40 50

REV	DATE	REVISION DETAILS
0	11 May 2020	Original Issue

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SEBASTIAANBURG
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Phone: +27 (0)21 523 504
Fax: +27 (0)21 523 504
Email: enq@fraser.co.za

PROJECT: **BEAUFORT WEST CEMETERY EXTENSION**

CLIENT: **AURECON**

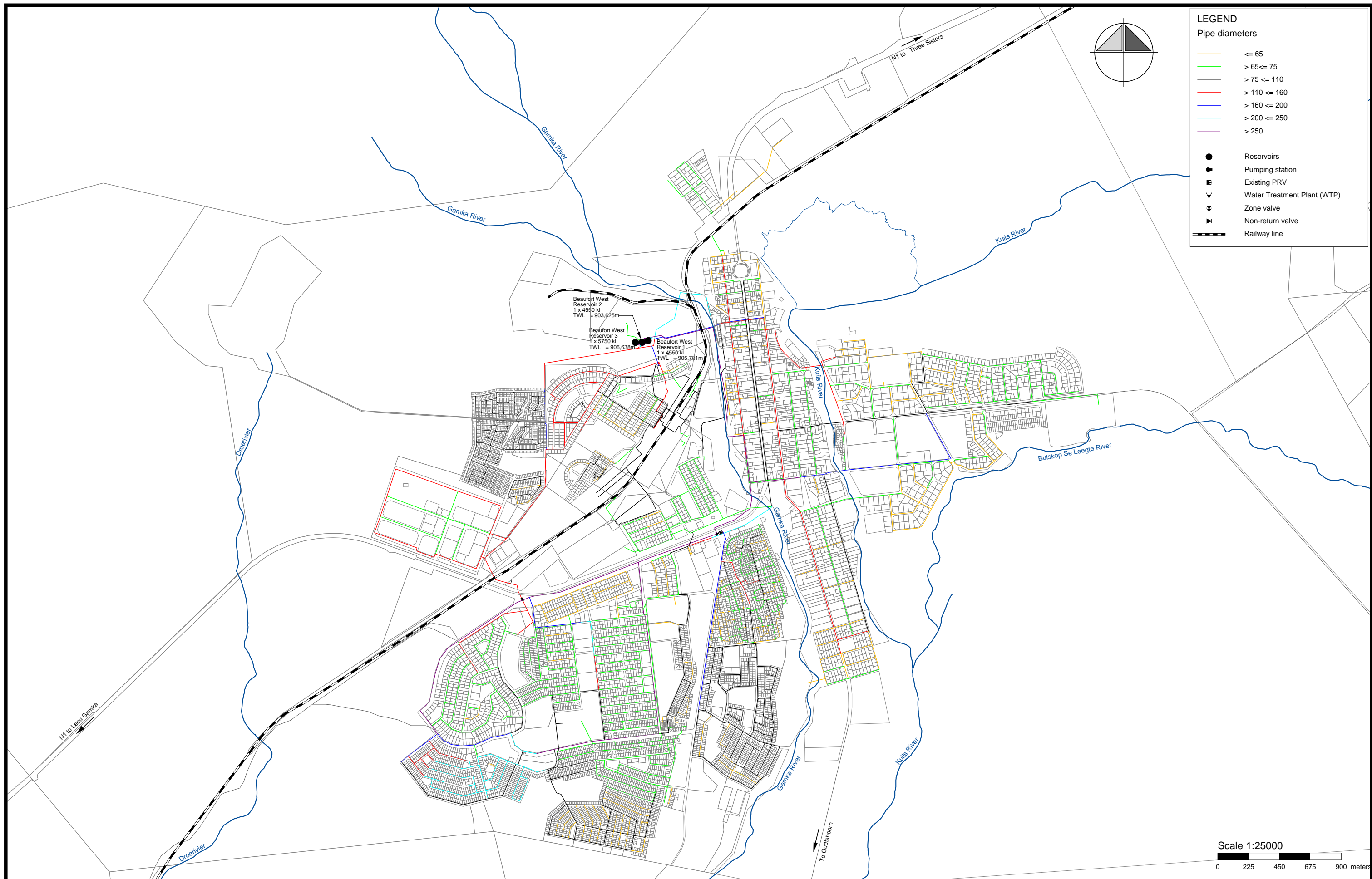
DRAWING TITLE: **100 YEAR FLOODLINE LAYOUT**

