NORTHERN CAPE CORRIDOR DESIGN REPORT

CLIENT

TRANSNET GROUP CAPITAL

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1 Introduction

Transnet intends to investigate opportunities to support government initiatives to expand and strengthen economic activity in the Northern Cape province. Major economic activities currently include mining, agriculture, tourism and renewable energy generation. Both mining and agricultural producers must deal with long logistics chains to move export commodities to suitable ports – most of which are located in neighbouring Western and Eastern Cape provinces.

Transnet is therefore considering the development of a deepwater port at Boegoebaai, a naturally deep harbour mouth located near the RSA-Namibia border. The port development would ideally be partnered with a rail transport solution to inland locations.

The aim of this study therefore is to consider and develop a range of plausible greenfields rail route options from Boegoebaai to suitable inland locations. Based on their existing rail connectivity to the broader national rail network and various mining and agricultural activities, the following three end destinations were considered:

- Upington,
- Prieska, and
- Postmasburg.

Apart from the three final destinations, the following important intermediate locations were also connected by the routes:

- Gamsberg,
- Kakamas.

These locations also have significant economic activities that will benefit from rail connectivity to a Boegoebaai port.

2 Approach

The study commenced with a high-level market assessment to identify areas of production and consumption within the Northern Cape province and thereby establish potential attractive rail corridors. Connectivity with other rail links was also a key consideration.

A review of previous studies and initiatives relating to the establishment of new transport links and port developments within the Northern Cape was completed to gain an appreciation of the pertinent transportation issues in the project area.

Future potential rail services were identified in the form of Origin-Destination pairs with accompanying volumes forecast and parcel type/s to inform train configuration and design standards.

Design criteria were established for each rail corridor studied based upon the type of rail service/s proposed for it. Rail route alignment options were determined for each corridor, including high-level capital cost estimates. Advantage was taken of existing infrastructure. Where existing lines could be utilised the routes tied into them ahead of final route destinations to avoid duplication of existing infrastructure.

Requisite publicly available data for the study was collected from various sources. The data collected included:

- List of probable commodities to be transported and their origins and destinations;
- Project area Shuttle Radar Topography Mission (SRTM) topography data;
- Online aerial imagery;
- Project area aerial imagery;
- Project area existing Rail routes;
- Project area existing Roads routes;

The data collected was reviewed on aspects such as reliability, adequacy and consistency. The data was then analysed to provide suitable input for the study.

Output from the analysis included a Computer Aided Design (CAD) background model of the project area that combined aerial photography, topography, and geospatial data of the project area to guide the high-level corridor determination. Based on the CAD design background, high-level rail route corridors were determined to connect the proposed Boegoebaai Port location with the three identified inland locations. The identified routes took account of:

- Towns that need to be accessed;
- Terrain of project area;
- Requisite horizontal and vertical rail alignment in view of the specified design criteria.

High level route costing was done base on a per km cost of rail line, allowing for high intensity cost items of bridges and tunnels separately.

The design of yards and sidings is beyond the scope of the study. Thus no yards and sidings were designed at the various locations connected by the routes identified.

3 Opportunities Analysis

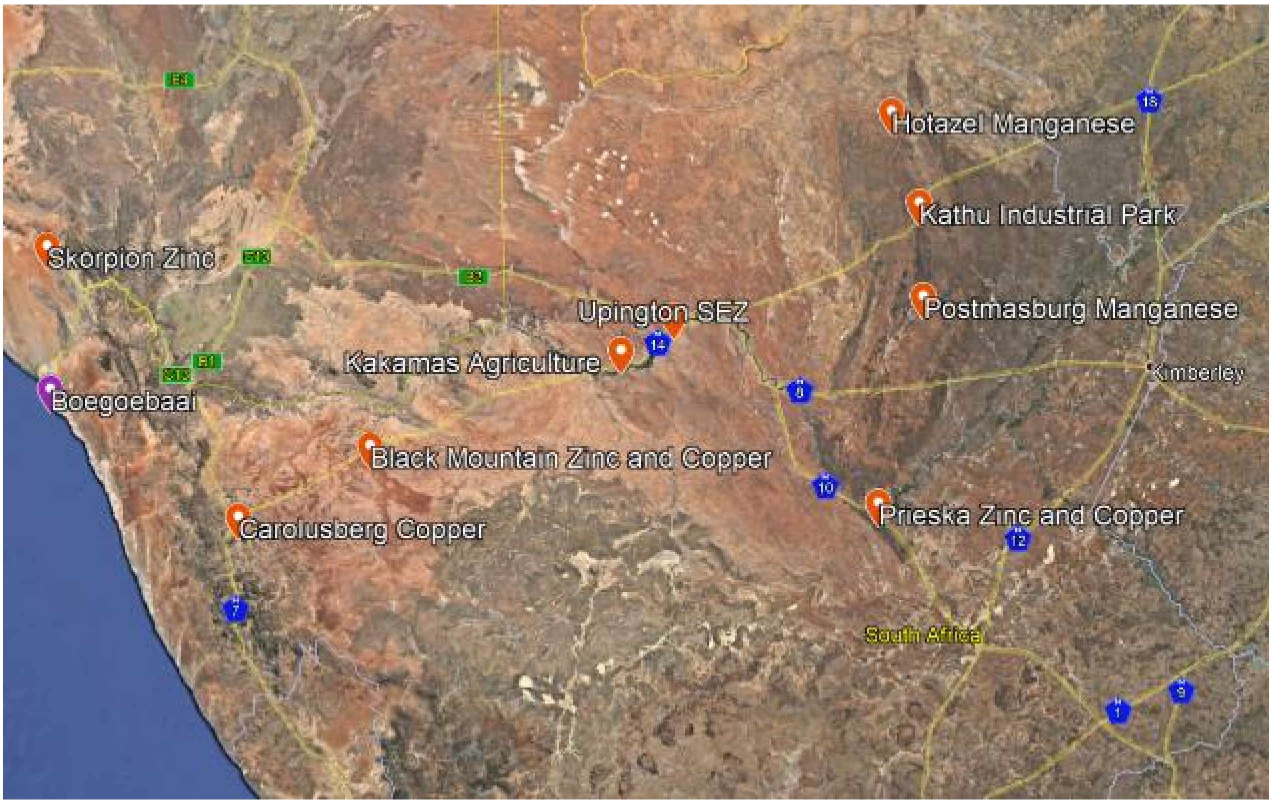

Figure 1: Opportunities Overview

The economic activities with potential rail transportation within the Northern Cape are depicted in Figure 1 above and discussed in the sections that follow.

3.1 Upington SEZ

Figure 2: Upington SEZ

The Upington Special Economic Zone (SEZ) is a business entity of the Northern Cape provincial government, responsible for leading a manufacturing revolution in the renewable and solar energy, mining, agricultural, aeronautical and other sectors. (Upington SEZ, 2019)

The SEZ aims to attract investment in processing and packaging of agricultural produce and the manufacture/assembly of equipment for the local mining and energy sectors.

The SEZ is located on the northern end of town along the R360. The area is presently rail-connected with multiple siding lines linking to the Upington rail yard. The yard and associated lines are non-electrified.

