Documentation of a number of
BRIDGE AND CULVERT STRUCTURES ON THE N10 NATIONAL ROAD
BETWEEN UPINGTON AND GROBLERSHOOP, NORTHERN CAPE PROVINCE

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Declaration:

I, J.A. van Schalkwyk, declare that I do not have any financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services.

J A van Schalkwyk (D Litt et Phil)
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May 2015

EXECUTIVE SUMMARY

DOCUMENTATION OF FOUR BRIDGES ON THE N10 NATIONAL ROAD BETWEEN UPINGTON AND GROBLERSHOOP, NORTHERN CAPE PROVINCE

It is the intention of the South African National Roads Agency Limited (SANRAL) to upgrade National Route N10 between Upington and Groblershoop in Northern Cape Province. The roadwork would include the upgrading of four bridges.

In accordance with the National Heritage Resource Act, an independent heritage consultant was appointed by **Chameleon Environmental Consultants** to evaluate and document the identified bridges in anticipation of SAHRA giving permission for their upgrading.

As no information could be obtained from any source on the construction of the bridges, the following approach was followed to determine their significance:

- A review of the technology and materials used in the construction of the two bridges was done.
- The history of the development of the N10 was reviewed in an effort to determine an approximate date for the construction of the bridges.
- The history of the larger region was reviewed to determine if any event of historical, cultural or political significance could be linked to any of the four bridges.

From the above information it was determined that these bridges does not exhibit any remarkable construction techniques, nor can they be linked to any event or person and that similar bridges are still to be found along the route. Therefore, the bridges are judged to have low significance on a regional level.

Therefore, from a heritage point of view it is recommended that the proposed development be allowed to continue, on condition of SAHRA's acceptance of the documentation presented.

J A van Schalkwyk
Heritage Consultant
May 2015

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DOCUMENTATION OF A NUMBER OF BRIDGE AND CULVERT STRUCTURES ON THE N10 NATIONAL ROAD BETWEEN UPINGTON AND GROBLERSHOOP, NORTHERN CAPE PROVINCE

1. INTRODUCTION

It is the intention of the South African National Roads Agency Limited (SANRAL) to upgrade National Route N10 between Upington and Groblershoop in Northern Cape Province. The roadwork would include the upgrading of five bridges and five culverts.

The current 10 structures are all in the region between 8.0m and 9.0m wide and do not comply with the required abnormal load width requirement of 12.4m. The purpose of this project is to widen the structures to a cross section of 12.4m that will enable safely and securely accommodate the current traffic and future abnormal loads. The current envisaged scope of work will include the following:

- Break down and remove current bridge balustrades and a portion of the decking;
- Excavate pier and abutment foundations in river bed;
- Extend piers and abutment walls by 1.8m to 2.2m on both sides;
- Widen existing concrete decks by 1.2m to 2.2m;
- New asphalt to bridge approaches and decks;
- Clearing of riverbed;
- Reshaping of riverbed;
- Installation of erosion protection;
- Concrete batching and mixing may be required on site.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), Act 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

As some of these structures are older than 60 years, and therefore enjoy general protection in accordance of the National Heritage Resource Act, No. 25 of 1999, an independent heritage consultant was appointed by **Chameleon Environmental** to evaluate and document the identified bridges and culverts in anticipation of SAHRA giving permission for their upgrading.

2. METHODOLOGY AND DETERMINATION OF SIGNIFICANCE

2.1 **Methodology**

2.1.1 *Previous experience*

A number of bridges in the Steelpoort River (Limpopo Province) were documented as part of a larger project for the Dept. of Water Affairs and Forestry (Van Schalkwyk 2010) as well as the documentation of bridges on the R104 (Van Schalkwyk 2011) and a sandstone bridge in KwaZulu-Natal (Van Schalkwyk 2009). Experience and terminology obtained during this project was applied during the current project.

2.1.2 *Literature*

Available literature, such as that of the US National Parks Services regarding documentation and conservation of bridges and other structures, were used as guideline in the documentation process.

An extensive archival search has revealed no information on the construction of the bridges under discussion.

2.1.3 *Field survey*

The various structures were visited on 26 and 27 May 2015. Basic drawings were made of each structure and they were photographically recorded by means of a Canon 550D camera. Measurements were taken by means of a Bosch PLR 30 Laser-instrument.

2.2 **Determination of significance**

As no information could be obtained from any source on the construction of the bridges and culverts, the following approach was followed to determine their significance:

- A review of the technology and materials used in the construction of the bridges was done.
- The history of the development of the N10 was reviewed in an effort to determine an approximate date for the construction of the bridges.
- The history of the larger region was reviewed to determine if any event of historical, cultural or political significance could be linked to any of the bridges and culverts.

From this it was concluded that none of the structures under consideration exhibit, in terms of the National Heritage Resources Act, Section 2 (vi), any aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

3. DESCRIPTION OF THE BRIDGES

3.1 **Historic overview**

Little information on the history of the N10 is available and the following is put together from a number of sources.

Donaldson (1924), in his encyclopaedic work on the road network in the early days of South African motoring, only shows routes going to and from Upington via Kenhardt or Kakamas. Apparently, at that stage, the predecessor of the N10 route did not exist or was not considered worth travelling on.

Originally the route south-eastwards from Upington to Prieska and further south followed a much more direct alignment, which was still in use by 1949 (Fig. 1). Based on the dates obtained from the various bridges, it seems as if the current alignment was constructed during the early 1950s. However, this does not imply that a road did not exist as a district road, which would have being required as a result of intensive farming activities in the region. It was only in 1977 decided to retain national route numbering for certain sections of existing roads, which seems to have led to the naming of the existing N10 national road (Floor 1985: 63).