DRAWING NUMBER: **AF-1033-01**

SCALE: **1:1000**

PAGE: **1** OF **1**

REVISION: **0**



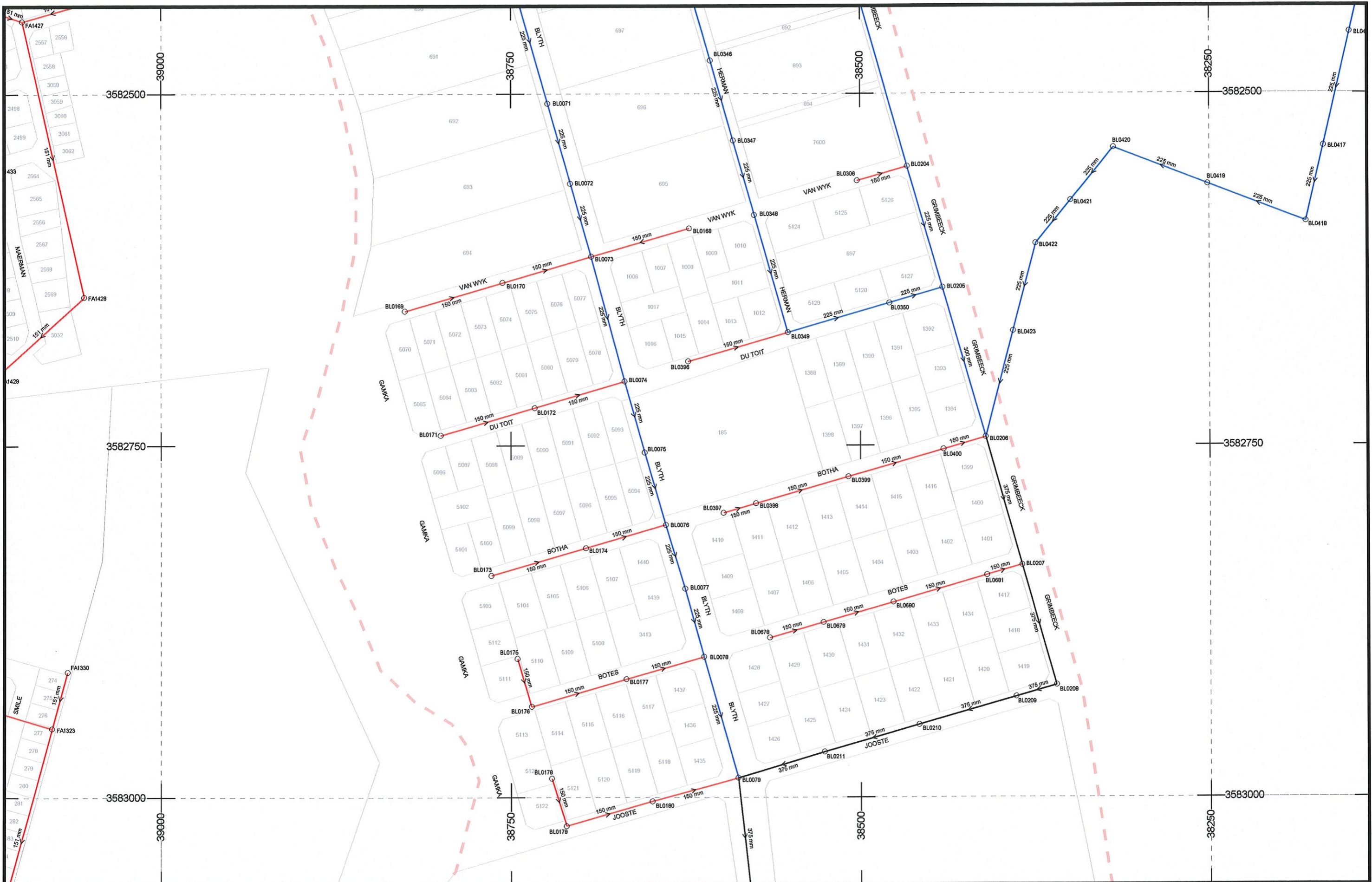
November 2008

WATER MASTER PLAN BEAUFORT WEST



Figure BWW 2.1a

Beaufort West
Existing water system layout



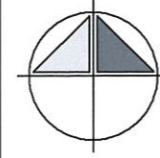
**Beaufort West
Sewer
System**

LEGEND

- PIPE DIAMETER LEGEND**
- ≤ 175 mmØ
 - > 175 ≤ 325 mmØ
 - > 325 mmØ
 - Direction Diameter
 - - - Rising Mains
 - - - Drainage Areas