3.2 Kathu Industrial Park

Figure 3: Kathu Industrial Park

The Kathu Industrial Park aims to provide space for local industrial and commercial activities stemming from the growth in mining and renewable energy sectors. (KIP, 2019). The park is located on the southern outskirts of Kathu, less than 5 km from the Erts private rail siding (Ore Line), and 20 km from the Droespruit rail station (Manganese Line)

3.3 Black Mountain Zinc and Copper Mine

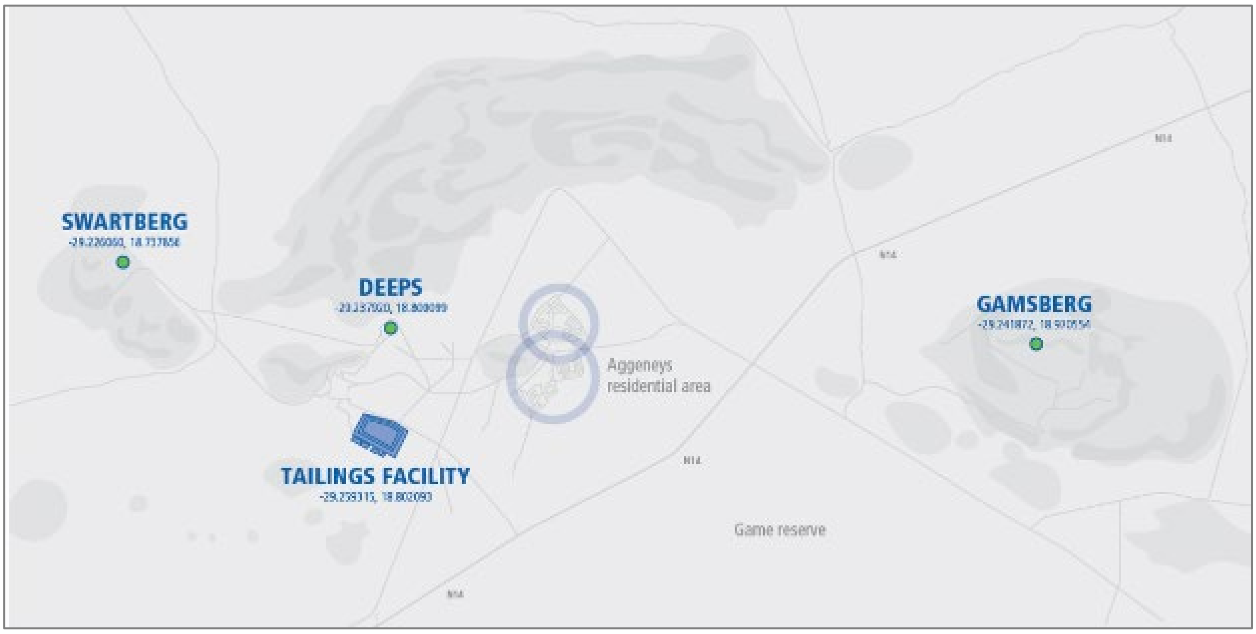

Figure 4: Black Mountain Vedanta

Vedanta produces copper and zinc from their Black Mountain Mining complex (BMM) at Aggeneys. Commodities are currently transported by road to Loop 10, also known as “Halfweg” on the Sishen-Saldanha Ore line where they are transferred onto trains and railed to the port of Saldanha. Current production is 115 000 t/a combined concentrates.

BMM is also developing its larger Gamsberg mine which was officially opened in February 2019 (Vedanta Zinc International, 2019). Production of various metal-in-concentrates may be exported or transported over-border to the Vedanta Skorpion refinery in Namibia. Planned production rump up is as follows:

- Phase 1: 250 000 t/a of concentrates
- Phase 2: 450 000 t/a of concentrates + 350 000 t/a of sulphuric acid which may be used to produce fertiliser.

The Vedanta Skorpion Zinc complex across the border in Namibia has a production capacity of 150 000 t//a of refined zinc (current est. 90 000). (Vedanta Zinc International, 2019)

3.4 Hotazel and Postmasburg Manganese Mines

The Hotazel and Postmasburg region is host to a number of Manganese mines. Established mines include:

- South32 Wessels and Mamathwane,
- Glosam,
- Lohatla, and
- Beeshoek

New developments are also underway at Bokkoppie.

Existing mining activities are supported by two major rail logistics chains; to Saldanha Port via the Iron Ore line and to Port Elizabeth Port via the Manganese Line. A route via Gauteng to Port of Durban is also utilised to a lesser degree. This suite of logistics solutions is however not optimised for Manganese exports, with capacity constraints on each rail route and limited capacity within the respective port terminals. A corridor to Boegoebaai port is therefore considered as an alternative to upgrading one or more of the existing routes. The potential manganese volume for the Boegoebaai corridor may be up to 6 – 9Mtpa. However this is highly dependent on the allocation strategy between the existing route and port systems.

3.5 Prieska Zinc Copper Project

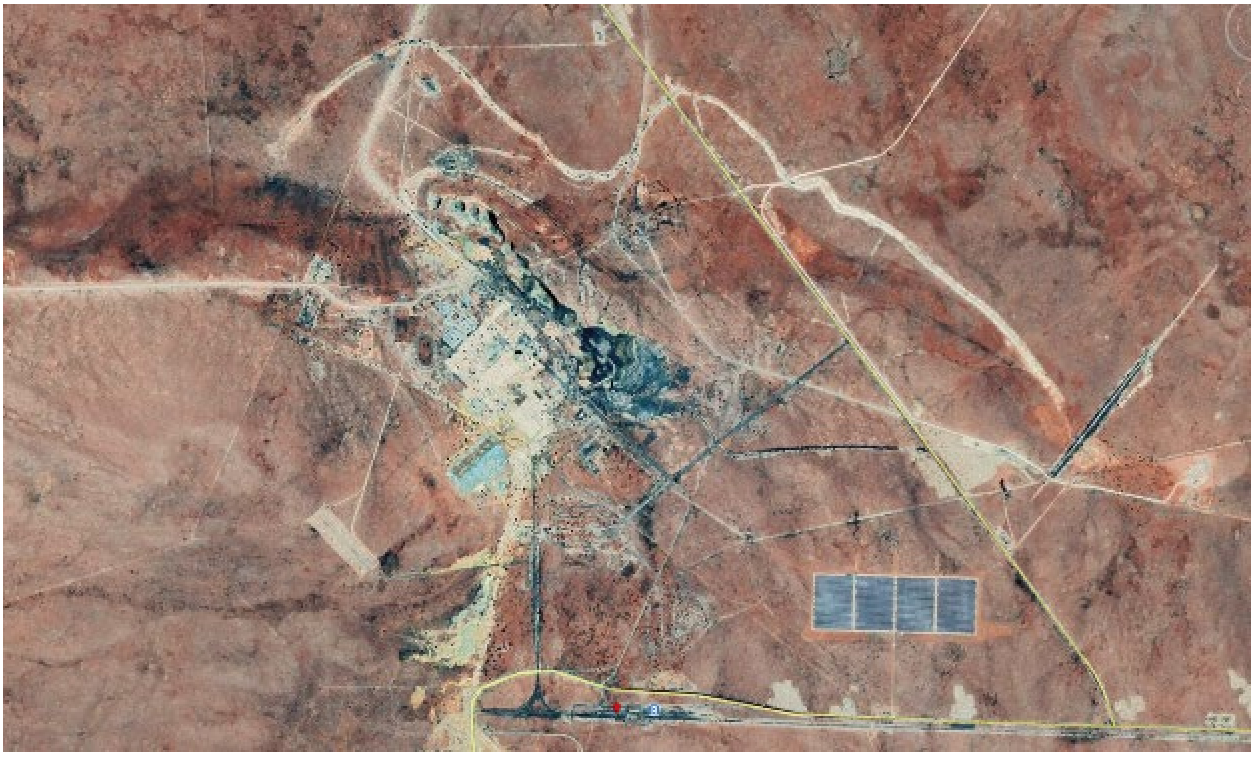

Figure 5: Prieska Region

Orion Minerals intends to reopen the Prieska copper and zinc mine. One of the current potential logistics solutions involves transit via road to the Groveput railway station, trans-loading, and transport via road to Coega port. (Seccombe, 2019). Expected volumes are:

- 18 900 t/a copper concentrate
- 58 000 t/a zinc concentrate

3.6 Carolusberg Copper

The tailings dams of the closed Carlusberg and O'Kiep copper mines are being investigated for reprocessing. (xtract resources, 2019). The mines are located along the N7 highway within 10 km of the town of Springbok. Previously the Okiep (and nearby Nababeep) mine were connected by narrow gauge rail to Port Nolloth, however this line has been out of commission since 1940, (Conradie, 2010).

