FORE
ENGINEERING SOLUTIONS
FORE ENGINEERING SOLUTIONS (PTY) LTD
TEL: (+27) 0215694360
E-MAIL: info@foreng.co.za
ADDRESS: Klein Joostenberg Farm, Die Steeg 1, R304, Muldersvlei, Stellenbosch, 7606

01/08/2025
Our Ref: 25017-R-01

EFRC AGRI OPERATIONS PTY LTD
PORTION 5 OF THE FARM
KLEIN STEENBOKS RIVIER
NO 487

DESIGN INFORMATION FOR FOUR WATER CROSSING STRUCTURES AT KLEINFONTEIN FARM

The farm Kleinfontein is being developed, and vehicular access roads is required to accommodate heavy vehicles travelling to and from a chicken production facility. The road alignment requires 4 waterway crossings as indicated in figure 1. In the figure markings No 1, 3 and 4 indicate low waterway brides and marking no 2 indicate a suspended bridge structure. Addendum A include detail drawings of the proposed structures.

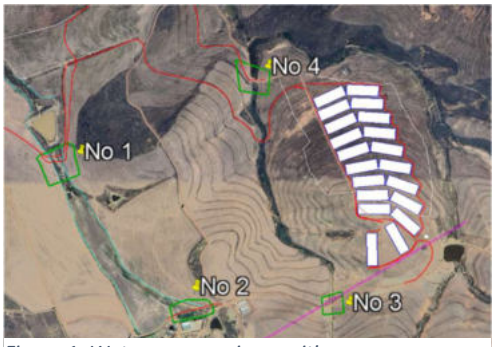


Figure 1: Waterway crossing positions

Low waterway bridges

Low waterway bridges are reinforced concrete structures with a driving surface (final top level) raised above ground (natural ground level) and these structures cross waterways nearly perpendicular to the natural water flow direction of the stream (see drawing in addendum A). Pipes will be installed at set intervals across the bridge length to allow water to freely pass through.

The final top level of the bridge is horizontal (level) and extends across the total width of the existing stream. Where the horizontal bridge section ends at the edge of the stream a further concrete slab on both ends extends at an incline (approach ramps) to a level 1m above natural ground level. This is to mitigate vehicle approach at a slope towards the bridge.

Bridge foundations are concrete walls with footings varying between 1,0 to 1,5m deep below natural ground level or until suitable founding material is found. G5 type materials will be used to fill the void between foundations walls to support the concrete slab (driving surface). However, where suitable founding materials is reached less than 1.0m deep below natural ground level, foundation walls are not required, and G5 type fill material is adequate.

A combination of Gabion baskets, blankets and biddim material will be used to prevent erosion directly up and downstream from the bridge. These erosion prevention measures will continue along the total length of the bridge structure, including the approach ramps on either side. Along the upstream side of the bridge the top of the gabion baskets will be level with the invert level of

the pipes going through the concrete. On the downstream side the top of the gabion baskets will be flush with the top of the driving surface.

Protruding concrete blocks will be placed at intervals on top of the driving surface along the edge of the road to indicate the side of the road during flood conditions. The height of the blocks will indicate if the water level is suitable for safe vehicle crossing.

Stream low flow conditions

Provision is made for pipes through the concrete with invert levels situated at natural ground level. An adequate number of pipes spaced along the bridge allows water to freely pass through and to prevent channelling or damming of the natural stream.

Stream high flow conditions

During high flow conditions the throughput capacity of the pipes is exceeded, and water will dam up and overtop the structure. Due to the top of the bridge being horizontal (level), water will evenly cross over along the total length and no channelling will occur. Vehicles will still be able to cross the bridge whilst water is overtopping until the water reaches a critical depth (pre-determined depth) when it will be unsafe to do so. Once the water level subsides to below the critical depth vehicle traffic may continue.

Stream sub-soil flow conditions

Free water inside the soil, below natural ground level, will seep downstream during times when the soil is saturated. When this water reaches the low water bridge (upstream side) a no fines sub-soil drain will collect the water and direct it through a pipe network underneath the bridge to the other side (downstream side). Water will then be released into another no fines drain along the downstream side of the bridge where it will be evenly distributed to continue seeping downstream.