- Sew_1941 Manhole
- Rodding Eye
- Top End
- Diversion
- Pump Station
- Special Structures

- Pipe Bridge
- Siphon
- Tunnel
- Encased
- Flow Meter
- House connections



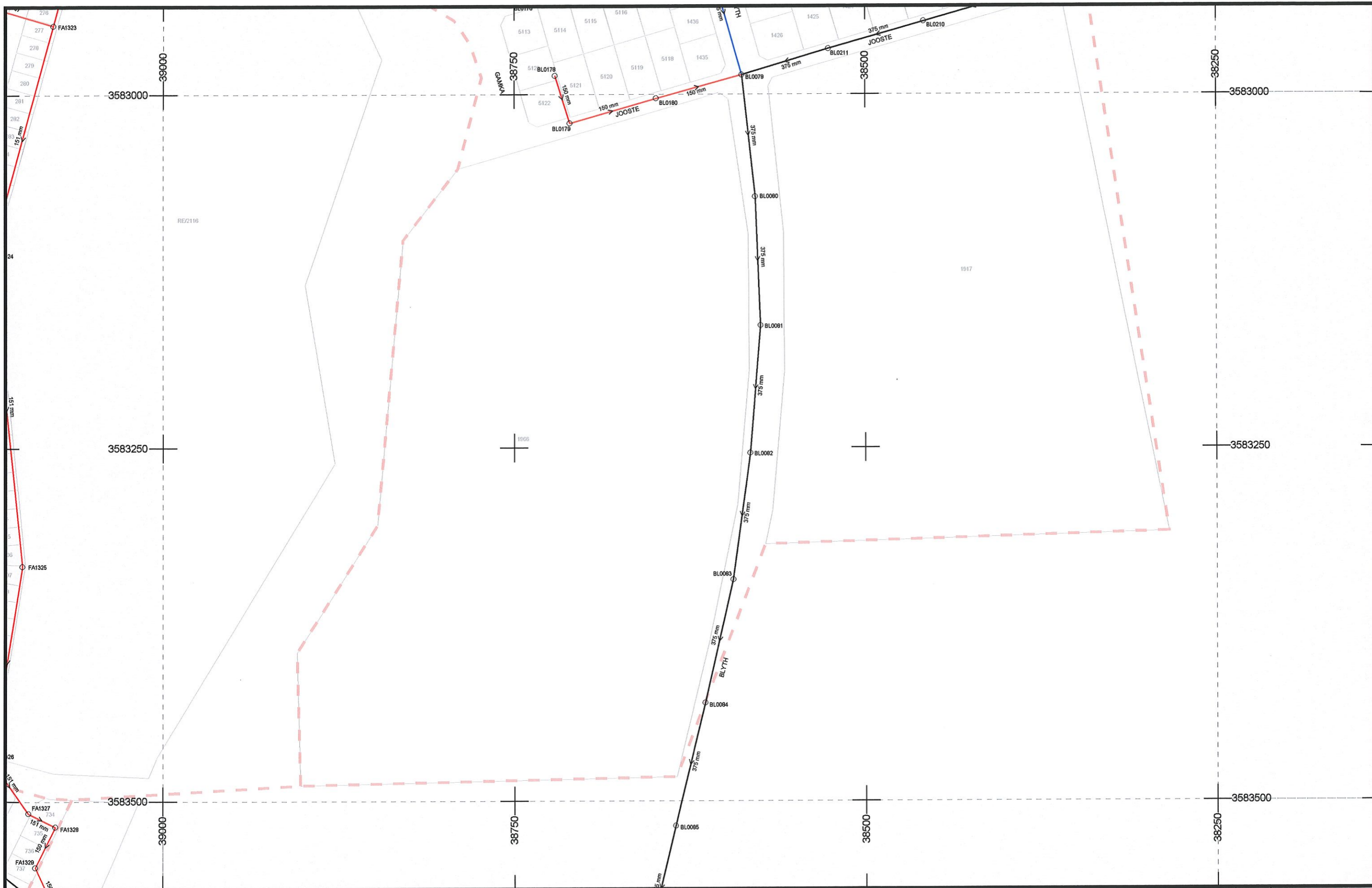
INDEX

BWS-C5B	BWS-D5A	BWS-D5B
BWS-C5D	BWS-D5C	BWS-D5D
BWS-C6B	BWS-D6A	BWS-D6B

**Sewer Distribution System
Beaufort West**

DATE: June 2005	REV: 0	SCALE: 1:2 500 0m 10m 20m 30m 40m 50m	WGS (Lo23)
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No.: **BWS-D5C**



