Draft Route Determination Report

Soweto Extension and Cosmo City Junction of the Proposed Gauteng Rapid Rail Integrated Network Extensions Project

GAUTENG
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

GAUTRAIN MANAGEMENT AGENCY
Implementing Agency

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ABBREVIATIONS AND DEFINITIONS

Abbreviation	Description
ABCD	At-grade, Bridge, Cut-and-cover, Deep Tunnel
CBD	Central Business District
CoJ	City of Johannesburg
COJMM SDF	City of Johannesburg Metropolitan Municipality Spatial Development Framework
CoT	City of Tshwane
DFFE	Department of Forestry, Fisheries and Environment
ECA	Environment Conservation Act
FS	Feasibility Study
GIS	Geographical Information System
GGDA	Gauteng Growth and Development Agency
GITMP	Gauteng Integrated Transport Master Plan (2013)
GLMP	Greater Lanseria Master Plan
GMA	Gautrain Management Agency
GPG	Gauteng Provincial Government
GRRL	Gautrain Rapid Rail Link
GRRIN	Gauteng Rapid Rail Integrated Network
GTIA	Gauteng Transport Infrastructure Act
ITMP	Integrated Transport Master Plan
JDA	Johannesburg Development Agency
km	kilometre
MCA	Multi-Criteria Assessment
MCLM	Mogale City Local Municipality
MEC	Member of the Executive Council
NEMA	National Environmental Management Act
NMT	Non-Motorised Transport
PFMA	Public Finance Management Act
PHDA	Priority Housing Development Area
PPP	Public Private Partnership
PRASA	Passenger Rail Agency of South Africa
RSDF	Regional Spatial Development Framework
RoW	Right of Way
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act
SPTN	Strategic Public Transport System
TOD	Transit Oriented Development
TMP	Transport Master Plan
UDB	Urban Development Boundary

Term	Definition
ABCD Model	Each route alternative has a unique vertical profile based on the design elevation of the route relative to the ground level. In this study the "ABCD model" was used to indicate the vertical profile of each route alternative and represents the following: A – At-grade (At ground level); B – Bridge/Viaduct (Above ground level); C – Cut-and-cover/Shallow tunnel (below ground level); D – Deep tunnel (Below ground level).
Gautrain Rapid Rail Link (GRRL)	This refers to the existing Gautrain system i.e. Park Station to Hatfield Station on the North-South line and Sandton to OR Tambo International Airport on the East-West line.
MEC	Member of the Executive Council – in this case, for the Province of Gauteng. Unless otherwise specified, "MEC" refers to the MEC for Roads & Transport in Gauteng.
Optimal Route Alignment	Refers to the optimal route alignment and configuration as determined within the context, parameters, and level of design development of this study.
Station Location	Station locations determined in the Feasibility Study for Possible Rapid Rail Extensions to the Gauteng Network (GMA, 2016). Route determination pertains to the identification of the optimal station position within these locations.

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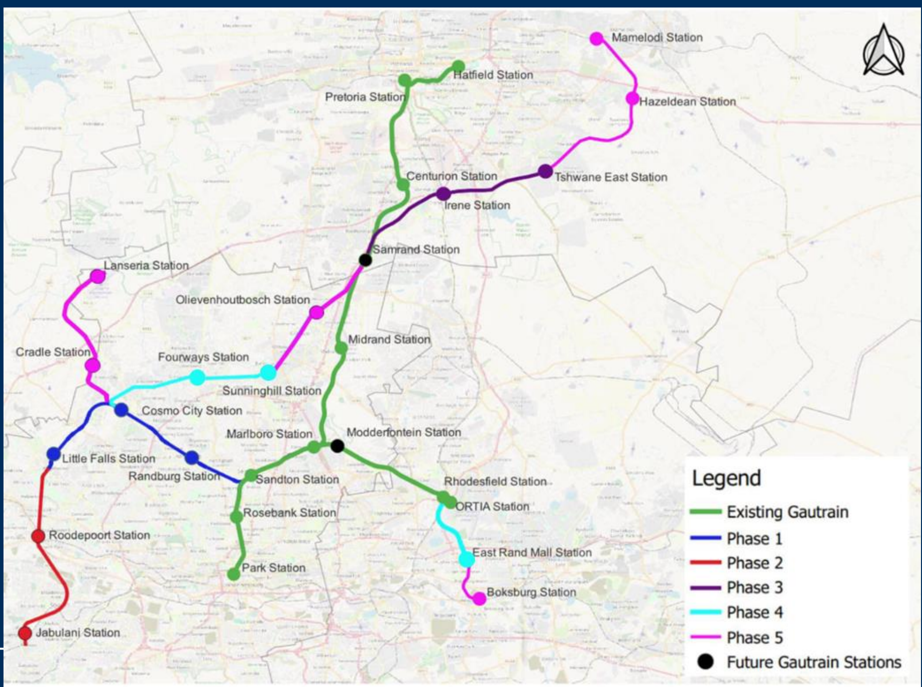
GAUTRAIN RAPID RAIL LINK TODAY

80km

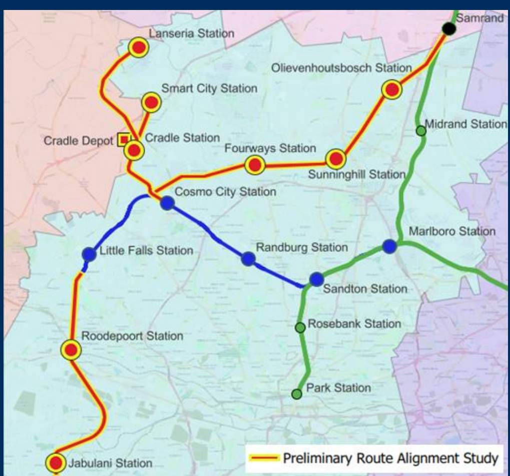
10 Stations

+ PROPOSED GRRIN EXTENSIONS (2016)

148km **19** Stations



THIS ROUTE DETERMINATION



Ties into Samrand Station (planned station on existing Gautrain), Cosmo City Station (Phase 1) and Little Falls Station (Phase 1)

EXECUTIVE SUMMARY

The existing Gautrain Rapid Rail Link (GRRL) Network, known as the Gautrain, was announced in February 2000. It is a mega-project, positioned to cater for the mobility needs of the Gauteng Province and to be used as an instrument for spatial restructuring and enabling economic growth. The Gautrain airport service commenced in June 2010, with the general train services being fully operational, just 2 years later, in 2012. Rail projects are conventionally mega-projects with intensive capital requirements, land reservation processes, environmental permitting processes, lengthy design durations and lengthy construction durations. Consequently, the lead time to the commencement of construction often takes decades from when the need for such infrastructure is first identified. This long lead time and complex interfaces present inherent risk to mega-projects (Flyvbjerg, 2007).

Amongst the many urban challenges facing the Gauteng Province, there is a need for a mobility ecosystem to satisfy the diverse travel needs of citizens, the National Rail Policy and the strong historical performance and benefit delivered by the existing Gautrain network (GMA, 2018). Investing in an extension to the Rapid Rail Network in Gauteng requires vision and foresight, not only to overcome the present challenges but also to ensure that the future potential can be fully realised.

It is important to minimise the risk of implementation of such projects with robust early planning and project preparation for investment and subsequent implementation. To ensure that the required infrastructure is ready for implementation at the opportune time, the GRRIN extensions arising from the anticipated long-term mobility needs, strategic planning of the Gauteng Province, project planning and early preparation are necessary.

The Gauteng Transport Infrastructure Act (GTIA) provides a clear and defined process to be followed when planning for road/rail corridors and will assist in enabling the route determination process.

Each route of the GRRIN (as for all provincial rail and road alignments) must be developed for implementation as per the GTIA, which includes:

1. Determination of the route (Section 6)
2. Preliminary Design (Section 8)
3. Proclamation (Section 11) and
4. Expropriation (Section 19)

The undertaking of this study is a critical building block in the four-step GTIA process to reserve the identified rail corridors. The GTIA prescribes that the Member of the Executive Council (MEC) for Roads and Transport must initiate and advance such studies aimed at determining future extension corridors and follow the process to determine an optimal rail corridor for development.

This Draft Route Determination Report, comprising a Preliminary Route Alignment Study and Environmental Investigation, serves this purpose.

Various options, for the positioning of Stations and the identification of possible routes, were investigated along each of the 3 corridors: Little Falls to Jabulani, Cosmo City to Lanseria, and Cosmo City to Samrand.

The optimal station position was determined for each station defined in the Feasibility Study (FS) for Possible Rapid Rail Extensions to the GRRL network (GMA, 2016).

Each corridor was comprised of 3 route alternatives: Option 0 (based on the 2016 FS) Option 1, which is the optimal route and Option 2, which is the second-most optimal route.

Each station position and route option are described in this report.

An additional station, Smart City, was introduced to future-proof the optimal route such that it does not terminate at Lanseria International Airport and aligns with future development plans for the Greater Lanseria area. This new station also enables future rail extension beyond Gauteng, for regional integration.

Various locations were also assessed for the rolling stock maintenance depot that will be required to support a new fleet of rolling stock for these three corridors and the optimal location was determined.

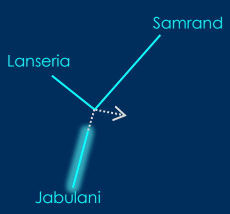
3 Corridors

8 Stations (excluding tie-in stations) **67** km

LITTLE FALLS TO JABULANI (SOWETO)

20 km

2 Stations
- Roodepoort
- Jabulani

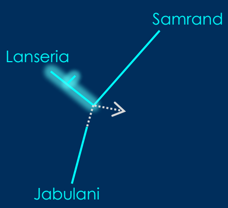


Ties into Little Falls Station at the northern end, which is part of the route determined in 2022 for Phase 1 of the GRRIN extensions

COSMO CITY TO SMART CITY AND LANSERIA

21 km

3 Stations
- Cradle
- Lanseria
- Smart City

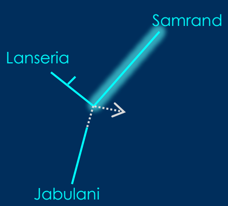


Additional Future Station Smart City Station: this **4km** branch is included to future-proof this corridor, in the event that the alignment needs be extended beyond Lanseria

COSMO CITY TO SAMRAND

30 km

3 Stations
- Fourways
- Sunninghill
- Olievenhoutbosch



Ties into Samrand Station at the northern end, which is planned as part of the existing GRRL and Cosmo City Station at the southern end which is part of the route determined for Phase 1 of the GRRIN extensions

The optimal station positions, routes and rolling stock maintenance depot locations were determined using a Multi-Criteria Analysis (MCA), which is a structured, scientific, well-evidenced and, where possible, a quantitative method used to assess and compare options based on multiple criteria. This facilitated decision-making, considering a variety of factors. The goals and criteria set out as per the MCA, ensured that the outcome extended beyond an engineering solution to a well-balanced and optimal solution, which considered people, places and the economy.

The MCA for station positions was comprised of goals to enhance customer utility, ease deliverability and enhance urban integration. The range of evaluation criteria included: public transport integration, station access, constructability, cost, alignment with statutory plans, catalysing development and growth, community severance and environmental impacts.

The MCA for routes was comprised of goals to ease deliverability and connect with care. The range of evaluation criteria included: constructability, construction cost, land acquisition, social impact and environmental impact.

A similar approach was adopted for selecting the optimal location of the rolling stock maintenance depot. In this case, the MCA was comprised of goals to operate efficiently, ease deliverability and connect with care. The range of evaluation criteria included: operational efficiency, constructability, construction cost, land acquisition, social impact and environmental impact.

These station-, route- and maintenance depot-specific goals were established as part of the overarching strategic goals for the Project; namely:

Optimal routes, with optimal station positions are contained in Section 6.7, with detailed layouts of the same, contained in Annexure A.

The Environmental Investigation Report (Annexure B) detailed outcomes of the environmental screening, with validation against current land use and environmental conditions, as well as consideration of vertical placement of the routes. This assessment, together with consideration of other criteria, informed the selection of optimal routes and station positions. A review of the legislative framework was completed, and the permitting strategy was developed to inform next steps.

Information was requested from the municipalities, main roads, bulk service providers, transport operators and development agencies.

These inputs have informed the design of route and station position options. The public is requested to review the preliminary route alignment study report, together with the environmental investigation report, and comment on these proposed routes, to ensure that the public's views are be accounted for in the determination of the final route. The comment period also allows for the municipalities, and infrastructure and service providers/operators/agencies to provide further input, close gaps and highlight potential blind spots that may have been overlooked.

The prescribed steps defined in the GTIA will ensure sound decision-making, while protecting the rights of individuals who may be affected by the process of defining a provincial railway line in Gauteng. Taking into consideration the interests of the public has far reaching implications for today and for generations to come. In recognising the length of time it takes to implement mega-projects; a prompt initiation of the planning phase is imperative.

1

CONTEXT

1. CONTEXT

This chapter presents the context for and purpose of the route determination for the Soweto Extension and Cosmo City Junction of the proposed GRRIN extensions (the "Project"). At the start, the urban challenges and the need for a response through investment in transport infrastructure are described, followed by an overview of previous reports/studies/projects that inform this route determination. Legislation that governs the process is explained and an overview of the Spatial Development Frameworks (SDFs) is provided for the respective municipalities.

1.1 Urban Challenges

The Gauteng Province has around 15.9 million people (StatsSA, 2024). It is an "arrival" city region where, apart from natural growth associated with births and deaths, migration of individuals and families from across South Africa and the continent, in search of better economic opportunities, also drives the growth in population. By 2050, the population of Gauteng is expected to reach 20 million (Council for Scientific and Industrial Research, 2019). This forecast growth presents both challenges and opportunities.

Below are some of the other urban challenges that Gauteng is facing:

Significant Traffic Congestion

- Peak hour trips on key arterial roads generally take 70% longer than equivalent free-flow trips (GMA, 2018).
- If no improvements are made, average road speeds of 48 km/h could deteriorate to 10 km/h by 2037 (GMA, 2018).
- Negative economic impacts – traffic congestion cost South Africa R1-billion in 2015 (GMA, 2018).

Deep Poverty and Inequality

- Gauteng's official unemployment rate is 34.0%, which is above the South African rate of 32.1% (StatsSA, 2024).
- Employment in the formal sector is around 68% – more formal sector jobs are required, especially for women and young people (StatsSA, 2024).

Poor and Deteriorating Air Quality

- Air pollution in Gauteng is higher than other provinces (GMA, 2018).

Intense Global Competition

- The City of Johannesburg is ranked 42nd out of 44 cities on the Global Power City Index (2018). Other cities that have invested in transport mega-projects (e.g., Jakarta at 41st, Fukuoka at 37th, Taipei at 35th and Kuala Lumpur at 32nd) are making strong progress in terms of investor attraction (GMA, 2018).
- Gauteng needs to invest in infrastructure to better compete on the global stage (GMA, 2018).

With population growth, there is a need to provide housing, education, and jobs for people. Gauteng, by global standards, is a low-density, sprawling city region in need of spatial restructuring to address issues of inequality and the burden of distances to travel to access economic opportunities.

Spatial restructuring takes decades to achieve. Transport needs to address present day travel demand while forming a "backbone" upon which future urban development can be directed and intensified to bring about greater urban efficiencies.

1.2 Responding through Investment in Transport Infrastructure

The need for transport infrastructure is driven by urban challenges faced by the Province and drives the requirement for investment in a wide range of assets and initiatives. Transport – often referred to as the lifeblood of cities – features as a critical element in achieving objectives such as improved quality of life and poverty alleviation (GMA, 2018). The investment in transport needs to be undertaken in a way that is sustainable, while reducing its impact on the environment and climate change.

The challenges of growing traffic volumes, including congestion, and the need for rail transport is also anticipated in the 25-Year Gauteng Integrated Transport Master Plan, 2013 ("GITMP25"*)* that was commissioned by the Gauteng Provincial Government (GPG). This Master Plan seeks to support integrated planning for province-wide mobility and societal development in the future; and affirms that the passenger rail network should form the backbone of a modernised, and integrated transport system in the Province.

People travel for a wide range of reasons, at various times of day over a variety of journey lengths. Some trips are suited to walking, while others require transport technology to move people over greater distances in a short space of time. For this reason, no single mode of transport can satisfy all needs for travel in an economical and sustainable way. Consequently, the transport solution for a City Region like Gauteng needs to be multifaceted by embracing a range of transport modes to satisfy the diverse travel needs of citizens, with a modern rail system as its backbone, as envisaged in Gauteng's ITMP25.

In order to reinforce rail as the backbone of the public transport network the following strategies were presented in the GITMP:

- Ensure that land-use spatial planning and rail transport planning continue to be well integrated. Identify the main passenger rail corridors in the Province and ensure that spatial densification takes place around these corridors and the main rail nodes.
- Develop a future network of passenger rail routes that serves the main provincial corridors.
- Develop public transport nodes on the rail corridors and ensure that these are well served by road-based public transport services. Rail and road public transport services should therefore act as feeder and distributor services for each other.

- Ensure sufficient line capacity on these routes.
- Modernise the existing passenger rail infrastructure.
- Set and stipulate performance levels for the public transport services and set measures in place to ensure that these performance levels are achieved.

A range of public transport solutions and their respective hierarchy applicability is shown in Figure 1-1.

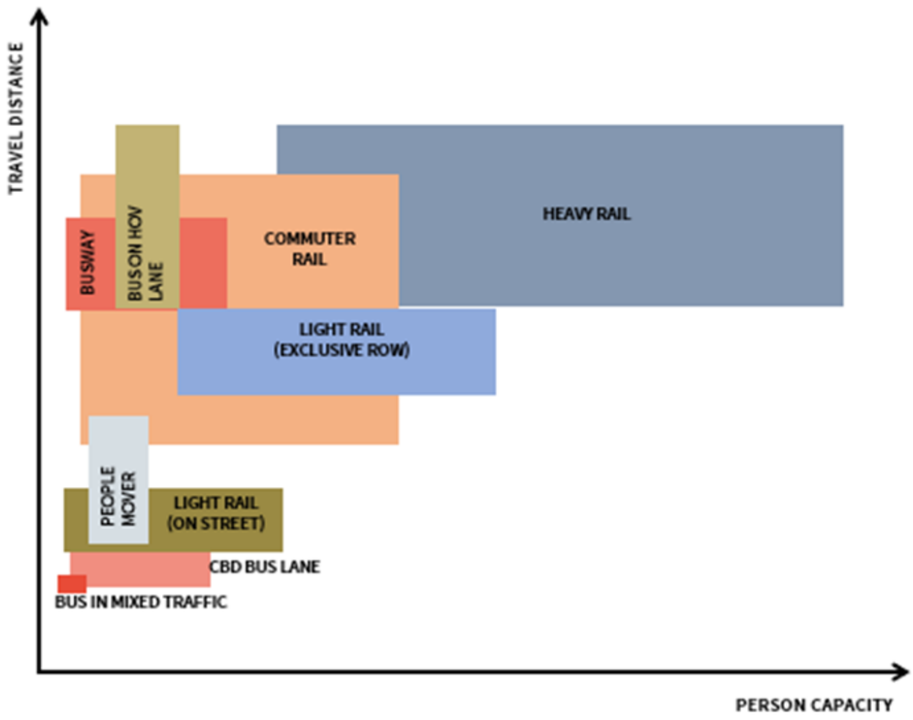


Figure 1-1: Transit Mode Performance
Adapted from (TCRP, 2003)

The selection of the best transport mode extends beyond capacity. Transport infrastructure investment around the world does more than move people. It is used to bring about efficiencies, improve environmental sustainability, and restructure land use patterns, especially as accessibility to land greatly impacts its attractiveness for development. Key considerations for mode selection include:

- Does the capacity capability of the mode meet travel demand?
- Can the mode be reliable and safe, especially within the context of growing congestion? Faster modes are needed to overcome distance, while dedicated Rights of Way (RoW) are needed to overcome the effects of congestion.
- Can the mode be financially and economically efficient (capital cost/km; passengers/cost)?
- Can the mode of transport shift travellers away from less sustainable modes of travel?
- Can the mode bring about spatial restructuring through regeneration/land use integration?

- Is the mode deliverability high, within the context of institutional capacity, technical constraints, etc.?

Travel needs of citizens and freight are diverse. Needs vary based on the time of travel, the distance to be travelled, life cycle stage of the traveller, and purpose of the journey. All transport modes need to operate efficiently in isolation but function as a whole in an integrated system.

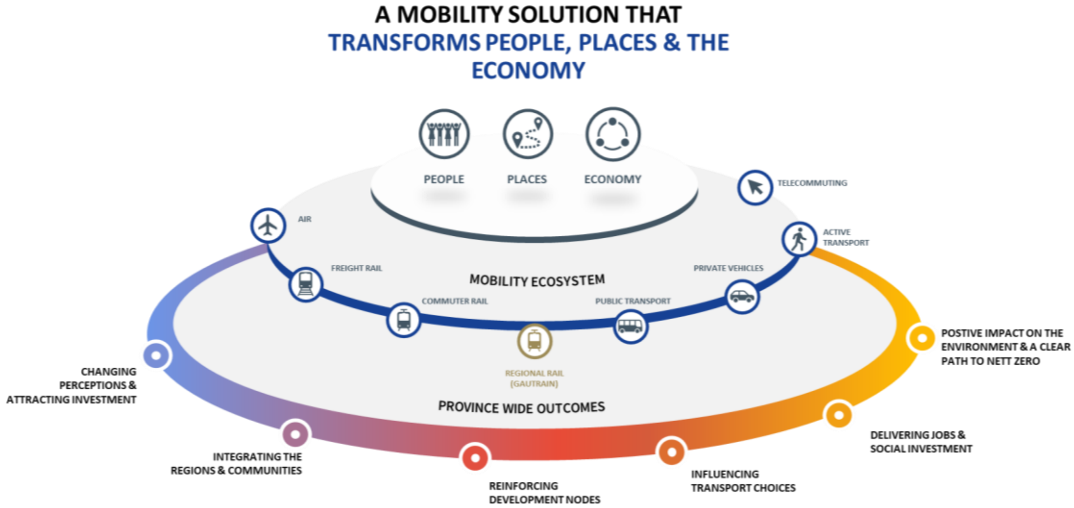


Figure 1-2: Mobility Ecosystem

On the balance of the challenges which Gauteng faces, the need for a mobility ecosystem (see Figure 1-2) to satisfy the diverse travel needs of citizens, the National Rail Policy and the strong historical performance and benefit delivered by the Gauteng Rapid Rail Integrated Network (GRRIN), investing in extending the Rapid Rail Network in Gauteng encompasses vision and foresight: not just to overcome the challenges of today but also to ensure that the full potential of the future can be realised.

1.3 Implications of the "Do-Nothing" Scenario

Investing ahead of a crisis is challenging, but a key requirement to escape the vicious cycle created by focusing only on the present. Consequently, there is a need to balance investment between solving today's challenges (e.g. congestion) and avoiding tomorrow's crises. The future-ready Gauteng requires radically different solutions. Prioritising investment only in what is "easy to do" is not sustainable. For example, investing only in incremental improvements to the road network, like freeway widening, without investing in public transport like rapid rail which, although more capital intensive, offers a longer-term horizon.

According to the draft transport model of the GITMP25 (Transport Authority for Gauteng, 2024), that is currently being reviewed and updated, there will be a 122% increase in travel time by 2050 as shown in Figure 1-3, if all planned road and road-based public transport improvements are implemented.

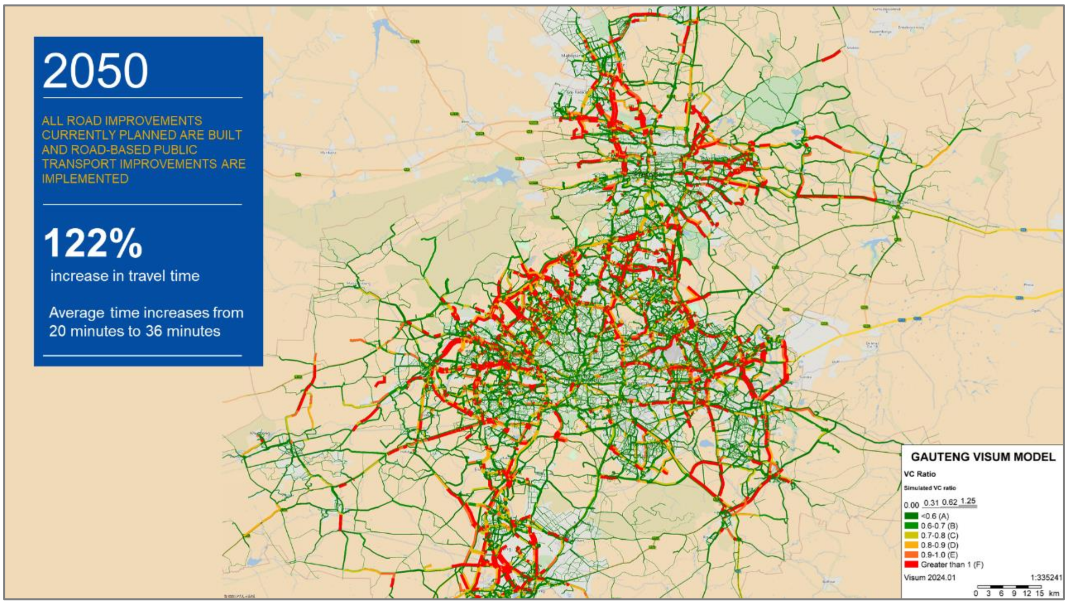


Figure 1-3: Implication of the "Do nothing" Scenario (Transport Authority for Gauteng, 2024)

This indicates that as distant as the future may be, investing today in transport and mobility planning is a much-needed step towards ensuring a future-ready Gauteng, which is able to respond to needs when they arise without compromising the present.

1.4 GRRIN Extensions Feasibility Study – 2016

Noting the affirmation in Section 1.3 above, the Gautrain Management Agency (GMA), under its mandate in relation to the integrated public transport and railway-related functions of the MEC responsible for provincial roads contemplated in Section 50 of the GTIA, developed a comprehensive strategy to improve rail coverage in the Province and subsequently undertook a comprehensive "Feasibility Study for Possible Rapid Rail Extensions to the Gauteng Network" (GMA, 2016), where alignment, operations, and suggested phasing were recommended. The "Gauteng Network" above refers to the Gauteng Rapid Rail Integrated Network ("GRRIN").

This study was carried out in terms of the Public Finance Management Act, 1999 ("PFMA") and under the relevant National Treasury regulations and guidelines for Public Private Partnerships ("PPP").

This Feasibility Study was completed and concludes that the extended rapid rail network will provide significant economic and transport related benefits to the Gauteng Province, and to the greater country. The GRRIN extensions identified through the Feasibility Study comprise of preliminary phasing that has been determined based on the projected demand and cost considerations as shown in Figure 1-4. If all these phases are to be developed; the future GRRIN layout could comprise of an additional 148 km of rapid rail extensions, as well as 19 new stations.

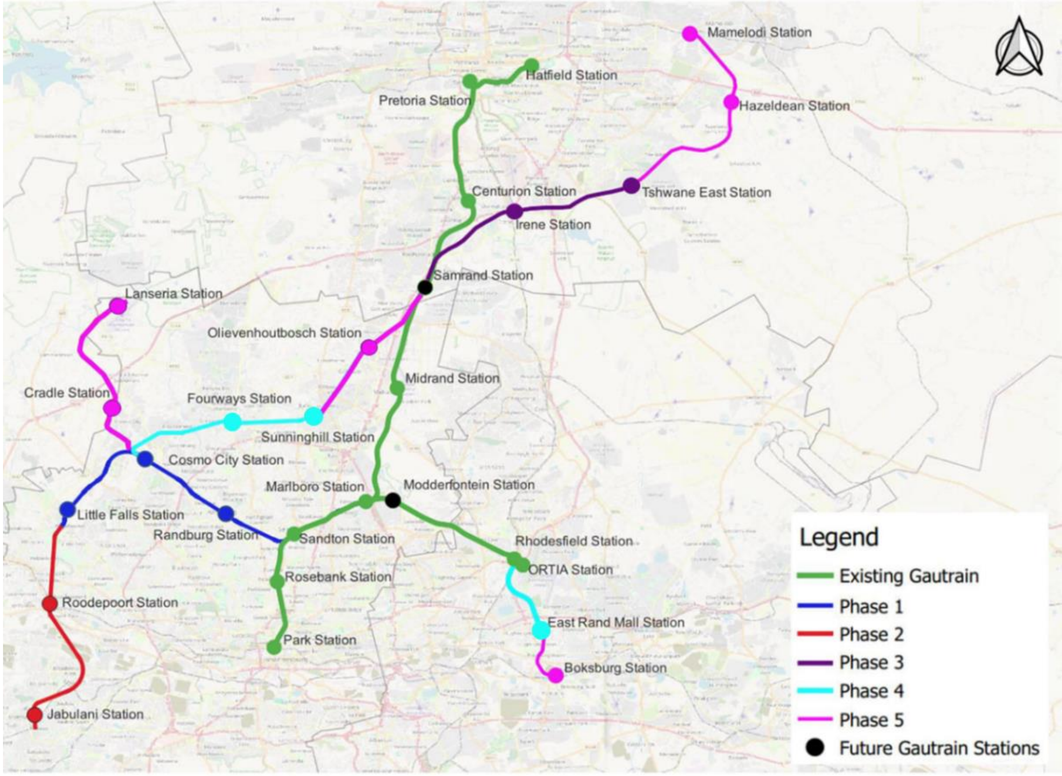


Figure 1-4: Gauteng Rapid Rail Integrated Network (GRRIN) Extensions

The current rapid rail network in Gauteng, referred to as the Gautrain Rapid Rail Link (GRRL) system, does not effectively service certain residential and economic nodes. Adjustments and/or extensions to the rapid rail network would enhance the service coverage and provide significant economic and transport related benefits to the Gauteng Province that include the transformation of spatial development, reindustrialisation of the transport industry, and economic stimulus. This would radically modernise the way Gauteng residents live and work.

Each phase of this extensive network requires further study, planning and design to progress toward implementation. The undertaking of the process to determine the routes of the GRRIN Extensions is the initial step of a long implementation journey. The planning for implementation phases requires defining the rail reserves within which the proposed extensions are to be designed, constructed and eventually operated. This process is described in Section 1.5.

1.5 The Gauteng Transport Infrastructure Act

The Gauteng Transport Infrastructure Act, Act No 8 of 2001, amended by the Gauteng Transport Infrastructure Act, Act No 6 of 2003 (the "GTIA") consolidates the laws related to roads and other types of transport infrastructure in the Gauteng Province. The GTIA stipulates the process for the planning, design, development, construction, financing, management, control, maintenance, protection, and rehabilitation of provincial roads, railway lines, and other transport infrastructure in the Province. The prescribed phases defined in the GTIA will ensure sound decision-making, while protecting the rights of individuals without compromising the interests of the greater public.

Within the context of this Project, the GTIA is an enabler for the route determination process.

Each route of the GRRIN (for all rail and road alignments) must be matured for implementation as per the GTIA i.e.:

1. Determination of the route (Section 6).
2. Preliminary Design (Section 8).
3. Proclamation (Section 11).
4. Expropriation (Section 19).

For this reason, the undertaking of this study is a critical building block in the four-step GTIA process to reserve the identified rail corridors. The MEC for Roads and Transport (the MEC) is mandated to initiate and advance such studies aimed at determining future extension corridors and to follow the GTIA process of determining an optimal rail corridor for development.

This Project is being executed in terms of the GTIA; and once concluded, affords the MEC the authority to determine the route and protect the corridor for the proposed rail extensions. Figure 1-5 illustrates the four steps for defining a provincial railway line in Gauteng in terms of the GTIA.

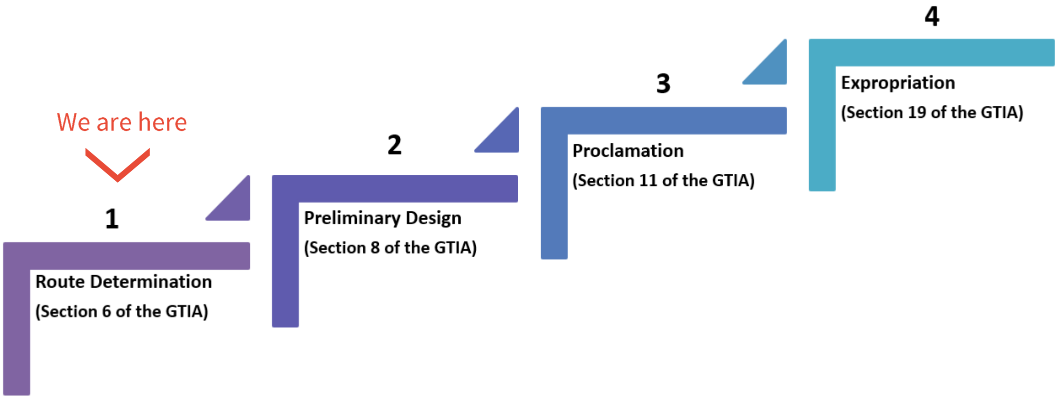


Figure 1-5: Four-Step Process for Defining a Provincial Railway Line in Gauteng in terms of the GTIA

1.5.1 Step 1 – Route Determination

Route Determination is the first step in the process of defining a future railway reserve. It requires that a preliminary route alignment study and environmental investigation be conducted, as shown in Figure 1-6, to enable the MEC responsible for provincial roads and transport in Gauteng to determine the route, and in this case, for the Little Falls to Jabulani, Cosmo City to Lanseria, and Cosmo City to Samrand sections of the GRRIN Extensions.

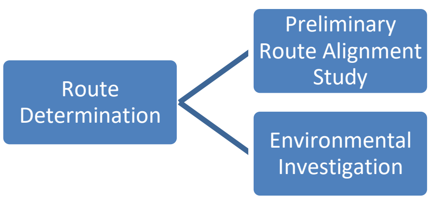


Figure 1-6: Components of Route Determination

This determined route comprises of a centreline as per Section 6 of the GTIA. For information, a 400 m wide land corridor is indicated (200 m measured from either side of the centreline of the route) within which the future railway line can be designed and implemented (as per Section 8 of the GTIA – Preliminary Design). The legal implication of route determination is that the MEC for Roads and Transport is afforded an opportunity to comment on any land-use change applications, or environmental approvals that are submitted to the local authorities for properties that are located within this 400 m wide corridor. The approvals remain with the local authority. This 400 m wide corridor buffer will narrow as railway line development progresses.

Figure 1-7 represents the activities within the route determination step.

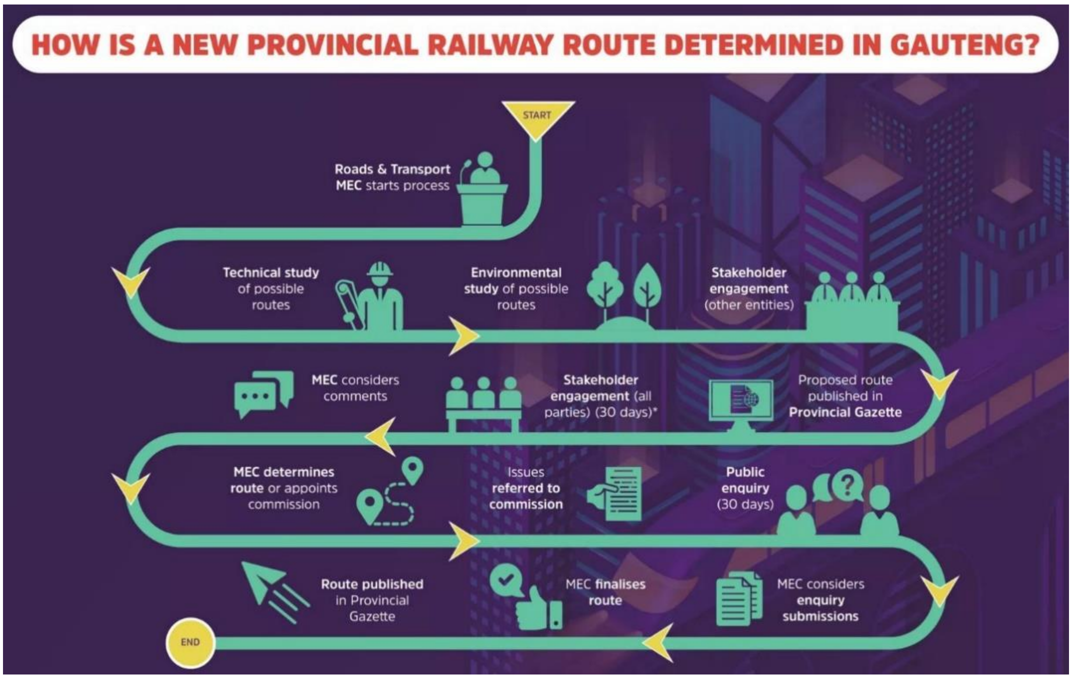


Figure 1-7: New Railway Line Route Determination Process in Gauteng

1.5.2 ***Step 2 – Preliminary Design***

The second step in the process of defining the future rail reserve is the undertaking of the Preliminary Design process. The Preliminary Design process is also legislated through the GTIA and provides further detail on how the proposed extension is comprised in terms of the extent to which it is at grade, on viaducts or underground, and the width of the rail reserve within this 400 m corridor; and, therefore, the land or properties that will be impacted.