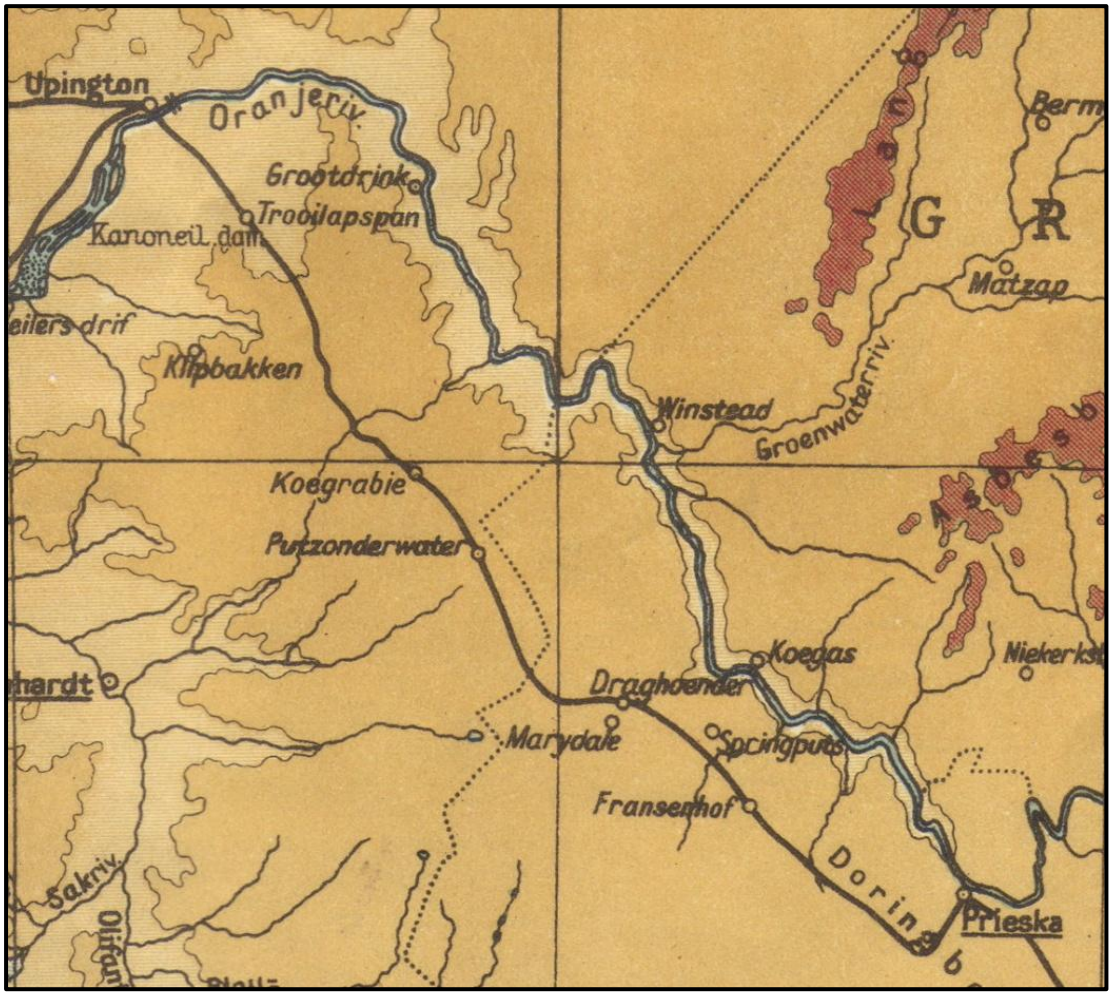

Fig. 1 Original alignment of the road.

3.2 **Recorded structures: Bridges**

A bridge is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle.

3.2.1 *Bridge 1* – Elmboogsloot River Bridge

Map	Municipality	Farm	Coordinates	Chainage
2821DB	!Kheis	Boegoeberg 48	S 28.67161, E 21.79467	35.0

Construction date: Unknown, probably middle 1950s.

Fig. 2. Views of the bridge.

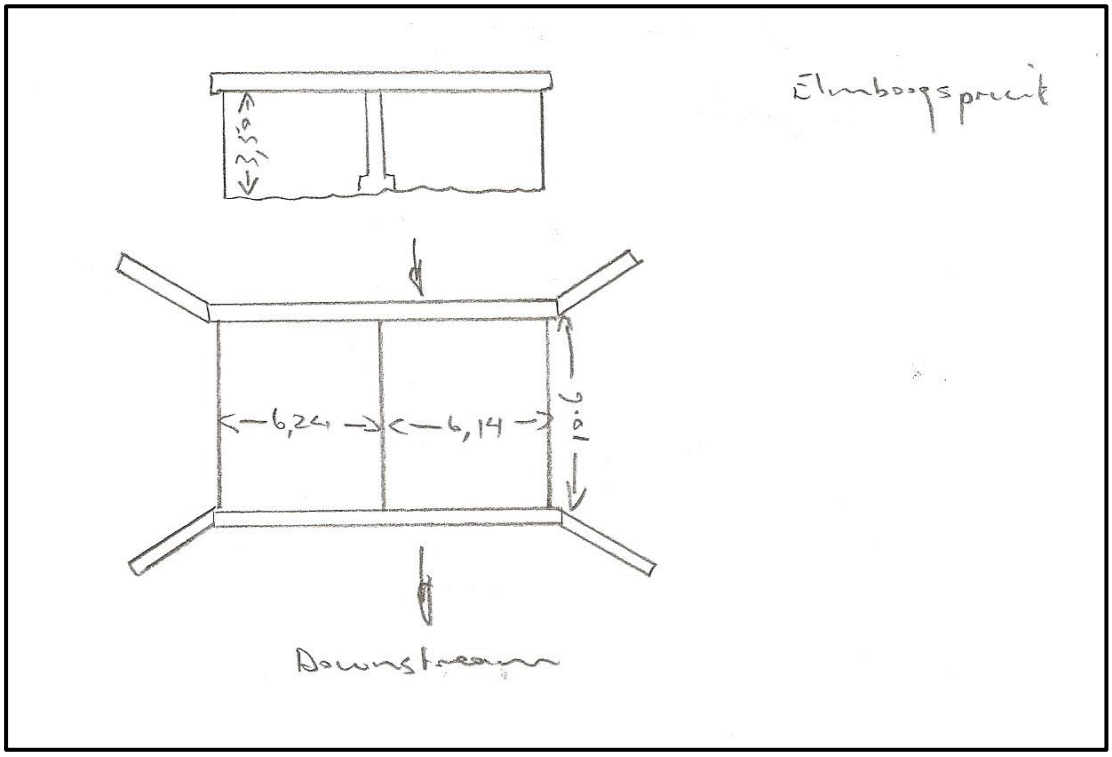

Fig. 3. Main dimensions of the bridge.