3.7 Kakamas – Upington Agricultural Produce

The region adjacent to the Orange river is home to many farms with agricultural produce including grapes, dates, nuts and livestock. Much of this produce is destined for export and could therefore be considered for routing to Boegoebaai. The region has been serviced in previous years by a 20 t/a rail line running on the northern side of the river. At Upington the Kakamas branch line joins to the main line connecting Nakop to De Aar.

3.8 Existing Rail Networks

The Northern Cape is traversed by various rail lines which present options for interconnectivity with the Greenfields line.

Table 1: Northern Cape Freight Rail

Route	***Line Type***	***Axle Load***	***Electrification***	***Ruling Gradient***	***Maximum Train Length***
Sishen – Saldanha	*Heavy Haul*	*30t/a*	*50kV AC*	*1:250*	*375*
Nakop – De Aar	*General Freight*	*20t/a*	*None*	*-*	*-*
Hotazel – Kimberley	*General Freight*	*20t/a*	*3kV DC*	*1:80*	*208*
Upington – Kakamas	*Branch Line*	*20t/a*	*None*	*-*	*40*

3.9 Summary

The high-level market assessment has identified potential rail cargo sources at seven (7) locations within the Northern Cape. These are summarised as follows:

- Upington SEZ – General Freight
- Kathu IDZ – General Freight
- Vendanta Aggeneys – Copper and Zinc Ore
- Hotazel/Postmasberg – Manganese Ore
- Prieska – Copper Ore
- Colusberg – Copper and Zinc Ore
- Kakamas/Upington – Agricultural produce

4 Potential Rail Corridors

The Origin-Destination pairs identified in the Opportunities Analysis are packaged into three potential rail corridors serving a proposed Boegoebaai port.

4.1 Boegoebaai – Upington (via Gamsberg, Kakamas)

The prevalence of existing rail network in the Northern Cape can be leveraged by creating a new ‘Western Export corridor’ connecting Upington to Boegoebaai. Upington would function as a collection point for various commodity sources from the Postmasburg, Prieska and Kathu regions.

The train service on this corridor is considered as general freight owing to the potential mix of commodities.

4.2 Boegoebaai – Prieska (via Gamsberg)

A high-value minerals corridor could connect boegoebaai to Gamsberg and Prieska to serve current as well as developing mine activities. The train service on this corridor would carry bulk minerals or break bulk – depending on clients’ preferred parcel types. The potential rail volume is less than 2 Mtpa.

4.3 Boegoebaai – Postmasburg

The expanding Manganese mining activities in the Hotazel/ Postmasburg regions have exceeded the capacity of Port Elizabeth harbour, causing overflow exports via Saldanha and Durban ports. Neither of these port complexes are well suited to bulk Manganese; creating the opportunity to redirect to Boegoebaai whilst also capturing new growth.

5 Design Data Analysis

The main objective of the study was the determination of viable railway corridor routes to connect a proposed port at Boegoebaai with selected inland locations. The viability of such routes is dependant to a large extent on the cost effectiveness of the railway infrastructure, which is in turn driven by the rail corridor route length and characteristics.

5.1 Design Data

The design data gathered for the study centred on the characteristics of the project area in terms of terrain and geospatial characteristics such as settlements, existing rail and road infrastructure, and water bodies. Since the study was high level in nature, the design data required did not have to be in-depth, consequently, publicly available data was found to be adequate for the level of detail and accuracy needed for the study and were used. Data of higher level of detail and accuracy would be required in future phases of the project as the accuracy requirements increase.

5.1.1 Terrain Data

Terrain data is vital to the determination of a viable railway corridor since a significant proportion of the capital expenditure requirement is directly dependant on the terrain traversed by the line. Publicly available topographical data for the project area was sourced and used. The data used was obtained from the Shuttle Radar Topography Mission (SRTM). It provided the topography of the entire project area and gave a good indication of the various land forms, which is required to direct the determination of a viable corridor.

5.1.2 Aerial Imagery

Satellite aerial imagery for the project area was obtained from GoogleEarth. This provided an aerial photographic view of the project area which aided in determining the availability as well as land use of the project area.

5.2 Design Data Analysis

The design data collected was collated and checked for reliability, adequacy and consistency. Where different sets of data were found to be inconsistent, other data from independent sources with proven reliability were used to verify reliability and the version found unreliable was discarded.

5.2.1 Digital Terrain Model

A 3D Digital Terrain Model (DTM), a computer generated terrain representation of the project area, was created based on the SRTM topography data. SRTM topography data, while not as accurate as ground survey data, is adequate for this initial stage since the object is to obtain plausible corridor routes for the proposed railway that will be further engineered and refined in future phases of the project. The use of SRTM data means the required high-level rail route corridors can be obtained without the time and cost required to conduct a topographical survey of the whole project area. Topographical surveys for the future detailed phases of the project will only be restricted to the identified corridors, there will be no need to cover the entire project area.

The DTM generated gave the required indication of the locations and extents of landforms such as hills, plains and valleys in the project area. Railway infrastructure cost is very sensitive to terrain so the DTM was imperative in deciding the location of the project corridors.

5.2.2 Project Area CAD Design Background

Figure 6: Project Area CAD Design Background

The DTM was combined with the aerial photographs, and the various other spatial data such as existing roads, railways, human settlements, and water bodies. This complete picture of the project area, the Project Area CAD Background, then guided the high-level routing and alignment determination of the project corridors. It is important that the project area background be comprehensive to ensure that no relevant factors are overlooked in the corridor determination.

5.3 Train Configuration

The train configuration design must consider the type of commodities to be transported, annual volume and batch size, various rolling stock technologies (including traction type) and interconnectivity with other rail systems.

As discussed in Chapter 3, the Boegoebaai rail corridor has the potential to carry mineral concentrates (copper and zinc), bulk minerals (manganese), general freight and agricultural produce. The mineral commodities are likely to contribute the majority of the annual throughput.

Of the mineral commodities, Manganese has existing services to multiple destination ports, to which Boegoebaai must offer a compelling and practical alternative service. Requirements for general freight are typically less stringent, and will therefore be readily supported

- **Train Length:** The minimum block train length for Manganese should be supported. Until 2019 this has been 114xCR wagons but recently increased to 125xCR wagons (1300m) for trains destined for Saldanha port.
- **Axle Load:** The existing Manganese services operate at 20 t axle loads, as do majority GFB services across the country. During later phases of investigation this may be revisited as the TFR Manganese export strategy develops over time.
- **Traction Type:** Electric traction is generally preferred for heavy-haul or intermodal services within South Africa, based on the associated operating cost savings over diesel traction. However for GFB and lower volume bulk services diesel traction is widely accepted, and conversion to electric traction has not been the norm owing to the high capital cost. E.g. Thabazimbi – Lephalale in the Waterberg region remains non-electrified even though growth prospects for export coal exceed 6 Mtpa. Given the potential length of the Boegoebaai corridor, relatively low commodity values, and volume potential, the line should be non-electrified and make use of diesel traction. Diesel traction locomotives will also be able to operate on the 3kV DC and 50kV AC systems present on the Manganese and Iron Ore lines respectively. The Boegoebaai routes interact with these existing lines.
- **Ruling Gradient:** It is not required to develop the Boegoebaai corridor to heavy haul standards, such as those of the Iron Ore line, as it is not a direct competitor, and therefore very flat gradients (1:250 westbound) are not required. The Manganese line's ruling gradient of 1:80 is therefore selected as more suitable, to remain competitive with the existing service. Flatter gradients would prove advantageous, however, and an iterative design process, trading off capital and operating cost, may be considered for more detailed study in future,

In Summary;

- **Train length:** 1300m
- **Axle load:** 20 tonnes
- **Ruling gradient:** 1:80
- **Traction:** non-electrified
- **Maximum speed:** 60km/h

6 Rail Route Corridor Determination

Based on the specified characteristics of the proposed railway lines, high-level railway corridors were determined. The corridors were designed to accommodate curvature and gradient requirements of the proposed railway taking into account speed, train length, functional requirements and topography.