The Preliminary Design process requires due consideration of, amongst other factors, its potential economic, environmental, and social impact while optimising capital and operational costs. Thus, all interested and affected parties are consulted and offered an opportunity to provide their written inputs on the proposed preliminary design for consideration prior to the finalisation of the Preliminary Design Process. This preliminary design is also subjected to a full Environmental Impact Assessment (EIA) that includes a public participation process that is legislated through the National Environmental Management Act, Act No. 107 of 1998, as amended (NEMA). This EIA will include specialist studies and provides recommendations on mitigation measures and management plans to be incorporated into the design and subsequent operating plan.

1.5.3 ***Step 3 – Proclamation***

The Preliminary Design is then followed by the third step, Proclamation of the railway line. The proclamation process is a process where the owners and occupiers of the properties that are identified as falling within the future railway reserve are consulted and afforded an opportunity to provide their comments or representations for consideration by the MEC prior to the proclamation of the rail reserve. During this proclamation process, owners of land that has been identified for expropriation are duly notified to enable the commencement of the expropriation process.

1.5.4 ***Step 4 – Expropriation***

According to the Section 3(1) of the Expropriation Act, 2024 (Act No. 13 of 2024), the minister may expropriate property for a public purpose or in the public interest, subject to the provisions of Chapter 5 of the act.

Chapter 3, Section 5 of the Expropriation Act, 2024 (Act No. 13 of 2024), states that the expropriating authority must consider all relevant circumstances when deciding to expropriate property, and as a result may require certain skilled persons to access the property (only with written authorisation from the expropriating authority) with necessary workers, equipment and vehicles to conduct the required tasks (e.g. ground surveys, geotechnical investigations, measuring, valuation or other inspections) to obtain relevant information to assist in determining whether the property is suitable for expropriation.

In the event where a property is identified for expropriation, after the undertaking of the Route Determination, Preliminary Design, and Proclamation processes, the expropriating authority must serve a notice of intention to expropriate property, on the owner or mortgagee, as per Section 7 of the Expropriation Act, 2024 (Act No. 13 of 2024). Amongst a few other things, the notice of intention to expropriate includes an offer of compensation with supporting information as to the manner in which the amount was calculated, based on supporting information and in accordance with Section 12 of the Expropriation Act, 2024 (Act No. 13 of 2024).

Property owners who receive such a notice, may accept or dispute the compensation offered, or may request further particulars of the notice. This communication must be a written response to the notice, within 30 days of the service or publication date of the notice. This is in accordance with Section 7(4) of the Expropriation Act, 2024 (Act No. 13 of 2024).

The expropriation authority is required to consider all responses received from property owners, prior to making a final decision to proceed with property expropriation. This decision must be communicated with the property owner, by serving a notice of expropriation in accordance with Section 8 of the Expropriation Act, 2024 (Act No. 13 of 2024).

On the date of expropriation, the ownership of the expropriated property vests in the expropriating authority as per Section 9 of the Expropriation Act, 2024 (Act No. 13 of 2024).

If the expropriating authority and the property owner do not agree on the amount, time or manner of payment of compensation, the dispute may be settled via mediation by court where the court will give regard to all circumstances and decide the amount, time or manner of payment of compensation, in accordance with Section 9 of the Expropriation Act, 2024 (Act No. 13 of 2024).

Construction of the railway line can only commence after the successful expropriation of the property has been completed in terms of the Expropriation Act, 2024 (Act No. 13 of 2024).

For more details and particulars regarding the expropriation of property, refer to the Expropriation Act, 2024 (Act No. 13 of 2024).

Figure 1-8 represents the activities within Steps 2, 3 and 4 discussed above.

Figure 1-8: What Happens After Railway Route Determination in Gauteng

1.6 Route Determination for Phase 1 of the GRRIN Extensions

Phase 1 extension is 30.3 km long and extends from the existing Marlboro Station to a new station at Little Falls on the West Rand, including an upgraded Sandton Station, as well as additional stations at Randburg, and Cosmo City. This phase connects to the scope of this project at Little Falls and Cosmo City stations.

In October 2018, the GMA initiated the Route Determination process for Phase 1 and undertook the Preliminary Route Alignment Study and Environmental Investigation to enable the MEC for Public Transport and Roads Infrastructure in the Province to determine the route for Phase 1 of the proposed GRRIN extensions.

The final route was published in the Provincial Gazette on 25 May 2022 together with the published Route Determination Report.

1.7 Scope of this Project

The scope of work is to complete a preliminary route alignment study and environmental investigation thereof to enable the MEC to determine the Soweto

Extension and Cosmo City Junction (the "Project") of the proposed GRRIN extensions. This aligns with:

a) the recommendations of the Feasibility Study for Possible Rapid Rail Extensions to the Gauteng Network (GMA, 2016); and

b) the prescripts of the GTIA.

The study takes cognisance of spatial frameworks, government development planning and applicable spatial planning legislation of the Gauteng Province and Spatial Planning and Land Use Management Act ("SPLUMA").

The corridors pertaining to this scope of work include routes from Cosmo City to Lanseria, Cosmo City to Samrand and Little Falls to Jabulani. This is described in more detail in Section 2.

1.8 Land Use and Spatial Planning

City of Johannesburg Metropolitan Municipality Spatial Development Framework (COJMM SDF) 2040

According to the COJMM SDF 2040, Transit Oriented Development (TOD) nodes were identified as a priority programme, with the objective to promote optimal growth of transit hubs throughout the city, to ensure affordable housing, bustling economic opportunities, efficient transportation, top-notch facilities, amenities, and social services.

TOD nodes are crucial elements of Johannesburg's compact polycentric vision. In this context, stations serve not only as access points to public transit but also as drivers of urban growth. Presently, too many stations in the city serve solely as starting points for journeys rather than destinations.

The aim is for stations to become both departure and arrival points, fostering high-density, mixed-use development. TOD nodes specifically revolve around transit facilities like the Gautrain Stations, ideally offering a diverse mix of land uses tailored to the node's function and scale. These areas hold significant promise for enhancing quality of life by creating vibrant mixed-use precincts within walking distance of public transport, thus facilitating a wide array of economic opportunities.

All station precincts fall within City of Johannesburg (CoJ), except for Cradle Station, which straddles both CoJ and Mogale City. Samrand falls within the City of Tshwane (CoT), however, it is an integration point of a currently planned station on the existing Gautrain (GRRL) network.

Mogale City SDF 2022-2027

The SDF indicates that the long-term spatial vision for the Municipality is:

"…A Mogale City that is inclusive, cohesive, resilient and transformative, which provides high quality of services within a spatially efficient environment, and thus delivering shared prosperity, hospitality, beauty and security and a sense of place…"

The objectives of the SDF are:

- Environmental Protection and Resource Management.

- Nodal Development Strategies.
- Economic Opportunity and Proximity.
- Accessibility and Connectivity.
- Densification and Growth Management.
- Liveability and Sense of Place.

The SDF indicates that *"rail provides one of the east-west to west movement connectivity in Mogale City Local Municipality (MCLM). Rail transport is an important focus in promotion of a sustainable public transport system within the framework of Transit Oriented Development and densification"*.

Only Cradle Station falls within Mogale City, which falls within the urban areas. Parts of the proposed line also fall within peri-urban/rural areas. The area of influence straddles both the City of Johannesburg and Mogale City in the West Rand District.

1.9 Document Map for this Report

This report is the Draft Route Determination Report. It is supported by a series of Annexures containing additional detail. Once the public has reviewed and commented on this report and the proposed route alignment, updates will be incorporated into the final Route Determination Report.

Figure 1-9: Document Map

2

LOCALITY AND OVERVIEW OF ROUTES

2. LOCALITY AND OVERVIEW OF ROUTES

The study area is located in the Province of Gauteng, South Africa. The map in Figure 2-1 below, shows the study area which includes the existing GRRL network, Phase 1 GRRIN extension (previously *determined in 2022*), and the proposed GRRIN extensions that are part of this study (Phase 2 and partial Phase 4 and 5 from the 2016 Feasibility Study).

The three rail corridors that form part of this study are:

- ***Little Falls to Jabulani (GRRIN Phase 2 Extension)***
- Route length of ±19.9 km, with new stations at Roodepoort and Jabulani. Little Falls station forms part of the GRRIN Phase 1 Extension.
- ***Cosmo City to Lanseria (Portion of GRRIN Phase 5 Extension)***
- Route length of ±17.4 km, with new stations at Cradle, Smart City and Lanseria. Cosmo City station forms part of the GRRIN Phase 1 Extension. The Smart City station is an additional station that has been incorporated post the Feasibility Study of 2016 to future-proof the route, such that it does not terminate at Lanseria International Airport, to align with the future development plans for the Greater Lanseria area and allow routes to be extendable beyond Gauteng Province for regional integration.
- ***Cosmo City to Samrand (Portion of GRRIN Phases 4 & 5 Extensions)***
- Route length of ±30.3 km, with new stations at Fourways, Sunninghill, Olievenhoutbosch and Samrand. Cosmo City station forms part of the GRRIN Phase 1 Extension.

The three corridors together comprise of approximately 68 km of rapid rail extensions.

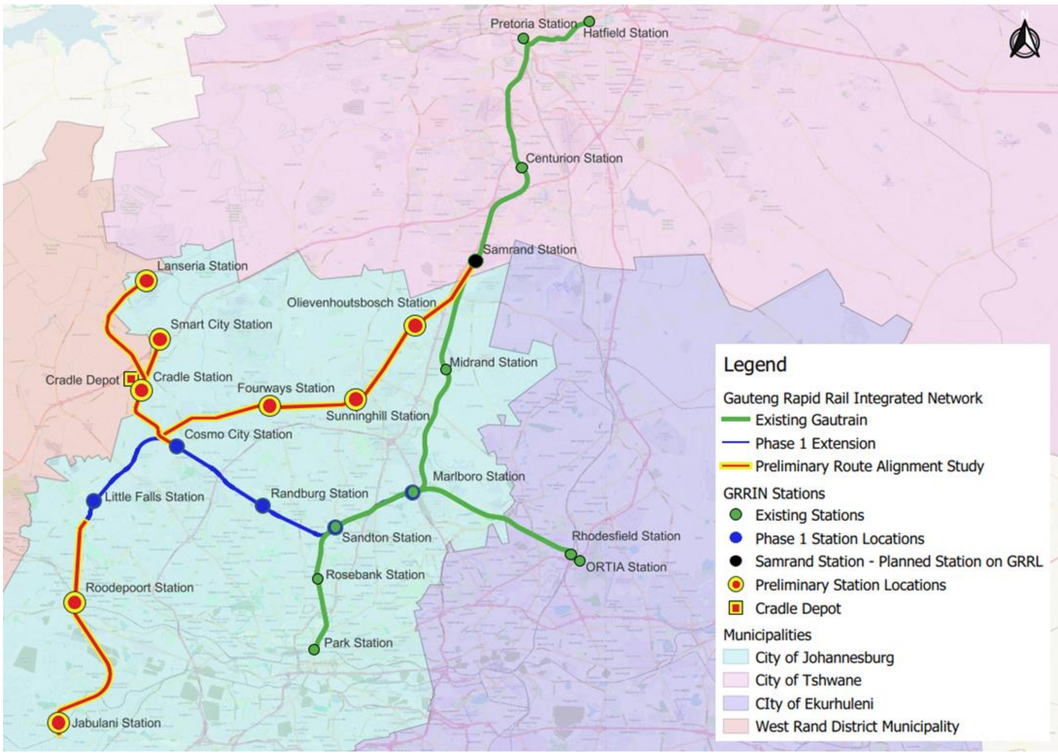


Figure 2-1: Preliminary Route Alignment Study in Relation to Existing Gautrain and Determined Phase 1 of the GRRIN Extensions

3

THE PRELIMINARY ROUTE ALIGNMENT STUDY APPROACH

3. THE PRELIMINARY ROUTE ALIGNMENT STUDY APPROACH

3.1 Overview

Route Determination is the first step in the process of defining a future railway reserve. It requires that a preliminary route alignment study and environmental investigation be completed to enable the MEC (who is responsible for provincial roads and transport in Gauteng) to determine the route; in this case, for the Little Falls to Jabulani, Cosmo City to Lanseria and Smart City, and Cosmo City to Samrand sections of the GRRIN Extensions.

This section pertains to the approach to the Preliminary Route Alignment Study. The Environmental Investigation is summarised in Section 7 with the full report in Annexure B.

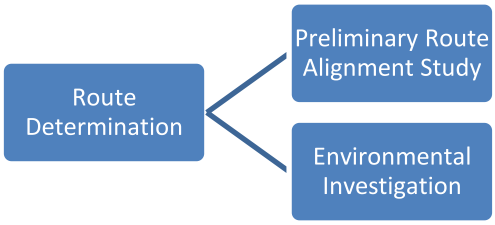


Figure 3-1:Components of Route Determination

To determine the optimal station positions and routes for this study, it was essential that the process was clear, logical and aligned with the objectives and goals of the study. Figure 3-2 below outlines the process used in this study, to determine the optimal route alignment and station positions.

The process began with defining the strategic goals of the Project. Goals for station positions and route alternatives were then defined. The goals were used to guide both the development of options and the criteria to be used for the assessment of options.

The determination of the optimal station positions was completed as a separate process from the determination of the optimal routes. Ultimately, once the optimal stations and routes were determined, the optimal routes were refined to align with the optimal stations.

Each of these steps are covered in more detail in Section 4 for the station positions and Section 6 for route alternatives.

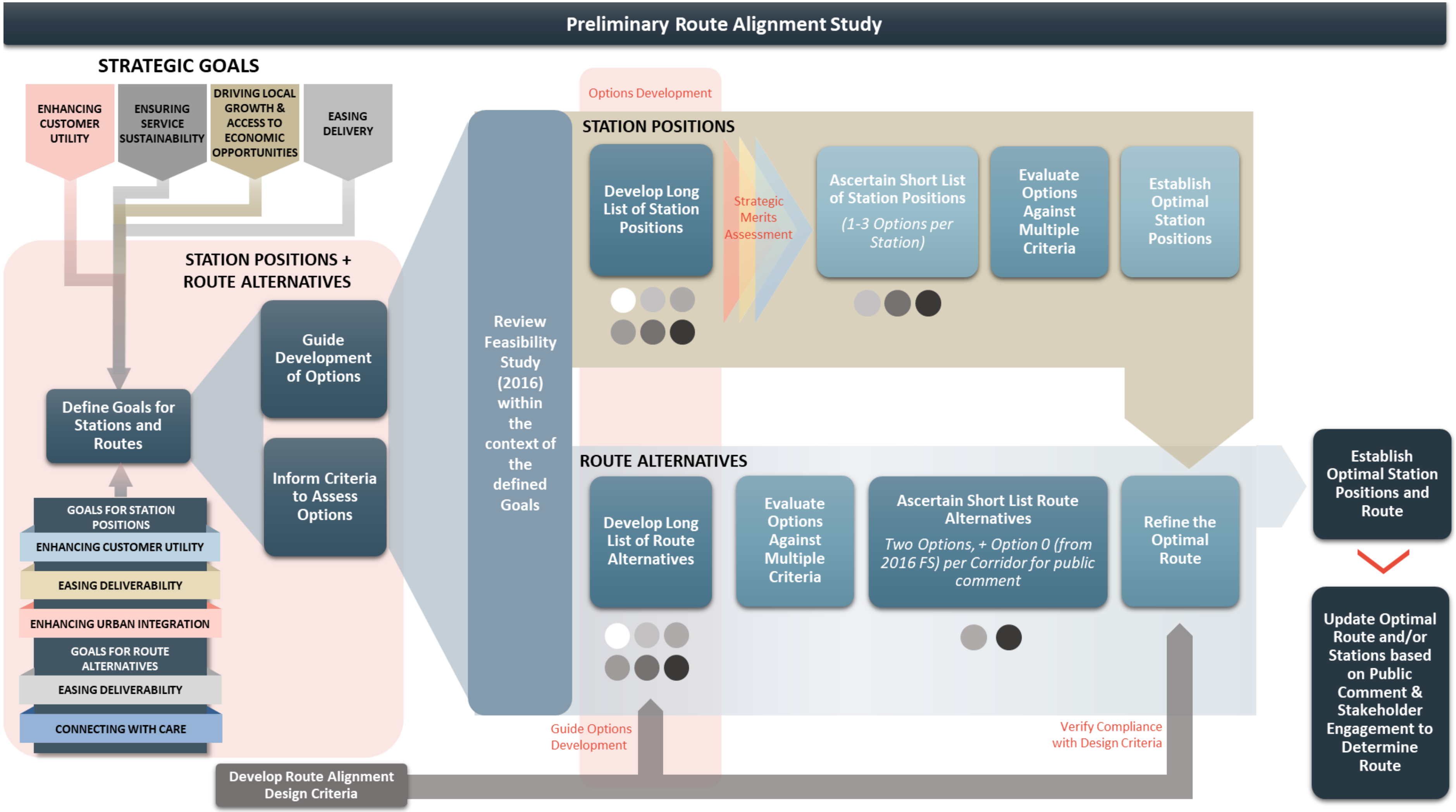


Figure 3-2: Preliminary Route Alignment Study Approach

3.2 Review of 2016 Feasibility Study

In the 2016 Feasibility Study (FS) for Possible Rapid Rail Extensions to the Gauteng Network (GMA, 2016), indicative routes were identified for the three corridors of this study. These are referred to as Option 0 for this study. The Option 0 routes are represented by the white lines in Figure 3-3 below. Locations for stations were also identified and are referred to as Position 0 for this study.

This study aims to improve on the previous 2016 FS by developing station and route alternatives that are based on the goals and design criteria defined for this study. A review of the 2016 routes and station positions was conducted to determine viability for this study.

The review of the station positions showed that the positions (Position 0) are viable for use in this study since there was no misalignment with the goals defined for this study.

Conversely, the defined goals and design criteria differ for the Option 0 routes and do not align with those established for this study.

Further, these Option 0 routes were aligned with the initial Cosmo City Station location as proposed in the 2016 FS. As part of the GRRIN Phase 1 Extension Route Determination Study (Section 3.3 below), the Cosmo City Station position was moved and therefore the Option 0 route from the 2016 FS does not align with the latest GRRIN Phase 1 Extension's determined route.

In addition, the Option 0 route does not align with the proposed location of the Cradle Rolling Stock Maintenance Depot as newly proposed in this study (see Section 5).

Therefore, the Option 0 routes are shown and described in this report for information only and were not considered as viable route alternatives for this preliminary route alignment study.

3.3 GRRIN Phase 1 Route Determination

A Preliminary Route Alignment Study for Phase 1 of the GRRIN extensions was conducted in 2021 (GMA, 2021), and the determined route was published in the Provincial Gazette on 25 May 2022. Phase 1 of the GRRIN extensions is a determined route that starts at Marlboro station and ends at the proposed Little Falls station, with the following stations located along the route:

- Sandton Station
- Randburg Station
- Cosmo City Station
- Little Falls Station.

The determined Phase 1 route was used for alignment and integration with the new route alternatives developed in this study. This Phase 1 alignment is shown by the green coloured route in Figure 3-3.

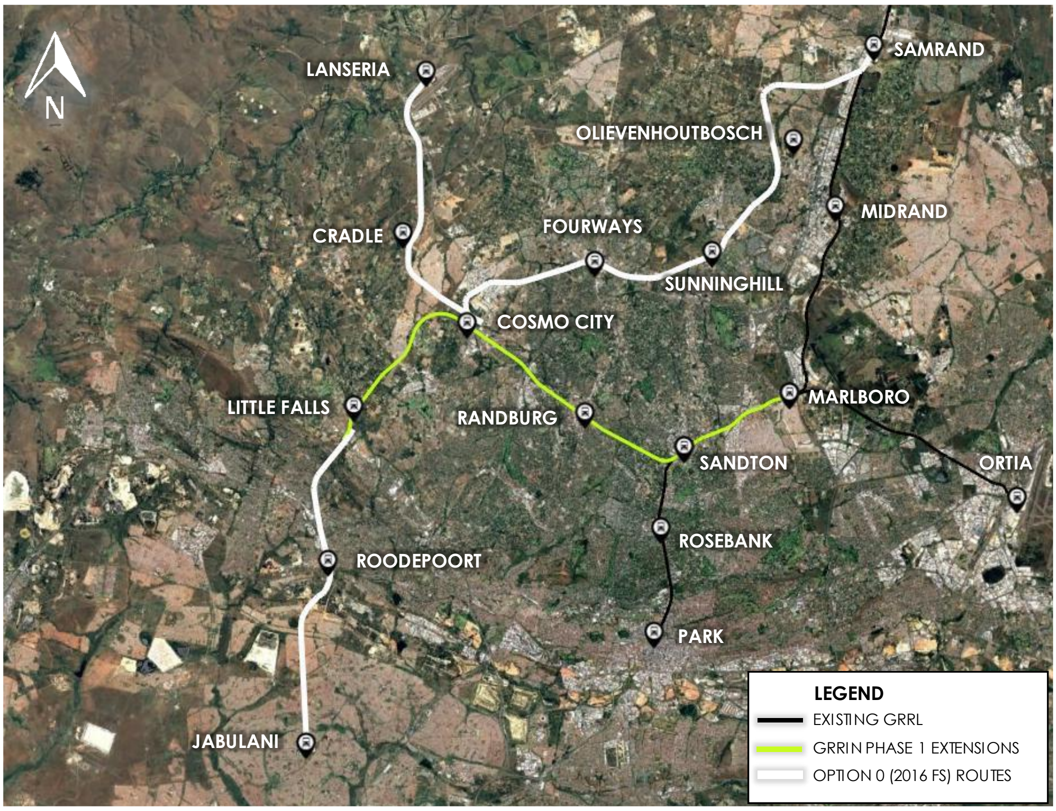


Figure 3-3: 2016 Option 0 Routes (White) and Determined Phase 1 Route (Green)

4

STATION POSITIONS

4. STATION POSITIONS

Identification of the optimal station positions was done independently of the route alternatives assessment. Identifying optimal station positions focuses on optimising the position of the station within the location defined in the 2016 FS (GMA, 2016), and does not determine if the proposed stations should be in a different area.

The proposed locations for the stations are at:

- Jabulani
- Roodepoort
- Cradle
- Lanseria Airport
- Fourways
- Sunninghill
- Olievenhoutbosch
- Samrand (tie-in point on existing GRRL network).

The location of the Samrand Station on the existing Gautrain Rapid Rail Link (GRRL) was already determined during the development of the GRRL network. Therefore, no additional options were considered for the future Samrand Station in this study, since the location is fixed between Midrand and Centurion Stations.

The station positions for Cosmo City and Little Falls were also regarded as fixed, since this was already determined as part of the GRRIN Phase 1 extensions (see Section 3.3 above).

Along the Cosmo City to Lanseria route, the Greater Lanseria Master Plan (GLMP) proposes a new city near the Lanseria Airport, named the Lanseria Smart City. Part of the proposed Smart City development will be a rapid rail station located within the new city.

The Smart City Station was not originally part of the previous 2016 FS and was added to this study to future-proof the route such that it does not terminate at Lanseria International Airport, in order to align with the future development plans for the Greater Lanseria area and allow routes to be extendable beyond Gauteng Province for regional integration.

4.1 Approach to Station Position Determination

Figure 4-1 illustrates the logical process that is applied as part of the options development and determination of the optimal station positions.

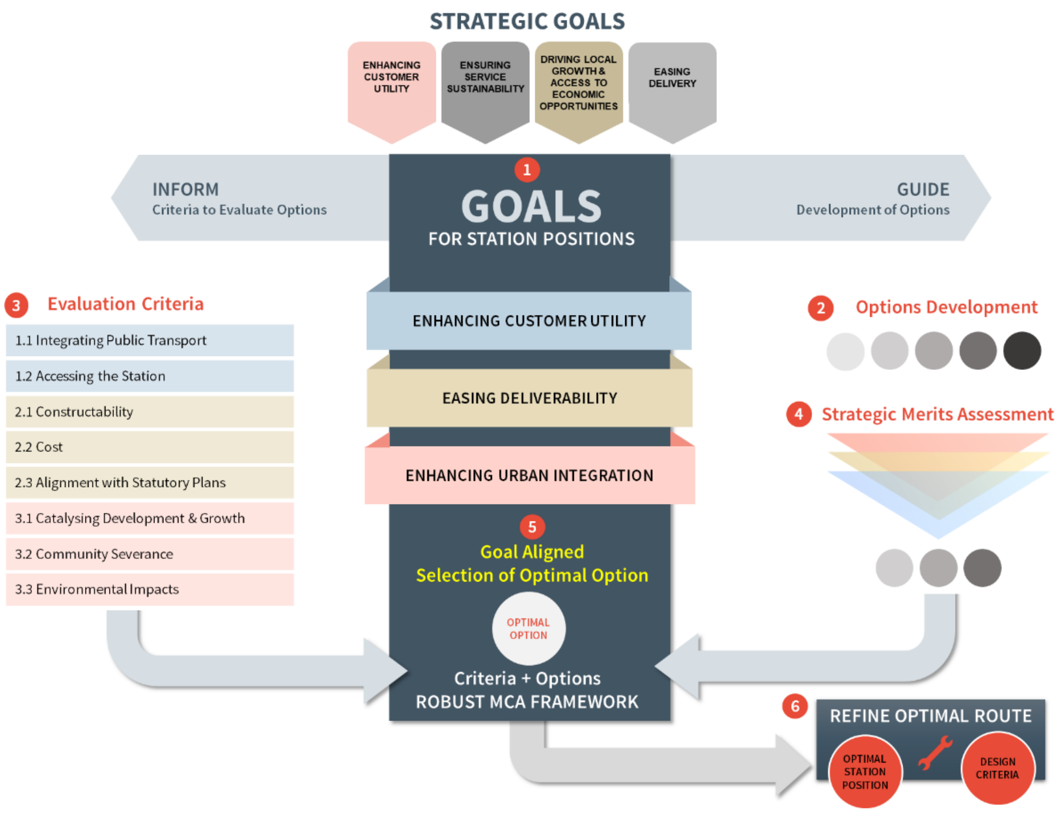


Figure 4-1: Approach for the Determination of Optimal Station Positions

1. The first step of the process was to define the goals of the stations to guide the development of options.
2. Thereafter, each station location was studied, and various potential options were identified for the position of the station.
3. The goals also informed the criteria to be selected for the evaluation of options.
4. These options were taken through a strategic merits assessment to ensure that only viable options were taken forward into the next step of the process, for the evaluation of options.
5. Options were further assessed through the Multiple Criteria Assessment (MCA) and the optimal station position was determined.
6. The final step was for the optimal station positions to be fed into the refinement process of the route options development. This was where the optimal route was refined to integrate with the optimal station positions.

This approach ensured that the optimal station position and optimal route were determined for the Project.

4.2 Goals & Assessment Criteria

Three goals were set for the station location options, namely:

- Enhancing customer utility
- Easing Deliverability
- Enhancing Urban Integration.

4.2.1 Goal 1: Enhancing Customer Utility

This goal considered the ways in which a passenger's experience is enriched by the station's position, within the context of an integrated public transport network and the ease of connectivity to the station's precinct and platforms from the surrounding urban developments.

4.2.2 Goal 2: Easing Deliverability

This goal was set to ensure that the options under consideration could be more easily delivered by minimising construction complexities and costs.

4.2.3 Goal 3: Enhancing Urban Integration

This goal was set to ensure that the options under consideration:

- had the potential to stimulate future urban growth and integrate with the current and future development plans of the surrounding area; and
- minimised the impact on the community, people, and the broader environment both during construction (temporary impact) and during railway operations (permanent disruption).

4.2.4 Assessment Criteria

Under each goal, a set of criteria was considered, against which each of the options were assessed, to determine the optimal station position. Table 4-1 below summarises the goals, criteria and a short description of the criteria considerations.

Table 4-1: Route Alignment Assessment Goals and Criteria

GOALS	CRITERIA	WHAT IT CONSIDERS
Enhancing Customer Utility	**Integrating Public Transport**	**Considers the proximity of the station's position relative to nearby transport modes and activity nodes.** *For example, a station located closer to nearby activity nodes, like a shopping mall, would be better integrated with the urban surroundings than a station located further away from activity nodes.*
	Accessing the station (360° Station Access)	**Considers the ease at which the station precinct is easily accessed or can be made accessible, by conducting a full 360-degree assessment of the area around the station's position.** *For example, a station position that only allows access from one side due to surrounding buildings, is less favourable to a station position that allows access from multiple directions.*

GOALS	CRITERIA	WHAT IT CONSIDERS
Easing Deliverability	**Constructability**	**Considers the complexity of construction and extent of disruption that could be caused by the construction of the station at a particular location.** *For example, constructing a station in a location that requires existing buildings to be demolished and relocated, will be more complex than constructing a station in a location where the land is vacant.*
	Cost	**Considers the capital cost required to construct the station in that position.** *A simple example would be the cost of constructing a station in a dense urban environment with lots of existing infrastructure surrounding it, would be more than constructing a station in a sparse urban environment with less existing infrastructure surrounding it.*
	Alignment with Strategic/Statutory Plans	**Considers the extent of conflict that the station position has with any pre-existing statutory plans, and the ease of resolving any such conflicts in future.** *An example would be a station in a position that conflicts with the government's plans to build a new water reservoir, is more challenging and less favourable to a position where the state plans to have future commercial developments like a shopping mall.*
Enhancing Urban Integration	**Catalysing Development & Growth**	**Considers the potential for transit Oriented Development (TOD) or space available for other commercialisation and its proximity to the station position.** *A simple example would be if there is vacant land available for commercial development around a station position, it would be more preferrable than a station positioned in an area with limited or no space for further commercialisation.*
	Community Severance	**Considers how communities are disrupted both during construction and operations of the station position. It also considers how the station position together with the railway route potentially separates communities and what impact it may have on the mobility of people.** *For example, a station and route going above ground through the middle of a city would be more disruptive than a station and route going through vacant land on the outskirts of a city.*
	Environmental Impacts	**Considers how the station position impacts environmental aspects like biodiversity, water, heritage, air, noise, etc.** *For example, a station positioned above ground near an existing river stream, would be less favourable to a station located in an already established urban precinct.*

4.3 Development of Station Options

4.3.1 Design Inputs

For the selection of station positions as options, certain information was used as inputs, including:

- Satellite ground level data.
- Satellite aerial imagery.
- Existing services and property data.
- Previous 2016 Feasibility Study (GMA, 2016).

Some of these aspects are discussed in more detail, in Section 8 below.

4.3.2 Naming of Options for Station Positions

The Feasibility Study (GMA, 2016) station positions (See Section 3.2 above) are referred to as Position 0 in this report.

All other newly proposed station positions identified in this study were named sequentially as Position 1 then Position 2, and so on.

4.3.3 Options Development

Design input information was utilised in the development of each station position. For example, the use of satellite aerial imagery and existing services data was extremely important to identify the location of existing infrastructure and vacant land, which guided the selection of options for station positions.

The station positions needed to be optimised within the defined location and, therefore, the position needed to provide easy access to the railway route and leverage existing urban infrastructure in and around the proposed station position. Station positions needed to avoid hindrance to travel in the immediate vicinity of the station, maximise potential passenger captivity, as well as provide economic growth opportunities for other businesses and communities located at or near the station precinct. There will also be further opportunities, in future stages of the project, for improvement on the station positioning (within the limits of the 400 m rail reserve).

Initially, a lengthy list of station positions was generated in this study in addition to Position 0. The list was taken through a strategic merits assessment to ensure that only viable options were taken forward into the next step for the evaluation of options.

The final list of additional positions to Option 0 was as follows, per station location:

- Jabulani: Two (2) additional positions.
- Roodepoort: One (1) additional position.
- Cradle: Two (2) additional positions.

- Smart City: Two (2) new positions[1].
- Lanseria: One (1) additional position.
- Fourways: One (1) additional position.
- Sunninghill: Zero (0) additional positions.
- Olievenhoutbosch: One (1) additional position.

These alternatives were then assessed using the goals and criteria established for the station positions (as per Section 4.2.4 above) and ranked against each other to determine the optimal station position.

The assessment of positions was done using both quantitative and qualitative measures. Using a simple scoring system, options were scored from 0 (worst) to 10 (best) for each criterion. Each criterion was given a unique weighting, and a weighted score was then calculated for each option. The final weighted scored provided an indication of the ranking of each option. The option with the highest score was optimal and the option with the lowest score was the least favourable option.

In addition, a sensitivity analysis was conducted on all station options to assess the sensitivity of the MCA. The results showed that the MCA was not sensitive to adjustments in the criteria weightings nor any of the criteria scoring. Thus, there was a higher level of confidence in the outcomes as determined by the MCA.

Once the optimal positions were determined, these were fed into the refinement process of the route options development, where the optimal route was refined to integrate with the optimal station location.

4.4 Options and Comparison of Station Position

The station positions were considered and a comparison, per station location, is summarised in the sections below.

4.4.1 Jabulani Station

For the Jabulani Station, only two station positions were identified, in addition to Position 0. These three options (Position 0 + two additional) are shown in Figure 4-2 below.

Well-known landmarks such as Jabulani Mall, the Soweto Theatre, Jabavu Stadium, Bheki Mlangeni District Hospital and Jabulani Technical School, are all situated within walking distance of the options. This station will service the surrounding suburbs including Jabulani, Soweto, Zondi, Jabavu, Moroka North, Molapo, Moletsane and others.

[1] Note that the Smart City Station was not originally part of the 2016 FS, therefore, there is no Option 0 for this station.

Figure 4-2: Options for Jabulani Station Positions

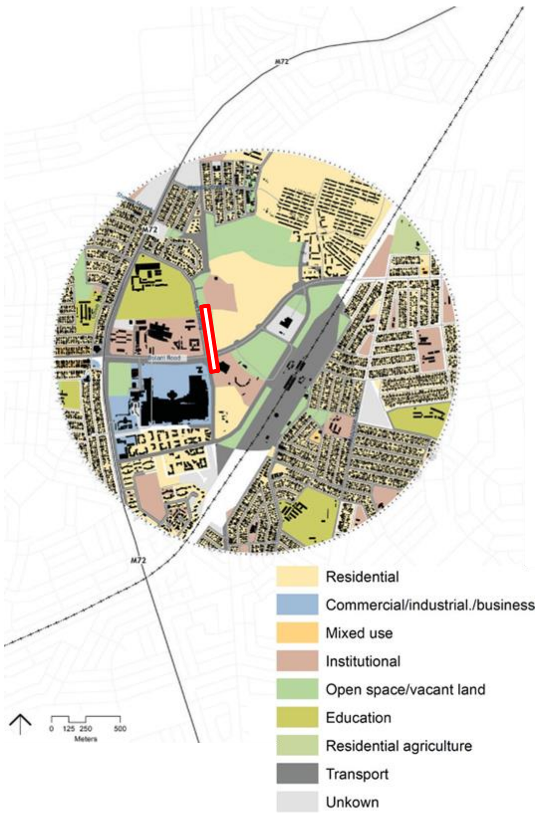
Based on the MCA conducted, Position 1 was determined as optimal for this location.

When compared to the other two options, station Position 1 is more central to a few key nodes and is better located for passengers to walk to the Bheki Mlangeni Hospital, the Jabulani Mall and the Soweto Theatre. The Position 1 site is flat and provides space for development around the station, with access roads close to various existing alternative transport modes.

Passengers transferring between the Passenger Rail Agency of South Africa (PRASA) Station and the Jabulani station at Position 1 would have to walk slightly farther (about 450 m) compared to the other two Positions. However, an integrated walkway or passage could be designed and constructed between the PRASA station and the proposed Jabulani station at Position 1, as part of the proposed station precinct development.

Synopsis of Planning Assessment with Land Uses

The Jabulani node located in Soweto is developing as a TOD node and presents the densities, land use and zoning conducive to a GRRIN station.



The proposed station will be advantageous to Jabulani and provide commuters with a choice in transportation, reinforce the TOD character of the node and connect residents to the greater region.

The COJMM SDF 2040 defines Soweto as a *"True City District"*. The vision of the area is to *"Transform Soweto into a liveable city district in its own right with access to jobs and the full array of urban amenities. Create a series of self-sufficient mixed-use nodes as growth points for jobs within the area. Develop mixed land uses (particularly economically productive ones) and social services, making use of a good street pattern and public transport."* This has steered development and continues to inform proposed projects within the Soweto region.

The Johannesburg Development Agency (JDA) together with the City of Johannesburg have been instrumental in the development of the Jabulani node through the development and urban design frameworks.