3.2.1.1 *Classification*

The Elmboogsloot River Bridge can be classified as a **two span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by one column.

3.2.1.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.2.1.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
T*he road leading up to the bridge on both sides.*

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- A single column supports the bridge deck. It is from cast concrete and is set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundation of the column is square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None

Railing:
Consists of a steel structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Abutment wall


Column

Fig. 4. Bridge elements

3.2.2 *Bridge 2* **–** Swartkopsleegte River Bridge

Map	Municipality	Farm	Coordinates	Chainage
2821BC	//Khara Hais	Karos	S 28.43803, E 21.43508	67.2

Construction date: 1956

Fig. 5. Views of the bridge.

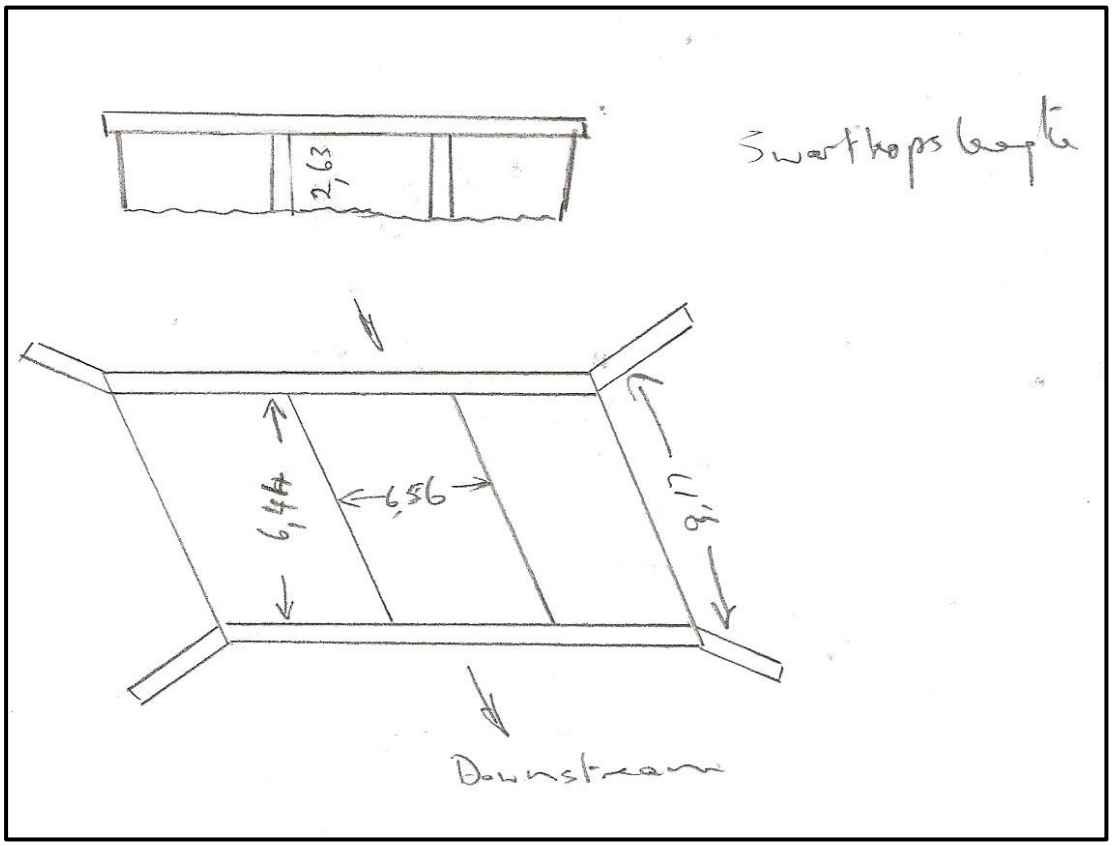

Fig. 6. Main dimensions of the bridge.

3.2.2.1 *Classification*

The Swartkopsleegte River Bridge can be classified as a **three span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by two columns.

3.2.2.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.2.2.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- Two columns support the bridge deck. They are all from cast concrete and are set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundations of the columns are square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- The guide rail is a raised platform of concrete, edged with angle iron that runs the length of the bridge.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- The pylons are rounded shaped slabs of concrete located on the corners of the bridge. Usually the number of the bridge and the date of construction are added to this.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The original railings were of concrete consist of a number of uprights and two horizontal railings attached to them. The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Pylon with date


Railing

Fig. 7. Bridge elements

3.2.3 *Bridge 3* **–** Matjes River Bridge

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Matjes Rivier 4	S 28.45639, E 21.40861	93.2

Construction date: 1954

Fig. 8. Views of the bridge.