6.1 Connecting Locations and Geospatial Elements

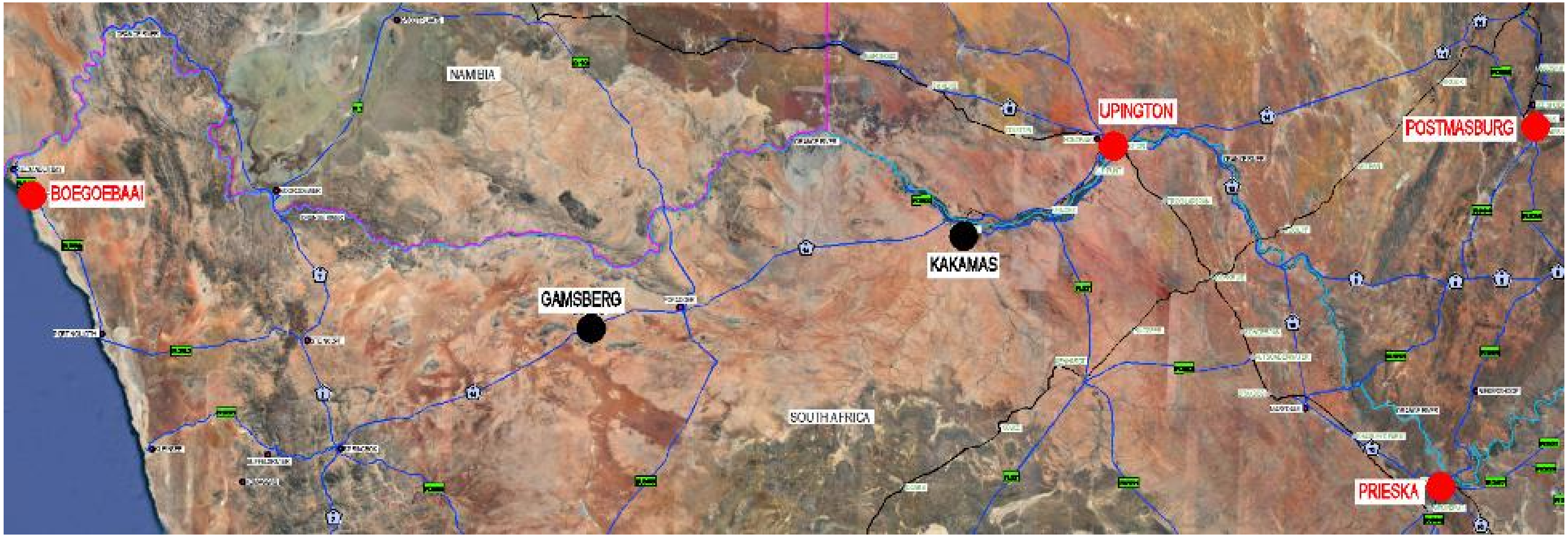

Figure 7: Project Area with Connecting Locations

The primary determinant of the railway corridor routes was the specified locations that the railway lines are required to connect. The specified locations, shown in Figure 7 above, are: Proposed Boegoebaai Port, Gamsberg, Kakamas, Upington, Prieska and Postmasburg. Boegoebaai, Upington, Prieska and Postmasburg are also terminal points of the corridors. Other important geospatial elements in the project area are the Orange River, existing railway lines, and existing roads.

6.2 Project Area Topography

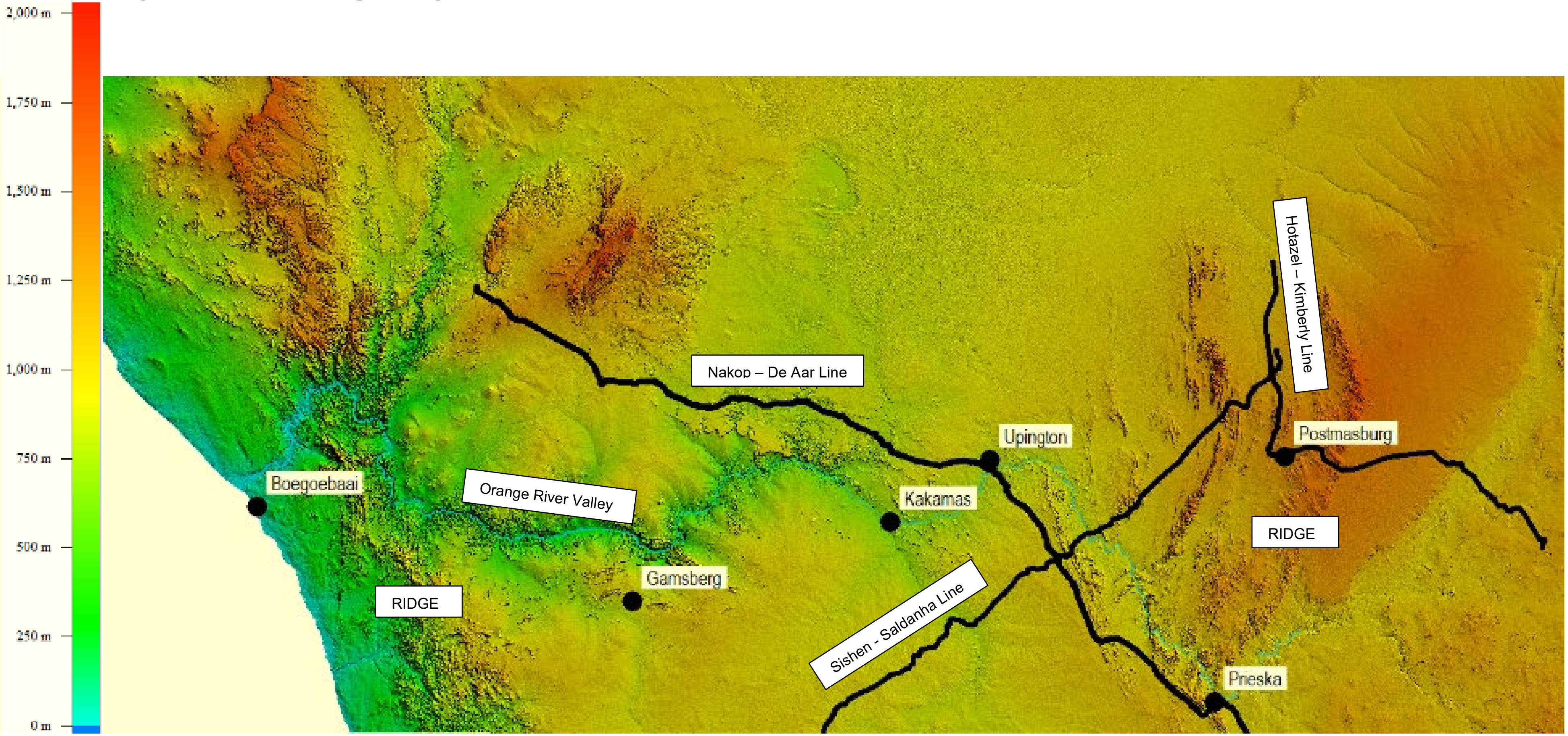

Figure 8: Topography of Project Area

Also important to the route determination was the topography of the project area. The topography of the project area is dominated by ridges running north to south on the western and eastern ends, and the Orange River valley crossing the area in an east-west direction. The central parts of the area is made up rolling planes. The western ridge is situated between the coast (Boegoebaai Port) and the inland connecting locations. It would have to be crossed by the railway corridors. The eastern ridge would not have to be crossed by the corridors as the connecting locations on the eastern end are accessible via existing rail lines.