LEGEND

PIPE DIAMETER LEGEND

- Red line: ≤ 175 mmØ
- Blue line: > 175 ≤ 325 mmØ
- Black line: > 325 mmØ
- Arrow: Direction Diameter
- Red dashed line: Rising Mains
- Red dashed line: Drainage Areas

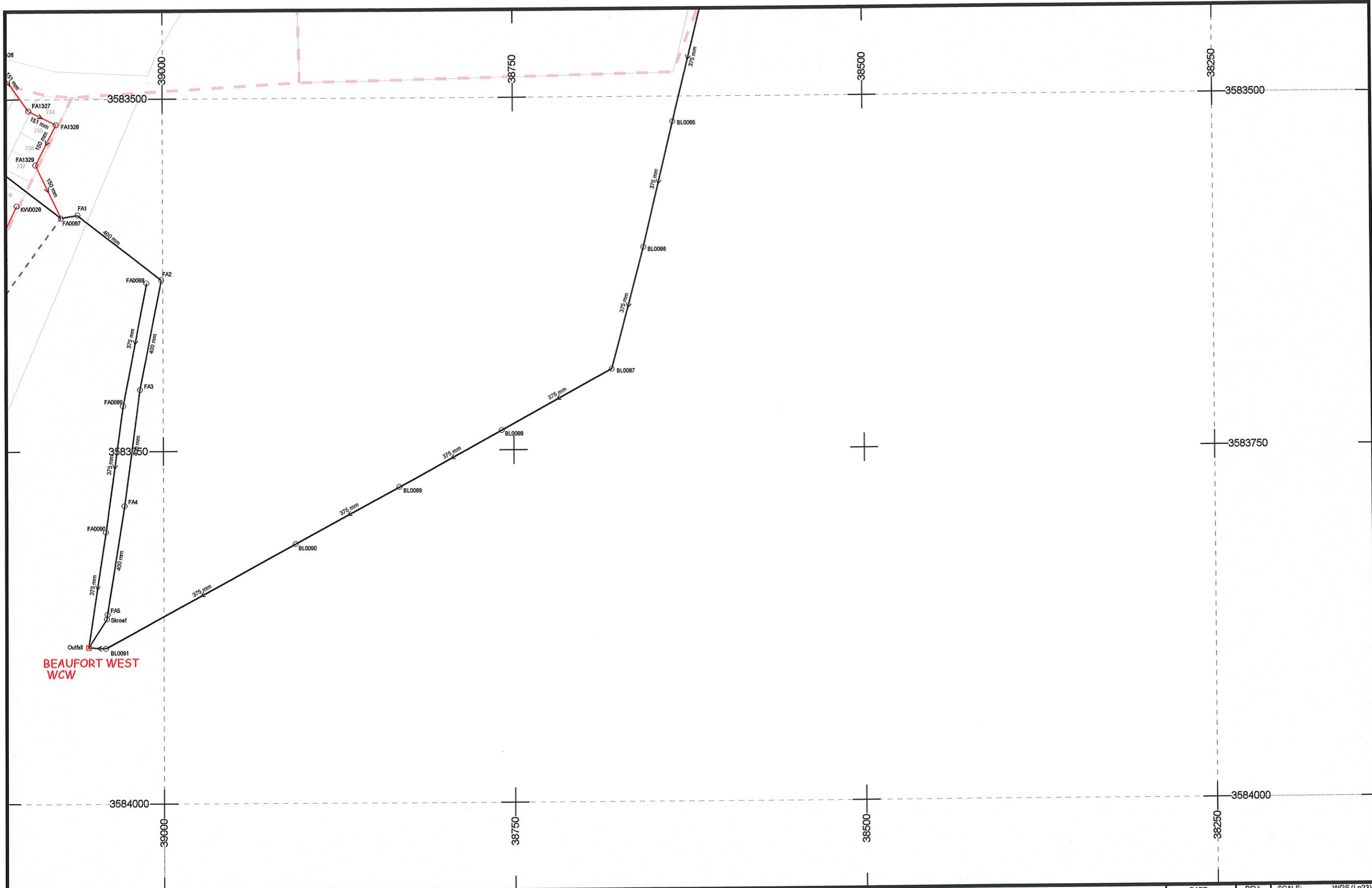
- Sew_1941: Manhole
- ⊙: Rodding Eye
- : Top End
- ⊠: Diversion
- ⊕: Pump Station
- ⊠: Special Structures
- |—|: Pipe Bridge
- S—S: Siphon
- T—T: Tunnel
- E—E: Encased
- M₂₀₀: Flow Meter
- : House connections