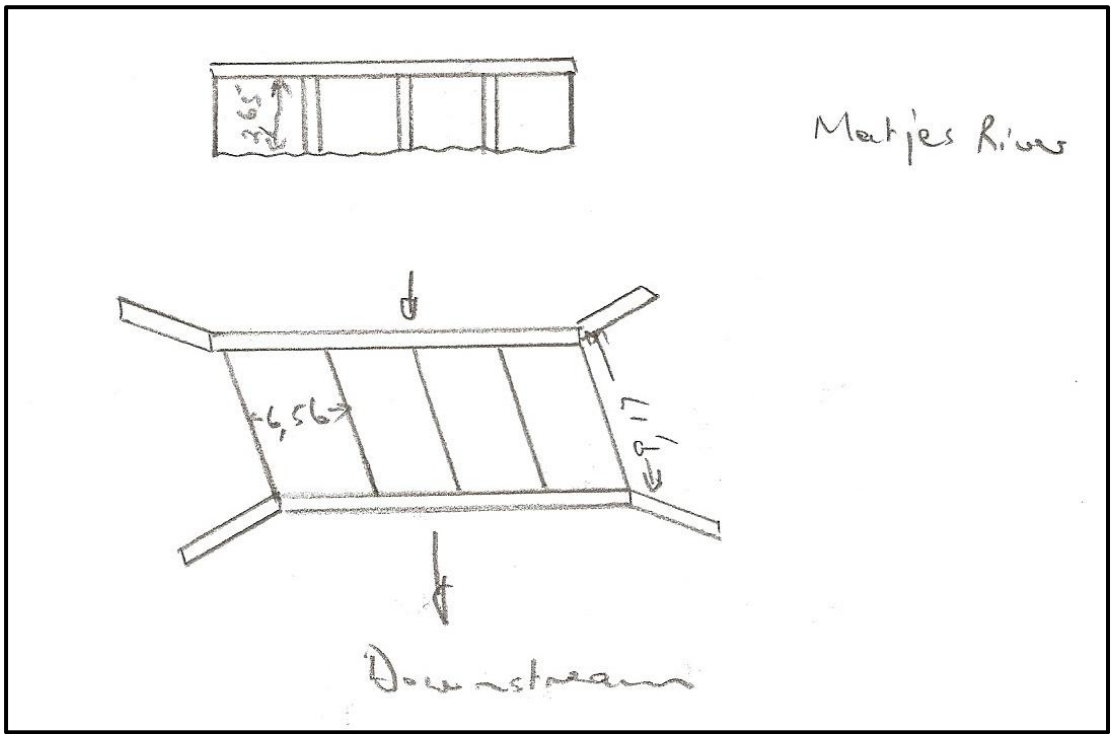

Fig. 9. Main dimensions of the bridge.

The remains of a structure that must have been the foundations of an older river crossing is still noticeable below the bridge (Fig. 10).

Fig. 10. Old foundation structures

3.2.3.1 *Classification*

The Matjes River Bridge can be classified as a **four span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by three columns.

3.2.3.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.2.3.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:

Vertical structure member used to support the load of the bridge deck.

- Three columns support the bridge deck. They are all from cast concrete and are set at a slight angle to the bridge deck in order to be parallel to the stream bed. The foundations of the columns are square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- The guide rail is a raised platform of concrete, edged with angle iron that runs the length of the bridge.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- The pylons are rounded shaped slabs of concrete located on the corners of the bridge. Usually the number of the bridge and the date of construction are added to this.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The original railings were of concrete consist of a number of uprights and two horizontal railings attached to them. The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Pylon with date


Railings

Fig. 11. Bridge elements

3.2.4 *Bridge 4* **–** Gifkloof River Bridge

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Matjes Rivier 4	S 28.44230, E 21.66239	96.6

Construction date: 1954

Fig. 12. Views of the bridge.

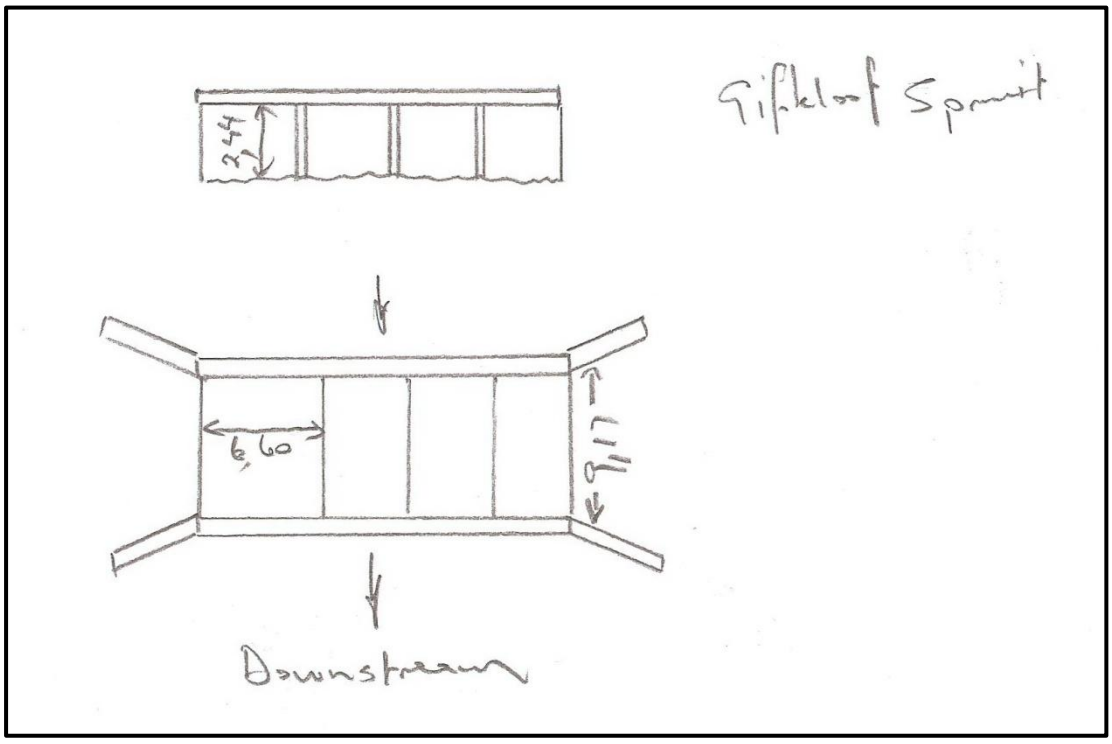

Fig. 13. Main dimensions of the bridge.

The remains of a structure that must have been the foundations of an older river crossing is still noticeable below the bridge (Fig. 14).

Fig. 14. Old foundation structures

3.2.4.1 *Classification*

The Gifkloof River Bridge can be classified as a **four span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by three columns.

3.2.4.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.2.4.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- A single column supports the bridge deck. It is from cast concrete and is set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundation of the column is square shaped.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- The guide rail is a raised platform of concrete, edged with angle iron that runs the length of the bridge.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- The pylons are rounded shaped slabs of concrete located on the corners of the bridge. Usually the number of the bridge and the date of construction are added to this.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The original railings were of concrete consist of a number of uprights and two horizontal railings attached to them. The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Pylon with date


Damaged railings

Fig. 15. Bridge elements

3.2.5 *Bridge 5* **–** Louisvale River Bridge

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Upington	S 28.47175, E 21.27878	112.1

Construction date: 1953

Fig. 16. Views of the bridge.