Suspended bridge structure

Where the natural runoff channel is deep and narrow (marking no 2 in figure 1) a suspended bridge will span across. Suspended bridges are reinforced concrete structures with a driving surface (final top level) raised above ground (natural ground level). The structure crosses the waterway at a skew angle to align with the approach roadway alignment (see drawing in addendum A). The final top level of the bridge is horizontal (level) and has upstand beams on both sides. Where the horizontal bridge section ends at the edge of the stream a further concrete slab on both ends extends at an incline (approach ramps) to natural ground level. This is to mitigate vehicle approach at a slope towards the bridge. There are 3 walls supporting the bridge, 2 on both sides of the stream and one in the centre.

Bridge support walls (3 in total) are reinforced concrete which is founded on rock. The foundations are sunk 300mm deep into the rock and water will flow in between the supporting walls. The flow area through bridge support walls is more than the width of the existing natural channel hence no channelling of the stream occurs.

Gabion structures both at the upstream and downstream side of the supporting walls will protect the structure against erosion.

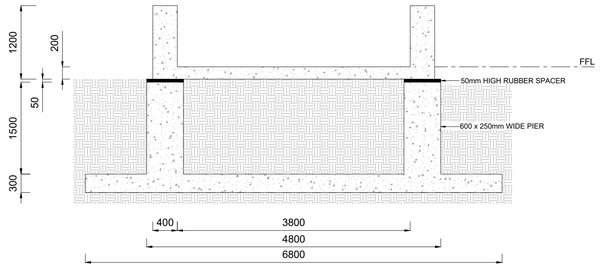
Earthworks

Installation of concrete structures requires a 2m workspace all round. Excavation depth for the low water bridges is a maximum of 2.0m and for the suspended bridge 3.0m deep. Backfilling will be with selected materials imported from commercial sources.

Concrete

Both ready mix concrete from commercial sources and concrete mixed on site (wet works) is required during construction. At the low water bridges there is enough space to temporarily divert stream flow to accommodate wet works. At the suspended bridge there is not enough space to

divert stream flow to accommodate wet works. An upstream coffer dam must to be constructed to temporarily divert stream water away from the wet works during construction.



SECTION A-A
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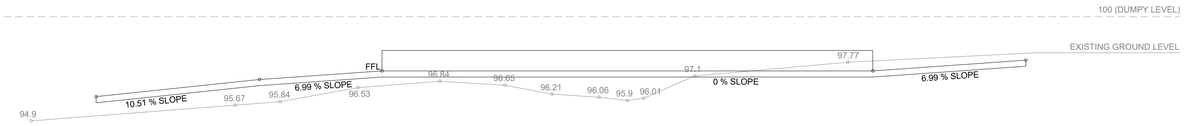
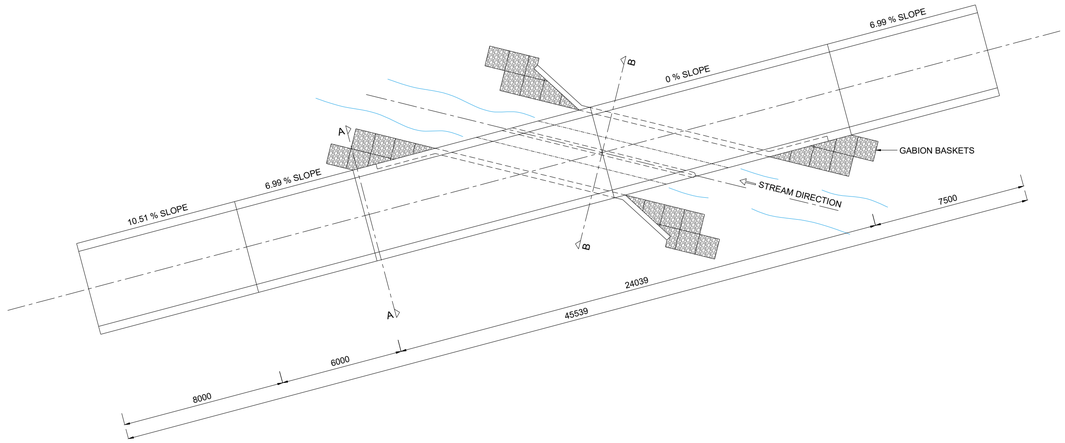
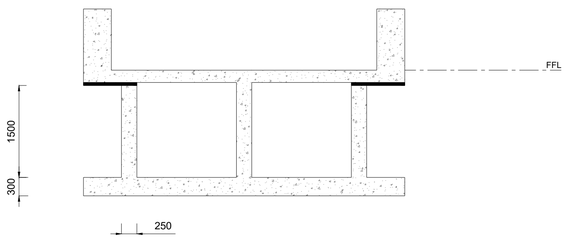