INDEX

BWS-C5D	BWS-D5C	BWS-D5D
BWS-C6B	BWS-D6A	BWS-D6B
BWS-C6D	BWS-D6C	BWS-D6D

Sewer Distribution System Beaufort West

DATE:	REV:	SCALE:	WGS (Lo23)
June 2005	0	1:2 500	
No.:		BWS-D6A	



**BEAUFORT WEST
WCW**



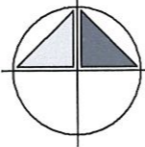
**Beaufort West
Sewer
System**

LEGEND

- PIPE DIAMETER LEGEND**
- ≤ 175 mmØ
 - > 175 ≤ 325 mmØ
 - > 325 mmØ
 - Direction Diameter
 - Rising Mains
 - Drainage Areas

- Sew_1641 Manhole
- Rodding Eye
- Top End
- Diversion
- Pump Station
- Special Structures

- Pipe Bridge
- Siphon
- Tunnel
- Encased
- Flow Meter
- House connections



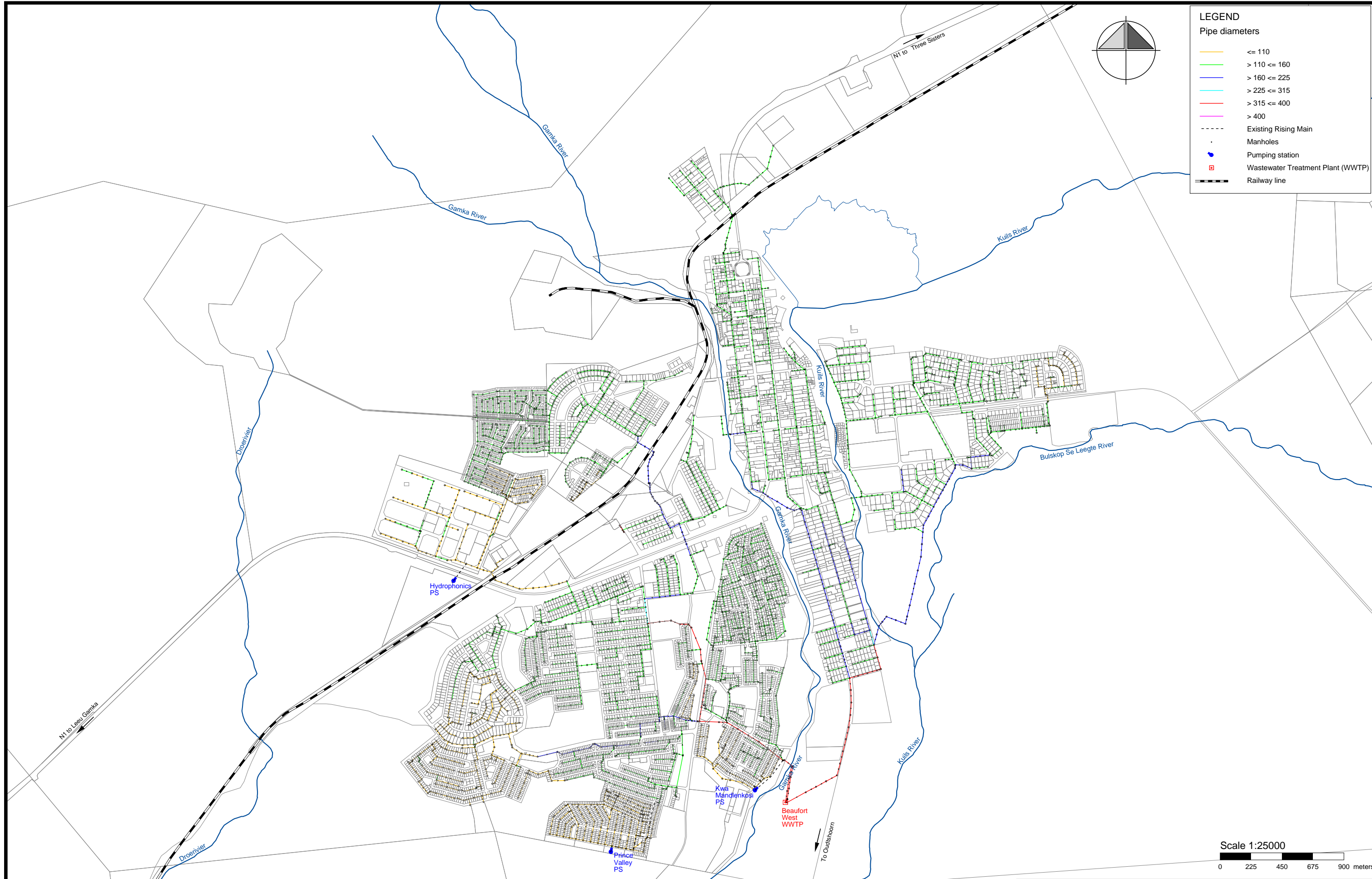
INDEX

BWS-C6B	BWS-D6A	BWS-D6B
BWS-C6D	BWS-D6C	BWS-D6D
BWS-C7B	BWS-D7A	BWS-D7B

**Sewer Distribution System
Beaufort West**

DATE: June 2005	REV: 0	SCALE: 1 : 2 500 	WGS (Lo23)
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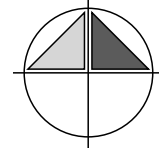
No.: **BWS-D6C**



LEGEND

Pipe diameters

- ≤ 110
- $> 110 \leq 160$
- $> 160 \leq 225$
- $> 225 \leq 315$
- $> 315 \leq 400$
- > 400
- - - Existing Rising Main
- Manholes
- Pumping station
- ▣ Wastewater Treatment Plant (WWTP)
- - - Railway line



Scale 1:25000
 0 225 450 675 900 meters





**MUNISIPALITEIT - MUNICIPALITY - UMASIPALA- WASE
BEAUFORT-WES/BEAUFORT WEST/BHOBHOFOLO**

**KANTOOR VAN DIE MUNISIPALE BESTUURDER/
OFFICE OF THE MUNICIPAL MANAGER
DEPARTEMENT KORPORATIEWE DIENSTE/