The dominant land use is residential, located on the periphery as single dwelling units. The typology consists of subsidised RDP houses. However, towards the central region, the typologies transition towards high density, 4-story walk-up units. Dwellings along the M72 and Bolani Street transition towards mixed-use activities.

The area is serviced by several institutional services such as the district hospital, civic centre, SAPS, Soweto Theatre and the Jabulani safe hub. Commercial offerings are within the Jabulani Mall for higher order retail whilst Bolani Street serves an activity street with lower order retail services.

4.4.2 Roodepoort Station

For the Roodepoort Station, only one station position was identified, in addition to Position 0. These two options (Position 0 + one additional) are shown in Figure 4-3 below.

Both these station positions are located adjacent to the existing PRASA Roodepoort Station, near Albertina Sisulu Road immediately east of the Roodepoort Central Business District (CBD). There are two key taxi ranks located on the north-eastern and south-western side of the existing PRASA station. This station will service the high-density surrounding suburbs including Roodepoort North, Horizon View, Roodepoort West, Davidsonville, Discovery, Creswell Park, Hamberg, Reefhaven and others.

Figure 4-3: Options for Roodepoort Station Positions

Based on the MCA conducted, Position 1 was optimal for this location.

The Roodepoort Position 1 is located on the western side of the existing PRASA rail line and is thus closer to the CBD area. The footprint indicated for the station development is already zoned as business and will provide the opportunity to revitalise the CBD area at this location.

Access routes to/from the station will be via major routes: the R24, Van Wyk Street, Albertina Sisulu Road and 4th Street. The relative distance from the planned station towards the CBD area, where shopping centres and other business areas are located, is closer than Position 0 and will provide a better connection to the key transport modes that run to/from the CBD.

This site also provides a higher potential for TOD and the development of commercial properties around the station footprint.

Synopsis of Planning Assessment with Land Uses

The Roodepoort CBD is CoJ's Municipal and Transport Node. The CBD Transport Master Plan (GIBB, 2021) identifies the following constraints:

- Roodepoort CBD Urban Decay.
- Inefficient transport systems in the CBD.
- Congestion and traffic issues.
- Poor urban connectivity.
- Poor urban safety and management.
- Lack of social and economic amenities and infrastructure.

The Transport Master Plan (TMP) was developed to resolve these constraints and is the foundation for regeneration in the CBD and future developments are required to align with the objectives and vision set out therein; namely:

1. Create a compact, well-connected neighbourhood that prioritises pedestrian movement and Non-Motorised Transport (NMT).
2. Build connective and accessible public spaces.
3. Promote access and use of public transport, walking and cycling that can enable land use development and investments.
4. Promote and enable mixed land use activities.
5. Limit on-street parking and more proactive management of parking.
6. Reduce dependency on private cars.
7. Identify possible interventions to improve road safety.

The southern portion of the precinct is earmarked as a Priority Housing Development Area (PHDA) where housing will be developed in the future.

The land use within the area is predominantly residential with a high street of commercial activity along the R24. Residential settlements are compact and dense with little to no vacant spaces and depict a typical suburban residential layout. Several schools are located in the area.

4.4.3 Cradle Station

For the Cradle Station, only two station positions were identified, in addition to Position 0. These three options (Position 0 + two additional) are shown in Figure 4-4 below.

This area is not densely populated with ample vacant land and the main activity nodes around the area are the Cosmo City suburb, Industrial developments near Marina Street, Malibongwe industrial Park and the Lion Park suburb.

The proposed Cradle Maintenance Depot (as described in Section 5) is also to be in this area.

Figure 4-4: Options for Cradle Station Positions

Based on the MCA conducted, Position 2 was optimal for this location.

The proximity of the Cosmo City suburb is a key activity node for this station location, however, with the planned maintenance depot to be located east of position 2, the maintenance depot would ultimately create a barrier between Cosmo City and the station position 2, making the access to the station more difficult from one of the key nodes.

This factor renders Position 1 more attractive, since it is located closer to the existing residential area and new planned developments. There is, however, a further challenge related to Position 1, with the existence of a cemetery close to this position.

Position 1 also separates the cemetery on the western side of the station from the community on the eastern side. However, various options can be designed and implemented during detail design to maintain mobility between the cemetery and the suburb, for example, an underpass passage/tunnel could be built beneath the railway line to allow pedestrians and light vehicles to move between the suburb and the cemetery. Other alternatives include designing and constructing a pedestrian bridge that allows pedestrians to walk over the railway line using the bridge to access the cemetery from the suburb.

It is therefore recommended that Position 1 be selected as the optimal station position for this location.

Synopsis of Planning Assessment with Land Uses

A GRRIN station is supported, however, it is dependent on the realisation of the housing projects and the implementation of the N14 Corridor Framework and Muldersdrift Precinct plan.

Muldersdrift Precinct Plan identifies an area for future mixed use, medium-high density residential opportunities along the N14 Development Corridor.

The N14 Corridor Development correlates with the land use proposals within the Muldersdrift Precinct plan. These uses are conducive for future TOD.

Mogale City has approved housing developments. These areas are in the process of being proclaimed as townships. Approximately 10 000 units are proposed, comprising low, medium and high-density typologies. Based on the information provided by Mogale City there are approximately 20 approved housing projects in the precinct.

The land use for the area differs between the east and west. Cosmo City on the east is residential whilst the west within Mogale City comprises of large vacant tracts of land that are semi-utilised for business and commercial uses or are greenfields.

4.4.4 Lanseria Station

For the Lanseria Station, only one station position was identified, in addition to Position 0. These two options (Position 0 + one additional) are shown in Figure 4-5.

This station location is specific for servicing the Lanseria airport, and therefore, both station positions are located near the Lanseria airport.

Figure 4-5: Options for Lanseria Station Positions

Based on the MCA conducted, Position 1 was optimal for this location.

Although Position 1 requires passengers to walk further from the station position to the airport terminal, it provides a better opportunity than Position 0, for future commercial development around the station area in the vacant land adjacent to Position 1.

Therefore, Position 1 was selected as the optimal position for the station location.

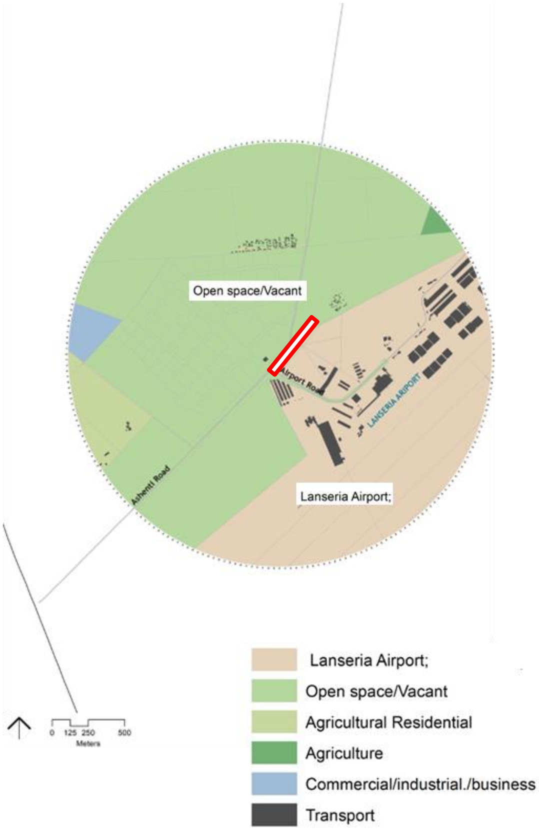
Synopsis of Planning Assessment with Land Uses

The area is earmarked for the proposed Lanseria Smart City, which will see the expansion of the current airport including an additional runway and the development of a new city around the airport.

The Greater Lanseria Masterplan (GLMP) has been endorsed by the CoJ, however, implementation requires infrastructure upgrades.

The current character of the area does not support the implementation of a GRRIN Station. Therefore, a future station is dependent on the realisation of the Lanseria Smart City, to ensure that the threshold is available to support a station and generate the required economic opportunities and commuter ridership.

Current applications approved by CoJ for this area reflect a development trajectory towards industrial and business uses, within a precinct known as the Lanseria Business District.



4.4.5 *Smart City Station*

The Smart City Station forms part of the GLMP (The GAPP Team, 2020) which plans to incorporate a rapid rail station as part of its public transport interventions for the city. Since this station was not originally part of the 2016 FS, there is no Option 0 for the station.

Two options were considered for the position of this station. The first option aligns with the Smart City development plans as per the GLMP, however, this option presented challenges for the route alternatives developed in this Project, to align with the station.

Therefore, a second option was considered, that is located nearby (but not within) the Smart city station and positioned where it could align better with the route alternatives.

Figure 4-6 below shows the station position relative to the Smart City as per the GLMP. The Smart City Station is located in an area designated as Public Open Space, within the Smart City.

Figure 4-6: Smart City Station Position

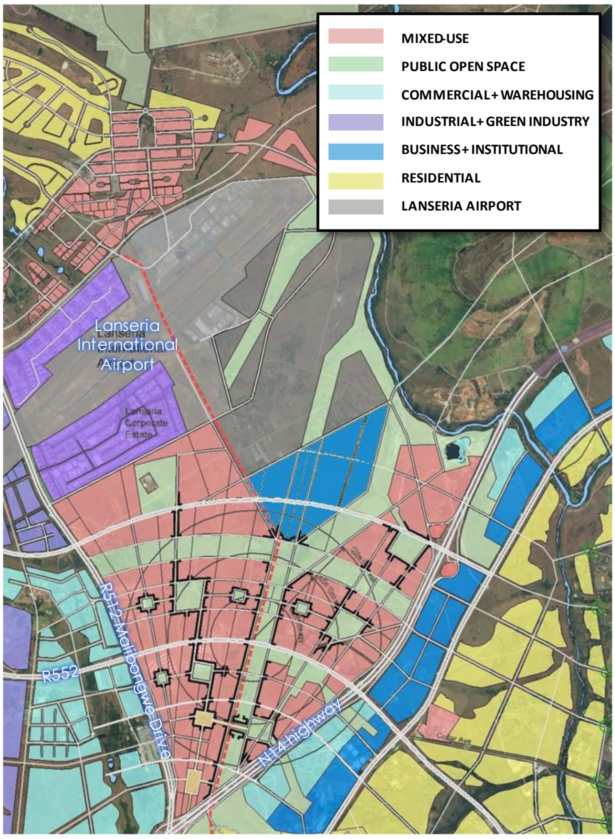
A desktop-level assessment was conducted for the Smart City Station positions. These options did not form part of the MCA process and were only qualitatively assessed to determine the optimal position.

Position 1 would allow for better integration with the GLMP, with its passengers mostly drawn from the planned city and the future planned businesses and industries in surrounding areas. Option 2 is located in an area that is planned for commercial and industrial development, which is a less suitable location for the station.

Position 1 would also enable easier and more convenient access to the station for Smart City residents. Option 2 would require the Smart City residents to use an alternative mode of transport from their homes to the station.

Therefore, Position 1 was selected as the optimal position for the station location.

Synopsis of Planning Assessment with Land Uses



The area is earmarked for the proposed Lanseria Smart City, which will see the development of a new city nearby the Lanseria airport.

The Greater Lanseria Masterplan (GLMP) has been endorsed by the CoJ, however, implementation requires infrastructure upgrades.

The current character of the area does not support the implementation of a GRRIN Station. Therefore, a future station is dependent on the realisation of the Lanseria Smart City, to ensure that the threshold is available to support a new station and generate the required economic opportunities and commuter ridership.

The Smart City will be the first post-apartheid planned city which is not simply a housing project. It is planned to contain economic, social and cultural activities where people can live, work fulfil their recreational, cultural and spiritual needs (The GAPP Team, 2020).

It is planned to be eco-friendly, safe and easy to walk, cycle or use alternative modes of transport that are to be made available.

The GLMP proposes commercial, warehousing and industrial zones situated along the N14 highway which will serve as a major logistical vein, connecting the new city with Centurion to the northeast and the central M5 interchange, linking Johannesburg and the North West Province.

Current applications approved by CoJ for this area reflect a development trajectory towards industrial and business uses, within a precinct known as the Lanseria Business District.

4.4.6 *Fourways Station*

For the Fourways Station, only one station position was identified, in addition to Position 0. These two options (Position 0 + one additional) are shown in Figure 4-7 below.

This Station will serve the major activity nodes located in the vicinity of the Winnie Mandela Drive and Witkoppen Road intersection; namely, Fourways Mall, Montecasino, and Fourways Crossing. The high-density surrounding areas that will also be serviced by this station include Fourways, Douglasdale, Jukskei Park, Maroeladal, Witkoppen, Lone Hill, Magaliessig and others.

Figure 4-7: Options for Fourways Station Positions

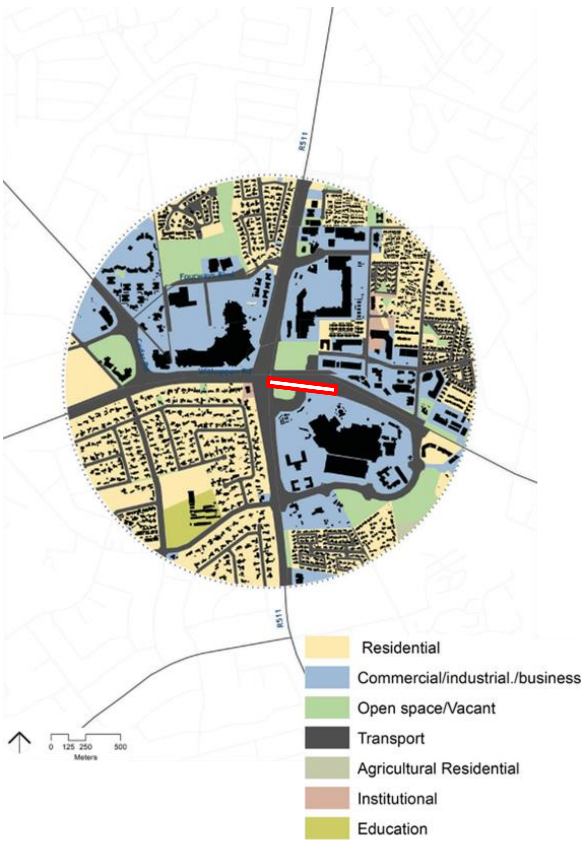
Based on the MCA conducted, Position 1 was optimal for this location.

As opposed to Option 0, which requires the relocation of existing residential homes, Position 1 is located on the east side of Winnie Mandela and closer to vacant land north of Witkoppen Road.

This property will be able to facilitate the development of station facilities that are better suited to link into the existing road network and commercial activities around the major road intersection point at Fourways. This site, although very contained, will also better facilitate future TOD around the station and can integrate more effectively with the other transportation modes that exist around the station Position 1.

Synopsis of Planning Assessment with Land Uses

This area is characterised by high-density urban residential components and well-defined mixed-use nodes. There are diverse services and employment opportunities. A well-defined Strategic Public Transport System (SPTN) connects the sub-area to the rest of the City.



The Draft Regional Spatial Development Framework (RSDF, 2010/11) states that the main objective for the precinct is to "*Promote the development of a sustainable spatial structure to ensure the efficiency, compatibility and integration of various land uses in the sub area*".

Fourways has developed into a mixed-use node premised on the principles of TOD. The vision of Fourways was to become a business hub, creating a "*second Sandton.*" Currently, the area is saturated with development and most recently, the upgrade of Fourways Mall to become the largest Mall in the Southern African Region. The mall is intended to catalyse additional urban growth.

Land use is predominantly residential and commercial with pockets of green spaces. The commercial areas are strategically located along major road networks to allow for greater accessibility, with high traffic volumes generated on Winnie Mandela Drive, Cedar Road and Witkoppen Road.

Opportunity exists to explore mixed-use developments with commercial offerings at ground floor level and residential above to optimise prime land and densify the node.

The proposed station is well-positioned within Fourways. The current densities, land-uses and future character intent identified in the CoJ Nodal Review policy support a future station in the area.

4.4.7 *Sunninghill Station*

For the Sunninghill Station, Position 0 was deemed optimal, as shown in Figure 4-8 below.

This Station is located near the Leeuwkop Prison and will serve the high-density suburb of Sunninghill and surrounding residential areas of Paulshof, Sunninghill, Waterfall Estate Kyalami Gardens, Barbeque Downs and others. While the position borders the urban development boundary (UDB), there may be potential for densification, subject to a more detailed environmental impact assessment (EIA) and further engagement with CoJ, with a possible requirement for biodiversity offsetting. Given the urban setting of Sunninghill, the likelihood of needing offsets will depend on the presence of any significant biodiversity features in the area. If the EIA finds that the impacts are minimal and can be mitigated through other measures, offsetting may not be necessary.

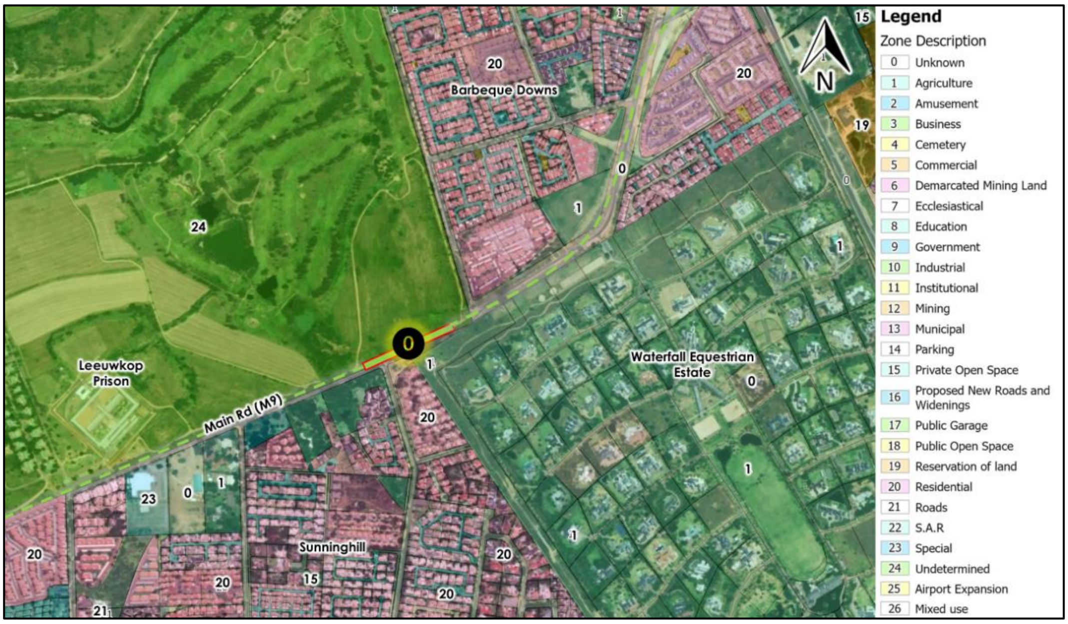


Figure 4-8: Sunninghill Station Position

If deemed necessary, another position southwest of the Position 0 could be considered on Van Der Bijl Avenue, shown in Figure 4-9. The area is developed with surrounding commercial, residential and schooling land uses. This position could be optimal given that this portion of the route is in tunnel. However, this would need to be supported by a feasibility assessment and further discussions with stakeholders such as the CoJ. For this position, existing infrastructure and land would need to be acquired, then demolished to enable development of a new station building and parking, resulting in more disruption to community than the Optimal Position 0.

Figure 4-9: Alternate Position for Sunninghill Station (for consideration, if required)

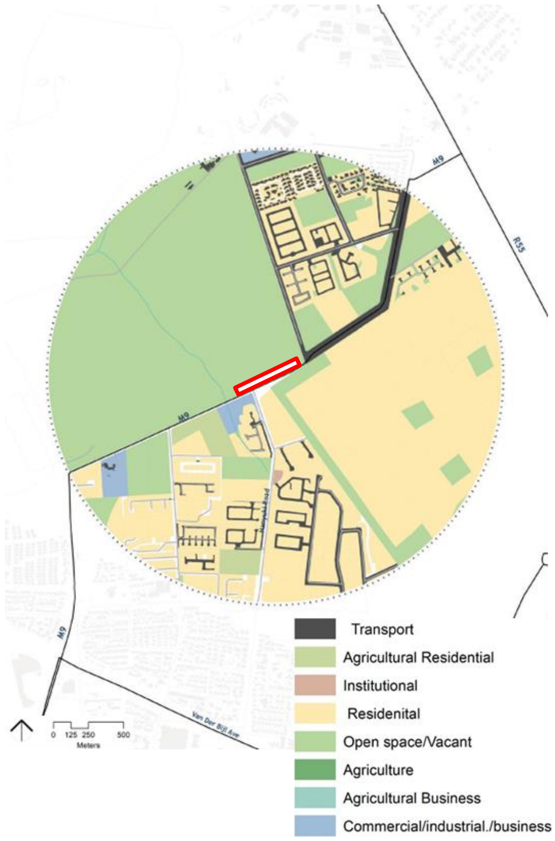
Synopsis of Planning Assessment with Land Uses

The current Woodmead Drive and Allandale Drive upgrade project will connect directly to Main Road and into Malindi Road where the proposed station is located.

The area is made up of interlocking high density residential estates and the Waterfall Equestrian Estate. Available land is located to the south of the area but exhibits environmental sensitivities.

The Draft RSDF (2010/11) indicates that the sub-area (Sub Area 8) falls outside the Urban Development Boundary (UDB). It comprises of environmentally sensitive areas, natural open spaces, agricultural holdings and farm portions. This means that further township establishments would likely not be supported within the area at this stage.

However, as indicated above, a more detailed environmental assessment (EIA) together would need to inform the feasibility of alternate locations.



4.4.8 *Olievenhoutbosch Station*

For the Olievenhoutbosch Station, only one station position was identified, in addition to Position 0. These two options (Position 0 + one additional) are shown in Figure 4-10 below.

These two station positions are located on two significantly different horizontal alignments. Both are located on available vacant land and will serve mainly the surrounding residential areas of Noordwyk, Blue Hills Carlswald, Midridge Park and others.

Figure 4-10: Options for Olievenhoutbosch Station Positions

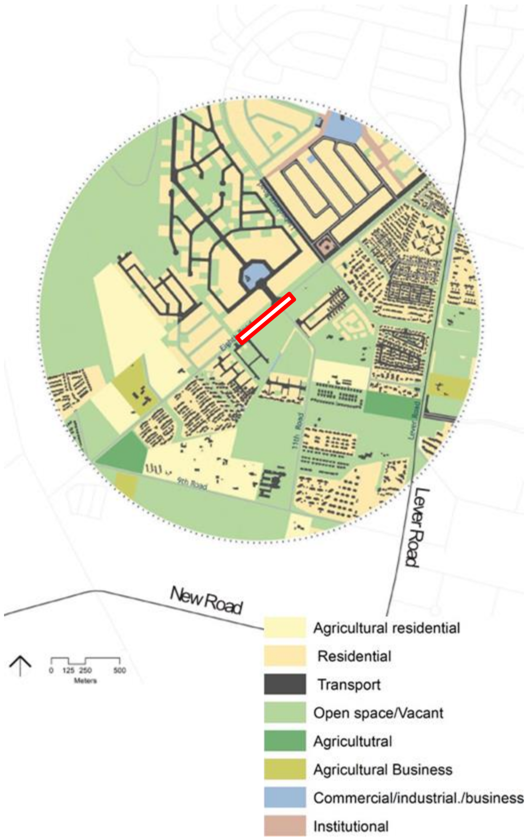
Based on the MCA conducted, Position 1 was optimal for this location.

Position 1 is in a more densely populated residential area, as opposed to Position 0, and is closer to the industrial area located east of the N1. Therefore, this position for the station is expected to have more riders/users than Option 0.

This optimal station position is located within the Noordwyk suburb, and it is recommended that the name of the station be amended accordingly, in the next design stage of the project.

Synopsis of Planning Assessment with Land Uses

Historically, farmlands occupied the area. Through years of transformation the dominant use is now residential, however, there are still pockets of vacant land of agricultural character.



The station precinct is located within the Noordwyk suburb and is built-up with multiple residential gated estates. The largest of these estates is the Crescent Wood country estate, making up a large portion of the area.

Single stand residential units are located within Noordwyk and filter into the precinct. The Rietspruit reserve runs through the precinct on the western end and is the only "vacant" land within the area. However, this land cannot be developed. The remaining vacant land, optimal for development, lies on the eastern side of the precinct and borders the proposed station position and Lever Road.

The residential character on the eastern side of the precinct is compact. Business and commercial land uses are not present, indicating low employment opportunities.

The RSDF highlights the following for the area:

- Retain and enhance the urban environment through the strengthening of economic growth and strategic densification within the Sub Area.
- Manage the growth of the Noordwyk Centre neighbourhood node by consolidating the non-residential uses within the Noordwyk Centre neighbourhood node.
- The are no proposed catalytic projects.

If required and given that this portion of the route is tunnel, consideration could be given to the station being positioned further southeast, along New Road, which could cater to Midridge Park, Erand, and Carlswald. Pockets of available land are located on New Road, which could support TOD. This suggestion can be investigated through a feasibility analysis, with due cognisance of the other criteria.

4.4.9 *Samrand Station*

For the Samrand Station, no additional station positions were considered, as the location was already determined as a future station on the existing GRRL network, between Centurion and Midrand. This station will remain in the planned position which is shown in Figure 4-11 below.

This Station is located near industrial developments, and will serve the Samrand Business Park, Randjespark, Louwlardia, N1 business Park and others in the surrounding areas.

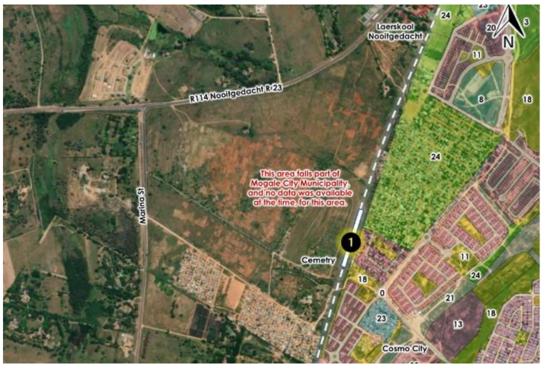
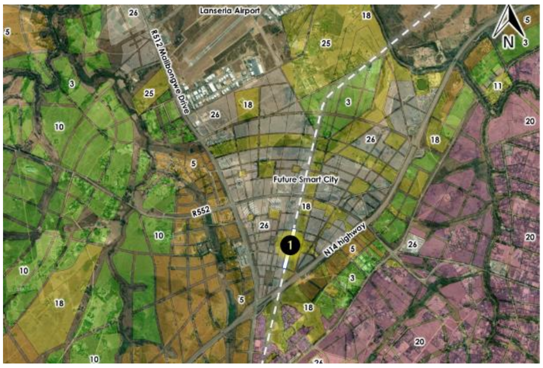
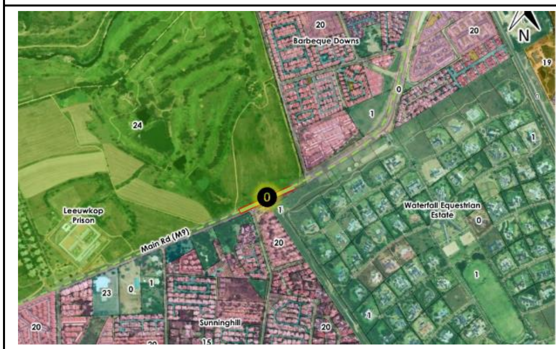
Figure 4-11: Samrand Station Position

No additional station positions were considered for Samrand, therefore, Position 0 was deemed as optimal.

4.5 Optimal Station Positions

The optimal station positions as determined through the MCA and described above, are summarised in Table 4-2.

Table 4-2:Summary of Optimal Station Positions for each Station Location

Station Location & Optimal Position	
 Jabulani Station - Position 1	 Roodepoort Station - Position 1
 Cradle Station - Position 1	 Smart City – Position 1
 Lanseria Station - Position 1	 Fourways Station - Position 1
 Sunninghill Station - Position 0	 Olievenhoutbosch Station - Position 1

<table>
<tr><th colspan="2">Station Location & Optimal Position</th></tr>
<tr><td>

Samrand Station - Position 0</td><td></td></tr>
</table>

These optimal positions fed into the refinement process of the route options development (as per Section 6.6), where the optimal route was refined to integrate with the optimal station position.

5

MAINTENANCE DEPOT LOCATION

5. MAINTENANCE DEPOT LOCATION

5.1 Approach to Maintenance Depot Location

Figure 5-1 illustrates the logical process that was applied as part of the options development and determination of the optimal location of the maintenance depot.

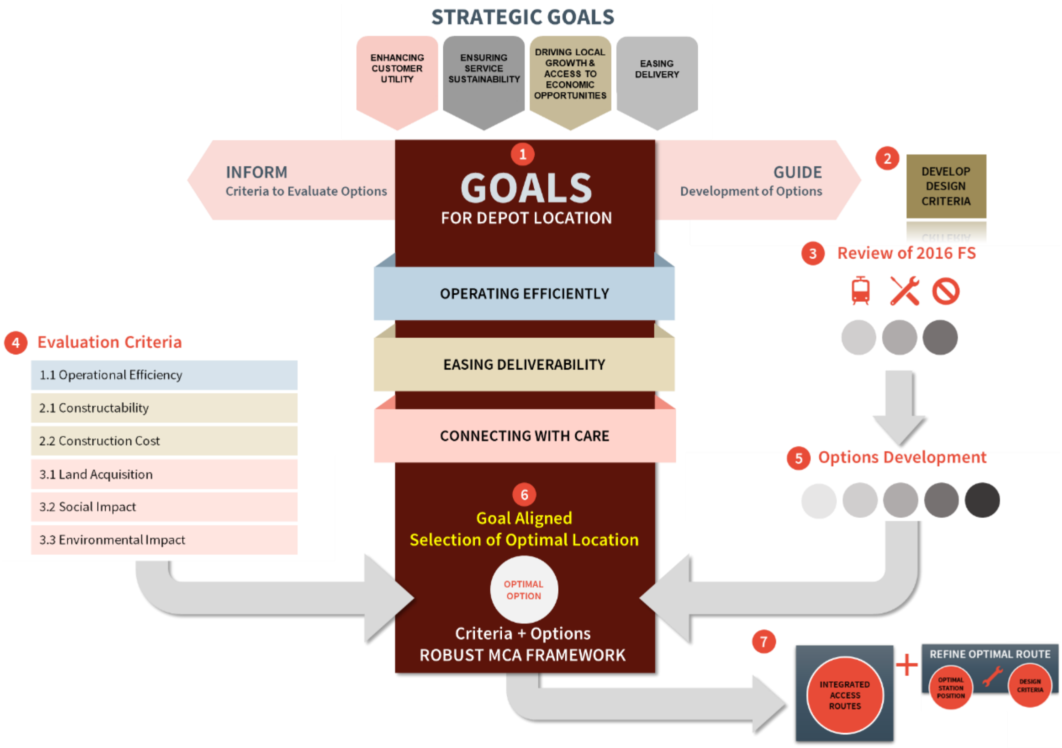


Figure 5-1: Approach for the Determination of Optimal Maintenance Depot Location

1. The first step of the process was to define the goals for the maintenance depot location.
2. The Design Criteria was then developed.
3. Thereafter, the 2016 FS location for the maintenance depot was reviewed to confirm alignment with the goals, before additional options were developed for the location of the maintenance depot.
4. The criteria were then selected for the evaluation of options which were guided by the goals defined in step 1.
5. The options were then developed, which were guided by the goals and design criteria defined in step 1 and 2 respectively.
6. Options were assessed through the Multiple Criteria Assessment (MCA) and the optimal location for the maintenance depot was determined.
7. The final step was when the optimal location of the maintenance depot was fed into the refinement process of the route alternatives. This occurred when the optimal route was refined to integrate with the optimal location for the maintenance depot, and to verify compliance with the design criteria.

This approach ensured that the optimal location for the maintenance depot was selected for the Project.

5.2 Goals and Assessment Criteria

Contrary to the approach for determining the optimal station positions in this study, the goal of "Enhancing Customer Utility" was not applicable to the location of the maintenance depot, since the maintenance depot will be used by the operator and not the customer.

For the determination of the optimal location for the maintenance depot, one additional criterion was considered, which is operating efficiently.

Therefore, the three goals set for the determination of the maintenance depot location, were:

- Operating Efficiently
- Easing Deliverability
- Connecting with Care.

5.2.1 Goal 1: Operating Efficiently

This goal was set to ensure that the options under consideration enabled efficient train operations by minimising the unproductive kilometers travelled by the trains in the daily operations.

5.2.2 Goal 2: Easing Deliverability

This goal was set to ensure that the options under consideration could be delivered more easily by minimising construction complexities and costs.

5.2.3 Goal 3: Connecting with Care

This goal was set to ensure that the options under consideration minimised the impact to the community, people, and the broader environment both during construction (temporary impact) and during operation of the corridor (permanent disruption).

5.2.4 Assessment Criteria

Under each goal, a set of criteria were considered against which each option was assessed, to determine the optimal route. Table 5-1 below summarises the goals, criteria and a short description of the considerations for each criterion.

In the process of assessing or comparing the options, a key aspect that supported the assessment process was the relative difference between options. For example, if a particular criterion affected all options equally, then it was not regarded as a significant differentiator between options and therefore did not change the outcome of the assessment. As a result, only criteria that were considered significant differentiators, were selected for the assessment process.

Several other criteria were considered as part of this study but were not deemed as significant differentiators in the selection of the optimal location of the maintenance depot. Therefore, these were not included in the final assessment criteria for this study.

Examples of these criteria include:

- Passenger comfort and travel time.
- Promoting urban development and growth.
- Presence of existing Bulk Services.
- Seismic events.
- Presence of previous underground mining activities.
- Land-use and zoning.
- Active mining rights.

Table 5-1: Assessment Goals and Criteria for the Maintenance Depot Location

GOALS	CRITERIA	WHAT IT CONSIDERS
Operating Efficiently	**Operational Efficiency**	**Considers the impact that the location of the maintenance depot would have on the efficiency of railway operations.** *For example, a maintenance depot located centrally within the network, would require less operational time and kilometers than a maintenance depot located further away from the centre of the network, since trains would travel longer distances without passengers for the start or end of day operations.*
Easing Deliverability	**Constructability**	**Considers the complexity of construction and extent of disruption that could be caused by the construction of the maintenance depot.** *For example, a maintenance depot that requires construction in an area with existing homes would be more complex and cause more disruption than a maintenance depot constructed in an area with more vacant land available.*
	Construction Costs	**Considers the capital cost required to construct the maintenance depot.** *A simple example would be the cost of constructing a maintenance depot over a valley is more than constructing a maintenance depot in a flatter area.*
Connecting with Care	**Land Acquisition**	**Considers the total size of land required to construct the maintenance depot.** *For example, a maintenance depot constructed over a valley, will require more land to be acquired, than a maintenance depot constructed in a flatter area, since the amount earth to be moved would be less for the flatter area.*

GOALS	CRITERIA	WHAT IT CONSIDERS
	Social Impact	**Considers how communities are disrupted both during construction and operations of the maintenance depot.** **It also considers how the maintenance depot potentially separates communities and what impact it may have on the mobility of people.** *For example, a maintenance depot that requires construction in an area with existing homes would cause more disruption than a maintenance depot constructed in an area with more vacant land available.*
	Environmental Impact	**Considers how the maintenance depot impacts environmental aspects like biodiversity, water, heritage, air, noise, etc.** *For example, a maintenance depot located over an existing river stream would be less favourable than a maintenance depot located not impacting on environmentally sensitive areas.*

5.3 Development of Options

A desktop exercise was conducted using satellite imagery, to determine possible alternative locations for the maintenance depot. The main drivers for the selection of the options were that the location should be:

- in an area where there was sufficient space available for a maintenance depot; and
- relatively close to the centre of the GRRIN extensions, Sandton Station.

Three other locations were therefore assessed, which included:

- Jackal Creek (Depot Option 1).
- Sunninghill (Depot Option 2).
- Cradle (Depot Option 3).

These locations, including the original location near Little Falls are shown in Figure 5-2.