6.3 Corridor Geometric Design

It was ensured that the geometry of the proposed corridor suited the function of the intended railway. The geometric design was based on the Transnet Freight Rail Manual for Track Maintenance, 2012. The corridors were designed to support 60 km/h design speed.

6.3.1 Horizontal Alignment

The horizontal alignment design of a railway line determines the maximum speed that a railway vehicle can safely travel on the line. The sharper the curvature of the line the lower the maximum speed. The horizontal alignment design parameters applied to the rail corridor are as shown in the table below.

Table 2: Horizontal Alignment Design Parameters

Description	Value
Maximum Design Speed	60 km/h
Minimum Curve Radius	300 m
Minimum Transition Curve Length	80 m

Source: Transnet Freight Rail Manual for Track Maintenance, 2012

6.3.2 Vertical Alignment

The vertical alignment of a railway line has an impact on both the construction cost and the cost of operations. The flatter the alignment the higher the construction cost is likely to be (depending on the route topography). A flat alignment, however, requires less energy to run trains and results in low operating cost. In designing the vertical alignment a reasonable balance has to be drawn between the line construction cost and its running cost. The length of the design train and mode of power i.e. either head-in or distributed power also influences the permissible minimum length of grades. It is preferable to avoid multiple changes of grade within a train length. Vertical alignment design parameters applied to the rail corridor are as shown in the table below.

Table 3: Vertical Alignment Design Parameter

Description	Value
Maximum Design Speed	60 km/h
Design train length	1.3 km
Ruling Gradient (both directions)	1:80
Minimum length of grades	1.3 km

6.4 Route Corridors

Three route corridors were identified by the study to connect the proposed sea port at Boegoebaai to the required inland destination locations. The routes end at the following locations:

- Route 1: Upington
- Route 2: Prieska

- Route 3: Postmasburg

For operational reasons all three routes, after leaving Boegoebaai, first access Gamsberg before heading to the three final destination locations. The first 300 km (Boegoebaai – Gamsberg) is thus identical for all three routes. For topography reasons the routes maintain an identical alignment for a further 70 km beyond Gamsberg before Route 1 separates from the others and heads in a north-easterly direction while Route 2 and Route 3 maintain their easterly direction (see Drawing 2161-002-G001).

The corridor routes do not interfere with the Square Kilometre Array (SKA) as shown in Figure 9 below.

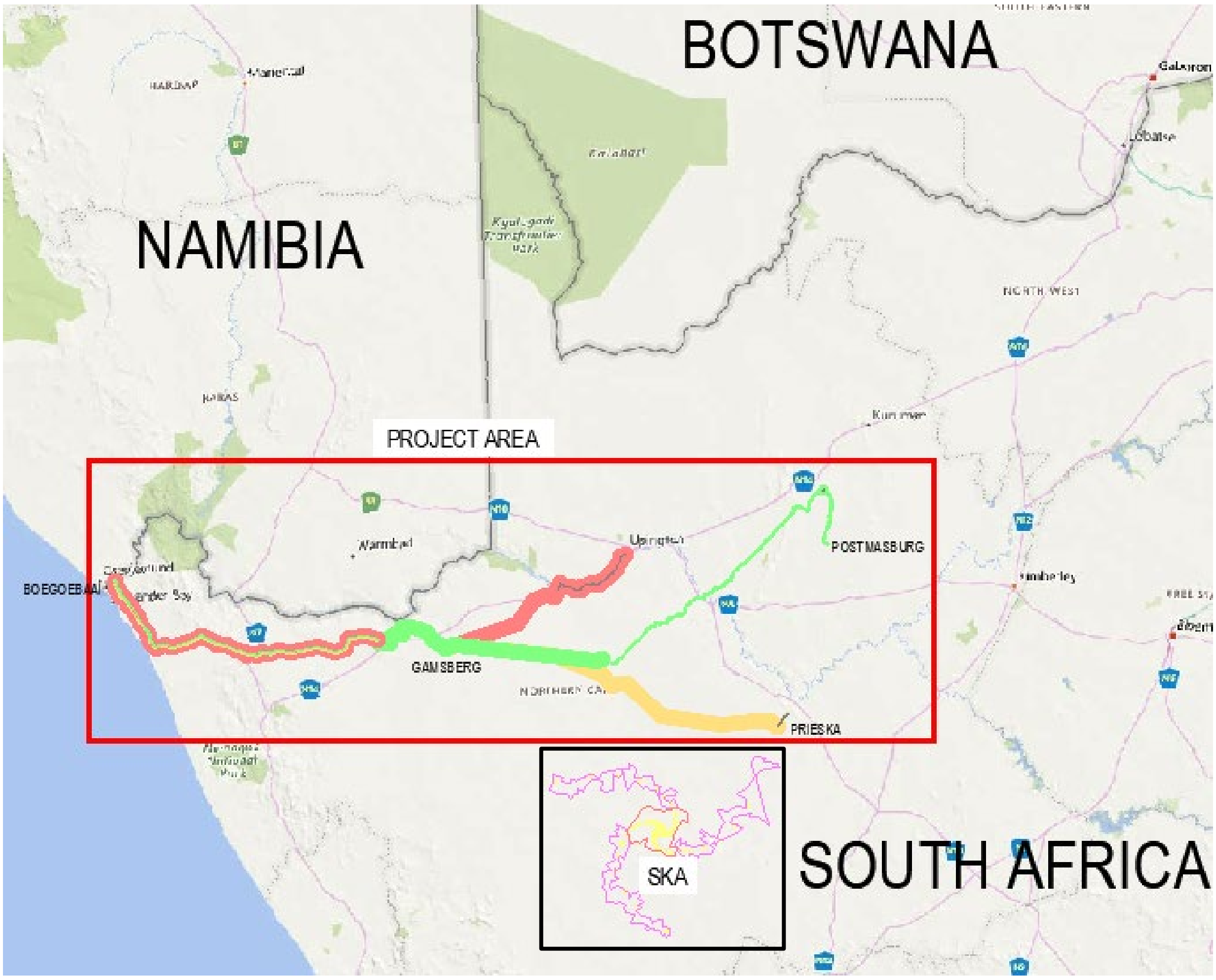

Figure 9: Project Area in relation to the Square Kilometre Array (SKA)

The topography of the project area between Boegoebaai and Gamsberg shown in Figure 10 below is dominated by the Orange River Valley that runs generally east-west and a long ridge that runs north-south. The route between the two points avoided crossing the Orange River valley thus eliminating the need for a long river crossing bridge. Crossing the ridge, however, could not be avoided due to its length and location.