Due to deep water level and dense vegetation growth (Fig. 16), all the measurements could not be completed.

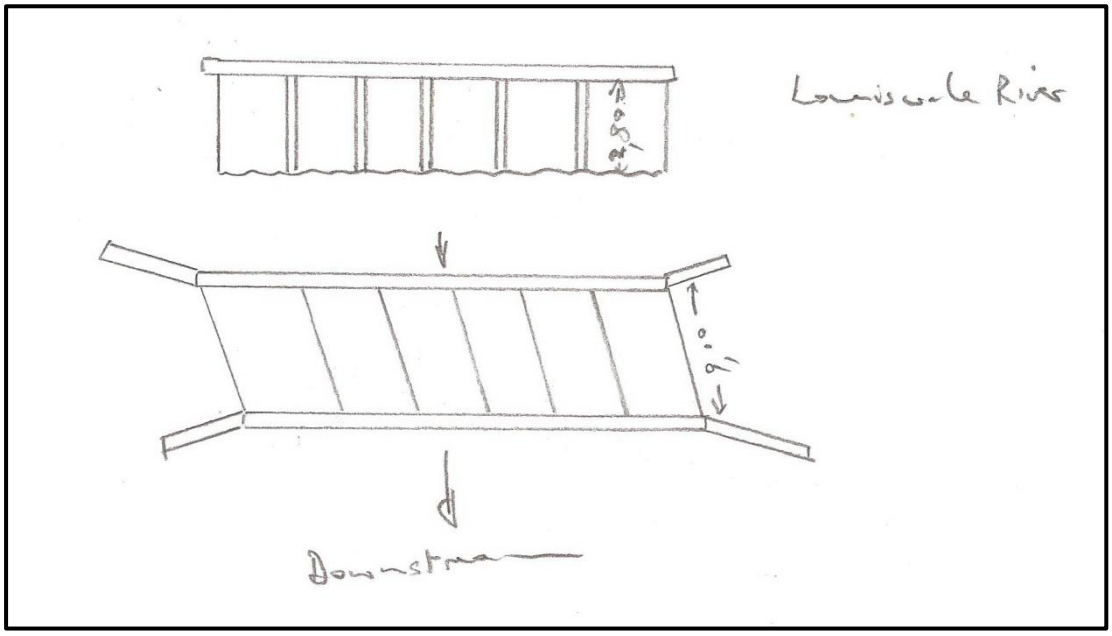

Fig. 17. Main dimensions of the bridge.

3.2.5.1 *Classification*

The Louisvale River Bridge can be classified as a **six span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by five columns.

3.2.5.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.2.5.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.
- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- Six columns support the bridge deck. They are all from cast concrete and are set at a slight angle to the bridge deck in order to be parallel to the stream bed. The foundations of the columns are square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- The guide rail is a raised platform of concrete, edged with angle iron that runs the length of the bridge.

Pylon:

A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- The pylons are rounded shaped slabs of concrete located on the corners of the bridge. Usually the number of the bridge and the date of construction are added to this.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The original railings were of concrete consist of a number of uprights and two horizontal railings attached to them. The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Pylon with date


Dense vegetation growth

Fig. 18. Bridge elements

3.3 Recorded structures: culverts

A culvert is a structure that allows the easy passage of water through a physical obstruction that can be a hill or a roadway or a passage or a walkway. Many culverts function as soil-structure interaction systems, relying heavily on the surrounding soil for support. Unlike bridges, culverts have no distinct separation of substructure and superstructure. Culverts often carry significant amounts of soil overburden loads while bridges generally do not.

3.3.1 *Culvert 1* – Boegoeberg Stream Culvert

Map	Municipality	Farm	Coordinates	Chainage
2821BC	//Khara Hais	Farm 943	S 28.48306, E 21.68729	61.9

Construction date: Unknown, probably middle 1950s.

Fig. 19. Views of the bridge.

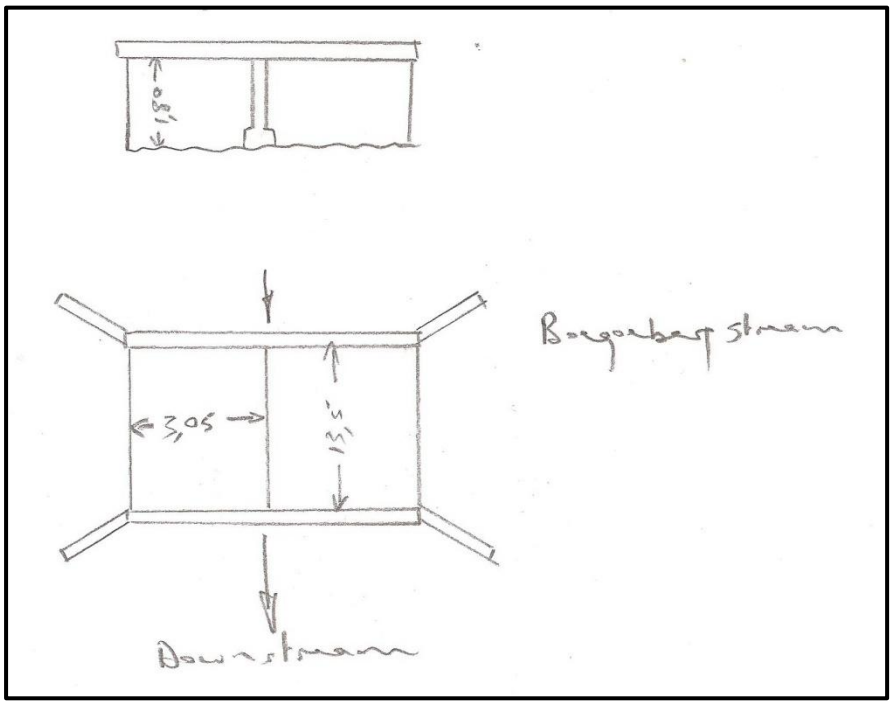

Fig. 20. Main dimensions of the culvert.

3.3.1.1 *Classification*

The Boegoeberg Stream Culvert can actually be classified as a **two span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by one column.