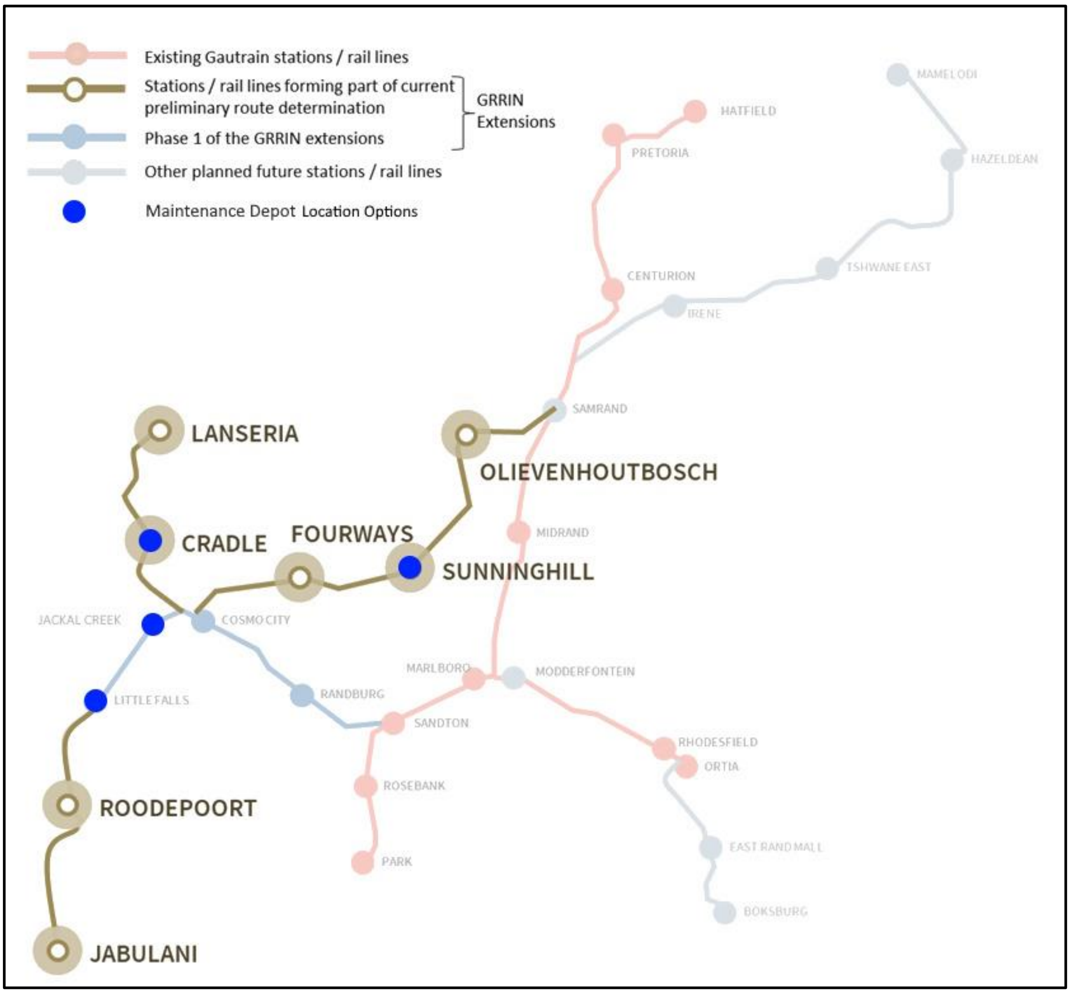


Figure 5-2: Key plan showing the proposed locations of the maintenance depot for the GRRIN Extensions

5.4 Maintenance Depot Location Options

5.4.1 Depot Option 0 – Little Falls

Figure 5-3 shows the area identified for the location of the maintenance depot near Little Falls Station as part of the 2016 FS. The red line represents a centreline through the proposed location of the maintenance depot. The longitudinal section shown at the bottom of the figure shows the existing ground profile beneath this centreline. The blue line in the longitudinal section represents the lowest point in the valley, and the blue dimensions indicate the height difference between the highest ground elevations and the bottom of the valley.

Figure 5-3: Little Falls Indicative Depot Location with Ground Profile

5.4.2 *Depot Option 1 – Jackal Creek*

Figure 5-4 shows the area considered for the location of the maintenance depot near Jackal Creek. The bright green line represents a centreline through the proposed location of the rolling stock maintenance depot. The longitudinal section shown at the bottom of the figure shows the ground profile beneath this centreline, from Google Earth. The blue line in the longitudinal section represents the lowest point in the valley, and the blue dimensions indicate the height difference between the highest ground elevations and the bottom of the valley.

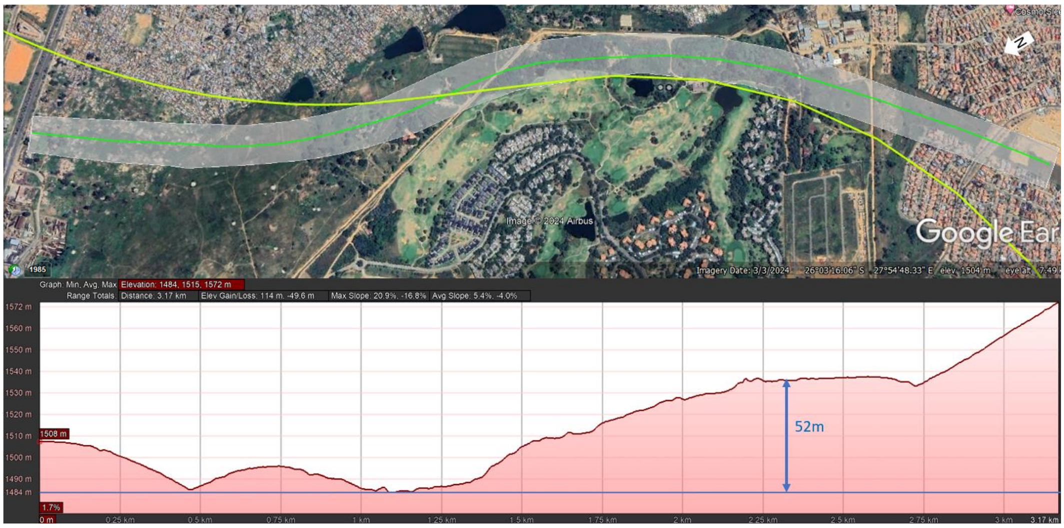


Figure 5-4: Jackal Creek Indicative Depot Location with Ground Profile

In the investigation of this location near Jackal Creek, the following was determined:

- The location is approximately 3 km away from the Cosmo City Station (which is anticipated to be the junction/integration point of the proposed GRRIN extensions).

- The challenging topography (due to a deep valley located near the Jackal Creek Golf Estate) would result in excessive earthworks to construct the yard for the maintenance depot.
- The access track from the mainline to the maintenance depot could require additional track infrastructure, depending on the geometry and levels of the mainline relative to the maintenance depot.
- The existing residential properties of the Zandspruit suburb will require relocation and a portion of the Jackal Creek Golf Estate and residential properties therein, could be impacted.
- New access roads will be required, and an existing gravel road may require deviating.
- Environmental impact is expected to be high due to the presence of the existing valley and some aquatic features.

5.4.3 Depot Option 2 – Sunninghill

Figure 5-5 shows the area considered for the location of the rolling stock maintenance depot near Sunninghill Station. This area is located in vacant land just north of the Leeuwkop Prison. The bright short green line represents a centreline through the proposed location of the maintenance depot and the longer bright green line represents the staging area for the trainset. The longitudinal section shown at the bottom of the figure shows the ground profile beneath this centreline, from Google Earth, for the staging lines. The blue line in the longitudinal section represents the lowest point in the valley, and the blue dimensions indicate the height difference between the highest ground elevations and the bottom of the valley.

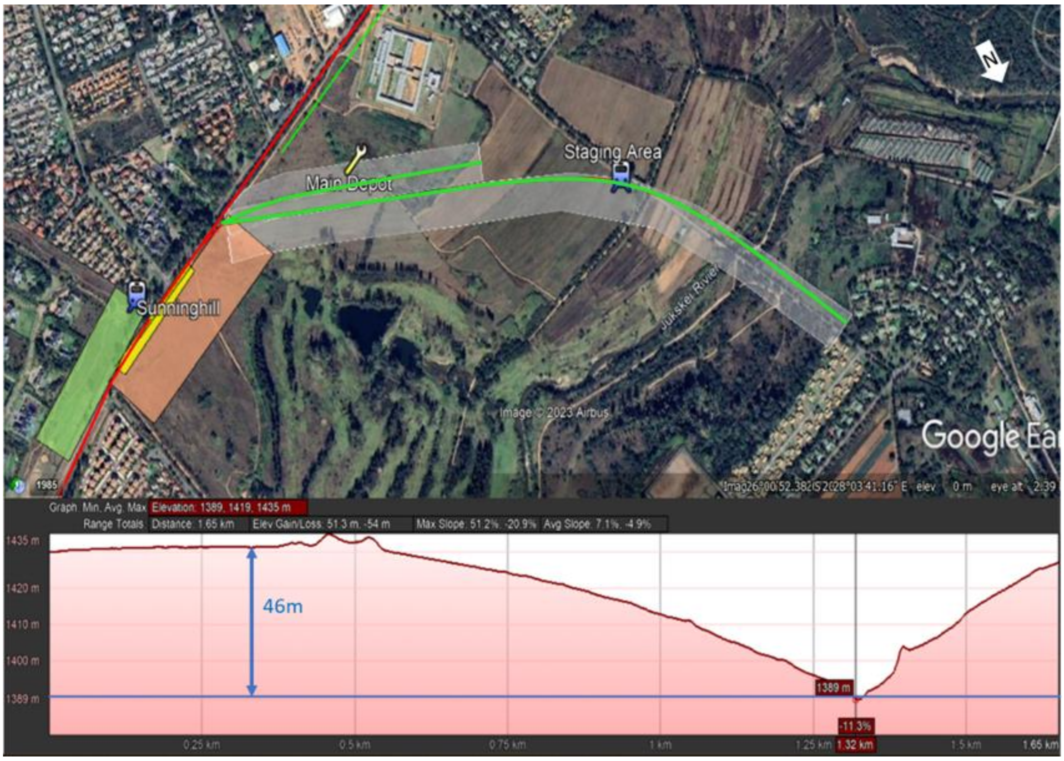


Figure 5-5: Sunninghill Indicative Maintenance Depot Location with Ground Profile

In the investigation of this location near Sunninghill, the following was determined:

- The location is approximately 15 km away from the Cosmo City Station (which is anticipated to be the junction/integration point of the proposed GRRIN extensions).
- The challenging topography (due to a deep valley located near the Jukskei River) would result in excessive earthworks to construct the yard for the maintenance depot.
- The access track from the mainline to the maintenance depot could require additional track infrastructure, depending on the geometry and levels of the mainline relative to the maintenance depot.
- A very small portion of the existing residential properties on the Leeuwkop Prison Farm could be impacted and may require relocation.
- Environmental impact is expected to be very high due to the presence of the existing valley and Jukskei river.

5.4.4 *Depot Option 3 - Cradle*

Figure 5-6 shows the area considered for the location of the maintenance depot near Cradle Station. The bright green line inside the white shaded area represents a centreline through the proposed location of the rolling stock maintenance depot. The longitudinal section shown at the bottom of the figure shows the ground profile beneath this centreline, from Google Earth. The blue line in the longitudinal section represents the lowest point, and the blue dimensions indicate the height difference between the highest ground elevations and the bottom of the lowest point.

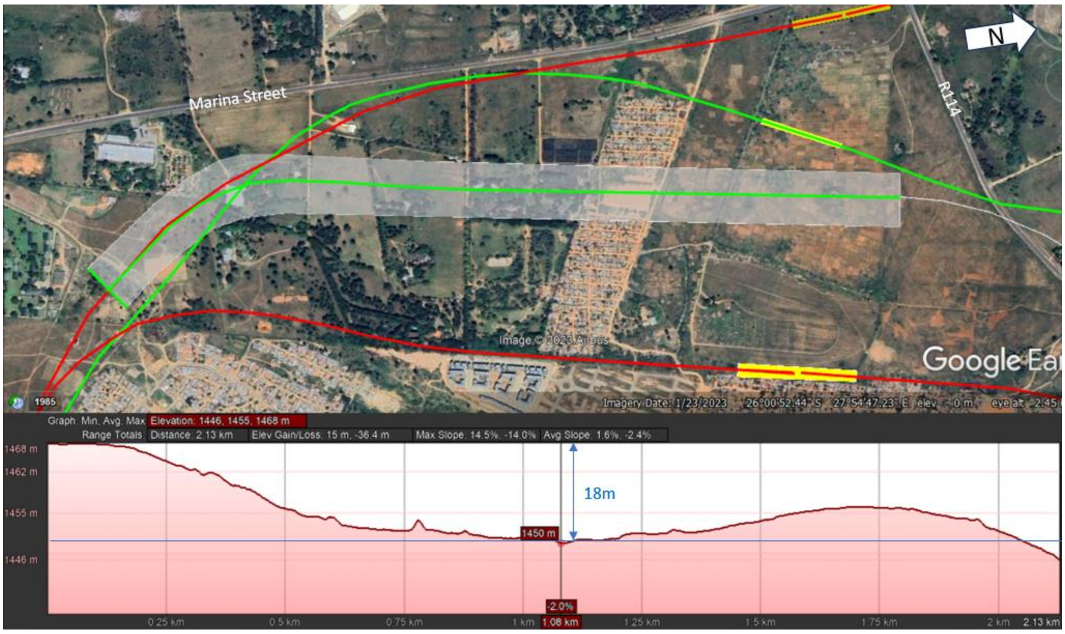


Figure 5-6: Cradle Indicative Depot Location with Ground Profile

In the investigation of this location near Cradle, the following was determined:

- The location is approximately 6 km away from the Cosmo City Station (which is anticipated to be the junction/integration point of the proposed GRRIN extensions).

- The topography is relatively flatter in this location, compared to the other Maintenance Depot locations considered. This location would result in the least amount of earthworks to construct the yard for the maintenance depot.
- The access track from the mainline to the maintenance depot could require additional track infrastructure, depending on the geometry and levels of the mainline relative to the maintenance depot.
- The existing residential properties and commercial properties will require relocation. However, there are only a small number of affected properties since the area is sparsely populated.
- New access roads will be required, and the existing R114 road will require deviating.
- Environmental impact is expected to be low.

5.5 Comparison of Options

These locations for the maintenance depot were all studied and assessed against the key criteria mentioned above, and the findings thereof are summarised in Table 5-2. The Option that had the best ranking is highlighted in green and the option that had the worst ranking is highlighted in red, for the specific criterion assessed.

Table 5-2: Assessment of Options for the Location of the Rolling Stock Maintenance Depot

Criteria	Option 0 *Little Falls*	Option 1 *Jackal Creek*	Option 2 *Sunninghill*	Option 3 *Cradle*
Operational Efficiency *(Distance from Sandton Station)*	22.5 km	18.0 km	30.0 km	20.0 km
Construction Complexity	Challenging Topography	Challenging Topography	Challenging Topography	Relatively Flat Topography
Construction Costs	Challenging Topography	Challenging Topography	Challenging Topography	Relatively Flat Topography
Land Acquisition	Largest land footprint	Average land footprint	Average land footprint	Smallest land footprint
Social Impact	Deviation of Road + Relocation of Several Houses	Relocation of a Few Houses	Relocation of Very Few Houses	Deviation of Road + Relocation of a Few Houses & Developments
Environmental Impact	Impact with Existing Valley	Impact with Existing Valley + Aquatic Features	Impact with Existing River	Low Impact

One of the considerations regarding operational efficiency, is the proximity of the maintenance depot to the core of the GRRIN extensions, which is anticipated to be near the Sandton Station. The closer the maintenance depot is to Sandton station, the more efficient and less costly the railway operations would be, making the location more favourable. From the assessment above, Option 1 is optimal, and Option 2 is least favoured from an Operational Efficiency perspective.

Regarding construction complexity: construction costs, land acquisition, and locations with challenging ground levels, will need to be considered, particularly where excessive earthworks construction and an increased land footprint will be required. Options with flatter ground levels will require less earthworks construction and a lower land footprint. Therefore, from the assessment above, Option 3 has flatter ground levels and requires the least amount of land to be procured, therefore making it a significantly more attractive option.

Due to the expected size of such a maintenance facility (approximately 300, 000 m^2), impacts to existing infrastructure are expected. In some cases, existing residential property and existing commercial or industrial developments would require demolition and relocation. This results in significant social disruptions which could negatively affect the community. From the above assessment, Option 2 would cause the least amount of disruption, and Option 0 would be the least favoured option.

Similarly, due to the large footprint of such a maintenance facility, some impact to environmentally sensitive areas is expected. The locations with deep valleys and aquatic features will almost certainly have an environmental impact. Since Option 3 has no deep valleys and no other environmentally sensitive areas, it is optimal from an environmental impact perspective.

5.6 Optimal Maintenance Depot Location

From this assessment, the Depot location 3 (Cradle) is the optimal location. The Option 0 location at Little Falls is the lowest ranked of the options.

Maintenance yards and staging areas require the track to be built on relatively flat areas and, ideally, where sufficient space is available.

Therefore, Depot Location 3 (Cradle) was selected as the optimal location for a maintenance depot for the GRRIN (See Figure 5-7).

This optimal location will then feed into the refinement process of the route alternatives development (as per Section 6.6), where the optimal route is refined to integrate with the optimal maintenance depot location.

Figure 5-7: Optimal Location for Maintenance Depot at Cradle

6

ROUTE ALTERNATIVES

6. ROUTE ALTERNATIVES

The study of the route alternatives was independent of the station positions study.

The 3 corridors that form part of this study are:

- Little Falls to Jabulani
- (GRRIN Phase 2 Extensions).
- Cosmo City to Lanseria
- (Portion of GRRIN Phase 5 Extensions).
- Cosmo City to Samrand
- (Portion of GRRIN Phase 4 & 5 Extensions).

The proposed locations for the stations through which the routes must run are at:

- Jabulani
- Roodepoort
- Cradle
- Smart City Station
- Lanseria Airport
- Fourways
- Sunninghill
- Olievenhoutbosch
- Samrand (on existing GRRL) network.

The location of the Samrand Station on the existing Gautrain Rapid Rail Link (GRRL) was already determined during the development of the GRRL network. Therefore, this location is fixed between Midrand and Centurion Stations.

The station positions for the Cosmo City and Little Falls were also regarded as fixed, since this was already determined as part of the GRRIN Phase 1 extensions (see Section 3.3 above above).

6.1 Approach to Route Alternatives

The diagram in Figure 6-1 below, illustrates the logical process that was applied as part of the development of route alternatives and determination of the optimal route.

Figure 6-1: Approach for Development of Route Alternatives and Determination of Optimal Route

1. The first step of the process was to define the goals of the route alignments.
2. The design criteria for the routes were developed.
3. Thereafter, the Option 0 routes (GMA, 2016) were reviewed to confirm alignment with the goals, before proceeding with development of route alternative options.
4. The goals also informed the criteria to be selected for the evaluation of options.
5. The goals, together with design criteria, guided the development of options.
6. Options were assessed through the Multiple Criteria Assessment (MCA) and the optimal route was determined.
7. The final step was to refine the optimal route to integrate with the optimal station positions, and to verify compliance against the design criteria.

This approach ensured that the optimal route option has been selected for the Project.

6.2 Goals & Assessment Criteria

In contrast to the approach for determining the optimal station positions in this study, the goal of "Enhancing Customer Utility" was not applicable to the development of route alternatives, since the positions of the stations already define the boundaries of the route.

Therefore, only two goals were set for the route alternatives, namely:

- Easing Deliverability.
- Connecting with Care.

6.2.1 *Goal 1: Easing Deliverability*

This goal was set to ensure that the options under consideration could be delivered more easily by minimising construction complexities and costs.

6.2.2 *Goal 2: Connecting with Care*

This goal was set to ensure that the options under consideration minimised the impact to the community, people, and the broader environment both during construction (temporary impact) and during the operation of the corridor (permanent disruption).

6.2.3 *Assessment Criteria*

Under each goal, a set of criteria were considered against which each of the options were assessed, to determine the optimal route. Table 6-1 below summarises the goals, criteria and a short description of the considerations of each criterion.

In the process of assessing or comparing the route alternatives, a key aspect that supported the assessment process was the relative difference between options. For example, if a particular criterion affected all options equally, then it was not regarded as a significant differentiator between options and therefore did not change the outcome of the assessment. As a result, only criteria that were considered significant differentiators, were selected for the assessment process.

Several other criteria were considered as part of this study but were not deemed as significant differentiators in the selection of the optimal route. Therefore, these were not included in the final assessment criteria for this study.

These criteria included:

- Passenger comfort and travel time.
- Promoting urban development and growth.
- Maintenance and Operating costs.
- Presence of existing Bulk Services.
- Seismic events.
- Presence of previous underground mining activities.
- Land-use and zoning.
- Active mining rights.

Table 6-1: Route Alignment Assessment Goals and Criteria

GOALS	CRITERIA	WHAT IT CONSIDERS
Easing Deliverability	**Constructability**	**Considers the complexity of construction and extent of disruption that could be caused by the construction of the route.** *For example, a route that requires construction of a railway line beneath an existing road would be more complex and cause more disruption than a route that runs on a bridge over the same road.*
	Construction Costs	**Considers the capital cost required to construct the route.** *A simple example would be the cost of constructing a tunnel route is more than constructing a route at-grade (above ground).*
Connecting with Care	**Land Acquisition**	**Considers the total size of land required to construct the route.** *For example, a tunnel route would not require any acquisition of land since it is located below ground, however a route at-grade (above ground) will require land to be acquired.*
	Social Impact	**Considers how communities are disrupted both during construction and operations of the railway route.** **It also considers how the route potentially separates communities and what impact it may have on the mobility of people.** *For example, a route going above ground through the middle of a city would be more disruptive than a route going through vacant land on the outskirts of a city.*
	Environmental Impact	**Considers how the route impacts environmental aspects like biodiversity, water, heritage, air, noise, etc.** *For example, a route going above ground through an existing river stream would be less favourable to a tunnel route going underground beneath the river.*

6.3 Development of Route Alternatives

6.3.1 Design Inputs

For the design development of the route alternative options, certain information was used as input data, including:

- Design criteria.
- Satellite ground level data.
- Satellite aerial imagery.
- Geology and Ground Settlement Assessments.

- Existing services and property data.
- Previous 2016 Feasibility Study routes (GMA, 2016).
- GRRIN Phase 1 determined route alignment (GMA, 2021).
- Some of these are discussed in more detail, in Section 8 below.

6.3.2 Naming of Route Alternatives

The Feasibility Study (GMA, 2016) routes for this study (which are discussed in this report for reference only as per Section 3.2) are referred to as Option 0, in this report.

The optimal option is referred to as Option 1, and the second optimal option as Option 2 in this report.

6.3.3 Development of Options

The design input information was utilised in the development of each route alternative. For example, the use of satellite aerial imagery was extremely important to identify the location of existing infrastructure which then guided the route alignment design by understanding which areas were to be avoided and which areas had potential for corridor development.

Where it was possible, the design of the route alternatives aimed to avoid/minimise:

- Impact on existing communities.
- Impact on existing major infrastructure (e.g. national roads, buildings, railway lines, bridges, rivers, existing bulk services, etc.).
- High-risk geological areas.
- Impact to known heritage sites.
- Impact to known environmental sensitive areas.

Initially, a long list of route options was generated as alternative routes to the Option 0 alignments.

These alternatives were then assessed through the MCA (goals and assessment criteria established in the section above) for the route alternatives, and the options were ranked.

The assessment of options was done using both quantitative and qualitative measures. Using a simple scoring system, options were scored from 0 (worst) to 10 (best) for each criterion. Each criterion was given a unique weighting, and a weighted score was then calculated for each option. The final weighted score provided an indication of the ranking of each option. The option with the highest score was optimal and the option with the lowest score was the least favoured option.

In addition, a sensitivity analysis was conducted on all route options to assess the sensitivity of the MCA. The results showed that the MCA is not sensitive to adjustments in the criteria weightings nor any of the criteria scoring. Thus, there is a higher level of confidence in the outcomes as determined by the MCA.

The route options were ranked, and the optimal route was determined. Two options generally scored similarly for each corridor, with the optimal option only marginally better than the second optimal option.

For this reason, the second optimal option (per corridor) is also included in this report for public comment.

As per the preliminary route alignment study approach, only the (first) optimal option was further refined, for the determination of the final station positions and route centreline per corridor.

Supporting Technical Layouts may be found in Annexure A.

6.3.4 *Vertical Placement of Routes*

Each route has a unique vertical placement based on the design of the route relative to the existing ground level. Therefore, sections of each route could either be at one of four different vertical positions, abbreviated as A, B, C or D. These are described as follows:

- **A – At-grade**

  At-grade is typically at ground level but may have a vertical placement up to 8m below or above existing ground level.

- **B – Bridge (or Viaduct)**

  A viaduct is a specific type of bridge that consists of a series of arches, piers or columns supporting a road or railway over a long distance. Bridges or Viaducts are typically located more than 8m above the existing ground level.

- **C – Cut-and-cover**

  Cut-and-cover is a method of building a shallow tunnel by cutting into the ground to the desired level, then lining or enclosing the tunnel with concrete and covering it with earth up to existing ground level. Cut-and-cover sections are typically between 8m and 28m below existing ground level.

- **D – Deep tunnel**

  A deep tunnel is an underground passageway, dug through the surrounding soil, earth or rock and then enclosed with concrete, except for the entrance and exit of the tunnel. Deep tunnel sections are typically placed at 28m or more below existing ground level.

Figure 6-2 below visually demonstrates examples of the various vertical placements that could be found along a route.

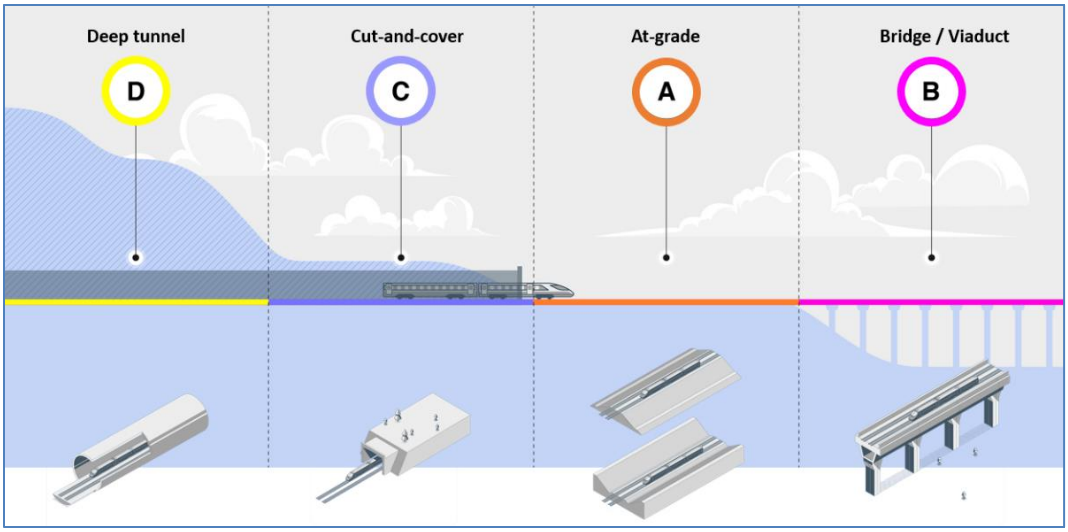


Figure 6-2: Typical Vertical Placements along a Route

6.3.5 Option 0 Routes from 2016 Feasibility Study

Section 3.2 describes the outcomes of the Feasibility Study (GMA, 2016) review. The Option 0 routes are shown and described for information only and were not considered as viable route alternatives in this study.

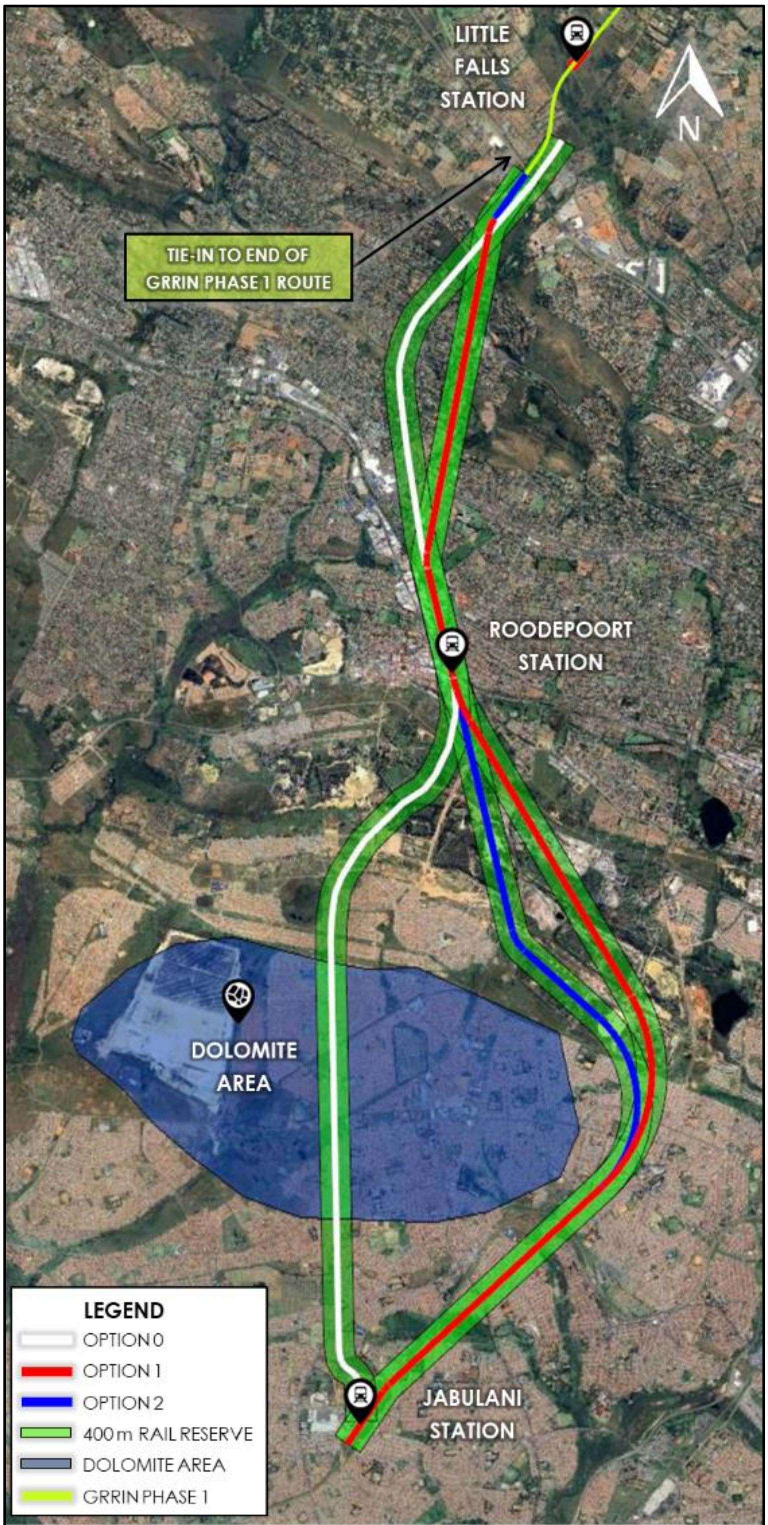
Notwithstanding, similar new route options were developed. These new routes closely match Option 0 routes, whilst ensuring compliance with goals and design criteria established for this study.

6.4 Route Alternatives

Sections 6.4.1 to 6.4.3 below, analyse and describe Option 0 routes as well as the two optimal route alternatives for each of the three corridors. Although Option 0 was not considered a viable option, it is described in this section for reference, context and comparison to the two other alternatives.

6.4.1 Little Falls to Jabulani

Options 0, 1 and 2 for Little Falls to Jabulani are indicated in Figure 6-3. Each option is discussed in further detail in the sections below.



NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed GRRIN Phase 1 Route (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the route was moved. Therefore, Route Option 0 does not align with the latest position of GRRIN Phase 1 Route.**

Figure 6-3: Route Options – Little Falls to Jabulani

6.4.1.1 Option 0

6.4.1.1.1 Route Description

Route Option 0, from the 2016 FS (GMA, 2016), spans approximately 18 km from Little Falls to Jabulani.

The section from Roodepoort to Little Falls is in a tunnel. The tunnel segment spans approximately 7 km, providing a continuous underground route that minimises ground-level infrastructure disruptions and environmental impacts. The proposed Roodepoort station building, including the track and access platforms, will be located on an elevated bridge structure.

The section from Roodepoort to Jabulani comprises of both at-grade and elevated bridge/viaduct route sections. Once built, these at-grade sections of the route between Jabulani and Roodepoort would become permanent barriers separating the communities in these areas.

Part of the route also crosses the previous underground mined areas near Roodepoort, presenting potential risks for the route in this region. To address this risk, additional supporting infrastructure, such as long bridges, may be required to navigate the terrain and minimise ground-level disruptions.

A significant portion of this route (approximately 3.3 km) runs above the dolomite area identified as part of this study. Construction on dolomite can be extremely complex and expensive and poses a major risk to the stability of the track infrastructure. A dolomitic stability assessment would need to be conducted to assess the depth and extent of the dolomite zone.

In addition, a small portion of the route (approximately 1.2 km) would need to be constructed in a cut-and-cover structure (shallow tunnel) beneath the existing Mphepheto Street. Construction of this section would be very complex requiring temporary road closures and deviations. This would be very disruptive to the mobility of the surrounding community.

The proposed Jabulani station building, including the track and access platforms, will be located on an elevated bridge structure.

6.4.1.1.2 Vertical Profile

The vertical profile data for Option 0 was not available from the 2016 FS and, therefore, no vertical profile diagram was generated for Option 0 in this study.

Therefore, the Little Falls to Jabulani Option 0, excluding its vertical profile, is indicated in Figure 6-4.

NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed location of Cosmo City Station (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the position of the Cosmo City station was moved. Therefore, Route Option 0 does not align with the latest position of Como City station.**

Figure 6-4: Option 0 – Little Falls to Jabulani – <u>Excluding</u> Vertical Profile

6.4.1.1.3 Affected Infrastructure

Some of the major infrastructure, developments and residential suburbs that the route runs through, are listed in Table 6-2 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The tunnel section of this route between Little Falls and Roodepoort will not have major impacts to infrastructure, developments and residential suburbs, above ground level. Therefore, only major infrastructure, developments and residential suburbs that are affected above ground level, are included in this list.

The extent of the potential impact to existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-2: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings: Little Falls to Jabulani – Option 0 – Little Falls to Jabulani

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Braamfischerville • Mmesi Park Dobsonville • Zondi • Jabulani	• Amatshe mining • Braamfischerville Primary School • The Bram Fischer Multi-purpose Centre • JB marks Primary School • Zion Cristian Church • Kgatelopele Secondary School • Sizwe School for Deaf Children • Thabang primary School • George Khosa Secondary School • PJ Simelane Secondary School • DSJ primary School • Etandweni Primary School • Doornkop Cemetery • Mxolisi Primary School • Soweto Theatre • Jabavu Stadium	• R24 (Albertina Sisulu Road) • Dumat Street • Roodeberg Avenue • Miles Stoker Road • PRASA railway yard and lines near the R41 • R41 (Randfontein Road) • Manyano Boulevard • Mphepheto street • M72 (Koma St)

6.4.1.2 Option 1

6.4.1.2.1 Route Description

This corridor starts at the end of the GRRIN Phase 1 determined route, near the M47 (Hendrik Potgieter Road), about 1.6 km south of the Little Falls station.

This route is a complete tunnel route, from start to end, with a total length of approximately 19 km. This complete underground tunnel minimises infrastructure and environmental impacts or disruptions to communities above ground, during both the construction and future railway operations.

The section between Little Falls and Roodepoort is a direct route up to the Horizon View area, where the route turns parallel to the existing PRASA line through the proposed Roodepoort station. The proposed Roodepoort station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the existing PRASA railway lines and the proposed station building.

The next section between Roodepoort and Jabulani is not a direct route and deviates around Braamfischerville and portions of the Meadowlands West and Dobsonville areas, to avoid the underlying dolomite area that was identified as part of the study.

Just after the Proposed Roodepoort station, the route runs beneath the R41 (Randfontein Road), the M77 (Elias Motsoaledi Road) and the Afrisam Roodepoort Plant. This section of the route crosses the underground mining areas in Roodepoort, presenting potential risks for the route through these undermined areas.

The route then proceeds in a tunnel around the Dolomite area, running beneath the Meadowlands East, Molofo North and Jabavu areas and crosses below the existing PRASA line twice, before it reaches the proposed Jabulani Station located parallel to the existing PRASA Inhlazane station.

The proposed Jabulani station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the station building.

6.4.1.2.2 Vertical Profile

The vertical profile for Little Falls to Jabulani Option 1 is indicated in Figure 6-5.