ELEVATION VIEW
SCALE: 1:150



PLAN VIEW
SCALE: 1:150



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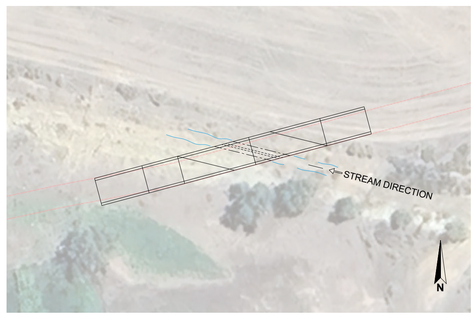

ON SITE VIEW
SCALE: 2:1

*NOTE: REFER TO FIGURE 1: MARKING NO 2 ON DESIGN REPORT.

LEGEND:

- CONCRETE

NOTES:

- DIMENSIONS IN MILLIMETERS.
- SITE SURVEYING AND MEASUREMENTS WERE DONE TO COMPLETE THESE DRAWINGS.
- THESE DRAWINGS ARE FOR INFORMATION AND NOT FINAL.

REV	DATE	DESCRIPTION	BY
R01	01-08-2025	ADDITIONS MADE	TR
R00	10-07-2025	INFORMATION	TR

REVISIONS

By:

FORE

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Client

KLEINFONTEIN

BRIDGE DETAIL

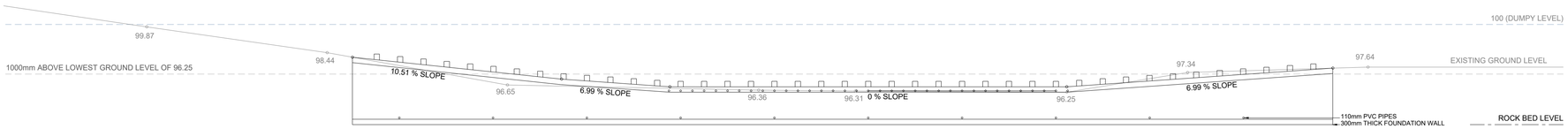
USE

INFORMATION

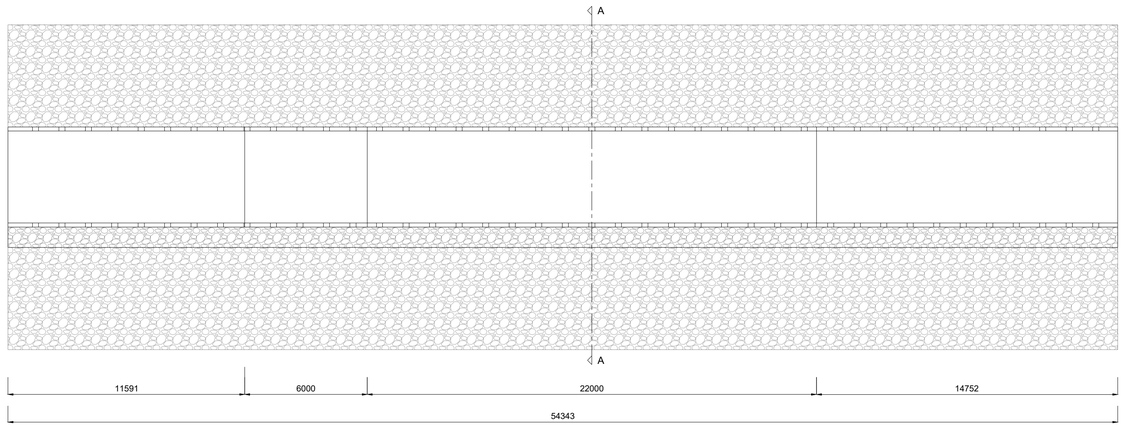
DRAWN	DATE	CHECKED	SCALE
TR	10-07-2025	WV/TR	AS SHOWN