3.3.1.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.3.1.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- A single column supports the bridge deck. It is from cast concrete and is set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundation of the column is square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The original railings were of concrete consist of a number of uprights and two horizontal railings attached to them. The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Wing wall


Water course

Fig. 21. Bridge elements

3.3.2 *Culvert 2* – Vaalkoppies Stream 1 Culvert

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Vaal Koppies 40	S 28.45068, E 21.31184	107.75

Construction date: Unknown, probably middle 1950s.

Fig. 22. Views of the bridge.

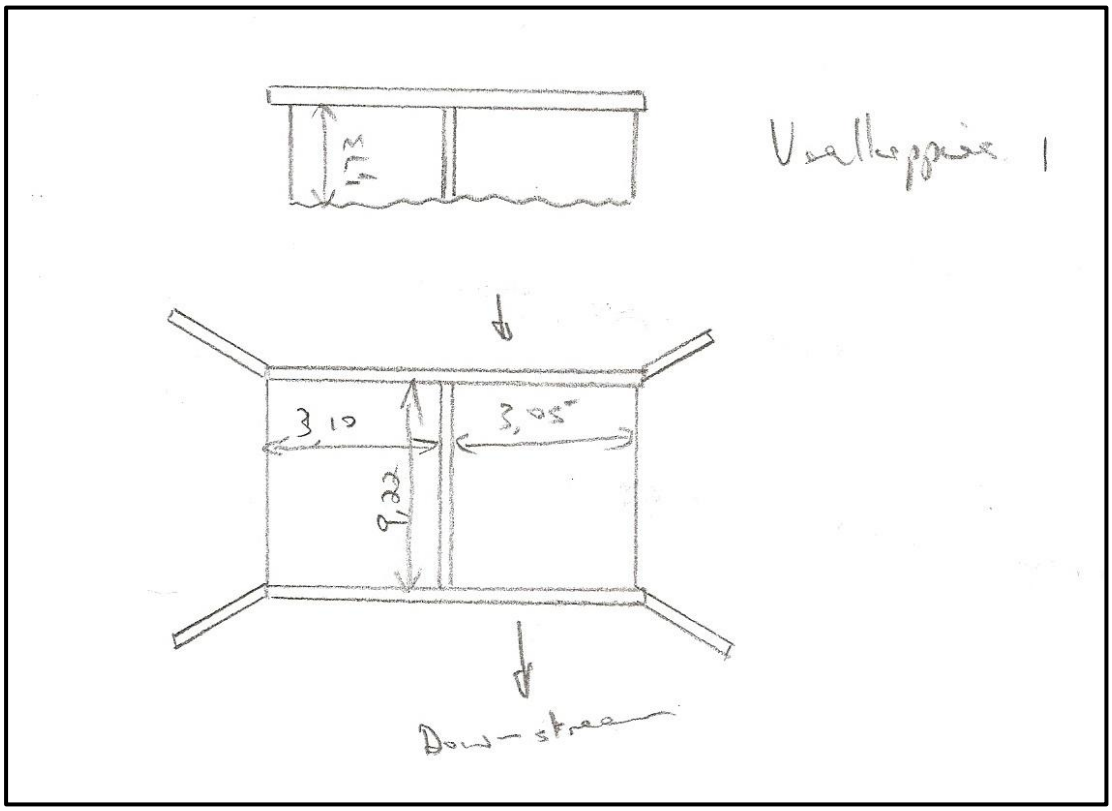

Fig. 23. Main dimensions of the culvert.

3.3.2.1 *Classification*

The Vaalkoppies Stream 1 Culvert can actually be classified as a **two span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by one column.

3.3.2.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.3.2.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- A single column supports the bridge deck. It is from cast concrete and is set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundation of the column is square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Railings


Wingwall

Fig. 24. Bridge elements

3.3.3 *Culvert 3* – Vaalkoppies Stream 2 Culvert

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Vaal Koppies 40	S 28.45301, E 21.30356	108.6

Construction date: Unknown, probably middle 1950s.

Fig. 25. Views of the bridge.