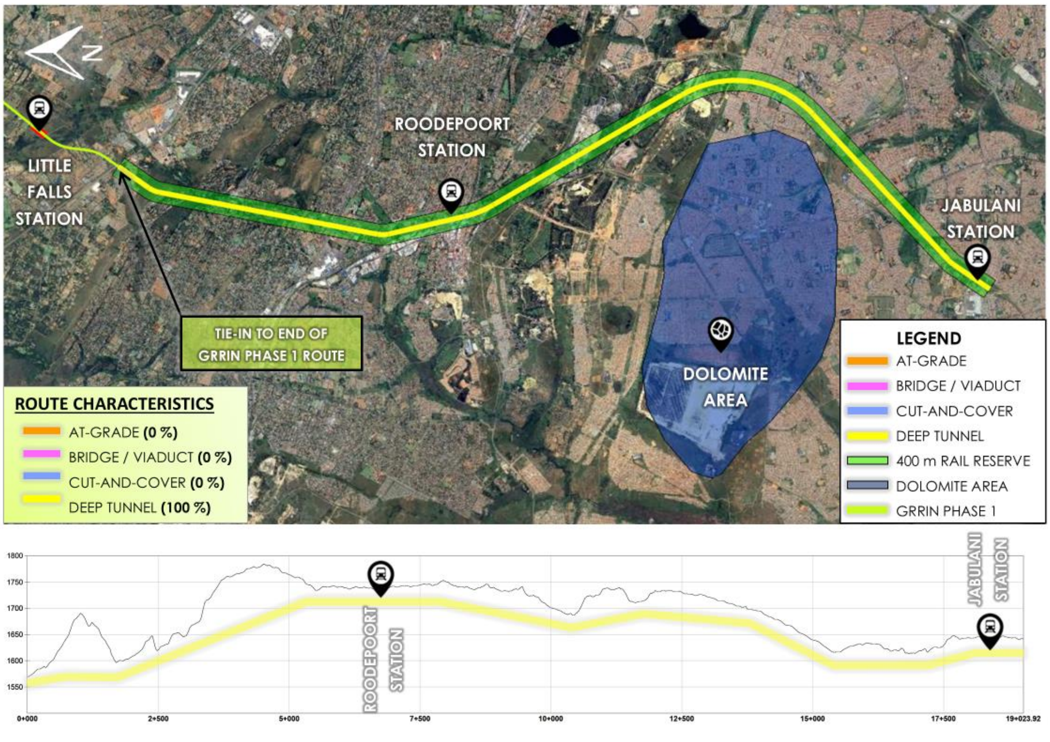


Figure 6-5: Option 1 – Little Falls to Jabulani – Including Vertical Profile

6.4.1.2.3 Affected Infrastructure

The route alignments for this study were developed such that the impact on existing major developments were minimised, however, this was not always possible and certain major infrastructure, developments and roads could be affected.

Since this route is a complete tunnel route, it will not have major impacts on infrastructure, developments and residential suburbs, above ground level. Therefore, no list of affected infrastructure was developed.

Tunnel routes require emergency exits from within the tunnel up to ground level. However, the space required for these exit buildings is minimal and no major impacts are anticipated.

The final extent of the potential impact on existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

6.4.1.3 Option 2

6.4.1.3.1 Route Description

This route is very similar to Option 1 (as described in Section6.4.1.2 above) that deviates around the dolomite area located near Braamfischerville and a portion of the Meadowlands West and Dobsonville areas. However, the route is not a complete tunnel route.

This route is approximately 19 km long and is mostly in a tunnel (approximately 15.5 km). The one key difference, when compared to Option 1, is in the section between Roodepoort and Meadowlands East, where a small portion of the route (approximately 3.5 km) between Roodepoort and Meadowlands East, is above ground.

In this area, the route mainly runs through the vacant areas of land, the M77 (Elias Motsoaledi Road) and old mine dumps. This section of the route crosses the underground mining areas in Roodepoort, presenting potential risks for the route above these areas.

With most of the route in a tunnel this option also minimises impacts or disruptions to communities above ground, during both the construction and future railway operations. The small section of the route that is above ground is not located in a residential area and runs mostly through vacant land and old mine dumps. Therefore, any potential impact or disruptions to communities during construction and future railway operations, is not expected to be major.

6.4.1.3.2 Vertical Profile

The vertical profile for Little Falls to Jabulani Option 2 is indicated in Figure 6-6.

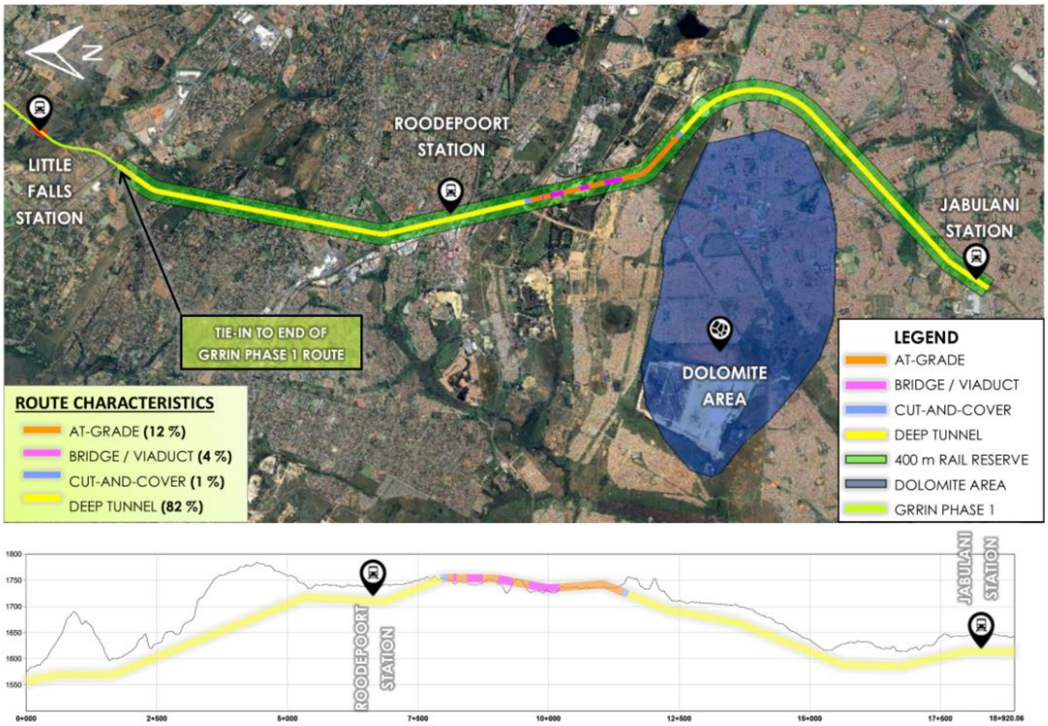


Figure 6-6: Option 2 – Little Falls to Jabulani – Including Vertical Profile

6.4.1.3.3 Affected Infrastructure

The route alignments for this study were developed such that the impact on existing major developments were minimised, however, this was not always possible and certain major infrastructure, developments and roads could be affected.

Since most of this route is a tunnel route, it will not have major impacts on infrastructure, developments and residential suburbs, above ground level. However, portions of the route that are not in a tunnel, may have some impact on existing infrastructure.

Therefore, for the sections of the route that are not in a tunnel, the major infrastructure, developments and residential suburbs that are affected, are listed in Table 6-3 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

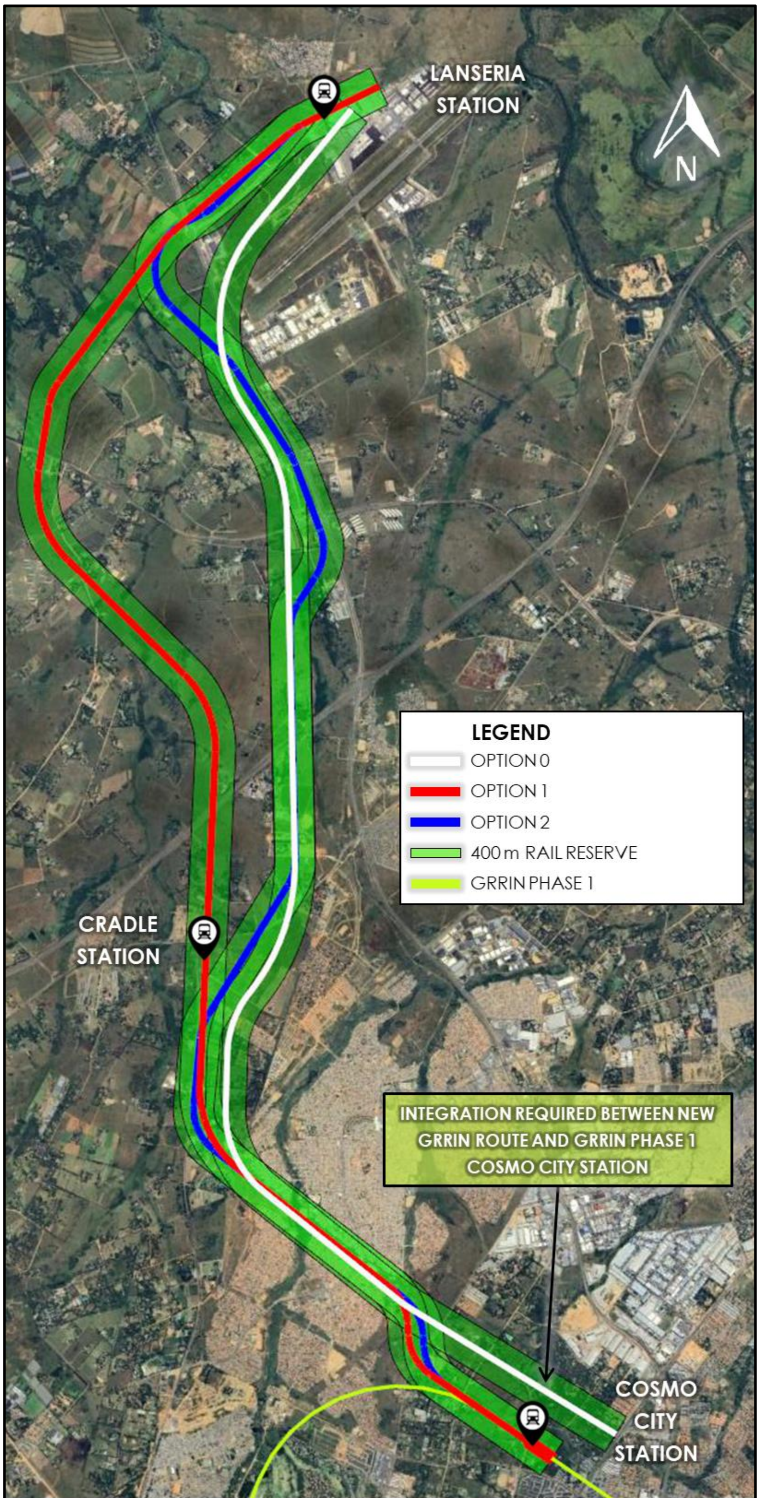
The extent of the potential impact on existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-3: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 2 – Little Falls to Jabulani

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Old Roodepoort Mine Dumps Area	• Artisan training Institute • Old Roodepoort Mine Dumps • Maxam Dantex Explosives Factory	• M77 (Elias Motsoaledi Road) near Soweto Cash & Carry

6.4.2 Cosmo City to Lanseria

Options 0, 1 and 2 for Cosmo City to Lanseria are indicated in Figure 6-7.



NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed location of Cosmo City Station (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the position of the Cosmo City station was moved. Therefore, Route Option 0 does not align with the latest position of Como City station.**

Figure 6-7: Route Options – Cosmo City to Lanseria

6.4.2.1 Option 0

6.4.2.1.1 Route Description

Route Option 0, from the 2016 FS (GMA, 2016), spans approximately 18 km from Little Falls to Jabulani.

The section from Cosmo City to the proposed Cradle station primarily comprises at-grade sections of the route with a few bridges and a tunnel section. The route starts off at-grade at Cosmo City station and progresses into an elevated bridge (approximately 800 m long) over the Kevin Ridge suburb. In this section over Kevin Ridge, possible relocation of the existing residential houses will be required to enable construction of this section of the route.

After the bridge section, the route runs underground into a tunnel (approximately 1.2 km long) through a currently vacant piece of land and continues below South Africa drive, before it exits the tunnel. The route continues onto another bridge (approximately 650 m long) to cross the valley through Cosmo City. This section is anticipated to run through a vacant piece of land, between two separate sections of the Cosmo City Suburb. Disruptions to the community can be expected during construction, however, a complete permanent separation of the community is not expected to be major since most of the route through this Cosmo City suburb, will be either underground in a tunnel or on the elevated bridge section. This will still allow residents to move between the separated areas of the Cosmo City Suburb.

The remaining section after the bridge runs at-grade through to the Proposed Cradle station. The proposed Cradle station, the railway route and the access platforms will also be at-grade. Through this, a few existing commercial and residential properties can be expected to be relocated. Disruptions during construction are expected and a permanent barrier will be created through this area of at-grade railway route.

The next section of the route from Cradle station to Lanseria station, is predominantly at-grade sections with a few bridges to cross major roads and valleys. The possible major roads affected by the route are listed in Table 6-4 below.

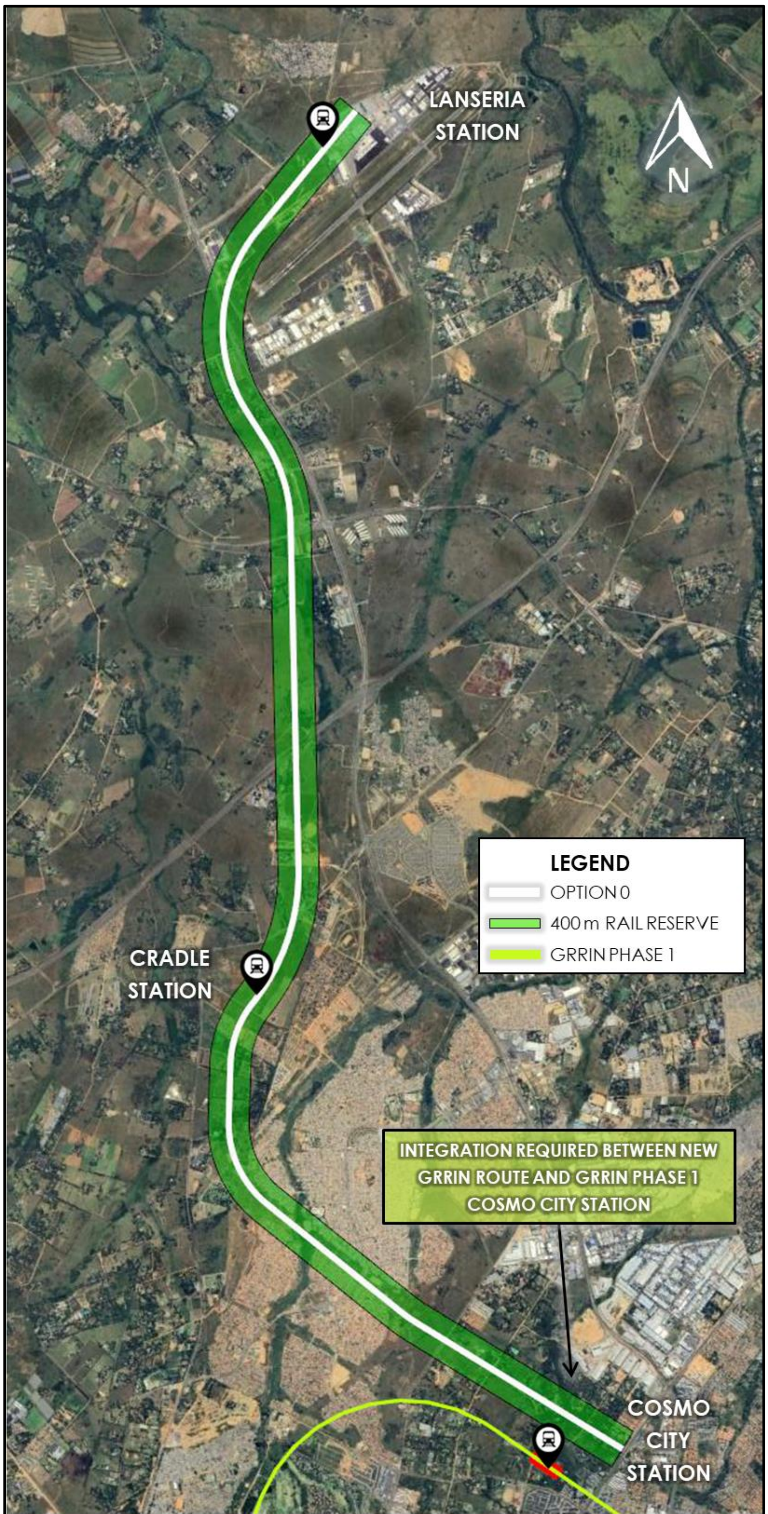
Although the areas, through which this section of the route runs, are very sparsely populated, there will still be a few commercial and residential developments that will be permanently impacted by the route. Some of these possible affected suburbs and developments are listed in Table 6-4 below. Through this, existing commercial and residential properties can be expected to be relocated. Disruptions during construction will be present and a permanent barrier will be created through this area of at-grade railway route. However, since this section of the route runs close to the existing R512 Pelindaba Road, the permanent separation of the community will not be as severe, since the R512 is an existing barrier.

The railway route, access platforms and the proposed station at the Lanseria airport will be at-grade in the existing parking area of the airport. The parking area will require relocation to accommodate the proposed station and railway route.

6.4.2.1.2 Vertical Profile

The vertical profile data for Option 0 was not available from the 2016 FS and, therefore, no vertical profile diagram was generated for Option 0, in this study.

Therefore, the Cosmo City to Lanseria Option 0, excluding its vertical profile, is indicated in Figure 6-8.



NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed location of Cosmo City Station (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the position of the Cosmo City station was moved. Therefore, Route Option 0 does not align with the latest position of Como City station.**

Figure 6-8: Option 0 – Cosmo City to Lanseria – Excluding Vertical Profile

6.4.2.1.3 Affected Infrastructure

Some of the major infrastructure, developments and residential suburbs through which the route runs, are listed in Table 6-4 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The extent of the potential impact to existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-4: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 0 – Cosmo City to Lanseria

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Cosmo City • Malibongwe Industrial Park • Elandsdrift • Northern Farm • Bultfontein • Lanseria	• Cosmo City West Primary School • For Africa Operational Offices • David Webb Wholesale Nursery • Eurofit Kitchens and Cupboards • Bragan Ingredients Johannesburg • Nucleus Mining Logistics • Stor-Now Nooitgedacht • Viva Formwork and Scaffolding • Mr farm PVT • Artwork Containers • Insta Space Containers Solutions • The Pallet and Crate Kingdom • Lanseria Cooperate Estate • Culinary Table • Lanseria Airport	• South Africa Drive • R114 • N14 Highway • R552 Elandsdrift Road • R512 Pelindaba Road • Ashenti Road • Airport Road

6.4.2.2 *Option 1*

6.4.2.2.1 Route Description

This corridor begins at the start of the Cosmo city platform as determined by the GRRIN Phase 1 route (GMA, 2021).

This route is approximately 17 km long and the complete route is above ground with no tunnels. About 7 km of the route will be on elevated bridge structures above the ground.

This route begins on an elevated bridge structure, at the proposed Cosmo City station platform, and runs in a North-westerly direction through a vacant piece of land through Cosmo City where it runs over the South African Drive.

The route then changes direction before Marina Street, where it proceeds parallel to Marina Street and continues over the R114 and the N14 highway. The route deviates slightly in a Northwesterly direction just after the N14, and as it crosses over the Elandsdrift road it changes direction again towards Lanseria airport.

Finally, the route crosses over the R552 Pelindaba Road, and makes its way to the proposed Lanseria Station located on the Northern side of the existing Lanseria Parking area.

6.4.2.2.2 Vertical Profile

The vertical profile for Cosmo City to Lanseria Option 1 is indicated in Figure 6-9.

Figure 6-9: Option 1 – Cosmo City to Lanseria – Including Vertical Profile

6.4.2.2.3 Affected Infrastructure

The route alignments for this study were developed such that the impact on existing major developments were minimised, however this was not always possible and certain major infrastructure, developments and roads could be affected.

Some of the major infrastructure, developments and residential suburbs that the route runs through, are listed in Table 6-5 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The extent of the potential impact on existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-5: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 1 – Cosmo City to Lanseria

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Cosmo City • Malibongwe Industrial Park • Elandsdrift • Lindley • Lanseria	• Glen College Primary School • Nemos Nursery School • Advent Hope Church • Cosmo City West primary School • For Africa Operational Offices • Safeline Breaks (GUD Holdings) • Eurofit Kitchens and Cupboards • Renisto Chemicals Wholesaler • Sutherland Academy • Shepherd's Fold Stables • Werco Plant Hire • Culinary Table • Lanseria Airport	• South Africa Drive • Marina Street • R114 • N14 Highway • R552 Elandsdrift Road • R512 Pelindaba Road • Ashenti Road

6.4.2.3 *Option 2*

6.4.2.3.1 Route Description

This route is approximately 17 km long and the complete route is above ground with no tunnels. About 7 km of the route will be on elevated bridge structures above the ground.

From Cosmo City to Marina Street the route is very similar to that described in Option 1. Shortly before the route reaches the R114, it deviates away from Route Option 1 in a North-easterly direction crossing over the R114, Malibongwe Industrial Park and the N14 highway.

As it reaches the R512 Pelindaba Road, the route runs parallel to the R512 and continues until it approaches the Lanseria Airport. At this point the route turns sharply to cross over the R512 and make its way to the Lanseria station located on the northern side of the Lanseria parking area.

6.4.2.3.2 Vertical Profile

The vertical profile for Cosmo City to Lanseria Option 2 is indicated in Figure 6-10.

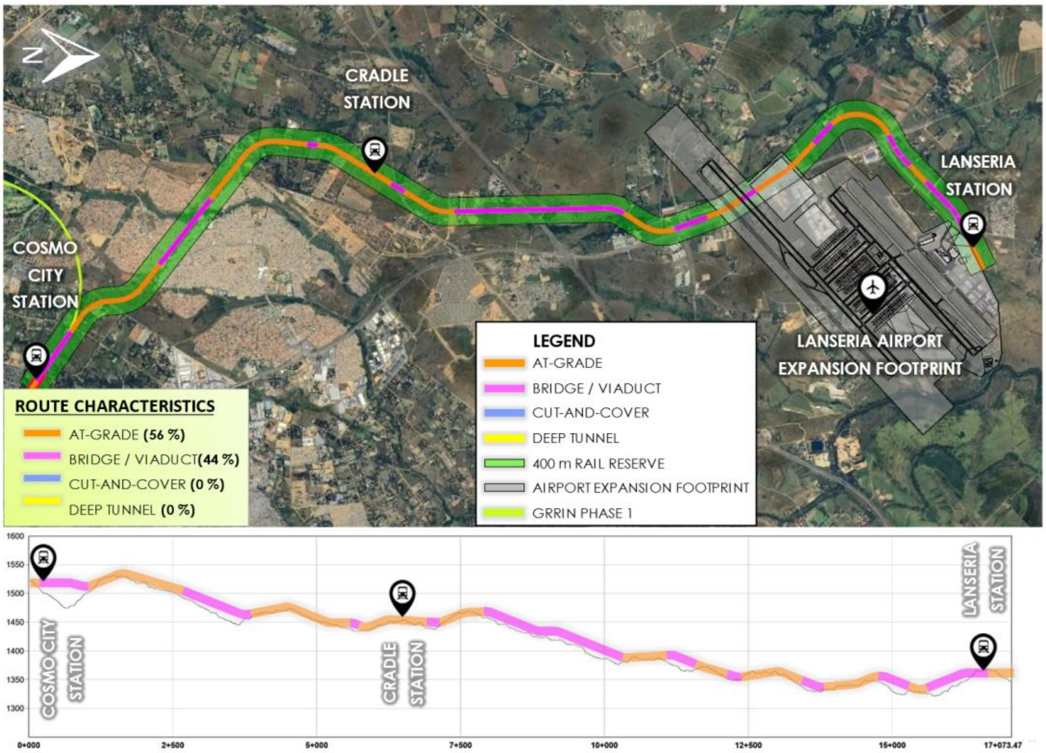


Figure 6-10: Option 2 – Cosmo City to Lanseria – Including Vertical Profile

6.4.2.3.3 Affected Infrastructure

The route alignments for this study were developed such that the impact to existing major developments was minimised, however, this was not always possible and certain major infrastructure, developments and roads could be affected.

Some of the major infrastructure developments and residential suburbs that the route runs through are listed in Table 6-6 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

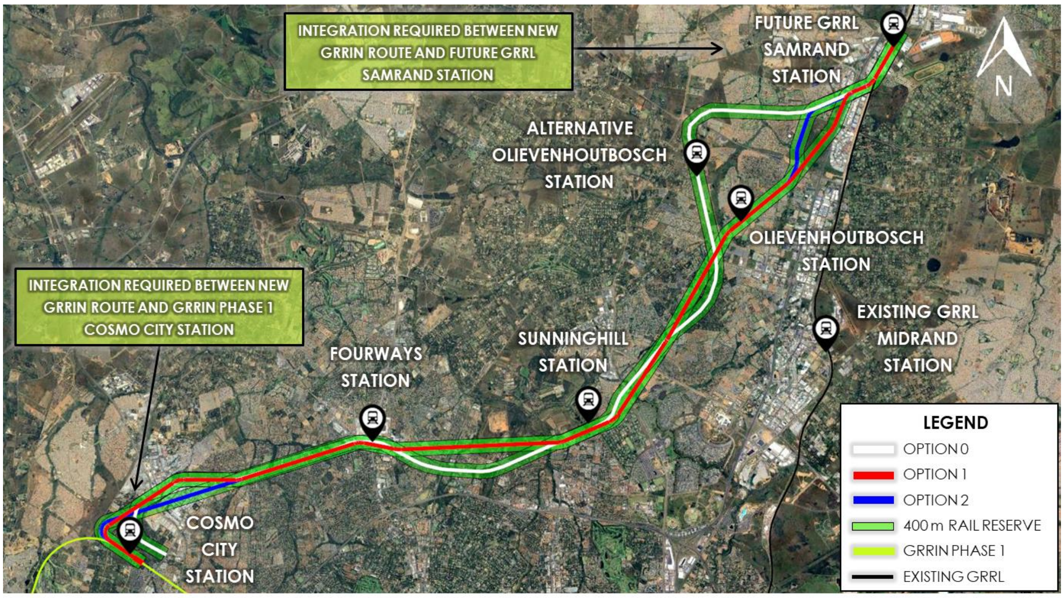
The extent of the potential impact to existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-6: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 2 – Cosmo City to Lanseria

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Cosmo City • Malibongwe Industrial Park • Elandsdrift • Lindley • Lanseria	• Glen College Primary School • Nemos Nursery School • Advent Hope Church • Cosmo City West primary School • For Africa Operational Offices • Safeline Breaks (GUD Holdings) • Kiepersol Poultry Farm • Eurofit Kitchens and Cupboards • Renisto Chemicals Wholesaler • Bragan Ingredients Johannesburg • Nucleus Mining Logistics • Stor-Now Nooitgedacht • Viva Formwork and Scaffolding • Kwikspar Lanseria • Mr farm PVT • Artwork Containers • Insta Space Containers Solutions • The Pallet and Crate kingdom • Shumba Valley Lodge • Lanseria Business Park • Culinary Table • Lanseria Airport	• South Africa Drive • Marina Street • R114 • N14 Highway • R552 Elandsdrift Road • R512 Pelindaba Road • Ashenti Road

6.4.3 Cosmo City to Samrand

Options 0, 1 and 2 for Cosmo City to Samrand are indicated in Figure 6-11.



NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed location of Cosmo City Station (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the position of the Cosmo City station was moved. Therefore, Route Option 0 does not align with the latest position of Como City station.**

Figure 6-11: Route Options – Cosmo City to Samrand

6.4.3.1 Option 0

6.4.3.1.1 Route Description

Route Option 0, from the 2016 FS (GMA, 2016), spans approximately 32 km from Cosmo City to Samrand.

The section from Cosmo City to the proposed Fourways station comprises of all types of track routes i.e. At-grade, Elevated Bridges/Viaducts, Cut-and-cover and Tunnel sections. The route starts off at-grade at Cosmo City station and progresses into an elevated bridge (approximately 800 m long) between the Kya Sands and Hoogland Industrial areas. The route then proceeds into a cut-and-cover section (shallow tunnel) through the vacant land and the Bloubosrand suburb before continuing at-grade just before Witkoppen Road. After the Klein Jukskei River, the route proceeds into a cut-and-cover section (shallow tunnel) underneath Witkoppen Road.

In this section described above, relocation of some existing residential houses and perhaps commercial businesses will be required to enable construction. Due to the at-grade sections of the route, disruptions to community during construction are expected and a permanent barrier will be created through the areas with at-grade railway routes. At the point where the route goes over Witkoppen Road, and then under it in a shallow tunnel, temporary road closures and road deviations will be required during construction.

After the Klein Jukskei River, the route remains in the cut-and-cover (shallow tunnel) beneath Witkoppen Road until Fourways mall, where the route would be in a deep tunnel until the proposed Fourways station, located near Monte Casino.

This short section where the route is underground (approximately 3 km), ground-level infrastructure disruptions are expected since Witkoppen Road would require temporary closure and road deviations to enable construction. The proposed Fourways station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the station building.

After the Fourways station, the route remains in a shallow tunnel beneath Witkoppen Road and changes to at-grade then, eventually, an elevated bridge/viaduct just after M71 (Main Road). Near Paulshof, the route proceeds into a cut-and-cover (shallow tunnel) then continues at-grade through vacant land next to Paulshof Suburb before going over the Jukskei River on an elevated bridge. There is another cut-and-cover section of the route shortly after the Jukskei River, before finally reaching the proposed Sunninghill station. The proposed Sunninghill station, the railway route and the access platforms will all be at-grade.

In this section, disruptions are expected since Witkoppen Road would require temporary closure and road deviations to enable construction. Near Paulshof, relocation of homes will be required to enable construction. Since this section of the route runs at the end of the Paulshof Suburb, the route is not separating any communities.

After the proposed Sunninghill Station, the route goes through a short cut-and-cover section beneath the newly constructed M9 Main Road before moving onto an elevated bridge over the R55 Woodmead Drive and the Jukskei River. Thereafter, the route remains at-grade through Kyalami Hills and Carlswald residential area. Near Walton Road, the route goes underground into a tunnel beneath Walton Road and exits the tunnel shortly after Adcock Ingram offices along Garden Road. Thereafter, the route remains at-grade up to the proposed Olievenhoutbosch station. The proposed Olievenhoutbosch station, the railway route and the access platforms will all be at-grade.

In this section, disruptions are expected since the newly constructed M9 Road would require temporary closure and road deviations to enable construction. Near Kyalami Hills and Carlswald, relocation of homes will be required to enable construction. The last section of at-grade route, just before the proposed Olievenhoutbosch station, will require relocation of residential estates and road closures or road deviations for Garden Road, leading to severe community disruptions and creating a permanent barrier in the community in future.

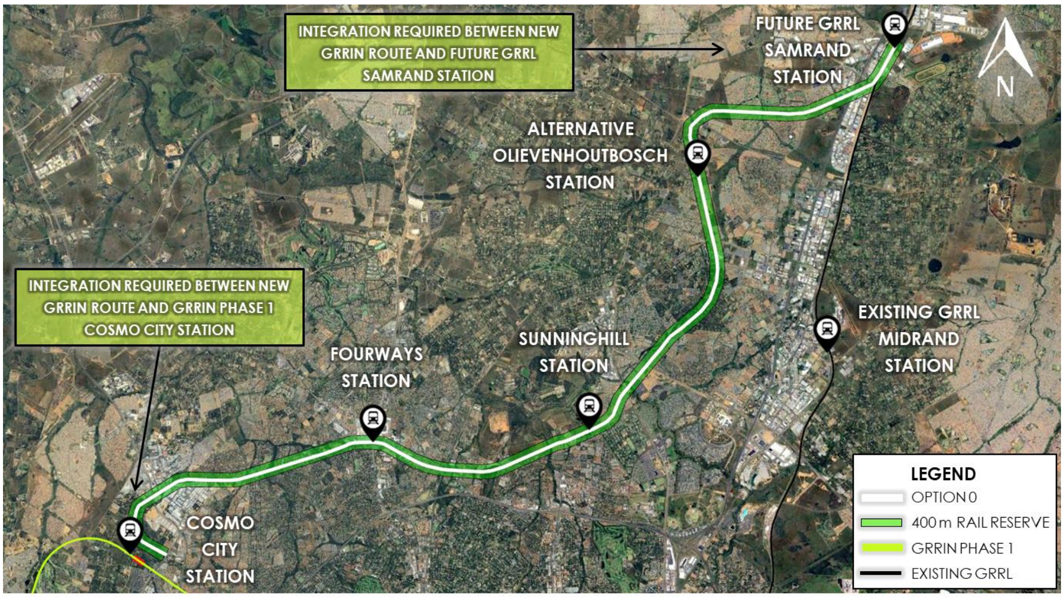
In the last section of the route between the proposed Olievenhoutbosch and Samrand stations, the route continues at-grade curving through Olifantsfontein Road whereafter it moves onto an elevated bridge/viaduct over the Blue Valley Golf Estate. The route then continues at-grade alongside the Blue Valley Golf Estate and crosses over the N1 Ben Schoeman Highway and R101 old Johannesburg Road on elevated bridges, before reaching the Samrand station, which will be situated on the existing GRRL network. The Samrand station, the railway route and the access platforms will all be at-grade.

In this last section, a few residential developments will require relocation through the Blue Hills area, and closer to Samrand station, a few industrial developments may require relocation to enable construction. The at-grade section of the route through the Blue Hills and Blue Valley Golf Estate will create a permanent barrier through the area, separating communities in future.

6.4.3.1.2 Vertical Profile

The vertical profile data for Option 0 was not available from the 2016 FS, and therefore no vertical profile diagram was generated for Option 0, in this study.

Therefore, the Cosmo City to Samrand Option 0, excluding its vertical profile, is indicated in Figure 6-12.



NOTE:

1. **Route Option 0, from previous 2016 Feasibility Study, aligns with the initial proposed location of Cosmo City Station (in 2016). As part of the GRRIN Phase 1 Route Determination Study (in 2021), the position of the Cosmo City station was moved. Therefore, Route Option 0 does not align with the latest position of Como City station.**

Figure 6-12: Option 0 – Cosmo City to Samrand – <u>Excluding</u> Vertical Profile

6.4.3.1.3 Affected Infrastructure

Some of the major infrastructure, developments and residential suburbs through which the route runs, are listed in Table 6-7 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The extent of the potential impact to existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-7: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 0 – Cosmo City to Samrand

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Boundary Park • Kaya Sands • Hoogland • Houtkoppen • Bloubosrand • Noordhang • Jukskei Park • Waterford Estate • Fourways • Palmlands • Pine Slopes • Magaliesview • Blandford Ridge • Paulshof • Sunninghill • Barbeque Downs • Waterfall Equestrian Estate • Plooysville • Kyalami Hills • Kyalami Estate • Carlswald • Carlswald Estate • Montecello • Summerset • Blue Hills • Blue Valley Golf Estate • Headway Hill • Samrand Business Park • N1 Business Park	• Various industrial developments in Kya Sands and Hoogland • Christian Revival Church Johannesburg • City Hope Church • Hammets Crossing Office Park • Waterford Office Park • The Buzz Shopping Centre • BMW Fourways • Porsche Centre Johannesburg • Sandton Family Market • SWAT Laser Tag Sandton • German Country Club • Crawford Lonehill Pre-Primary School • Leeuwkop Prison • Sandton Seventh-day Adventist Church • Sandton Assemblies of God • ISKCON Midrand • Noordwyk Secondary School • Blue Valley Golf Estate • Development Bank of South Africa (DBSA) • Various industrial developments in Samrand and N1 Business Parks	• R512 (Malibongwe Drive) • Klein Jukskei River near Witkoppen Road • Witkoppen Road • R511 (Winnie Mandela Drive) • M71 (Main Road) • Jukskei River Near M9 • M9 (Malindi Road) • R55 (Woodmead Drive) • Jukskei River near R55 • M39 (Allandale Road) • Walton Ave/New Road • Garden Road • R562 (Olifantsfontein Road) • N1 (Ben Schoeman Highway) • R101 (Old Johannesburg Road) • Olievenhoutbosch Road

6.4.3.2 *Option 1*

6.4.3.2.1 Route Description

This corridor begins at the start of the Cosmo City platform as determined by the GRRIN Phase 1 route (GMA, 2021).

This route is approximately 30 km long and is mostly in a tunnel (approximately 25 km). Only the start and the end of the routes (approximately 4.5 km near Cosmo City station and 0.5 km near Samrand Station) are above ground level.

This route begins above ground level, at the start of the proposed Cosmo City station platform and runs in a North-westerly direction before sharply changing direction to run North-easterly towards Fourways.

The route then proceeds between the Kya Sands and Hoogland industrial area where it then goes into a tunnel just before Witkoppen Road. The route then runs beneath Witkoppen Road towards the proposed Fourways station near Monte

Casino. The proposed Fourways station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the station building.

Between Fourways and Sunninghill, the route remains in a tunnel, going beneath M71 (Main Road) before changing direction near the M9 where it runs beneath the M9 (Leeuwkop Road) towards the proposed Sunninghill station. The proposed Sunninghill station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the station building.