DEPARTMENT CORPORATIVE SERVICES**

Rig asseblief alle korrespondensie aan die Munisipale Bestuurder/Kindly address all correspondence to the Municipal Manager/Yonke imbalelwano mayihunyelwe kuMlawuli kaMasipala

Verwysing

Reference 13/1/1
Isalathiso

Navrae

Enquiries C.B. Wright
Imibuzo

Datum

Date

Umhla 27 May 2020

Privaatsak/Private Bag 582

Faks/Fax 023-4151373

Tel 023-4148020

E-pos / E-mail admin@beaufortwestmun.co.za

Donkinstraat 112 Donkin Street

BEAUFORT-WES

BEAUFORT WEST

BHOBHOFOLO

6970

AURECON
65 York Street
PO Box 509
George
6530

Attention: Mr. M. Botha

**BULK WATER AND SANITATION SERVICES FOR THE EXTENSION OF THE GOUE AKKER
CEMETERY**

With reverence to your email regarding the availability of bulk water and sanitation services for the upgrading of the Beaufort West Goue Akker Cemetery the following:

As indicated in the preliminary layout plan of the project the request for water and sanitation services will only be required for the caretaker's facility.

The project will therefore have no impact on the rendering of bulk services relating to water and sanitation.

The Beaufort West Municipality hereby confirms that the bulk services will be able to accommodate the additional water and sanitation services required by the Beaufort West Goue Akker project.

For you further attention.

Regards.

**C.B. WRIGHT
MANAGER: TECHNICAL SERVICES**