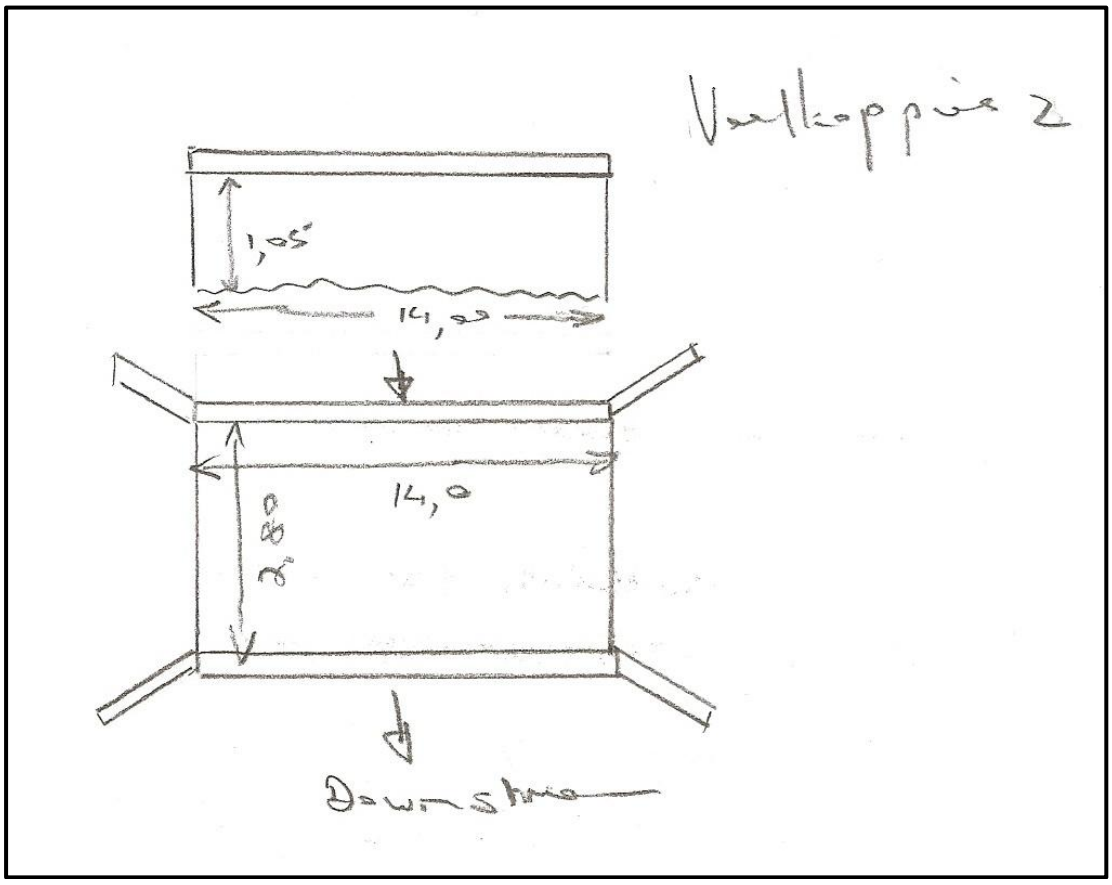

Fig. 26. Main dimensions of the culvert.

3.3.3.1 *Classification*

The Vaalkoppies Stream 2 Culvert can be classified as a **box culvert** as the spanning superstructure extends from one vertical support, called abutment, to another.

3.3.3.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.3.3.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None.

Railing:

Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- None.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Wingwall


River course

Fig. 27. Bridge elements

3.3.4 *Culvert 4* – Vaalkoppies Stream 3 Culvert

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Vaal Koppies 40	S 28.45745, E 21.29032	109.95

Construction date: Unknown, probably middle 1950s.

Fig. 28. Views of the bridge.

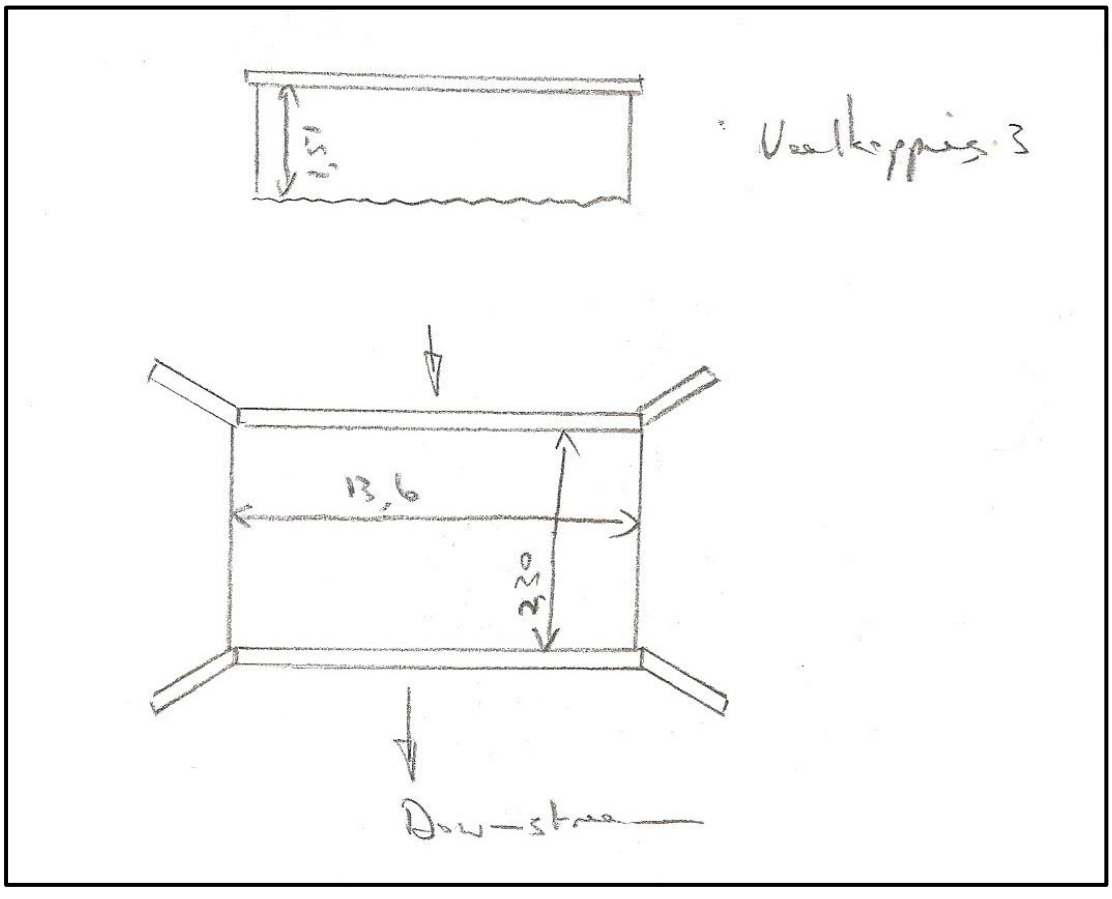

Fig. 29. Main dimensions of the culvert.

3.3.4.1 *Classification*

The Vaalkoppies Stream 3 Culvert can be classified as a **box culvert** as the spanning superstructure extends from one vertical support, called abutment, to another.

3.3.4.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.3.4.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.

- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None.

Pylon:
A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None.

Railing:

Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- None.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


River course


Wingwall

Fig. 30. Bridge elements

3.3.5 *Culvert 5* – Louisvale Stream 1 Culvert

Map	Municipality	Farm	Coordinates	Chainage
2821AD	//Khara Hais	Upington	S 28.47677, E 21.27013	113.3

Construction date: Unknown, probably middle 1950s.

Fig. 31. Views of the bridge.