DRAWING NUMBER

F 2 5 0 1 7	I	0 0 3	R 0 1
PROJECT NUMBER	DISC	DRAWING CODE	REVISION



ELEVATION VIEW
SCALE: 1:150



PLAN VIEW
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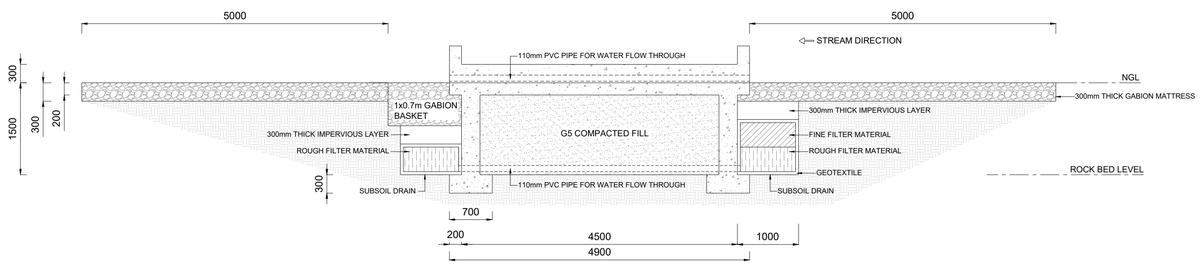

SECTION A-A
SCALE: 1:50

*NOTE: REFER TO FIGURE 1: MARKING NO 1 ON DESIGN REPORT.

ON SITE VIEW
SCALE: 2:1

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LOW WATERWAY BRIDGE 1 DETAIL

USE

INFORMATION

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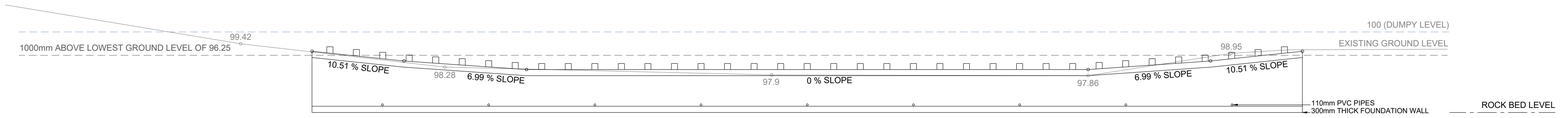
DRAWING NUMBER

F 2 5 0 1 7 I 0 0 1 R 0 1

PROJECT NUMBER | DISC | DRAWING CODE | REVISION



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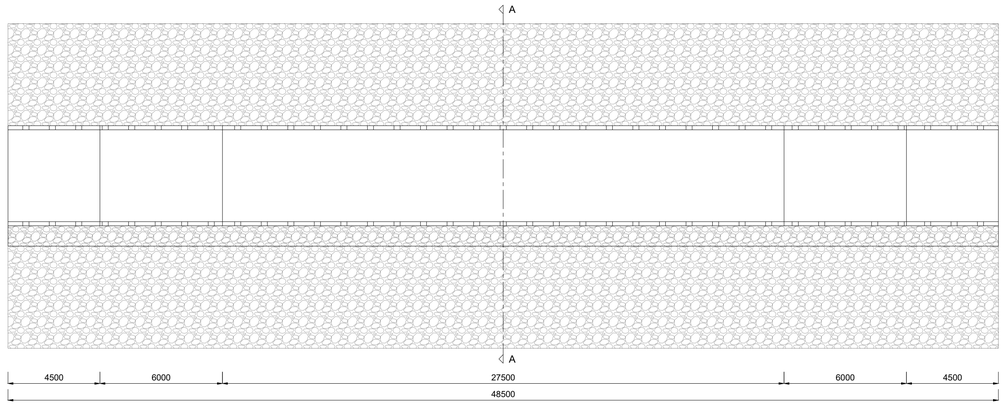