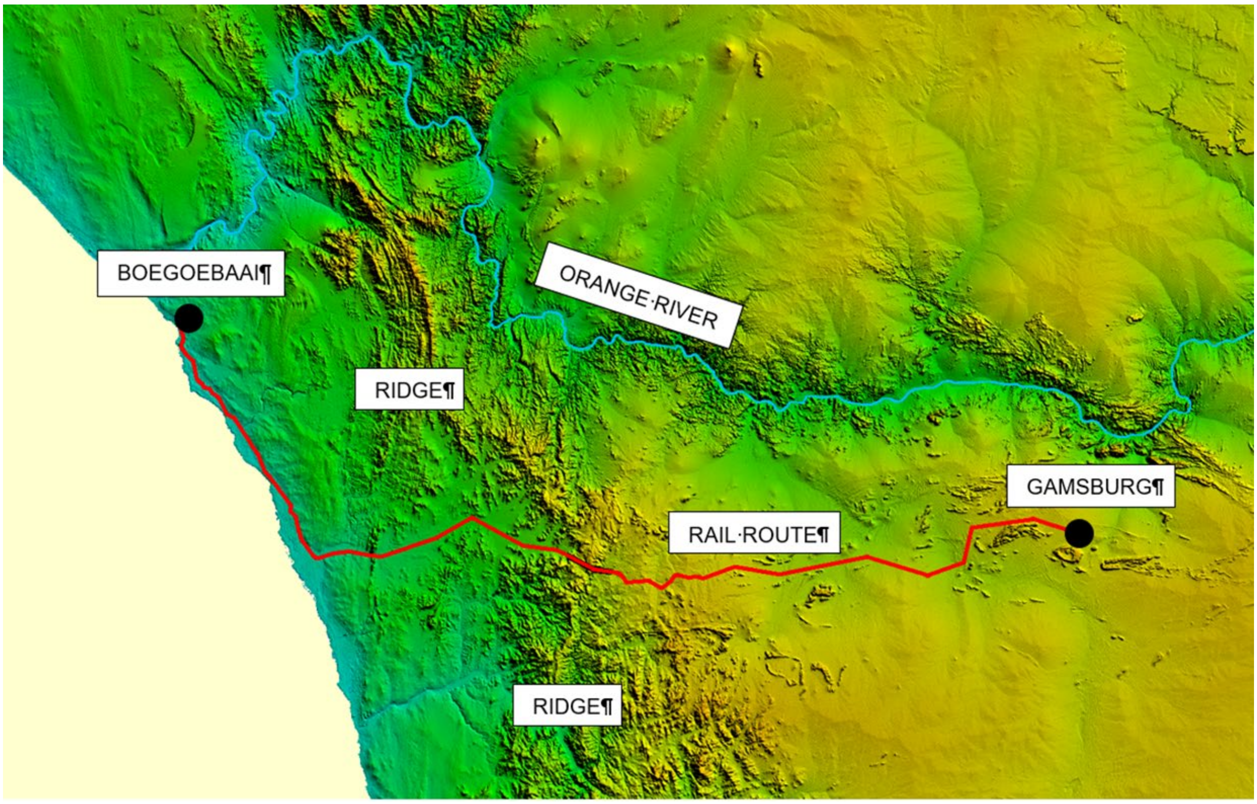

Figure 10: Topography and Rail Route between Boegoebaai and Gamsberg

Crossing the ridge directly from Boegoebaai would have required a tunnel longer than 50 km as can be seen in Figure 11 below. To reduce cost, the route was designed to cross the ridge at a narrow point about 70 km south of Boegoebaai as shown in Figure 12 below. This minimised the length and cost of the crossing structure. A 12.5 km tunnel with estimated cost of R7.5b is proposed to cross the ridge.