After the proposed Sunninghill station, the route runs North-easterly beneath the R55 (Woodmead Drive), the M39 (Allandale Road) and Walton Avenue/New Road towards the proposed Olievenhoutbosch station. The proposed Olievenhoutbosch station building will be located above ground, however, the rail route and station platforms will remain below ground in a tunnel, directly beneath the station building.

From Olievenhoutbosch to the Samrand station, the route remains in a tunnel beneath Eight Road and crosses under Lever and Olifantsfontein Road before continuing in a North-easterly direction through the vacant land. It remains beneath the ground under the Development Bank of South Africa (DBSA), and shortly after it crosses beneath the N1 highway and the R101 (Old Johannesburg Road). The route then runs below the existing GRRL system before exiting the tunnel and terminating next to the Samrand station above ground level, where the Samrand station building will be located.

6.4.3.2.2 Vertical Profile

The vertical profile for Cosmo City to Samrand Option 1 is indicated in Figure 6-13.

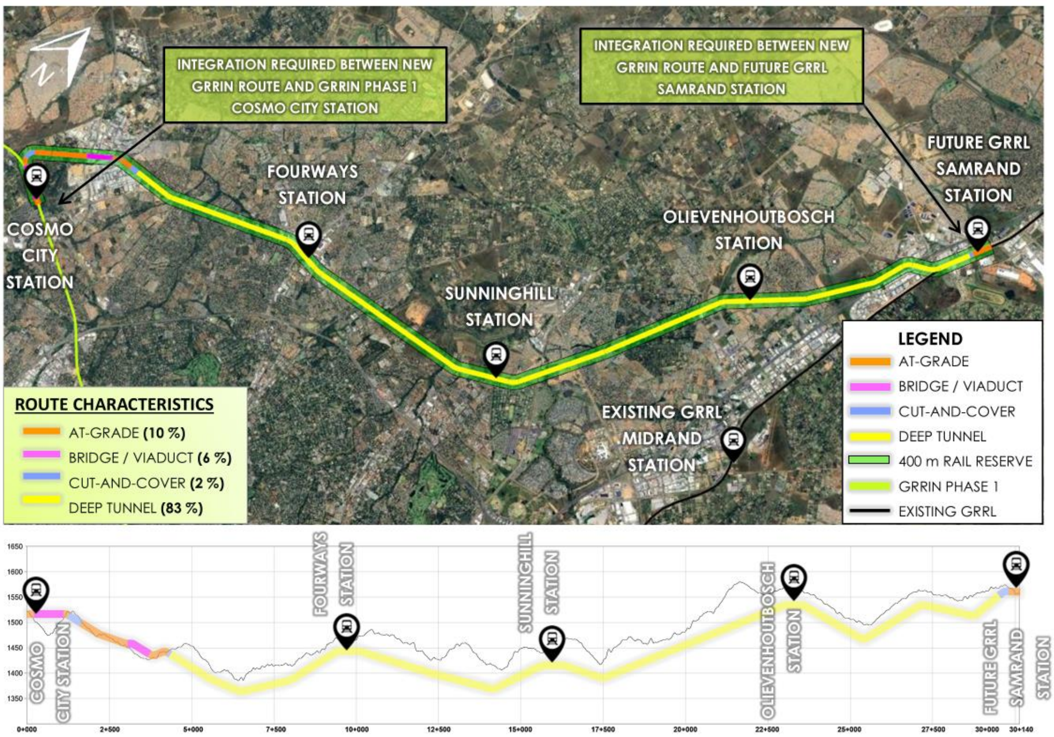


Figure 6-13: Option 1 – Cosmo City to Samrand – Including Vertical Profile

6.4.3.2.3 Affected Infrastructure

The route alignments for this study were developed such that the impact to existing major developments were minimised, however this was not always possible and certain major infrastructure, developments and roads could be affected.

Since most of this route is in a tunnel route, it will not have a major impact on infrastructure, developments and residential suburbs, above ground level. However, portions of the route that are not in a tunnel, may have some impact on existing infrastructure.

Therefore, for the sections of the route that are not in a tunnel, the major infrastructure, developments and residential suburbs affected, are listed in Table 6-8 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The extent of the potential impact to existing infrastructure and developments is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-8: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 1 – Cosmo City to Samrand

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Boundary Park • Kaya Sands • Hoogland • Houtkoppen	• Various industrial developments in Kya Sands and Hoogland • Some industrial developments in Samrand and N1 Business Parks	• R512 (Malibongwe Drive)

6.4.3.3 Option 2

6.4.3.3.1 Route Description

This route is very similar to Option 1 with very minor deviations near Cosmo City and Samrand stations.

This route is approximately 30 km long and is mostly in a tunnel (approximately 23 km). The key differences when compared to Option 1 are noticed in the following areas:

- Near Cosmo City where the route does not go through the Kya Sands area and enters a tunnel route before R512 (Malibongwe Drive)
- Near Samrand station where the route exits the tunnel sooner, just after the R562 (Olifantsfontein Road), runs parallel to Lever Road above ground level, before turning North-east over the N1 and R101 before reaching the Samrand station.

This route has a slightly longer route length (7 km vs 5 km for Option 1) that is above ground.

6.4.3.3.2 Vertical Profile

The vertical profile for Cosmo City to Samrand Option 2 is indicated in Figure 6-14.

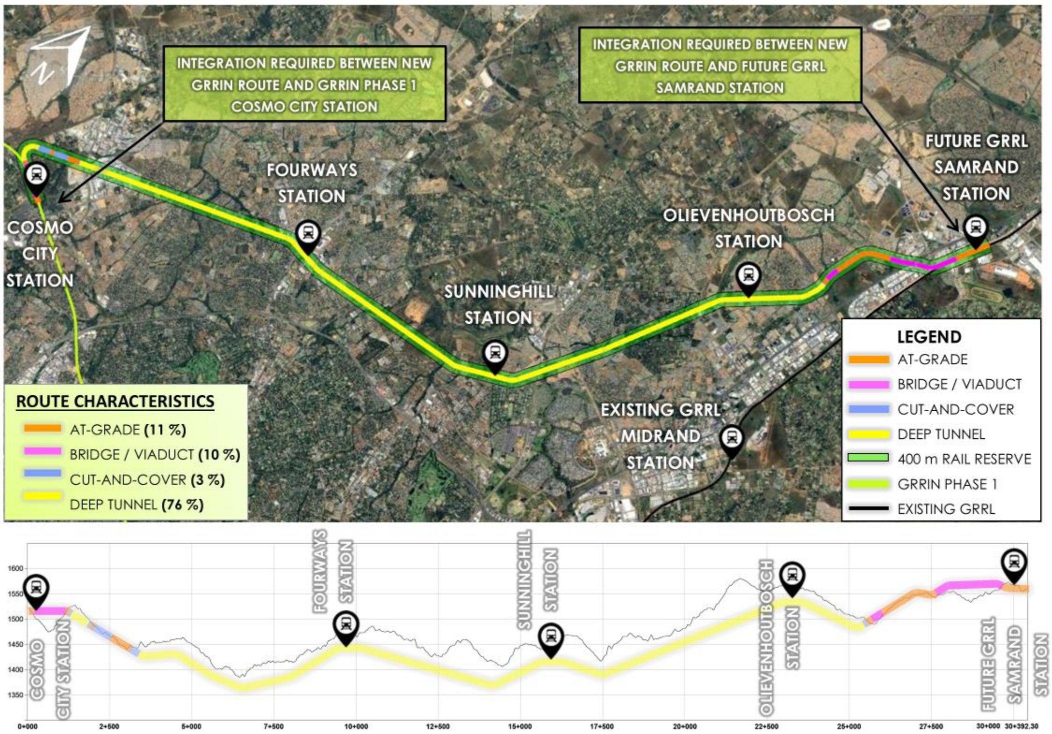


Figure 6-14: Option 2 – Cosmo City to Samrand – Including Vertical Profile

6.4.3.3.3 Affected Infrastructure

The route alignments for this study were developed such that the impact on existing major developments was minimised, however, this was not always possible and certain major infrastructure, developments and roads could be affected.

Since most of this route is in a tunnel, it will not have a major impact on infrastructure, developments and residential suburbs, above ground level. However, portions of the route that are not in a tunnel, may have some impact on existing infrastructure.

Therefore, for the sections of the route that are not in a tunnel, the major infrastructure, developments and residential suburbs that are affected, are listed in Table 6-9 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The extent of the potential impact to existing infrastructure and developments is unknown at this level of the study and will only be quantified in more detail during future design stages of the determined route.

Table 6-9: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Option 2 – Cosmo City to Samrand

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Boundary Park • Country View • Valley View Estate • Headway Hill • Randjespark • Samrand Business Park	• Various industrial developments in Hoogland • Some industrial developments in Samrand Business Parks • Development Bank of South Africa (DBSA) • Some industrial developments in Samrand Business Parks	• R512 (Malibongwe Drive) • N1 (Ben Schoeman Highway) • R101 (Old Johannesburg Road) • Olievenhoutbosch Road

6.5 Comparison of Options

The sections below show a comparison between Option 1 and 2 for each of the corridors, based on the outcomes of the MCA.

6.5.1 Little Falls to Jabulani

Table 6-10: Comparison of Options 1 and 2

Criteria	Option 1	Option 2
Construction Complexity	Easiest to construct	Slightly more Complex
Construction Costs	Slightly Higher Costs	Slightly Lower Costs
Land Acquisition	Least Land Required	Slightly more land Required
Social Impacts	Lowest impact	Slightly more impact
Environmental impacts	Lowest Impact	Slightly more impact

Both options are predominantly tunnel routes with minimal ground-level impacts, however, Option 2 has a portion of the route between Roodepoort and Meadowlands East that is above ground with some surface-level disruptions. Although construction costs are relatively lower for Option 2, it will result in slightly more complex construction works, some land acquisition requirements and more social and environmental impacts, compared to Option 1.

Therefore, based on the goals and criteria set for the Project, Option 1 is the optimal route, for the Little Falls to Jabulani Corridor.

6.5.2 *Cosmo City to Lanseria*

Table 6-11: Comparison of Options 1 and 2

Criteria	Option 1	Option 2
Construction Complexity	Easiest to construct	Slightly more complex
Construction Costs	Very Similar Option 2	Very Similar to Option 1
Land Acquisition	Very Similar Option 2	Very Similar to Option 1
Social Impacts	Very Similar Option 2	Very Similar to Option 1
Environmental impacts	Very Similar Option 2	Very Similar to Option 1

From this comparison, both Option1 and Option 2 are very similar, with slight differences between them.

Between the N14 and the Lanseria airport, Option 2 runs closer to the R512 which has slightly more existing residential and commercial developments along this route. Between the N14 and the Lanseria Airport, Option 1 deviates away from the R512, into a more sparsely populated area, causing less ground-level infrastructure and community disruptions.

Therefore, Option 2 is slightly more disruptive to the existing infrastructure and community than Option 1.

With Option 2 following the R512, it impacts on the footprint of the Lanseria airport future plans, where Option 1 avoids this future expansion footprint. Thus, Option 2, is not a future-proof option, and will pose some difficulty in getting a railway reserve approved through this region.

In conclusion, Option 1 is the most optimal route for the Cosmo City to Lanseria Corridor.

6.5.3 *Cosmo City to Samrand*

Table 6-12: Comparison of Options 1 and 2

Criteria	Option 1	Option 2
Construction Complexity	Very Similar Option 2	Very Similar to Option 1
Construction Costs	Very Similar Option 2	Very Similar to Option 1
Land Acquisition	Very Similar Option 2	Very Similar to Option 1
Social Impacts	Slightly Lower Impact	Slightly more Impact
Environmental impacts	Very Similar Option 2	Very Similar to Option 1

Options 1 and 2 are very similar when considering all aspects of the assessment criteria. Both are predominantly tunnel routes with very minimal ground-level impacts closer to the Samrand and Cosmo City stations.

However, as per the detailed scoring conducted through the MCA process, Option 1 is a slightly more favourable route than Option 2. This is due to the marginally lower social impact of Option 1.

Therefore, based on the MCA, Option 1 was regarded the optimal route, for the Cosmo City to Samrand Corridor, albeit by a narrow margin.

6.6 Refinement of Optimal Routes

As part of the route determination process for this study, the optimal routes for each corridor were then further refined, to:

- align with the optimal station positions (Section 4.5) and,
- comply with critical parameters in the design criteria (Section 8.1 below).

The optimal routes (as determined through the MCA and described above) that align with the optimal station positions are summarised in Table 6-13 below.

Table 6-13: Summary of Optimal Routes for each Corridor combined with the Optimal Station Positions

Station Location	Optimal Route	Optimal Station Position
Little Falls to Jabulani	Option 1	
Jabulani Station		Position 1
Roodepoort Station		Position 1
Cosmo City to Lanseria	Option 1	
Cradle Station		Position 1
Lanseria Station		Position 1
Cosmo City to Samrand	Option 1	
Fourways Station		Position 1
Sunninghill Station		Position 0
Olievenhoutbosch Station		Position 1
Samrand Station		Position 0

Optimal route refinements were only required at the proposed Jabulani and Cradle stations along the three corridors. All other proposed station positions were already aligned with the optimal routes.

Further, various refinements were made to the optimal route, to achieve compliance with the design criteria. Some of the criteria that drove refinement of the optimal alignment, include:

- Minimum requirements for horizontal and vertical curve radii.
- Minimum requirements for horizontal and vertical element lengths.
- Minimum requirements for vertical grades.
- Minimum horizontal and vertical geometry requirements near station platforms.

The refined optimal routes for each corridor, are described in the Sections below.

6.6.1 Little Falls to Jabulani

6.6.1.1 Optimal Route Refinements

Compared to the Original Option 1 route (as described in Section 6.4.1.2 above) the following sections of the route were refined:

Little Falls and Roodepoort

Since this route is in a tunnel, refinement was done to straighten out the route to reduce route length and improve alignment.

This refinement resulted in the route shifting slightly to the east. The maximum shift of the route in this section was approximately 0 to 450 m.

Roodepoort to Meadowlands East

Due to the refinements of the route between Little Falls and Roodepoort, this section of the route also required refinement to achieve compliance with the design criteria.

This refinement has resulted in the route shifting slightly to the south-west. The maximum shift of the route in this section was approximately 0 to 500 m.

Meadowlands East to Jabulani

The refinements in this section were due to needing to align with the location of the optimal Jabulani station position and, to allow for the route to be extended to other areas in future, the route direction at the terminal station was changed to face southwards.

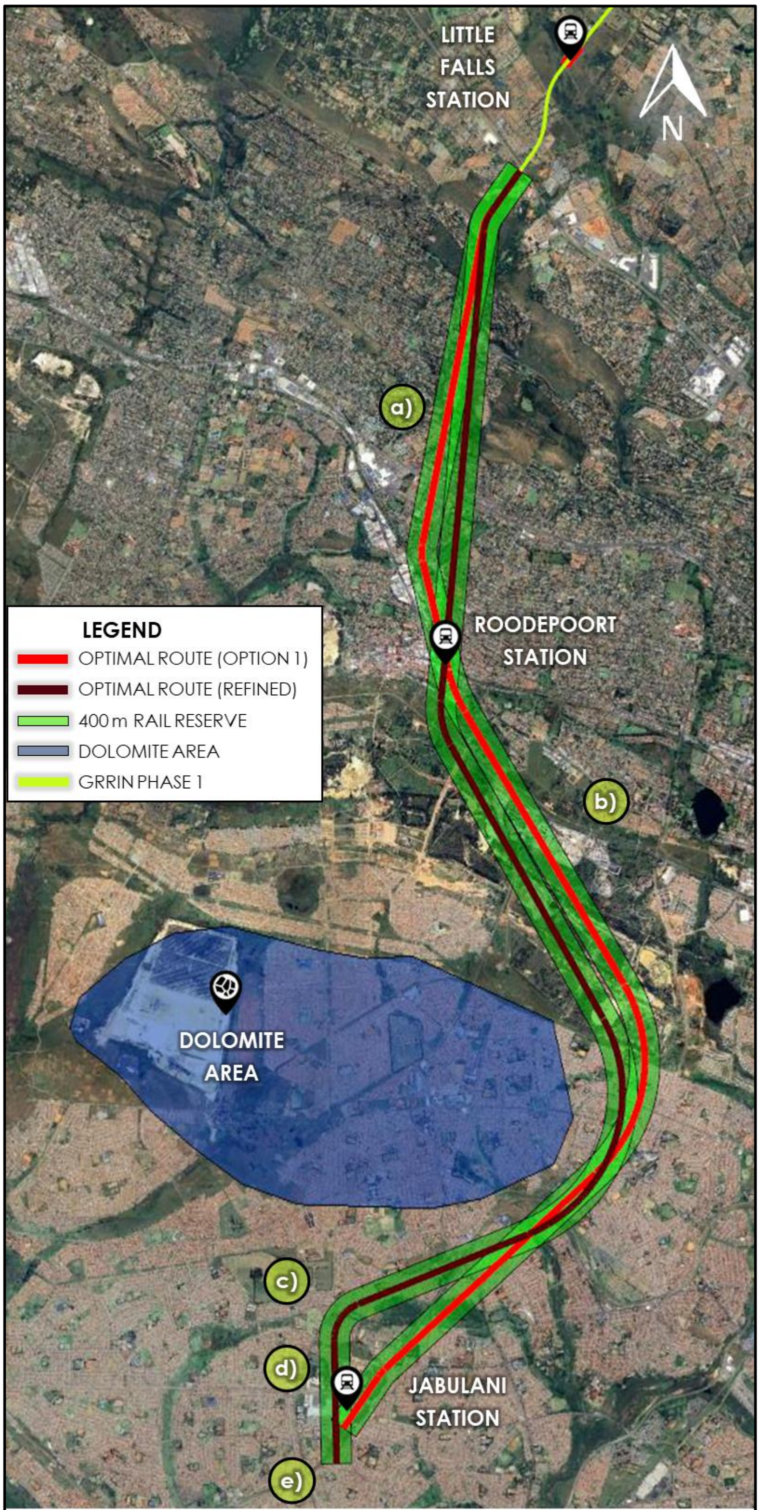
This refinement resulted in the route shifting slightly to the west. The maximum shift of the route in this section was approximately 0 to 900 m.

At Jabulani Station

Refinement in this section was to extend the end of the route approximately 350 m further, to allow for potential staging of trains overnight, at the Jabulani station.

The final length of the refined optimal Little Falls to Jabulani route is a total of 19.9 km from start to end, comprising of a complete tunnel route.

Figure 6-15 below shows the final refined optimal route (dark red/maroon) versus the original optimal route developed (red).



NOTE:

1. **Optimal Route (Option 1) was refined as follows:**
    - **a) Straighter route between Little Falls and Roodepoort Station**
    - **b) Further refinement due to point a) above and to comply with Design Criteria**
    - **c) Change of route direction at Jabulani Station to allow future extension Southwards**
    - **d) Align with Optimal Jabulani Station Position**
    - **e) Extension of route end at Jabulani Station**

Figure 6-15: Comparison of Little Falls to Jabulani Optimal Route (Red) and Refined Optimal Route (Dark Red/Maroon)

6.6.1.2 Affected Infrastructure and Services

With the optimal route undergoing refinement, the list of affected infrastructure also required updating.

Since this route is a complete tunnel route, it will not have a major impact on infrastructure, developments and residential suburbs, above ground level. Therefore, no list of affected infrastructure was developed.

Tunnel routes do however require emergency exits from within the tunnel up to ground level. However, the space required for these exit buildings is minimal and no major impacts are anticipated.

Also, during the construction phase of the tunnel route, certain areas where the tunnel is closer to ground level may require temporary evacuation of areas, for a period of time, until the construction is completed.

The construction of tunnels does involve a series of steps that include surveying, site investigations, ground condition assessments, tunnel design, excavation, construction and lastly finishing work. These steps are carefully planned and executed to ensure safety, durability and to minimise impact on the surrounding environment.

The final extent of these potentially affected areas, existing infrastructure and services is unknown at this level of study and will only be quantified in more detail during future design stages of the determined route.

6.6.2 Cosmo City to Lanseria

6.6.2.1 Optimal Route Refinements

Compared to the Original Option 1 route (as described in Section 6.4.2.2 above) the following sections of the route were refined:

Cosmo City Station to "For Afrika" Offices

The refinement in the section was to straighten out the route such that it is centred in the vacant land between the west and east parts of Cosmo City suburb.

This refinement resulted in minor shifting of the route to the east. The maximum shift of the route in this section was approximately 0 to 40 m.

"For Afrika" Offices to North of N14:

The refinements in this section were due to needing to align with the location of the optimal Cradle station position and, to allow for integration with the Cradle Maintenance Depot.

This refinement resulted in the route shifting significantly to the east side of the proposed Cradle Maintenance Depot. The maximum shift of the route in this section was approximately 0 to 900 m.

At Lanseria Station

Refinement in this section was to extend the end of the route approximately 80 m further, to allow for potential staging of trains overnight at the Lanseria station.

Integration with Maintenance Depot

To integrate and provide access to the Optimal Maintenance Depot at Cradle (as described in Section 5 above), an access route to the Maintenance Depot was incorporated which runs parallel to the main route.

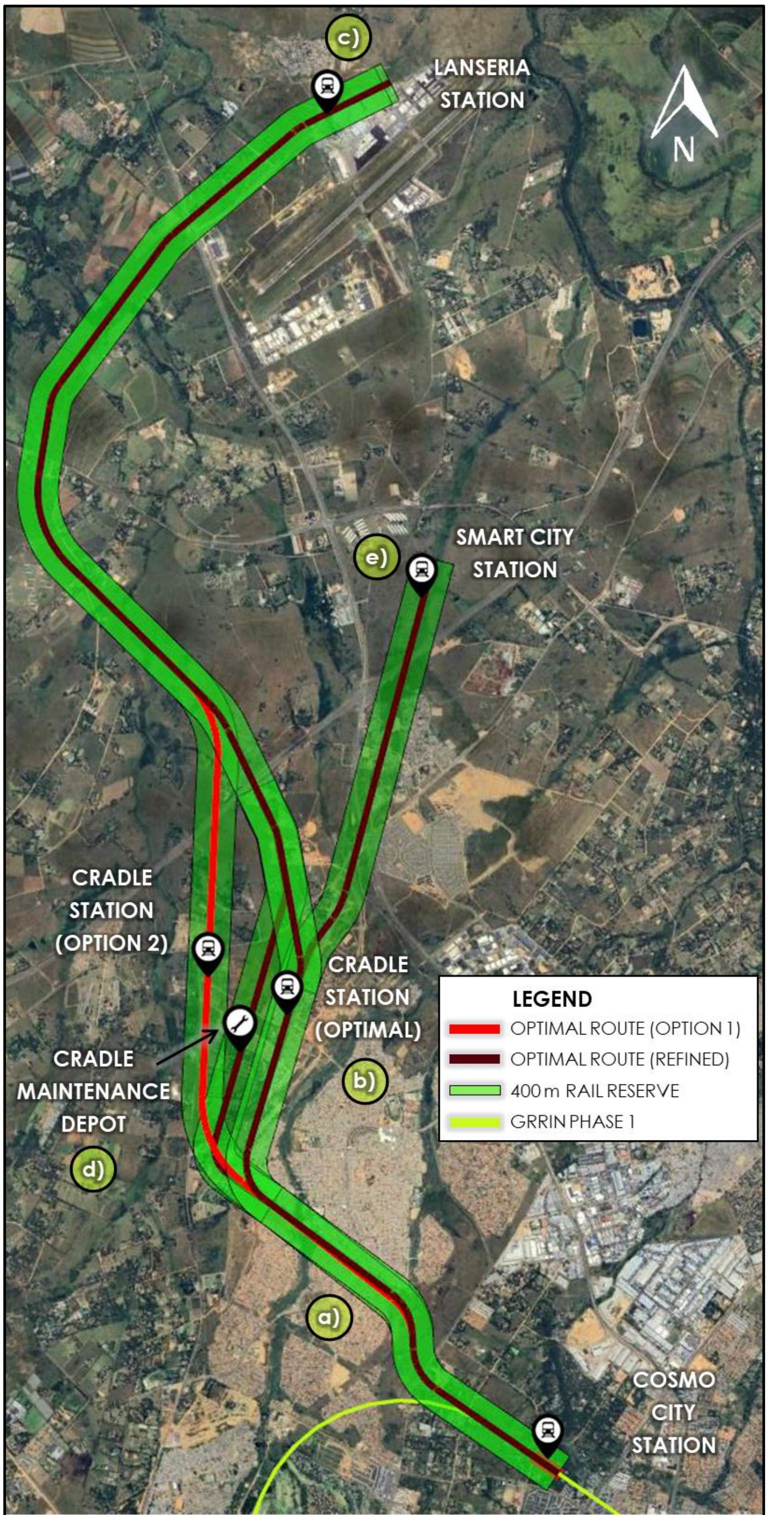
Integration with Smart City Station

To integrate and provide access to the Optimal Smart City Station (as described in Section 4.4.5 above), a route to the Smart City Station was incorporated as a spur connected to the main route.

The final length of the refined optimal Cosmo City to Lanseria route is a total of 17.4km from start to end, comprising 45% At-grade, 48% Bridge/Viaduct and 7% Cut-and-Cover.

The integrated Cradle Rolling Stock Maintenance Depot access route is approximately 4.5 km long and is a complete at-grade route whilst the integrated Smart City route is approximately 4.4 km long, comprising 13% At-grade, 3% Cut-and-Cover and 84% Deep Tunnel.

Figure 6-16 below shows the final refined optimal route (dark red/maroon) with the integrated Maintenance Depot and Smart City routes versus the original optimal route developed (red).



NOTE:

1. Optimal Route (Option 1) was refined as follows:
   a) Route centered in vacant land between West and East parts of Cosmo City Suburb
   b) Align with Optimal Cradle Station Position
   c) Extension of route end at Lanseria Station
   d) Integration of Maintenance Depot
   e) Integration of Future Smart City Station

Figure 6-16: Comparison of Cosmo City to Lanseria Optimal Route (Red) incl. Integrated access routes and Refined Optimal Route (Dark Red/Maroon)

6.6.2.2 *Affected Infrastructure*

With the optimal route undergoing refinement, the list of affected infrastructure also requires updating.

Some of the major infrastructure, developments and residential suburbs that the route runs through/beneath, are listed in the updated Table 6-14 below. The tunnel portions of the route will not have major impacts on infrastructure, developments and residential suburbs, above ground level.

A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The full extent of the potential impact on existing infrastructure and developments is not known at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-14: List of potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Cosmo City to Lanseria

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
COSMO CITY TO LANSERIA (MAINLINE ROUTE)		
• Kevin Ridge • Cosmo City • Malibongwe Industrial Park • Elandsdrift • Lindley • Lanseria	• Glen College Primary School • Nemos Nursery School • Advent Hope Church • Cosmo City West Primary School • For Afrika Offices • The Commissioned Church • Laerskool Nooitgedacht • Various developments in Malibongwe Industrial Park • Shepherd's Fold Stables • Werco Plant Hire • Culinary Table • Lanseria Airport	• South Africa Drive • R114 • N14 Highway • R552 Elandsdrift Road • R512 Pelindaba Road • Ashenti Road
MAINTENANCE DEPOT ACCESS ROUTE		
• Malibongwe Industrial Park	• Safeline Breaks (GUD Holdings) • Eurofit Kitchens and Cupboards • Various developments in Malibongwe Industrial Park	• R114
FUTURE SMART CITY ROUTE		
• Cosmo City	• ZCC Bultfontein • Nederduitche Hervormde Kerk - Noordrand	• None.

6.6.3 Cosmo City to Samrand

6.6.3.1 Optimal Route Refinements

Compared to the Original Option 1 route (as described in Section 6.4.3.2 above) the following sections of the route were refined:

Cosmo City to Boundary Park

At the sharp curve just north-west of Cosmo City station, refinement was done to achieve compliance with the design criteria.

The refinement in this section resulted in a minor shifting of the route to the east. The maximum shift of the route in this section was approximately 0 to 20 m.

Noordwyk to Samrand

Since this section of the route is in a tunnel, the refinement was done to straighten out the route to reduce route length and improve alignment.

The refinement in this section resulted in the route shifting slightly to the east. The maximum shift of the route in this section was approximately 0 to 450 m.

At Samrand Station

Refinement in this section was done to extend the end of the route approximately 250 m further, to allow for potential staging of trains overnight, at the Samrand station.

The final length of the refined optimal Cosmo City to Samrand route is a total of 30.3 km from start to end, comprising 5% At-grade, 10% Bridge/Viaduct, 2% Cut-and-Cover and 83% Deep Tunnel.

Figure 6-17 below shows the final refined optimal route (dark red/maroon) versus the original optimal route developed (red).

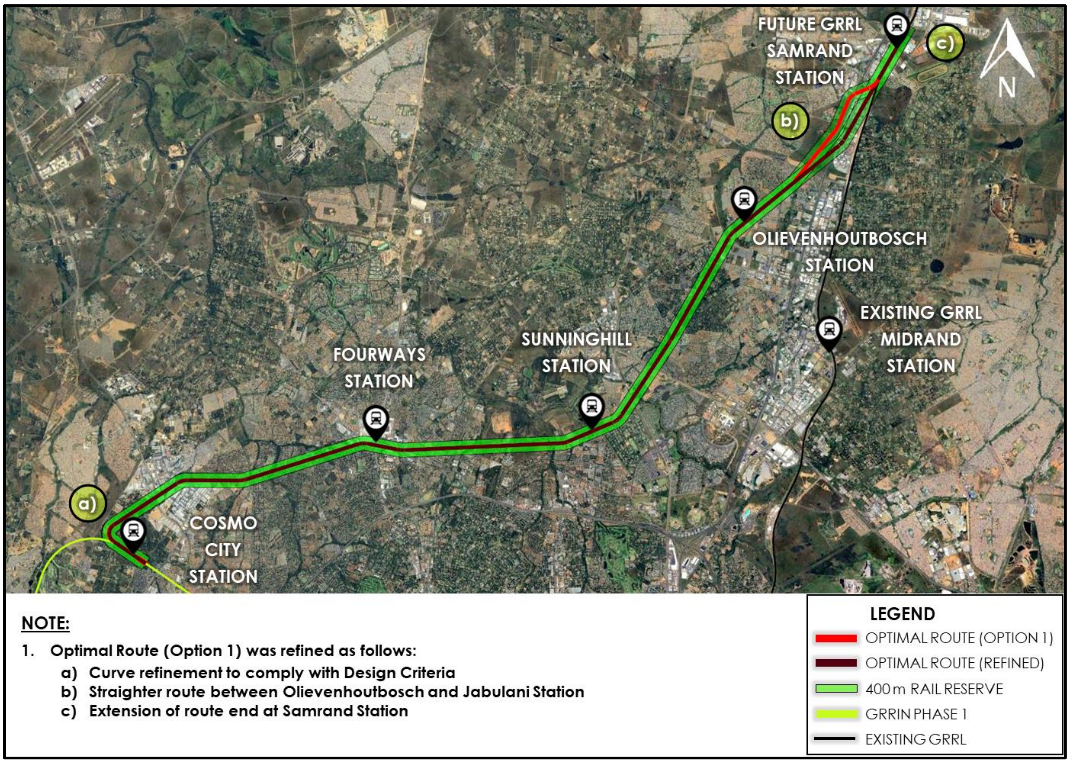


Figure 6-17: Comparison of Cosmo City to Samrand Optimal Route (Red) and Refined Optimal Route (Dark Red/Maroon)

6.6.3.2 *Affected Infrastructure*

With the optimal route undergoing refinement, the list of affected infrastructure also requires updating.

Since most of this route is in a tunnel route, it will not have a major impact on infrastructure, developments and residential suburbs above ground level. However, portions of the route that are not in a tunnel, may have some impact on existing infrastructure.

Therefore, for the sections of the route that are not in a tunnel, the updated major infrastructure, developments and residential suburbs that are affected, are listed in Table 6-15 below. A more comprehensive list of affected infrastructure, developments and residential suburbs will only be available during the future design stages of the determined route.

The full extent of the potential impact to existing infrastructure and developments is not known at this level of study and will only be quantified in more detail during future design stages of the determined route.

Table 6-15: List of Potentially affected Suburbs, Infrastructure, Developments, Road and Rail Crossings – Cosmo City to Samrand

Suburbs	Major Infrastructure & Developments	Major River, Roads & Rail Crossings
• Kevin Ridge • Boundary Park • Kaya Sands • Hoogland • Houtkoppen	• Various industrial developments in Kya Sands and Hoogland • Some industrial developments in Samrand and N1 Business Parks	• R512 (Malibongwe Drive)

6.6.4 *Cosmo City Junction*

The Cosmo City station is part of the GRRIN Phase 1 Route and is planned to be a junction station. A junction station is a railway station where multiple tracks to different destinations on different routes come together.

The Cosmo City Junction is required to:

- allow the three routes (to Lanseria, Samrand and Jabulani) to come together and integrate at the Cosmo City Station;
- allow connecting routes that may be required to improve operational efficiency; and
- connect with the determined route for Phase 1 of the GRRIN extensions (GMA, 2021).

The configuration of this junction is illustrated in Figure 6-18. This figure shows the integration of the various routes, as described above, as well as the rail reserve boundary required (highlighted in green) to cater for the operational and technical integration needs at the Cosmo City Junction Station.

Therefore, the rail reserve required for the Cosmo City Junction needs to be included as part of the final optimal routes determined as part of this study.

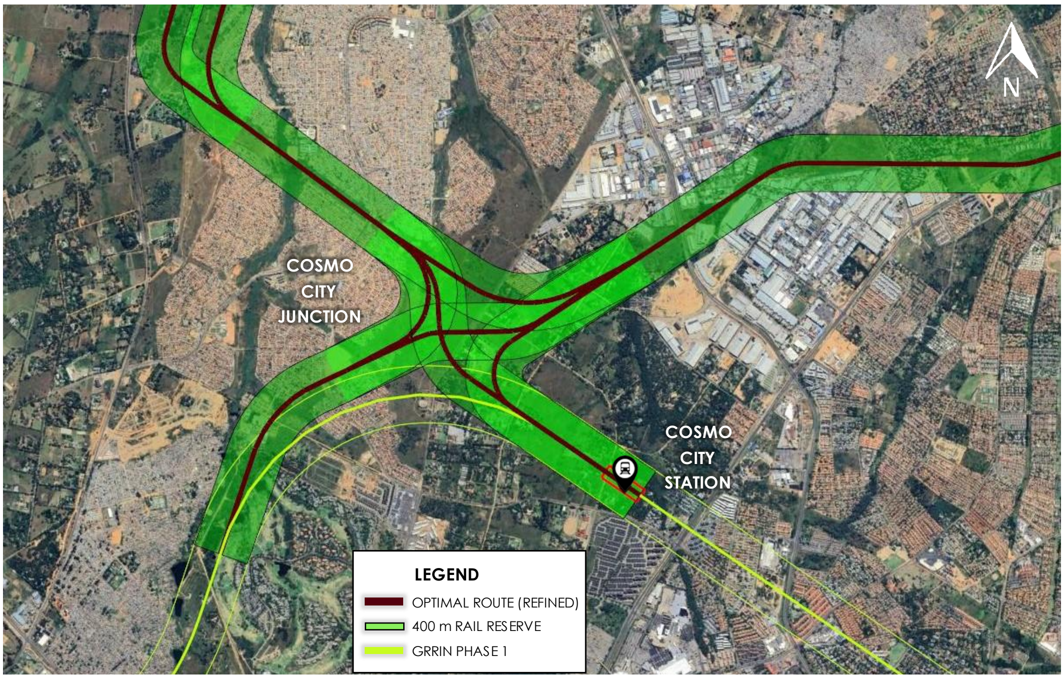


Figure 6-18: Cosmo City Junction and Rail Reserve Boundary

6.7 Final Optimal Routes

The final optimal routes as determined through the MCA and as refined above, are shown in Figure 6-19, Figure 6-20 & Figure 6-21 below.