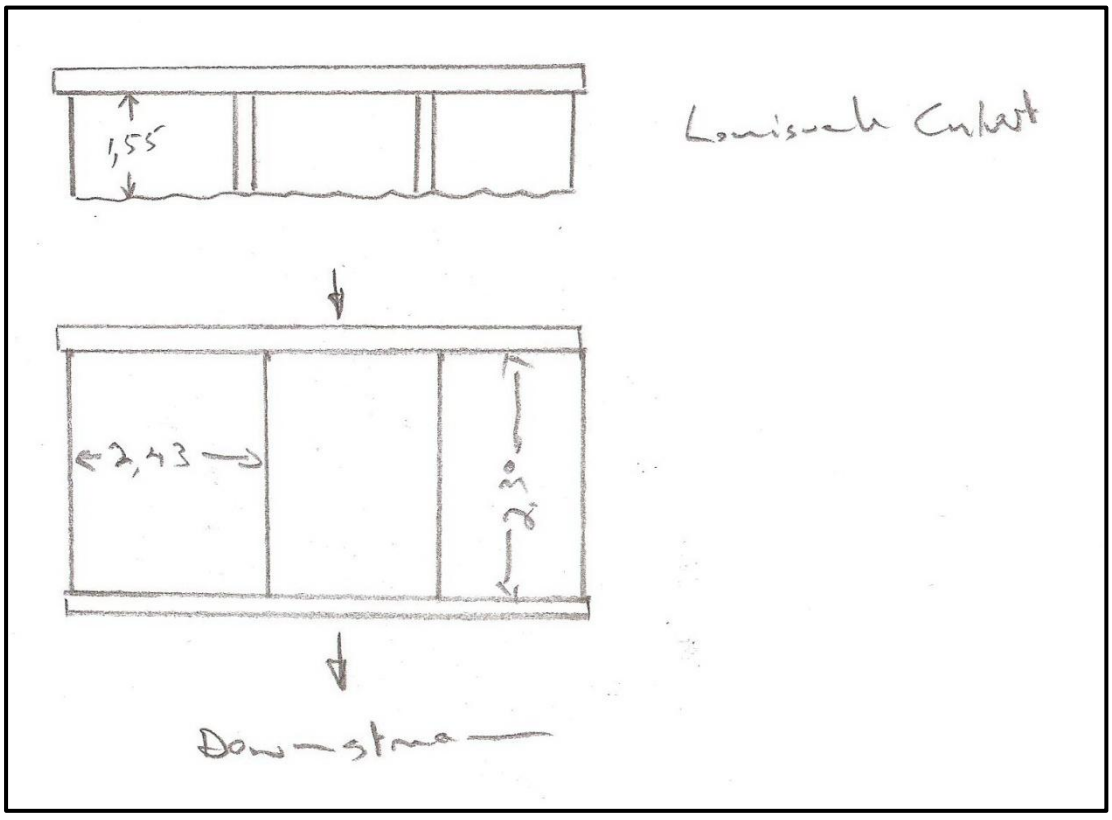

Fig. 32. Main dimensions of the culvert.

3.3.5.1 *Classification*

The Louisvale Stream 1 Culvert can actually be classified as a **three span** bridge as the spanning superstructure extends from one vertical support, called abutment, to another, being supported by two columns.

3.3.5.2 *Materials*

The material used in the construction of the bridge is cast concrete. The latter technique, although used to some extent prior to that, came into 'fashion' only during the Second World War as iron and for that matter all metals was declared a strategic resource. The use of iron was limited to the minimum and was only used for guide rails and other railings, as well as for reinforcing the concrete.

3.3.5.3 *Bridge elements*

The various elements making up the bridge will be discussed and illustrated in alphabetic order.

Abutment Wall:
Part of a structure which supports the end of a span or accepts the thrust of the arch; it often supports and retains the approach embankment.

- The walls are constructed from concrete that was cast in slabs.

Approach Road:
The road leading up to the bridge on both sides.
- The approach road runs between Upington and Groblershoop and carries a large volume of traffic.

Bridge Deck:
The roadway portion of the bridge that carries the traffic.

- The bridge deck seems to be a single concrete slab reinforced by girders. The top layer of the bridge deck consists of concrete, which is also part of the construction of the bridge and is then covered with a layer of tarmac.

Columns:
Vertical structure member used to support the load of the bridge deck.

- Two columns support the bridge deck. They are all from cast concrete and are set at a right angle to the bridge deck in order to be parallel to the stream bed. The foundations of the columns are square.

Embankment:
Angled grading of the ground, leading up to the bridge.

- Formed by packing down soil to achieve the necessary height and then sloping down gradually the further away one moves from the river.

Guide rail:
A low railing alongside the outer edge of a bridge deck used to protect vehicles and pedestrians from going too close to the edge.

- None.

Pylon:

A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

- None.

Railing:
Consists of a steel/concrete structure made up of a number of upright sections or stanchions, on which horizontal railings are suspended.

- The current railings are reinforced by Armco crash barriers.

Revetment:
A facing of masonry or stones to protect an embankment from erosion.

- The revetment walls are constructed from cast concrete. The base of the wings has a foundation that possibly extends down to the bedrock.


Railings


Watercourse

Fig. 33. Bridge elements

4. STATEMENT OF SIGNIFICANCE

As no information could be obtained from any source on the construction of the bridges, the following approach was followed to determine their significance:

- A review of the technology and materials used in the construction of the four bridges was done.
- The history of the development of the N10 was reviewed in an effort to determine an approximate date for the construction of the bridges.
- The history of the larger region was reviewed to determine if any event of historical, cultural or political significance could be linked to any of the two bridges.

From the above information it was determined that these bridges does not exhibit any remarkable construction techniques, nor can they be linked to any event or person and that similar bridges are still to be found along the route. Therefore, the bridges are judged to have low significance on a regional level.

Therefore, from a heritage point of view it is recommended that the proposed development be allowed to continue, on condition of SAHRA's acceptance of the documentation presented in this report.

5. REFERENCES

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National Archives of South Africa

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Van Schalkwyk, J.A. 2015. Bridging the country: a short history of nearly all South African bridges. *South African Archaeological Bulletin* in press.

4.3 **Maps and aerial photographs**

1: 50 000 Topocadastral maps
Google Earth

APPENDIX 1. SPECIALIST COMPETENCY

Johan (Johnny) van Schalkwyk

J A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 30 years. Based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape, Northern Cape, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 60 papers, many in scientifically accredited journals. During this period he has done more than 2000 impact assessments (archaeological, anthropological historical and social) for various government departments and developers. Projects include environmental management frameworks, road-, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.