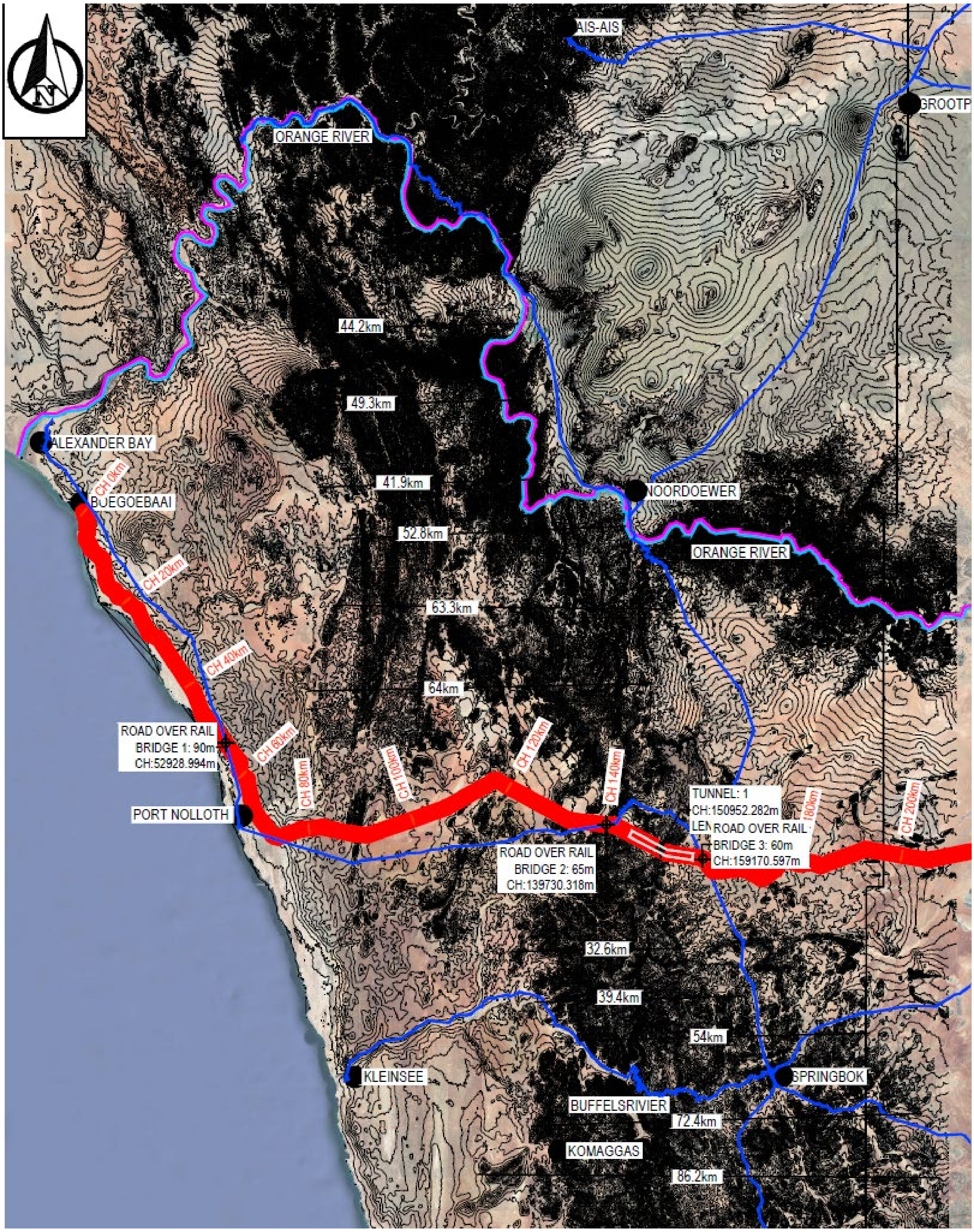

Figure 11: Width of ridge east of Boegoebaai

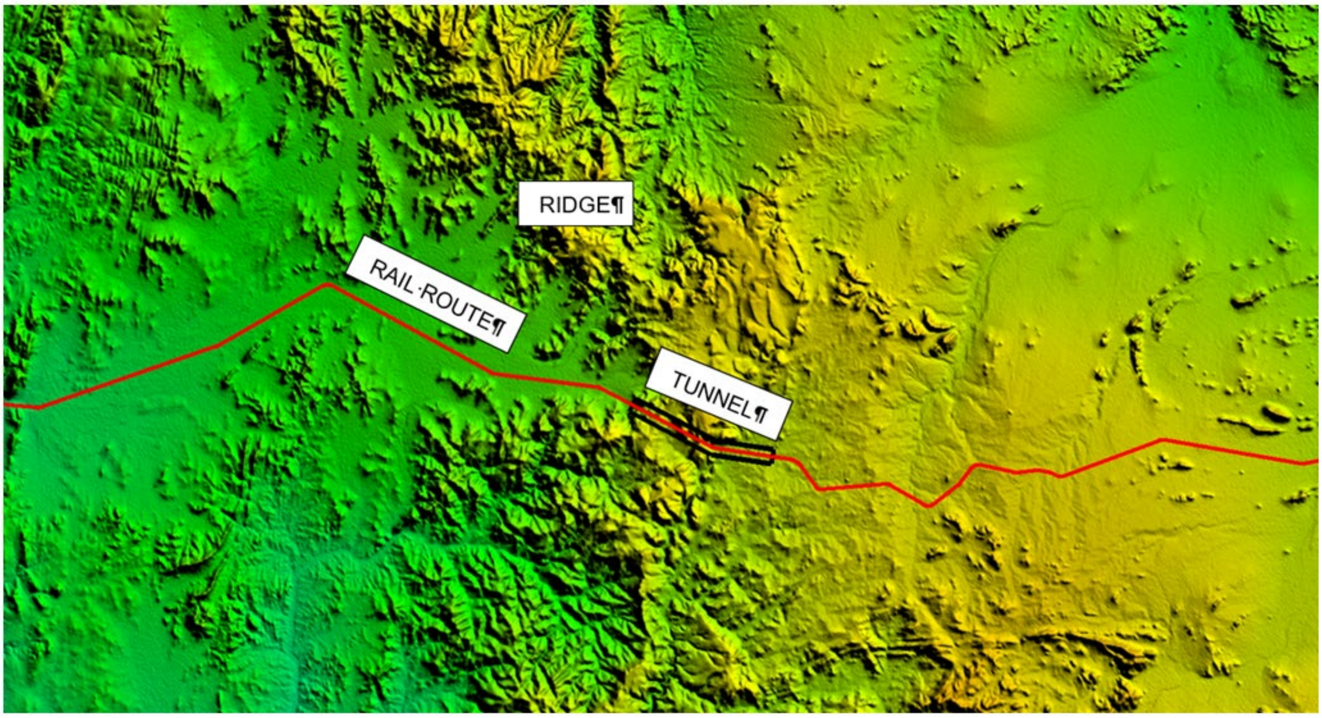

Figure 12: Ridge Crossing

6.4.1 Route 1: Boegoebaai to Upington

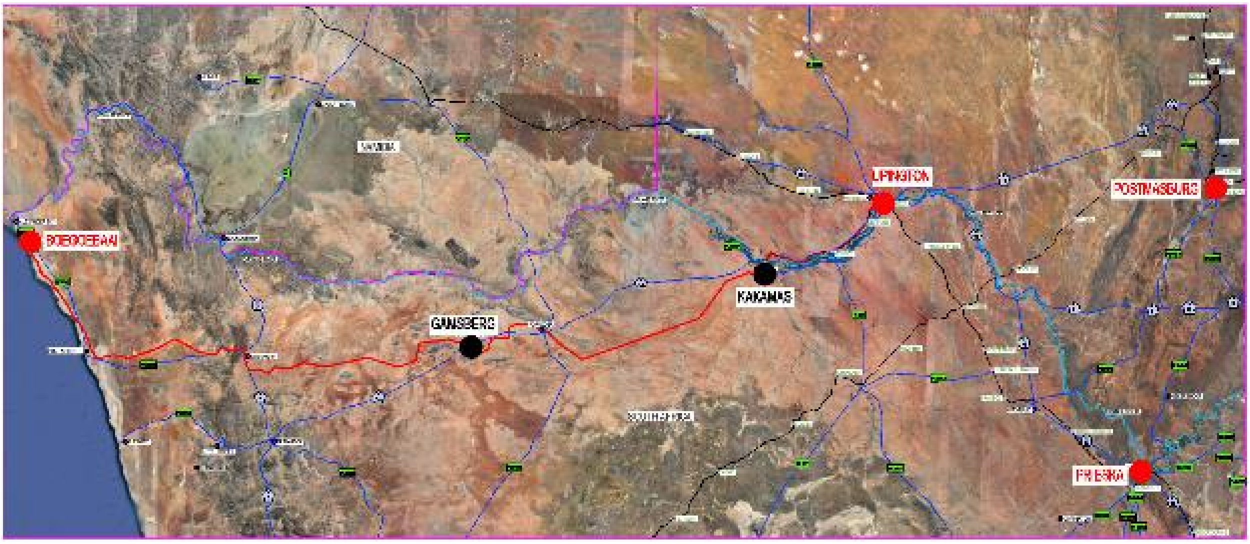

Figure 13: Route 1 Corridor (Boegoebaai – Upington) shown in red

Route 1 corridor starts at the proposed Boegoebaai Port and heads south for 70 km running parallel to the coast until Port Nolloth. At Port Nolloth the route turns east heading inland. It crosses a ridge east of Port Nolloth at km150 requiring a 12.5 km long tunnel just west of Steinkopf. The route continues eastwards towards Upington reaching Gamsberg at km300. The eastward direction of the route is maintained beyond Gamsberg until km370 where it turns in a north-easterly direction reaching Kakamas at km490 and its final destination, Upington, at km575.

Route 1 crosses the R382 road two times requiring two new road over rail bridges. The N14 road is also crossed three times require three road over rail bridges.

Between Kakamas (km490) and Upington (km575) , the route mainly utilises the right-of-way of the existing Kakamas – Upington branch line. The existing line is currently closed. An effort was made to follow the alignment of the existing line as much as possible, but this was not always possible due to the lower design standard of the existing line. Deviations were made to accommodate project design standards where the existing curvature was below the project requirements. The existing railway bridge crossing over the Orange River (shown in Figure 14 below) was utilised. The condition of the 380 m long bridge is not known and is beyond the scope of the current study. However, bridge structure rehabilitation cost, amounting to 25% of a new structure was included in the project cost estimation.

Figure 14: Existing bridge crossing of the Orange River

Route 1 ends at the Upington Station, approaching from the west, covering a total distance of 575 km. See Drawings P001 and P002 for plan and profile drawings of Route 1.

Figure 15:End of route 1 at Upington station

6.4.2 Route 2: Boegoebaai to Prieska

Figure 16:Route 2 Corridor (Boegoebaai – Prieska) shown in Gold

Route 2 corridor also starts at the proposed Boegoebaai Port and follows the same alignment as Route 1 to km370, beyond Gamsberg. Route 2 maintains an easterly direction until km470 before adopting a south-easterly direction till km580. It finally then turns eastwards towards Prieska. The route connects to the existing Nakop – De Aar Line at Groveput Station (km688) and runs on the existing line for 20 km to end at Prieska.

Route 2 crosses the R358, R27, and R361 roads once each with a new road over rail bridge each. The existing Sishen – Saldanha Line is also crossed once by the Route with a new rail over rail bridge. See Drawings P003, P004 and P005 for plan and profile drawings of Route 2.