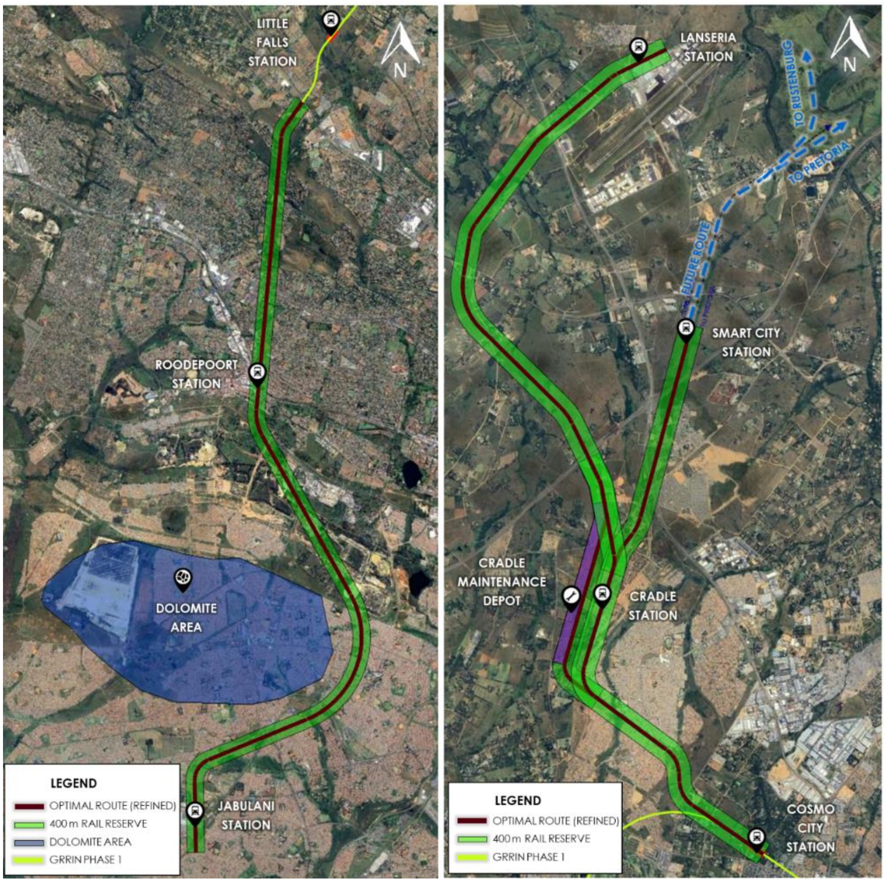


Figure 6-19: Final Optimal Routes for Little Falls to Jabulani (Left) and Cosmo City to Lanseria (Right)

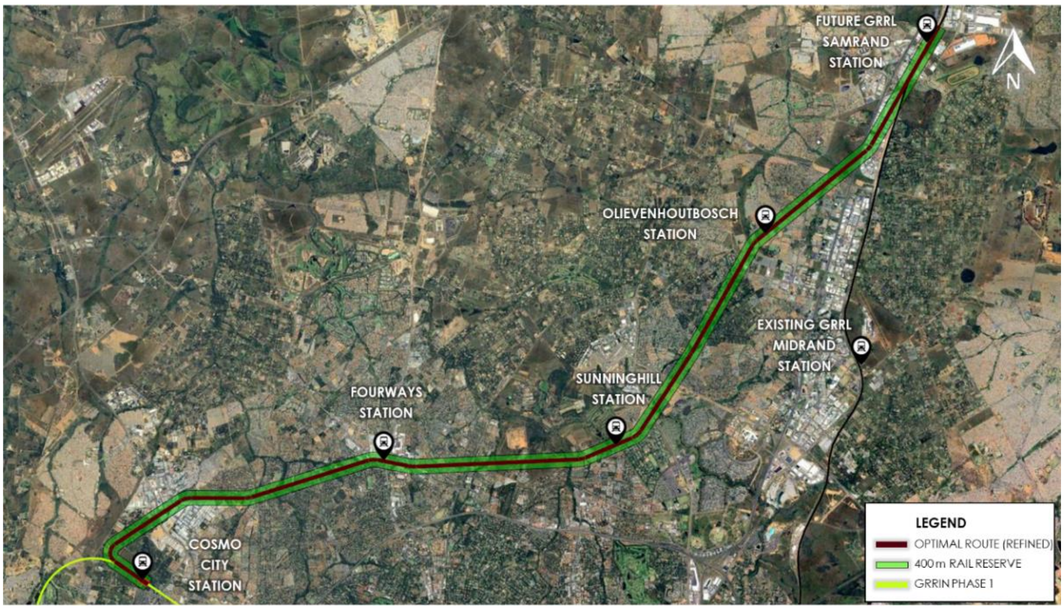


Figure 6-20: Final Optimal Route for Cosmo City to Samrand

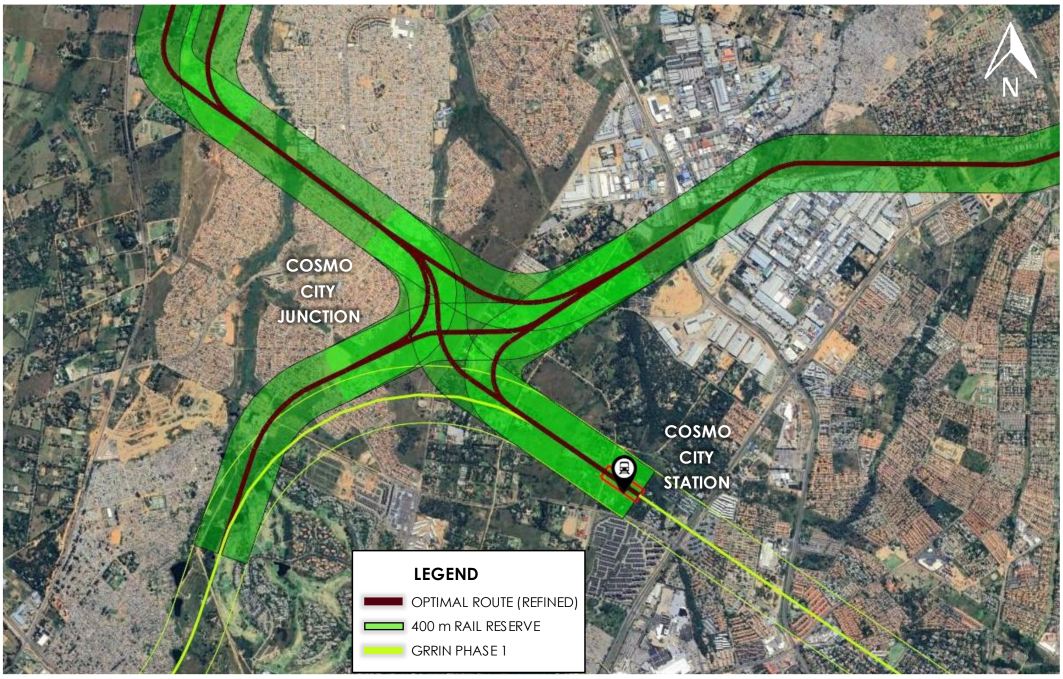


Figure 6-21: Final Optimal Rail Reserve Boundary for the Cosmo City Junction

7

ENVIRONMENTAL ASSESSMENT

7. ENVIRONMENTAL ASSESSMENT

This section provides an overview of the environmental assessment conducted for the route determination. A separate Report (Annexure B) was prepared to investigate the potential environmental sensitivities and impacts of the GRRIN Project.

7.1 Guiding Framework for Sustainable Development and Regulatory Compliance of GRRIN Extension

The extension of the GRRIN is set within the framework of both national and international policies, underscoring the South African Government's commitment to sustainable development and environmental protection. At the heart of this commitment is the National Development Plan: Vision for 2030 (NDP), which aims to eradicate poverty, create jobs, and reduce inequality by 2030. The NDP also emphasises the importance of environmental sustainability and resilience, ensuring that natural resources are protected while benefiting human communities.

The Gauteng Transport Infrastructure Act (GTIA) provides a comprehensive legislative framework for transport infrastructure in Gauteng Province. It ensures that all transport projects comply with provincial policies and regulations, promoting sustainable development and efficient resource use. Compliance with the GTIA requires rigorous planning and design processes, including thorough environmental investigations to ensure projects do not adversely impact the environment and align with sustainable development principles.

The Gauteng Department of Agriculture and Rural Development (GDARD) plays a crucial role in overseeing the environmental screening and assessment processes for the project. GDARD ensures that all environmental impacts are identified and mitigated according to provincial and national regulations. This includes reviewing environmental impact assessments (EIAs), issuing environmental authorisations, and monitoring compliance with environmental management plans. GDARD's involvement ensures adherence to stringent environmental standards, protecting biodiversity, water resources, and other critical environmental assets.

By adhering to the provisions of the GTIA and collaborating closely with GDARD, the GRRIN extension aims to balance infrastructure development with environmental conservation, contributing to the overall sustainability and resilience of the Gauteng Province.

7.2 Environmental Investigation Report

The Environmental Investigation Report (EIR) was written to fulfil the requirements set forth by the GTIA and the GDARD. The GTIA mandates an environmental investigation and reporting process to ensure that all proposed transport infrastructure projects align with sustainable development goals and comply with relevant environmental legislation. When conducting a route determination study, GDARD has several key requirements to ensure environmental and social considerations are addressed.

For route determination, the focus is typically on evaluating the practicality and potential impacts of different route options before detailed assessments and EIAs are conducted. The process in this Project involved several key components, namely:

- **Preliminary Environmental Screening:** This initial phase involved a high-level assessment to identify any obvious environmental constraints or sensitive areas that could affect the feasibility of proposed routes. The goal was to highlight potential environmental challenges early in the planning process, allowing for informed decision-making and the identification of viable route alternatives. Key considerations during this phase included the presence of protected areas, wetlands, and other sensitive ecosystems.
- **The Route Alternatives Analysis:** This phase involved systematically comparing different route options based on a range of criteria, including environmental impact, cost, social implications, and technical feasibility. The analysis aimed to identify the most optimal route (from a practical, sustainable and cost efficiency perspective), while minimising negative impacts on the environment and local communities. Each alternative was evaluated for its potential to avoid or mitigate significant environmental and social impacts, and the feasibility of implementing necessary mitigation measures was considered.
- **Preliminary Biodiversity and Social Assessments:** This consisted of basic examination to understand the potential impacts on biodiversity and local communities. These assessments, while not as detailed as full Environmental Impact Assessments (EIAs), provide sufficient information to inform the feasibility study and highlight any significant issues that need to be addressed in subsequent detailed assessments. Assessments focused on identifying the presence of Red Data species, critical habitats, and ecological corridors, and potential impacts on local communities, including displacement, changes in land use, and effects on livelihoods.

7.2.1 Approach to Assessment

In order to fulfil the requirements for an environmental screening report investigating the various environmental components of the Project, the primary objectives of this EIR were to present:

- The findings of the screening of the various station positions and route alignment options for the extension.
- An overview of the potential impacts, risks, and opportunities associated with this Project.
- An assessment of the South African environmental legislative framework that may influence the Project. This included identifying regulatory requirements, permits, and licenses needed, the Environmental Impact Assessment (EIA) process required, specialist studies needed, and an approach to the authorisation process.

- To achieve these objectives, the study employed a comprehensive approach, including:
  - **Environmental Screening:** Utilised tools such as the Department of Forestry, Fisheries and Environment (DFFE) Screening Tool, Geographic Information System (GIS), drone footage, high-level visual assessments, and ground truthing to identify environmental sensitivities. In doing so associated impacts and opportunities were also identified.
  - **Options Assessment:** Evaluated different route and station options based on environmental screening results, considering site status quo such as land use, and considering not only the physical footprint of the station location and the rail alignment, but also what impact the different vertical placements (at-grade, bridge, cut-and-cover and deep tunnel) would have on the identified sensitivities.
  - **Regulatory Framework Assessment:** Outlined applicable legislation and identified necessary permits and licenses, including the necessary Environmental Impact Assessment (EIA) process, and proposed an approach to undertaking this environmental authorisation process based on lessons learned from the existing Gautrain (GRRL) project.

It is important to note that the screening and environmental and social risks and opportunities have been identified from a desktop-level perspective only, without specialist field assessments. The extent of work required to mitigate environmental impacts, as well as the actual sensitivities, will need to be confirmed by registered specialists through a detailed Environmental Impact Assessment (EIA) process and thorough field investigations once the project reaches the preliminary design stage.

7.3 Summary of Environmental Sensitivity Screening for Stations

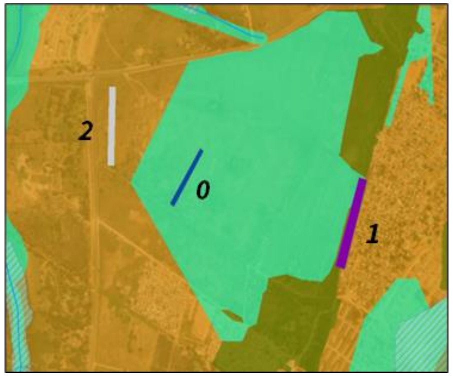
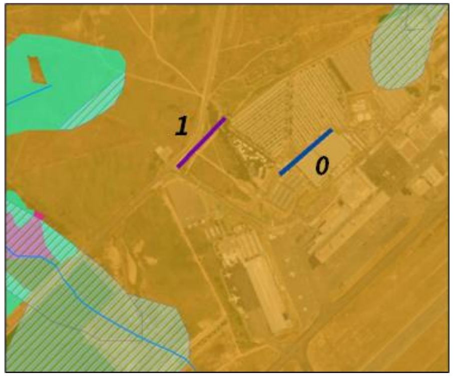
The screening revealed several environmental sensitivities, including agricultural potential, biodiversity, and proximity to heritage sites. These sensitivities exist due to the presence of critical habitats, watercourses, and conservation zones, as well as potential historical landmarks.

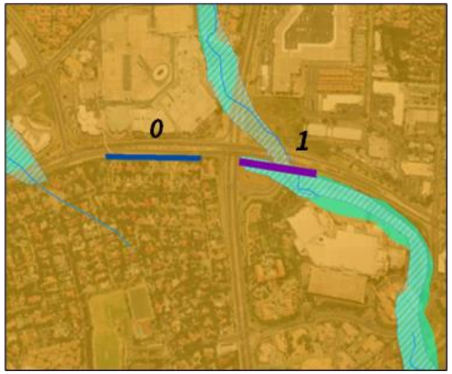
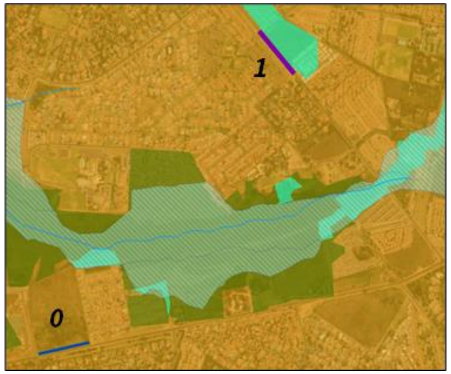
The sensitivities differed between the route options. In most cases, these differences were marginal, but in others, such as the presence of sensitive species and watercourse crossings, the differences were more pronounced. For instance, areas with high agricultural potential were identified, which could be impacted by construction activities. Biodiversity concerns were significant, particularly in regions with critical habitats for vulnerable and endangered species. The presence of watercourses and wetlands added another layer of complexity, as these ecosystems are crucial for maintaining local biodiversity and water quality.

Furthermore, the proximity to heritage sites required careful consideration to avoid damaging culturally and historically significant areas. Additional environmental themes were considered based on Screening Tool findings, namely Civil Aviation and Defence. Any adverse impact to surrounding communities from an environmental perspective (such as air, noise, vibration, sense of place, etc.) was also considered. All optimal stations will be subject to detailed impact and specialist assessments in future EIA phases to ensure comprehensive assessment and mitigation of potential impacts.

Several station positioning options were developed for each station. In the option assessment process (MCA), in many instances the option that was considered less sensitive did not always emerge as the optimal option in the MCA. Nonetheless, the environmental sensitivities of these station positions were assessed in detail and taken into consideration in the MCA process, ensuring that the final choices balanced environmental concerns with practical and developmental needs. All optimal stations selected will be subject to detailed impact and specialist assessments in future EIA phases to ensure comprehensive assessment and mitigation of potential impacts.

Table 7-1: Summary of Station Positions Screening Findings

Jabulani	Roodepoort	Cradle	Lanseria
Position 0 has a lower overall environmental sensitivity compared to Positions 1 and 2. It has a medium sensitivity rating for agriculture, similar to Position 1, but significantly lower than Position 2, which has a high sensitivity. This means Position 0 is less likely to require detailed specialist assessment. In terms of terrestrial biodiversity, Position 0 and Position 1 both have very high sensitivity ratings, while Position 2 is even more sensitive due to its classification as a CBA and its inclusion in the NPAES. This makes Position 0 less sensitive and more favourable from a biodiversity perspective. Additionally, Position 0 avoids significant social impacts, such as those associated with the Jabulani Taxi rank near Position 1, making it a more socially acceptable option.	Both Position 0 and Position 1 present similar environmental impacts, exhibiting the same sensitivity ratings. The urban and industrial nature of the area, combined with the presence of existing infrastructure, mitigates some potential impacts from Position 0, and particularly for Position 1, which is situated on a brownfield site. Given the lack of differentiation in environmental sensitivity and scoring between the two positions, the decision on the optimal station hinges on other critical factors such as cost, ease of construction, and integration with existing infrastructure. Both positions are strategically located to serve the Roodepoort Central Business District (CBD) and are well-connected to key transport routes, enhancing their viability.	Position 2 has high sensitivity for agriculture, similar to the other positions, but avoids the additional sensitivities associated with Position 1, such as the presence of more sensitive animal species and its proximity to a graveyard site, which could result in higher negative social impacts. It also has a slightly lower sensitivity for palaeontology aspects compared to Position 0. From a terrestrial biodiversity perspective, Position 2 is classified within the Critically Endangered Egoli Granite Grassland Ecosystem, similar to the other positions. However, Position 1 is more sensitive due to additional classifications as ESA 1, CBA 1, CBA 2, and NPAES, making Position 2 a more favourable option. In terms of social impact, including noise and visual intrusion, Position 2 is also likely to be lower in impact severity.	Position 0 is the less sensitive option due to its location within the already developed footprint of the Lanseria Airport, which reduces the need for extensive natural vegetation clearance and associated habitat disruption, regardless of the screening tool findings.
			
✓ *Position 0 is least sensitive* *Position 2 is most sensitive*	✓ *Both options are equally sensitive*	✓ *Position 2 is least sensitive* *Position 1 is most sensitive*	✓ *Position 0 is least sensitive* *Position 1 is more sensitive*

Smart City Station	Fourways	Sunninghill	Olievenhoutbosch"
The position exhibits several high and very high sensitivities. Given its location in a biodiversity-sensitive area, adjacent to a non-perennial river, wetland system, and overlapping CBAs and ESAs, and in close proximity to heritage sites, these aspects require particular attention. Low social sensitivity is anticipated as the development does not infringe on any existing properties or activities, and there is lower potential for noise impact (possibly moderate for visual). Nonetheless, the position is optimal considering integration with the Smart City plans.	Position 0 is generally the optimal option from an environmental perspective as it has lower sensitivities in several key themes, including aquatic biodiversity, archaeological and cultural heritage, and plant species (i.e. already developed). Contrary to this social impact causes additional complications for a land acquisition perspective. Nonetheless, from an environmental perspective, Position 0 a more favourable choice for minimising environmental impacts and simplifying the compliance and mitigation processes	The site has high sensitivity for agriculture due to its proximity to the Leeuwkop Prison Grounds. It also shows medium sensitivity for animal species and plant species, and very high sensitivity for aquatic biodiversity and terrestrial biodiversity. The site is a greenfield area, raising concerns about habitat loss. Social impacts are generally low but include moderate visual impacts and potential disruptions to recreational activities like hiking and mountain biking on the now-debunked Leeuwkop Golf Course grounds.	Position 1 is the optimal choice due to its lower overall environmental sensitivity compared to Position 0. It presents fewer challenges in terms of plant species and terrestrial biodiversity, making it the most suitable option for development with minimal environmental disruption. Position 0 has higher sensitivity due to its proximity to the Rietspruit River greenbelt and the potential presence of sensitive species. Both positions have similar high sensitivities in several other themes, but Position 1's lower sensitivity in some themes makes it the more favourable option.
			
Only one option - Position is relatively sensitive and undisturbed	✓ *Position 0 is least sensitive* *Position 1 is more sensitive*	*Only one option - Position 0 is relatively sensitive and undisturbed*	✓ *Position 1 is least sensitive* *Position 0 is more sensitive*

Legend:

- Position 0
- Position 1
- Position 2
- Watercourse
- Watercourse (Smart City)
- Future Route to Pretoria
- ESA
- Wetlands
- Wetlands (Smart City)
- CBA Important
- CBA Irreplaceable
- Endangered Tsakane Clay Grassland

7.4 Summary of Environmental Sensitivity Screening for Routes

7.4.1 Route Alignment Options Screening

As with the stations assessment, the desktop screening revealed similar environmental sensitivities, including agricultural potential, biodiversity, proximity to heritage sites, and adverse impacts to surrounding communities. Differences between the route options were generally marginal, but more pronounced in areas with sensitive species and watercourse crossings.

Unlike the stations, for the route alignment, the footprint associated with the construction and operation of the railway lines (including any associated infrastructure) has varying degrees of impact at the different vertical placement levels. These vertical placement impacts were evaluated in conjunction with the Screening Tool findings and the current land use to determine the actual status quo of sensitivities. This comprehensive approach ensured that the assessment did not rely solely on the screening tool findings but also considered the real-world conditions and existing land uses, providing a more accurate assessment of environmental sensitivities.

Two options for each corridor underwent the MCA process, which included detailed environmental screening and assessment. In two out of the three corridors, the optimal route alignment option was also found to be the least sensitive from an environmental perspective. All optimal route alignments will need to undergo detailed impact and specialist assessments in future EIA phases to ensure comprehensive assessment and mitigation of potential impacts.

7.4.1.1 Little Falls to Jabulani Corridor

The Jabulani Corridor is characterised by a variety of environmental sensitivities across several themes. The Screening Tool highlighted high sensitivity areas for animal species, aquatic biodiversity, and terrestrial biodiversity due to the presence of essential habitats, watercourses, and conservation zones.

Additionally, the corridor traverses' regions with medium sensitivity for plant species, indicating the potential presence of vulnerable and critically endangered flora. The corridor's proximity to heritage sites and civil aviation aerodromes further contributes to its sensitivity ratings. Overall, the environmental sensitivities within the Jabulani Corridor require meticulous planning and effective mitigation strategies to minimise impacts, especially in areas of significant ecological and cultural value.

- **Option 1**, which features a longer deep tunnel section, consistently shows lower sensitivity ratings across most environmental themes. This is due to the reduced surface-level disruption associated with deep tunnelling, which minimises impacts on agricultural land, sensitive animal and plant habitats, heritage sites, as well as terrestrial biodiversity and aquatic ecosystems and other critical areas (Figure 7-1). The deep tunnel method also avoids extensive land acquisition and surface-level construction activities, further reducing the potential for environmental harm.
- **Option 2**, while similar in many respects, includes a 3.39 km section that is above ground. This section increases the potential for surface-level impacts, particularly in areas of high sensitivity, such as the presence of ESAs and wetlands in this portion (Figure 7-1). As a result, Option 2 generally exhibits higher sensitivity ratings compared to Option 1.

In summary, the EIR highlights the adjusted sensitivity ratings for various environmental themes, demonstrating how the deep tunnel method inherently and significantly mitigates surface-level impacts. Option 1, with its extended deep tunnel section, generally exhibits lower sensitivity ratings across most themes. This makes it the superior choice for minimising environmental disruption and preserving natural resources.

This option was the Optimal Option in the MCA and also the least sensitive option from an Environmental perspective.

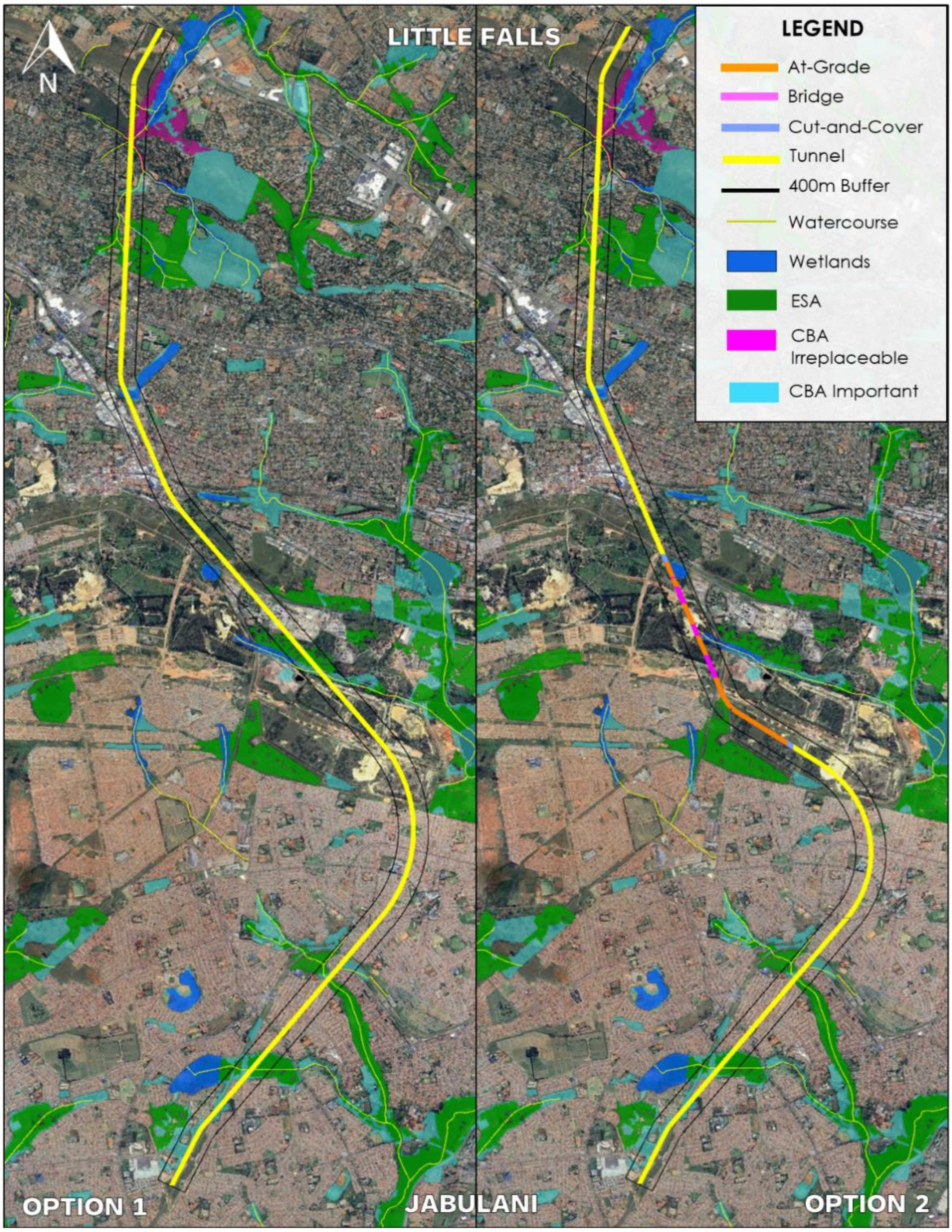


Figure 7-1: Visual Representation of the Vertical Profiles of Option 1 and Option 2 including Various Biodiversity and Aquatic Sensitivities – Little Falls to Jabulani

7.4.1.2 Cosmo City to Lanseria Corridor

The Cosmo City to Lanseria Corridor exhibits a range of environmental sensitivities across various themes. The Screening Tool identified very high sensitivity areas for agriculture, aquatic biodiversity, and civil aviation due to the presence of critical habitats, watercourses, and proximity to Lanseria International Airport. Additionally, the corridor crosses regions with high sensitivity for animal species and archaeological and cultural heritage, reflecting the potential presence of vulnerable species and heritage sites. The corridor also shows medium sensitivity for plant species and defence, indicating the presence of sensitive flora and proximity to military sites. Overall, the environmental sensitivities within the Cosmo City to Lanseria Corridor necessitate careful planning and mitigation measures to minimise impacts, particularly in areas of high ecological and cultural importance.

- **Option 1** shows higher sensitivity ratings across most environmental themes due to its route alignment. This option crosses more sensitive features, such as small holdings and areas of annual crops/cultivation and includes a portion of land with pivot irrigation. The combination of at-grade and bridge sections does not significantly alter the sensitivity rating because of the associated impacts. However, the bridge sections may slightly reduce the impact on agricultural land by allowing for some continued use of the land underneath (if and where applicable). Additionally, Option 1 crosses a longer distance of high sensitivity areas for animal species and aquatic biodiversity, which increases its potential of overall environmental impact (Figure 7-2). The proximity to heritage sites also contributes to its higher sensitivity rating. Overall, Option 1, purely from an environmental sensitivity perspective, is less favourable.
- **Option 2**, while similar in many respects, crosses fewer sensitive features compared to Option 1. This option has a shorter distance crossing high sensitivity areas for animal species and aquatic biodiversity. The use of bridges in some sections of both options may reduce the impact on sensitive habitats by allowing for the preservation of natural habitats underneath. However, the at-grade sections will still require significant vegetation clearance, which can disturb habitats (Figure 7-2). Option 2 generally exhibits lower sensitivity ratings compared to Option 1, making it a more favourable option in terms of minimising environmental impacts, making it a more environmentally sustainable choice. Additionally, Option 2 avoids proximity to heritage sites, which further reduces its sensitivity rating.

In summary, both routes consist of a similar combination of at-grade and bridge/viaduct sections, limiting the difference in terms of vertical placement. The key differences lie in the alignment and the sensitivities they traverse. Option 2, with its shorter distance crossing high sensitivity areas and fewer sensitive features, generally exhibits lower sensitivity ratings across most themes. This makes it the superior choice for minimising environmental disruption and preserving natural resources. The reduced need for land acquisition and other social impacts further enhances this.

However, it is important to note that Option 1, despite being more sensitive from an environmental perspective, emerged as the overall optimal option from the MCA. This indicates that while Option 1 may have marginally higher environmental sensitivities, it likely performed better across other criteria considered in the MCA, leading to its selection as the optimal route. While this option presents higher sensitivity, the impacts can be adequately managed and mitigated with careful planning and the implementation of effective management plans and mitigation measures.

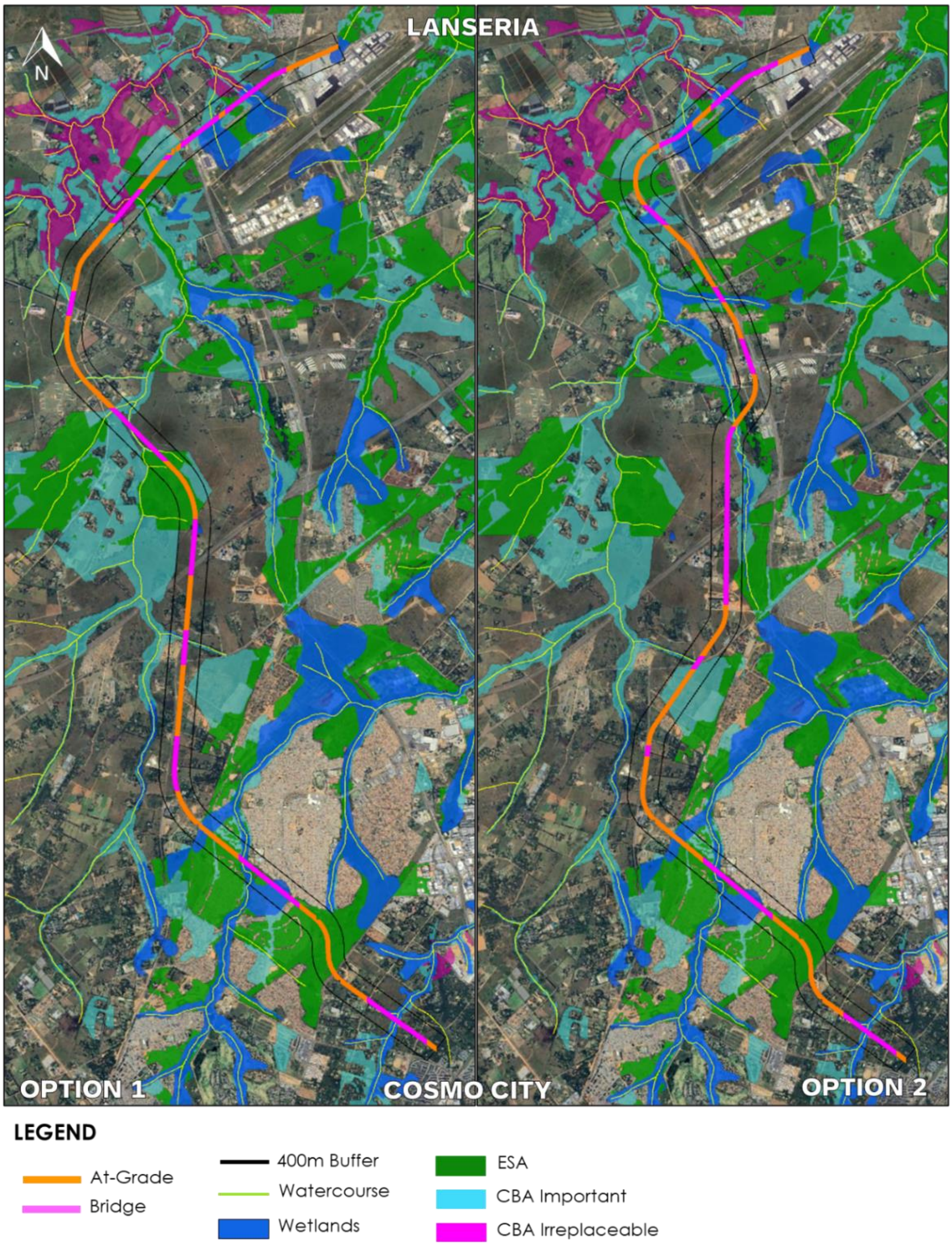


Figure 7-2: Visual Representation of the Vertical Profiles of Option 1 and Option 2 including Various Biodiversity and Aquatic Sensitivities – Cosmo City to Lanseria

7.4.1.3 Cosmo City to Samrand

The Cosmo City to Samrand Corridor exhibits a range of environmental sensitivities across various themes. The Screening Tool identified high sensitivity areas for animal species, aquatic biodiversity, and terrestrial biodiversity due to the presence of critical habitats, watercourses, and conservation areas. Additionally, the corridor crosses regions with medium sensitivity for plant species, reflecting the potential presence of vulnerable and critically endangered flora. The proximity to heritage sites and civil aviation aerodromes also contributes to the sensitivity ratings. Overall, the corridor's environmental sensitivities necessitate careful planning and mitigation measures to minimise impacts, particularly in areas of high ecological and cultural importance.

- **Option 1**, which features a longer deep tunnel section, consistently shows lower sensitivity ratings across most environmental themes. This is due to the reduced surface-level disruption associated with deep tunnelling, which minimises impacts on agricultural land, sensitive animal and plant habitats, heritage sites, and terrestrial biodiversity and aquatic ecosystems and other critical areas (Figure 7-3). The deep tunnel method also avoids extensive land acquisition and surface-level construction activities, further reducing the potential for environmental harm. The longer underground alignment ensures that sensitive areas are preserved, making it an environmentally sustainable option.
- **Option 2**, while similar in many respects, includes a 7.30 km section that is above ground. Albeit only 1.89 km longer above ground than Option 1, this section increases the potential for surface-level impacts, particularly in areas of high sensitivity, such as the presence of ESAs and wetlands in this portion (Figure 7-3). The above-ground sections in Option 2 are more likely to disrupt sensitive habitats and require more extensive land acquisition, leading to higher social and environmental impacts. As a result, Option 2 generally exhibits higher sensitivity ratings compared to Option 1.

In summary, the table highlights the adjusted sensitivity ratings for various environmental themes, demonstrating how the deep tunnel method significantly mitigates surface-level impacts. Option 1, with its extended deep tunnel section, generally exhibits lower sensitivity ratings across most themes. This makes it the superior choice for minimising environmental disruption and preserving natural resources. The reduced need for land acquisition and the minimised surface-level construction activities further enhance its suitability as the optimal route alignment.

This option was the Optimal Option from the MCA and also the least sensitive options from an Environmental perspective.