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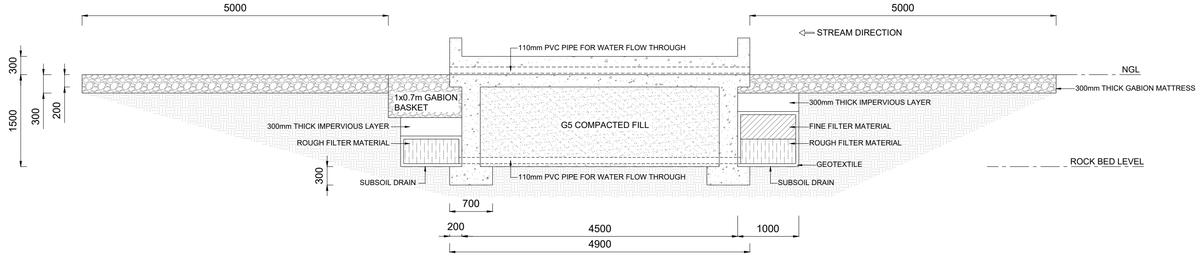

SECTION A-A
SCALE: 1:50

*NOTE: REFER TO FIGURE 1: MARKING NO 4 ON DESIGN REPORT.

ON SITE VIEW
SCALE: 2:1

LEGEND:

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LOW WATERWAY BRIDGE 2 DETAIL

USE

INFORMATION

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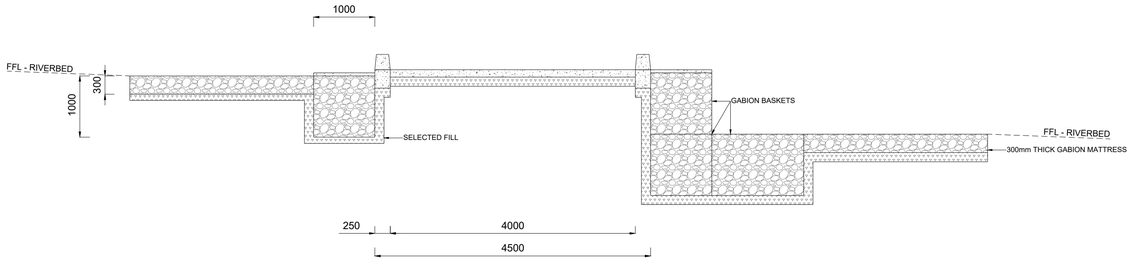
DRAWING NUMBER

F 2 5 0 1 7 I 0 0 2 R 0 1

PROJECT NUMBER | DISC | DRAWING CODE | REVISION



SECTION A-A
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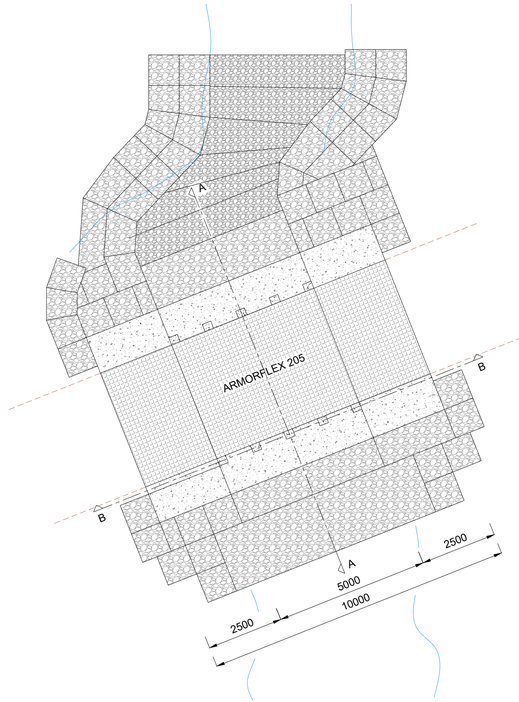

PLAN VIEW
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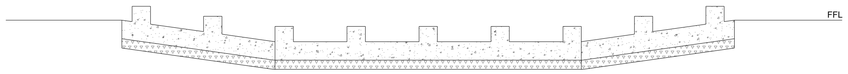

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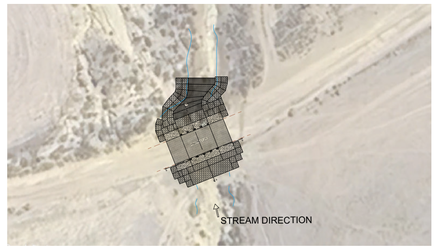

ON SITE VIEW
SCALE: 2:1

N

*NOTE: REFER TO FIGURE 1: MARKING NO 3 ON DESIGN REPORT.

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STREAM CROSSING DETAIL

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