6.4.3 Route 3: Boegoebaai to Postmasburg

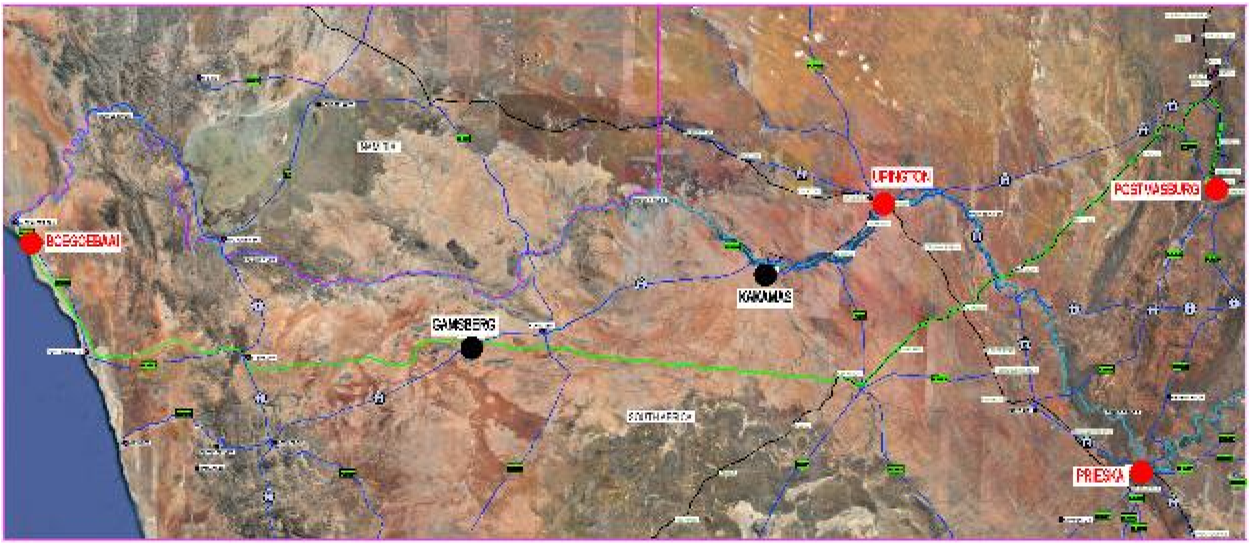

Figure 17: Route 3 Corridor (Boegoebaai – Postmasburg) shown in Green

Route 3 corridor also starts at the proposed Boegoebaai Port and follows the same alignment as Route 2 up to km470. Route 3 keeps its easterly direction beyond this point connecting with the Sishen – Saldanha Line at Kenhardt Station (km511). The route then continues on the existing line until about 20 km south of Sishen where it connects to the existing Manganese Line with a new connecting line 2.5 km long shown in Figure 18 below. The connection also crosses the N14 road with a road over rail bridge.

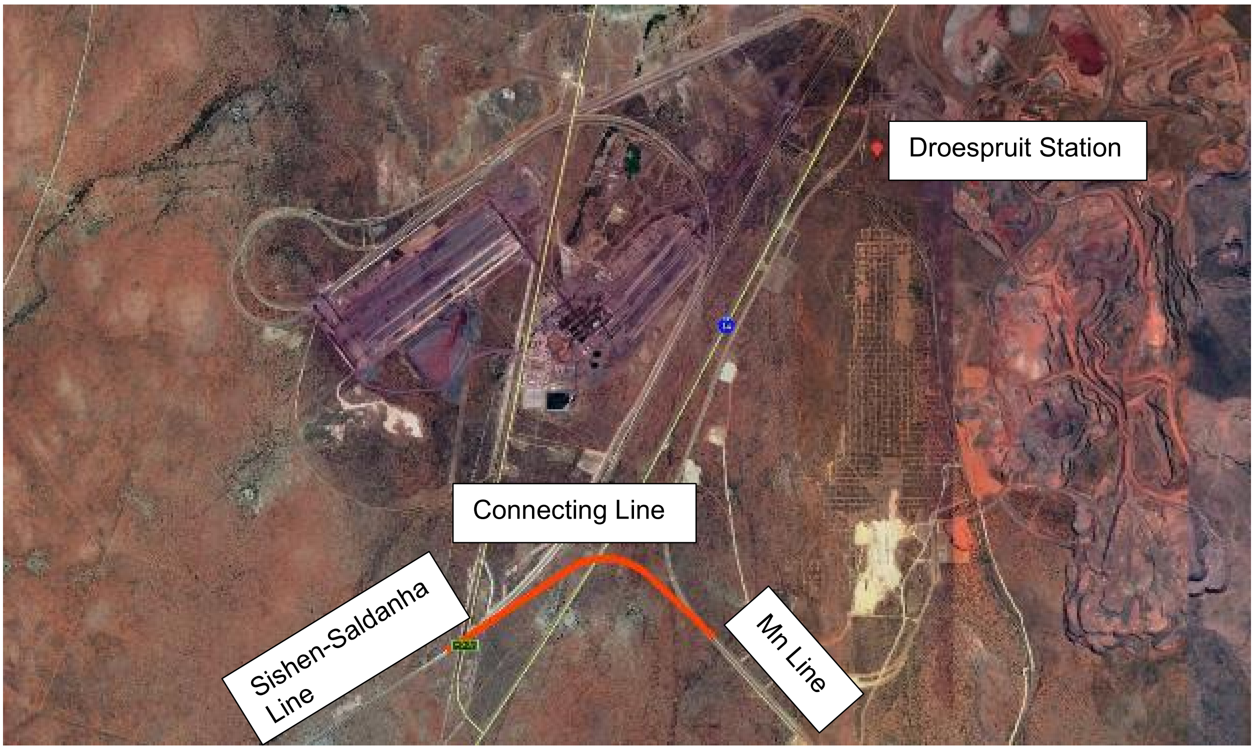

Figure 18: Route 3 Corridor Connection between Sishen – Saldanha Line and Manganese Line

See Drawings P006 and P007 for plan and profile drawings of Route 3.

6.5 Project Drawings

Drawings prepared for the study are listed in Table 4 below.

Table 4: Study Drawings

Drawing No.	***Drawing Description***
G001	*GENERAL LAYOUT OF ALL CORRIDOR ROUTES*
P001	*ROUTE 1: SHEET 1 OF 2 PLAN AND LONGITUNIDAL SECTION CH0.00km TO CH291.6km*
P002	*ROUTE 1: SHEET 2 OF 2 PLAN AND LONGITUNIDAL SECTION CH291.6km TO CH575.1km*
P003	*ROUTE 2: SHEET 1 OF 3 PLAN AND LONGITUNIDAL SECTION CH0.00km TO CH291.6km*
P004	*ROUTE 2: SHEET 2 OF 3 PLAN AND LONGITUNIDAL SECTION CH291.6km TO CH600km*
P005	*ROUTE 2: SHEET 3 OF 3 PLAN AND LONGITUNIDAL SECTION CH600km TO CH687km*
P006	*ROUTE 3: SHEET 1 OF 2 PLAN AND LONGITUNIDAL SECTION CH0.00km TO CH291.6km*
P007	*ROUTE 3: SHEET 2 OF 2 PLAN AND LONGITUNIDAL SECTION CH291.6km TO CH511km*

7 Route Capital Costing

High level capital cost estimates were calculated for each of the three routes considered. .The costs are based on an average per unit length cost estimate for rail track, bridge, and tunnel. The high level capital cost estimates for the three corridor routes inclusive of contingency are shown in Table 5 below.

Table 5: High Level Route Cost Estimates

Route	Total Length of Bridges (m)	Total Length of Tunnels (m)	Track Construction Length (km)	Cost (R Million)	Contingency (30%)	Total Cost (R Million
Route 1: Boegoebaai - Upington	*1 066*	*12 500*	*575 (including existing closed line Kakamas - Upington)*	*R 25 098.3*	*R 7 529.5*	*R 32 627.8*
Route 2: Boegoebaai - Prieska	*1 701*	*12 500*	*688*	*R 28 650.3*	*R 8 595.1*	*R 37 245.4*
Route 3: Boegoebaai - Postmasburg	*1 046*	*12 500*	*514*	*R 23 218.8*	*R 6 965.6*	*R 30 184.4*

8 Conclusions and Recommendations

The three routes identified by the study are plausible alternative connections for a proposed Boegoebaai port to the national rail network.

Route 1 appears to be the most advantageous in terms of operations. It connects to the northern most destination, Upington. This avoids traffic having to reverse direction after entering the rail network.

Route 2 does not appear to have any particular advantages over the other routes. It is the longest and connects southmost out of the three options. It could rank higher if future studies show that a vast majority of the traffic from Boegoebaai would end up at Prieska and capacities on the exiting lines to Prieska are constrained. Route 2 would then provide the most direct connection to Prieska with minimum utilisation of existing network capacity.

Route 3 has the best cost advantage as it provides the most direct connection to the existing rail network. However, because it connects south of Upington, traffic destined for Upington will have to travel back north after reaching the existing network.

It is recommended that if the Boegoebaai Port project proceeds, the three routes identified be further studied to select the most preferred for future development. The route studies should also include an assessment of the conditions and capacities of the sections of the existing network that will be utilised by the routes to account for rehabilitation and expansion works that might be required. These works were excluded from the current study.

9 References

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