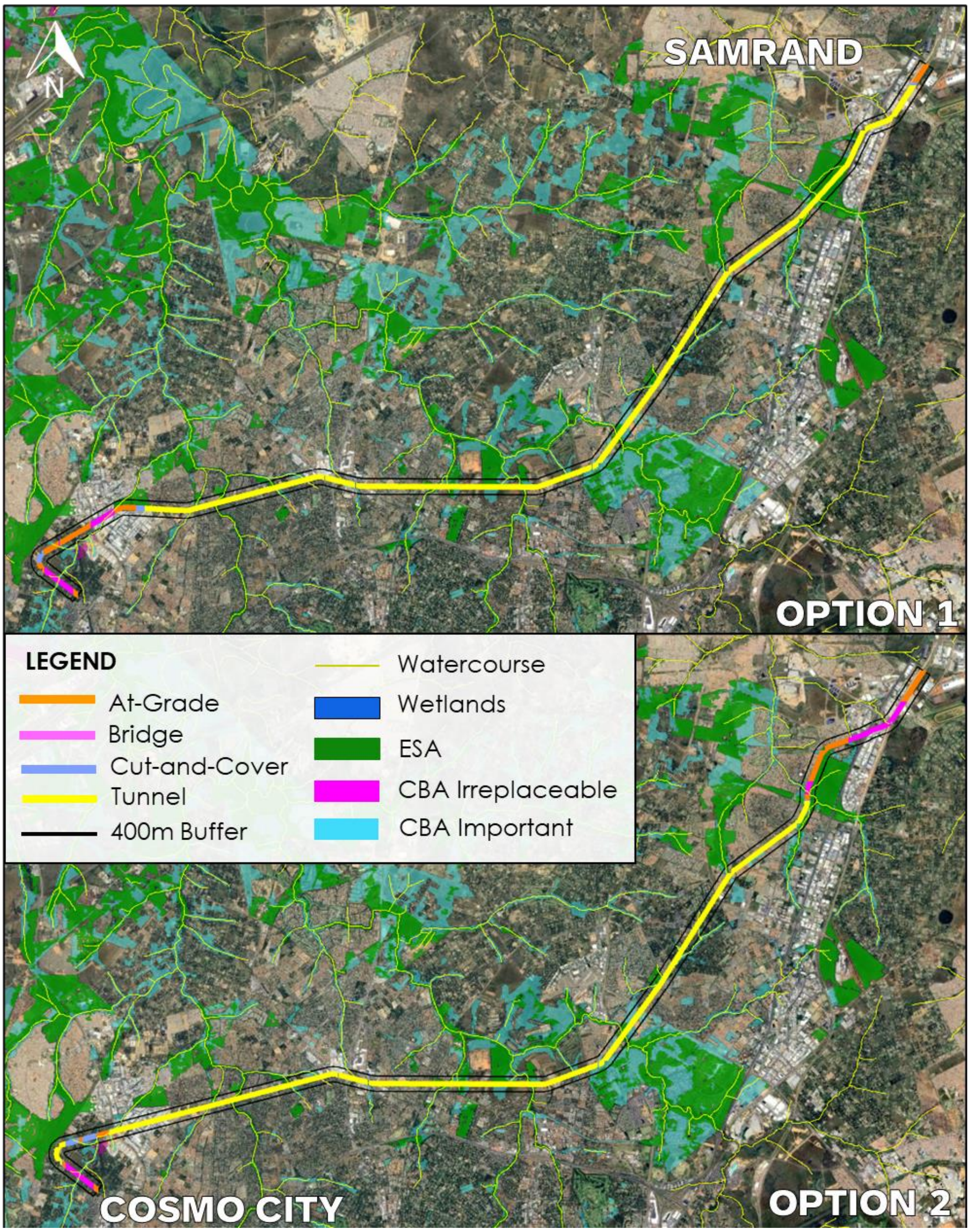


Figure 7-3: Visual Representation of the Vertical Profiles of Option 1 and Option 2 including Various Biodiversity and Aquatic Sensitivities – Cosmo City to Samrand

7.4.2 Refined Optimal Route Alignments Sensitivities

Optimal routes that underwent further refinement to enhance the feasibility and sustainability of the alignments were also assessed to understand associated sensitivities:

- **Little Falls to Jabulani Corridor** – The Refined Optimal route showed slight variations in alignment compared to Optimal Option 1 route. Nonetheless, both routes maintained a consistent vertical placement as deep tunnels, ensuring minimal surface-level disruption. This deep tunnel approach significantly reduced impacts on surface-level ecosystems, habitats, and human activities, preserving critical biodiversity areas, watercourses, and heritage sites. Consequently, despite the minor horizontal deviations, the environmental impacts of both routes were essentially the same. The deep tunnel placement ensured that the Refined Optimal route and Optimal Option 1 were equally effective in minimising environmental disruption, providing a sustainable solution for the corridor.
- **Cosmo City to Lanseria** – Compared to Optimal Option 1 route, the Refined Optimal route had several differences affecting environmental sensitivities. The length of at-grade railway line from Cosmo City to the Cradle Station was reduced, with more cut-and-cover and bridge sections, slightly lowering the environmental impact. However, the fully at-grade portion near the Cradle Station and the rolling stock maintenance depot location had higher environmental and social impacts due to vegetation clearance and proximity to rural communities, including a graveyard site. Towards Lanseria Airport, the alignment remained mostly unchanged, with some vertical placement adjustments reducing the at-grade length and slightly lowering the environmental impact. These refinements were necessary to integrate with the rolling stock maintenance depot and Smart City Station, but overall, the Refined Optimal presented greater environmental and social impacts, mainly due to the proximity of the rolling stock maintenance depot and Cradle Station locations.
- **Cosmo City to Samrand** – Compared to the Optimal Option 1 route, the Refined Optimal route presented some differences. At the Cosmo City end, the route was primarily on a bridge, which exhibited slightly reduced impacts compared to the more mixed placement in Optimal Option 1. There was a slight deviation in the Refined Optimal route near the DBSA at the Samrand end, but since this section was also a deep tunnel, the deviation made no difference to the sensitivity findings. Additionally, there was a change to a cut-and-cover section at the Samrand end of the route that was a tunnel in Optimal Option 1. This area, however, was not environmentally sensitive. These refinements were necessary to optimise the alignment and comply with critical parameters in the design criteria, ensuring the most sustainable and feasible route. From an environmental sensitivity perspective, both the Refined Optimal and Optimal Option 1 routes were essentially the same due to their primarily deep tunnel design.

7.5 Environmental and Social Risks and Opportunities

The Project will have various environmental and social impacts during construction and operation. Key impacts include air quality issues from dust and emissions, increased noise levels, vibration affecting nearby structures, visual intrusion, habitat destruction, and potential contamination of water sources. Socio-Economic impacts include displacement of communities and businesses, increased traffic, and disruption to local transport systems.

To mitigate these impacts, measures such as dust suppression, noise attenuation barriers, vibration dampening, and habitat restoration plans are proposed. Contamination risks can be managed through sediment and erosion control, spill containment systems, and water quality monitoring. Soil erosion and compaction will be addressed by stabilising soil and rehabilitating disturbed areas. Fair compensation and relocation assistance will be provided to affected communities, and a Traffic Management Plan will be developed. Addressing the taxi industry and related Socio-Economic impacts will require careful stakeholder engagement and mitigation planning.

Conversely, the Project is expected to bring social and economic benefits, including job creation, opportunities for local businesses, and economic stimulation through improved connectivity. It will provide a reliable public transport system, reducing travel times and traffic congestion, and contributing to cleaner air. Social benefits include enhanced quality of life, community development, and increased safety and convenience. The Project will stimulate urban renewal and development around stations, transforming areas into vibrant hubs. Training programs for construction workers and engineers, and ongoing training for operational staff, will be offered. Improved accessibility for all individuals, including those with disabilities, and a boost to tourism are additional benefits.

Overall, the Project represents a comprehensive approach to sustainable development, balancing economic growth, environmental stewardship, and social well-being. To ensure this, the Project will need to undergo comprehensive impact assessments and detailed specialist environmental and social assessments. These assessments will define site and project-specific impacts and develop targeted mitigation and enhancement measures, ensuring that the Project proceeds in an environmentally responsible and socially inclusive manner.

7.6 Legal Framework and Permitting Strategy

7.6.1 Applicable Legislation

The development of the GRRIN Extensions Project triggers a wide range of South African environmental legislation. The Project will need to conform with the National Environmental Management Act (NEMA, Act No. 107 of 1998), the National Water Act (NWA), and several other Specific Environmental Management Acts (SEMAs). NEMA serves as the primary legislation for environmental authorisation, providing a comprehensive framework for environmental governance, ensuring that the Project adheres to principles of sustainable development, environmental protection, and public participation. The Gauteng Provincial Environmental Management Framework (GPEMF) also comes into effect, providing guidelines for sustainable development and environmental management within the Province. The GPEMF identifies specific zones where certain activities may be excluded from the requirement to obtain Environmental Authorisation, thereby streamlining the approval process for developments that align with provincial environmental priorities.

Given the scale and nature of this Project, a formal Scoping and Environmental Impact Reporting (S&EIR) process, in accordance with NEMA and the EIA Regulations (GNR 982 of 2014, as amended) will be required. This comprehensive process will include various specialist assessments to evaluate potential impacts on agriculture, biodiversity, heritage resources, and more. Several permits may also be required due to the Project's potential impacts on water resources, air quality, waste management, and protected species. These may include a Water Use License (WUL) under the NWA for activities impacting water resources, an Atmospheric Emission License (AEL) under the National Environmental Management: Air Quality Act (NEM:AQA, Act No. 39 of 2004) for specific air quality impacts, a Waste Management License (WML) under the National Environmental Management: Waste Act (NEM:WA, Act No. 59 of 2008) for certain waste-related activities, Heritage Permits under the National Heritage Resources Act (NHRA, Act No. 25 of 1999) for activities impacting heritage resources, Biodiversity and Forestry Permits under the National Environmental Management: Biodiversity Act (NEM:BA, Act No. 10 of 2004) and the National Forests Act (NFA, Act No. 84 of 1998) for activities involving protected species or trees, and Borrow Pit Permits under the Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002) for the extraction of construction materials.

An integrated environmental approvals process will streamline permitting and public participation, reducing duplication and enhancing transparency. Key authorities involved include the DFFE, GDARD, and the Department of Water and Sanitation (DWS), the South African Heritage Resources Agency (SAHRA). Other competent authorities involved in the environmental approvals process for the Project will likely include, among others, the Department of Mineral Resources and Energy (DMRE) which handles the approval of borrow pit permits under MPRDA, the Civil Aviation Authority (CAA), and Local Municipalities.

7.6.2 Approach to the Authorisation of this Project

In developing this strategy, the lessons learned from the existing Gautrain Rapid Rail Link System project (the currently operating Gautrain line) were examined. This project was a comprehensive and complex undertaking that spanned nine years, highlighting several critical aspects and challenges essential for future phases. Initially, the EIA process was planned to take four years but extended to nine years due to the project's complexity and evolving legislative requirements. These experiences underscore the importance of realistic timelines, flexibility, and thorough planning in managing large-scale infrastructure projects. Key challenges included navigating newly emerging environmental legislation, addressing biophysical and Socio-Economic impacts, and ensuring effective public participation. The involvement of senior management and robust relationship management strategies were crucial for successfully engaging stakeholders and obtaining the necessary environmental authorisations.

Based on the lessons learnt from the GRRL, the approach to the EIA process (i.e. the S&EIR) for the GRRIN extensions (this Project) can vary based on several factors, including the scale of the Project, the specific environmental impacts, and regulatory requirements.

As per the Economic Analysis of the 2016 Feasibility Study [2], the GRINN Extension Project is planned to be rolled out in five phases over a 24-year period. Normally, a project of this magnitude would benefit from a single, comprehensive EIA, while also preparing supplementary focused assessments for particularly sensitive corridors. However, this approach is not viable for the Project due to its phased implementation over a 24-year period. The extended timeline means that the necessary preliminary designs for all corridors will not be available simultaneously, leading to significant delays and inefficiencies. Additionally, the financial burden of conducting a comprehensive EIA upfront would be immense, potentially straining the Project's budget and delaying progress. Furthermore, there are legislated timeframes associated with the commencement of construction works when a project is authorised. This approach also complicates stakeholder engagement, as maintaining focused and effective communication across such an extended timeline and diverse geographic areas would be challenging. Therefore, a phased EIA process is more practical, allowing for detailed, focused assessments and approvals that align with the project's staggered rollout, including the stations and route alignments associated with each. This ensures both financial prudence and timely execution.

To address the environmental authorisation requirements effectively, a hybrid approach is recommended. This approach combines phase-specific EIA with a supplementary cumulative impact assessment. This strategy ensures detailed and focused assessments for each phase while providing a comprehensive understanding of the overall environmental impacts.

By conducting phase-specific EIAs, the Project can address unique environmental conditions and regulatory requirements for each corridor and station. This phased strategy allows for timely approvals and construction commencement in ready segments, while managing costs effectively. A cumulative impact assessment integrates findings from each phase, providing a holistic view of the overall environmental impacts. Early consultation with relevant authorities is recommended to ensure a smooth and efficient environmental authorisation process. Engaging with regulatory bodies early helps identify and resolve potential issues, understand regulatory requirements, and incorporate feedback into the EIA process, enhancing the quality and acceptability of the assessments. Nonetheless, the appointment of an experienced EAP and ongoing consultation with authorities will determine the best approach. Flexibility and adaptability are essential, as new information and changing circumstances may influence the EIA strategy.

[2] *Source:* Feasibility Study for the Possible Rapid Rail Extensions to the Gauteng Network- Volume I: Section 6: Economic Analysis Part 2: BBBEE & SED Due Diligence Report (August 2016).

7.6.3 Recommendations

Based on this assessment the following recommendations are proposed (for each phase, based on as and when implementation commences per phase):

- Undertake the next step in the GTIA process by conducting the preliminary design and further developing the route alignments and Project description. This will provide a detailed understanding of the specific activities involved and their potential environmental impacts. A detailed Project description will provide a clear basis for engaging with stakeholders and the public. t.
- Appoint a registered EAP to undertake a comprehensive S&EIR process as per NEMA, including all the necessary specialist studies.
- Engage early with regulatory authorities to determine the appropriate EIA process and identify environmental sensitivities.
- Conduct comprehensive fieldwork assessments to identify and mitigate impacts on agricultural resources, cultural heritage, wetlands, water sources, and protected areas/species.
- Obtain all necessary permits and licenses, including WUL, WML and AEL (if required), for regulatory compliance.
- Establish Environmental Design Criteria for sustainability, covering climate change mitigation, energy efficiency, water conservation, waste management, air quality, biodiversity protection, noise control, community integration, health and safety, and continuous monitoring.
- Develop and implement detailed management and monitoring plans to ensure effective mitigation and compliance.
- As various phases progress, continuously develop a supplementary cumulative impact assessment to track, manage and/mitigate potential impacts.
- Use lessons learnt from the first phase implemented for this Project, for subsequent phases, to mitigate any challenges or concerns.

By following these recommendations, the GRRIN Extensions Project can balance infrastructure development with environmental conservation, contributing to the sustainability and resilience of Gauteng Province.

8

DESIGN INPUT DATA

8. DESIGN INPUT DATA

8.1 Design Criteria

A set of design criteria was developed for this study that contains several track design parameters used to guide the design of the route alignment alternatives in this study. The design criteria align with the objectives of the design criteria that were used for the development of the existing Gautrain Rapid Rail Link (GRRL) network.

As part of the route alignment study approach, the optimal route alternatives from this study were checked to verify compliance with the design criteria, thereby minimising the risk of potential future alignment design deviations, outside the 400 m wide rail reserve boundaries required per the GTIA.

8.2 Ground Level data and Aerial Imagery

Satellite data of the ground levels of the study area, was obtained to use as input data for the development of route alternative options. This data was used to assess the ground levels of each corridor in the development of route options.

Satellite Aerial imagery was also obtained and used to indicate the locations of various existing features (such as existing buildings, vacant land, roads, bridges, railway lines, rivers, streams and many others).

8.3 Geology and Ground Settlement Assessments

8.3.1 Assessments Conducted

Geology refers to the study of the physical structure of the Earth on and beneath its surface, as well as the substance, history and processes that have shaped that structure. Underlying geology can influence route alignment design and was considered as part of the development of the route alternatives.

A desktop study was conducted to provide a high-level overview of the underlying geology along each corridor. This study investigated the likely geotechnical conditions that could be expected and highlighted certain risks.

Further, the physical change in ground levels over time was investigated, along the three corridors of the study area (i.e. ground settlement). Satellite imagery was used to conduct an analysis on the changes in ground levels over time. The analysis was conducted using data from a period between 2018 and 2022.

Figure 8-1 below shows a heatmap of the cumulative change in ground level results of the three corridors in the study area. This heatmap shows the overall ground height changes over the investigation period.

Six zones were identified that reveal the highest cumulative subsidence between 2018 and 2022. These six zones are indicated on the heatmap.

Although it is not foreseen that these six areas pose any risks at this level, it is however recommended that further ground investigations be conducted at these six zones in later (Preliminary and Detail design) stages of the project.

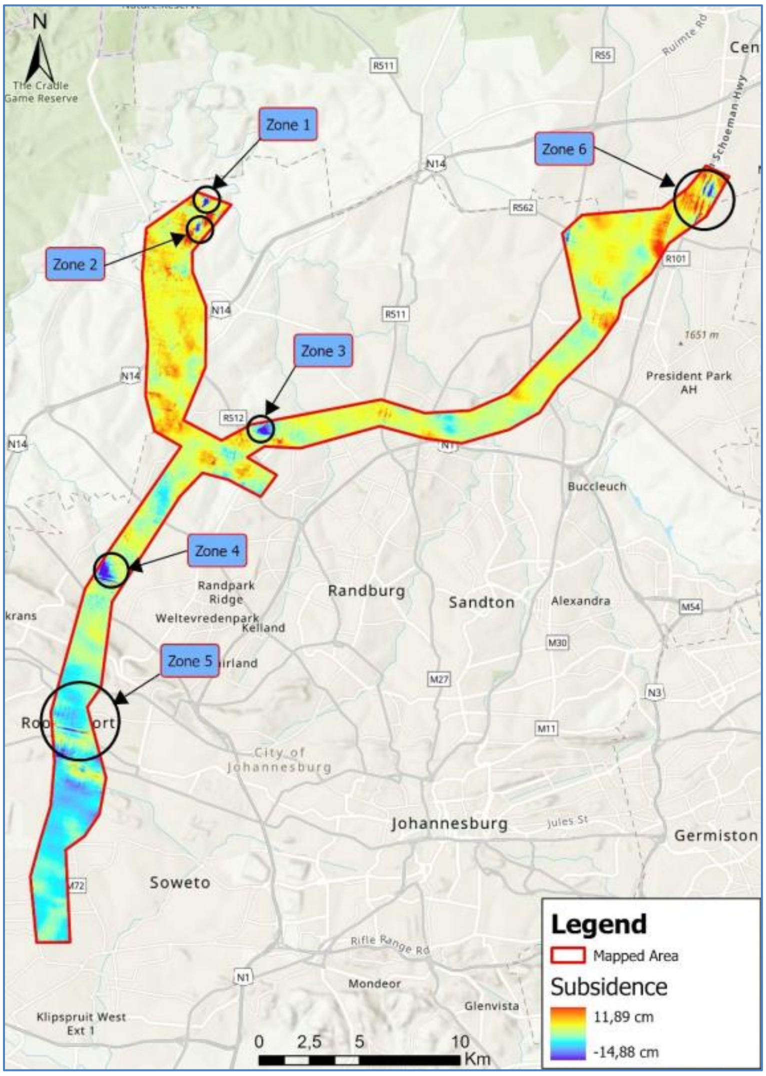


Figure 8-1: Cumulative ground surface settlement between 2018 and 2022

8.3.2 Possible Risk Areas

Through the Geology desktop study, two key risks were identified:

- Previous underground mining areas in Roodepoort.
- Dolomite area beneath the Braamfischerville and portions of the Meadowlands West and Dobsonville areas.

Figure 8-2 below highlights these geology risk areas. These risk areas only occur on the Little Falls to Jabulani Corridor. No geology risk areas were identified on the other two corridors of this study.

At this level of study, the use of this information is sufficient to identify areas of concern regarding geology that could influence the route option selection. However, any detailed geotechnical investigations of these areas and recommended solutions, will only be conducted in the later (Preliminary and Detail design) stages of the project.

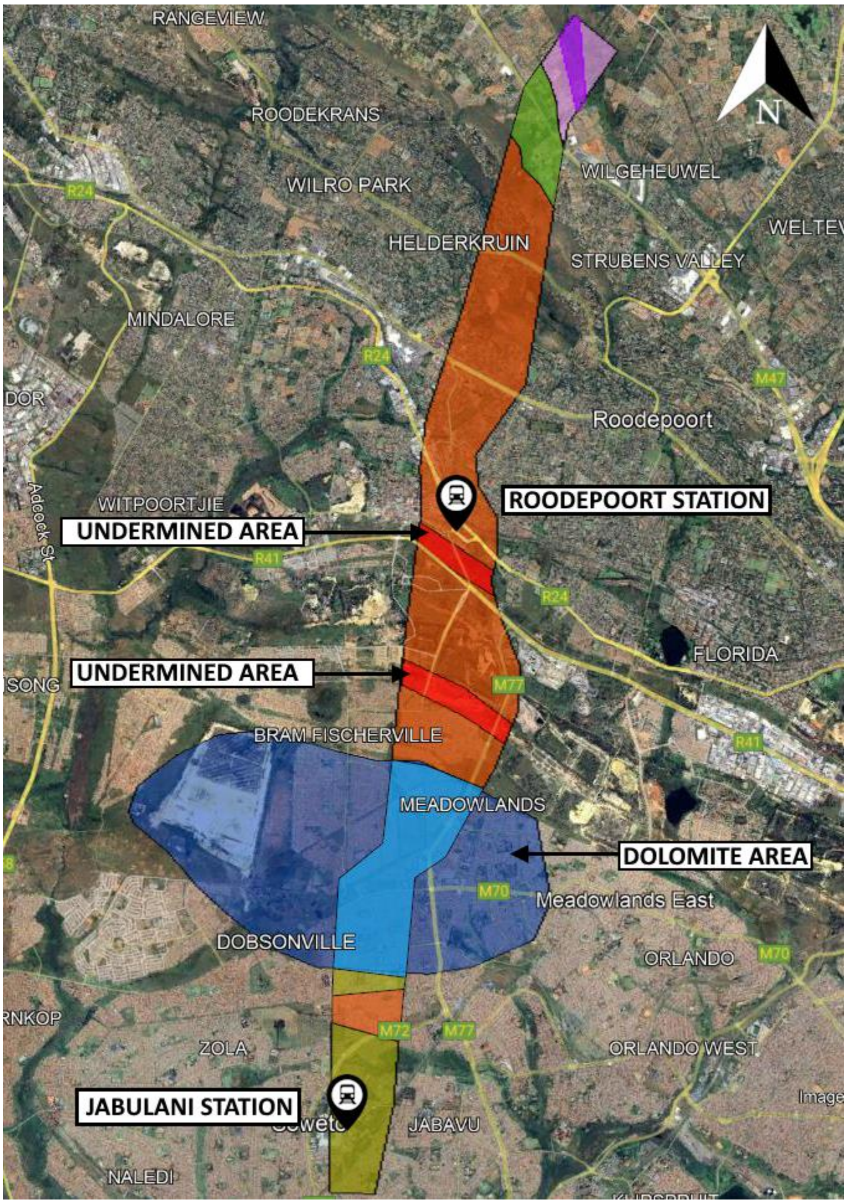


Figure 8-2: Geology Risk Areas along the Little Falls to Jabulani Corridor

8.4 Existing Services and Infrastructure Data

For this study, various types of existing services and infrastructure could potentially be affected by the new GRRIN Extensions, including:

- Water services and infrastructure
- Sewer services and infrastructure
- Electricity services and infrastructure
- Road and Bridge infrastructure
- Gas pipeline infrastructure and
- Telecommunication infrastructure.

Data was sourced from potentially affected stakeholders, which is listed in Section 9.3.6.

For this study, the following determination was made, with regard to the impact on existing services and infrastructure:

- Tunnel areas of the route will not affect existing infrastructure and services (except at station buildings and emergency exits), since the depth of tunnels will be significantly deeper relative to these services located below ground,
- Other parts of the route with vertical placement either at-grade, on a bridge/viaduct or in a cut & cover, may affect existing infrastructure.
- Affected services and infrastructure will be required to be relocated or protected, to accommodate the new GRRIN route infrastructure.

Affected services and infrastructure would be limited to the 400 m wide rail corridor, which would progressively reduce through further design stages.

For this level of study, it is important to identify the types of services and infrastructure that are potentially affected and to commence initial communications with the relevant stakeholders (i.e. owners of the potentially affected services and infrastructure), as described Section 9 below.

The Table 8-1 below lists the relevant stakeholders, and the affected infrastructure and services that were identified in this study.

Table 8-1: List of Stakeholders and the Impacts with Each of the Three Corridors

Note 1: The Little Falls to Jabulani Route is a complete (100%) tunnel route. The Cosmo City to Samrand route is predominantly (83%) in a tunnel. These tunnel sections of the routes will not have major impacts to existing infrastructure (except at station and emergency exit buildings). Checks will be done to confirm this during future stages of the project, through further engineering and design.

Note 2: Additional measures will need to be engineered in future stages of the project, to manage potential impacts to the infrastructure, where required.

Note 3: The extent of the potential impact to existing services and infrastructure is unknown at this level of study and more detailed information can only be determined during future stages of the project, through further engineering and design.

Stakeholder	Little Falls to Jabulani (Complete Tunnel Route)	Cosmo City to Lanseria	Cosmo City to Samrand (Predominantly Tunnel Route)
EGOLI Gas	No infrastructure impacts on this route.	No infrastructure impacts on this route.	No infrastructure impacts on this route.
SANRAL	Metropolitan and Regional SANRAL infrastructure that may be impacted on by the route includes: 1) Hendrik Potgieter Road (M47) in Wilgeheuwel 2) Ontdekkers Road (M18) in Horizon View 3) Albertina Sisulu Road (R24) in Roodepoort 4) Main Reef Road (R41) near Creswell Park 5) Elius Motsoaledi Road (M77) near Soweto 6) Reverend Frederick Samuel Modise Road (M70) in Meadowlands East. Numerous other residential roads will also be affected.	Metropolitan and Regional SANRAL infrastructure that will be impacted on by the route includes: 7) Nooitgedacht Road (R114), Cosmo City 8) Malibongwe Drive (R512) in Cosmo City 9) N14 in Cosmo City/Randburg 10) Elandsdrift Road (R552) in Lammermoor 11) Pelindaba Road (R512) near Lanseria. Numerous other residential and unpaved roads will also be affected.	Metropolitan and Regional SANRAL infrastructure that may be impacted on by the route includes: 12) Malibongwe Drive (R512) in Cosmo City 13) Witkoppen Road (R564) in Randburg 14) Winnie Mandela Drive (R511) in Douglasdale/Fourways 15) Main Road (M71) in Lonehill 16) Malindi road (M9) near Barbeque Downs 17) Woodmead Drive (R55) near Barbeque Downs 18) Allandale Road (M39) near Willow Way/Kyalami Estate 19) New Road (M71) in Midrand 20) Lever Road (R564) in Midrand 21) Summit Road (R562) in Olievenhoutbosch 22) N1 in Samrand 23) Samrand Avenue (M37) in Samrand 24) Old Johannesburg Road (R101) in Samrand 25) Olievenhoutbosch Road (M37) in Samrand. Numerous other residential roads will also be affected.

Note 1: The Little Falls to Jabulani Route is a complete (100%) tunnel route. The Cosmo City to Samrand route is predominantly (83%) in a tunnel. These tunnel sections of the routes will not have major impacts to existing infrastructure (except at station and emergency exit buildings). Checks will be done to confirm this during future stages of the project, through further engineering and design.

Note 2: Additional measures will need to be engineered in future stages of the project, to manage potential impacts to the infrastructure, where required.

Note 3: The extent of the potential impact to existing services and infrastructure is unknown at this level of study and more detailed information can only be determined during future stages of the project, through further engineering and design.

Stakeholder	Little Falls to Jabulani (Complete Tunnel Route)	Cosmo City to Lanseria	Cosmo City to Samrand (Predominantly Tunnel Route)
Sasol Pipeline Operations	An Existing Sasol gas pipelines run along the existing PRASA rail network and along Thistle Street, Eight street, Handel street, Adderley street and Albertina Sisulu road in Roodepoort.	No infrastructure impacts on this route.	No infrastructure impacts on this route.
Rand Water	Numerous aboveground and underground water transport network pipelines exist along this route.	Numerous aboveground and underground water transport network pipelines exist along this route.	Numerous aboveground and underground water transport network pipelines exist along this route.
Telkom/Openserve/ SENTECH	Numerous aboveground and underground communication lines exist along this route. Of note are SENTECH's existing Helderkruin T97.6 Transmission Stations and SENTECH's Johannesburg T97 Transmitter Stations.	Numerous aboveground and underground communication lines exist along this route.	Numerous aboveground and underground communication lines exist along this route.
Eskom	Numerous aboveground and underground power and electrical lines exist along this route.	Numerous aboveground and underground power and electrical lines exist along this route.	Numerous aboveground and underground power and electrical lines exist along this route.
Johannesburg Roads Agency	Numerous structures and infrastructure associated with Johannesburg Roads Agency exists along this route, including stormwater drainage systems, manhole locations, stormwater culverts and transport network infrastructure.	Numerous structures and infrastructure associated with Johannesburg Roads Agency exists along this route, including stormwater drainage systems, manhole locations, stormwater culverts and transport network infrastructure.	Numerous structures and infrastructure associated with Johannesburg Roads Agency exists along this route, including stormwater drainage systems, manhole locations, stormwater culverts and transport network infrastructure.
Joburg Water	Numerous aboveground and underground water transport network pipelines exist along this route.	Numerous aboveground and underground water transport network pipelines exist along this route.	Numerous aboveground and underground water transport network pipelines exist along this route.
City Power	Numerous aboveground and underground power and electrical lines exist along this route.	Numerous aboveground and underground power and electrical lines exist along this route.	Numerous aboveground and underground power and electrical lines exist along this route.

Note 1: The Little Falls to Jabulani Route is a complete (100%) tunnel route. The Cosmo City to Samrand route is predominantly (83%) in a tunnel. These tunnel sections of the routes will not have major impacts to existing infrastructure (except at station and emergency exit buildings). Checks will be done to confirm this during future stages of the project, through further engineering and design.

Note 2: Additional measures will need to be engineered in future stages of the project, to manage potential impacts to the infrastructure, where required.

Note 3: The extent of the potential impact to existing services and infrastructure is unknown at this level of study and more detailed information can only be determined during future stages of the project, through further engineering and design.

Stakeholder	Little Falls to Jabulani (Complete Tunnel Route)	Cosmo City to Lanseria	Cosmo City to Samrand (Predominantly Tunnel Route)
PRASA	This route interfaces with existing PRASA railway lines at the following locations: 26) South of PRASA Roodepoort Station 27) West of PRASA Dube Station 28) West of PRASA Ikwezi Station 29) South of PRASA Inhlazane Station.	No infrastructure impacts on this route.	No infrastructure impacts on this route.

8.5 Land Use Data

For this study, land use data was sought from the following municipalities that are impacted by the GRRIN extensions:

- City of Johannesburg (CoJ)
- City of Tshwane (CoT)
- Mogale City.

The Mogale City Municipality provided the integrated Development Plan which covered the greater Lanseria area. This information contained plans of the Lanseria Smart City which was then incorporated as part of the Cosmo City to Lanseria Route (as per Section 4.4.5 above).

The CoJ and Mogale City municipalities provided some land-use data for the relevant areas impacted by the GRRIN extensions.

A very small portion of the route from Cosmo City to Samrand (specifically the area around Samrand Station) falls into the CoT jurisdiction. Samrand station location is fixed for this study since it integrates with the existing GRRL network.

This data was mainly used to select appropriate station positions, rolling stock maintenance depot locations and route alignments as options to be compared and assessed via the MCA.

9

STAKEHOLDER ENGAGEMENT

9. STAKEHOLDER ENGAGEMENT

9.1 Introduction

The Route Determination, including the associated Stakeholder Engagement process, is legislated by the GTIA and is deemed as the initial stage of defining the railway reserve as prescribed in Section 6 of the GTIA. The purpose of Stakeholder Engagement is to solicit opinions, experiences, and comments from a representative sample of stakeholders to ensure that the preliminary route alignments and the subsequent regulatory framework for the implementation of the Project is owned and successful in meeting its intended goals. The stakeholder comment period and consultation process will prepare the way for the application processes and the legislative public participation processes which will follow during the Scoping and Environmental Impact Reporting process (also referred to as the Environmental Impact Assessment process) of the Project during the subsequent Preliminary Design stage.

There are four distinct stages of Stakeholder Engagement:

Stage I: Pre-publishment of the proposed route: engagement largely comprised of obtaining information from stakeholders such as municipalities and bulk service providers to inform the route alignment design and compile a database of information for preliminary design.

Stage II: Public comment period: This is the period of no less than 30 days, where the public is invited to provide comments on the report (Route Determination Report).

Stage III: Comment consideration and refinement of route centreline: This is the period during which comments are considered, responded to and, where applicable, applied to the route centreline for determination.

Stage IV: Article III. Post-publishment of the final route: a 30-day period during which the public may request reasons for the decision regarding the determination of the route.

9.2 Stakeholder Groups

A live stakeholder database exists for the project which will be updated during the course of the Stakeholder Engagement process. The database currently comprises of:

- Wards – 32 No.
  - Little Falls to Jabulani – 16 wards
  - Cosmo City to Lanseria – 3 wards
  - Cosmo City to Samrand – 13 wards.
- Organs of State – 92 No.
- Private Businesses – Number to be confirmed pending the final alignment.
- Transport Operators – 8 No.

This database is live and will grow and be refined as the Stakeholder Engagement process of the Project progresses.

To manage the Stakeholder Engagement process, stakeholders were divided into four groups, based on the four stages of engagement. Table 9-1 illustrates the way the stakeholders were grouped.

Table 9-1: Stakeholder Groups

Stakeholder Type	Who
Stage 1a Stakeholders *(Before concluding the draft Route Determination Report)*	• MEC • Utility Providers • Infrastructure Services • Municipalities • Various transport operators having jurisdiction of the Project • Entities responsible for any spatial framework or other strategic Government development planning formulated in terms of applicable spatial planning legislation of the Gauteng Province including the Spatial Planning and Land Use Management Act (Act No. 16 of 2013) (SPLUMA)
Stage 1b Stakeholders *After draft Route Determination Report is concluded, before public comment period*	• MEC • Municipalities
Stage 2 Stakeholders *Public comment period (minimum 30 days)*	• General Public • Interested and/or Affected Parties (I&APs) • MEC for Public Roads and Transportation, MEC for Infrastructure Development and Cooperative Governance and Traditional Affair, MEC for Economic Development, Agriculture and Environment • Portfolio Committee
Stage 3 Stakeholders *Comment consideration and refinement of route centreline with/without commission process*	• MEC • Municipalities/service providers if/where required • Commission Interested and Affected Parties (I&APs) (if applicable)
Stage 4 Stakeholders 30-day question period post publishment of the final route	• General Public • I&APs • MEC

9.3 Stakeholder Communication Channels

9.3.1 *Provincial Gazette*

Section 6 of the GTIA provides the process to follow to determine a route in Gauteng. Specifically, Section 6(3) of the GTIA prescribes that the notice of the proposed routes be published in the Provincial Gazette and that the notice must include:

- A broad description of the proposed routes.
- Instances where the Preliminary Route Alignment Report and the Environmental Investigation Report can be inspected.
- An invitation to all Interested and Affected Parties (I&APs) to comment in writing before closing date, not less than 30 days after publication of the notice.
- A reference to the regulatory measures which take effect in terms of Section 7 of the GTIA on the publication of the route, after which the MEC has determined the route.

The notice has been published in the Provincial Gazette in English.

To ensure that the widest range of potential stakeholders and I&APs are reached/ notified, additional communication channels have been included as part of the Stakeholder Engagement, which is not prescribed in terms of the GTIA. These are described in subsequent sub-sections.

9.3.2 *Online Platform/Website*

This contains additional information such as the links to the electronic report (Draft Route Determination Report, including the Environmental Investigation Report), process of determining the route, means to register as an I&AP, means to formally provide any comments, issues or concerns about the Project, next phases of the Project and processes to follow to stay informed.

9.3.3 *Newspapers*

Notification of the Project in national and local newspapers, notifying the public of the Project, and locations where the Draft Route Determination Report and the Environmental Investigation Report can be inspected, as well as ways in which additional information can be obtained. The following newspapers were used to publish the notices:

Table 9-2: Newspapers used for Publication of Notices

Newspaper	Language
The Star/Pretoria News	English
Beeld	Afrikaans
Sowetan	English
Fourways Review	English
Midrand Reporter	English
Roodepoort Record	English
Krugersdorp News	English

Newspaper	Language
Pretoria Centurion Record	English
Dobsonville Newspaper/Soweto Urban	English

9.3.4 *Posters*

Distribution of posters in English, Afrikaans, Sesotho and isiZulu to notify the public of the Project and where additional information can be obtained. The posters have been erected at public areas, government buildings and at specific areas around affected communities such as shopping malls/shops, fuel/service stations, business parks, churches, police stations, schools, clinics and businesses.

9.3.5 *Social Media*

Information will be posted on various government digital platforms such as X, Instagram and Facebook. Additional information of this can be requested from GMA and/or referenced on the online portal/website.

9.3.6 *Direct Communication*

At this stage this has been limited to requests for information from Stage 1 Stakeholders, including, but not limited to:

- Bulk services that may impact on, or be impacted by, the Project.
- Existing structures and infrastructure that may impact on, or could be impacted by, the Project.
- Future or planned structures and infrastructure, as well as planned bulk services, that could be impacted by the Project.

Any servitudes or wayleaves that need to be considered for the Project.

The following Stage 1 Stakeholders were communicated with:

Table 9-3: Stage 1 Stakeholders

Ref.	Stage 1 Stakeholder
1.	City of Johannesburg
2.	EGOLI Gas
3.	SANRAL
4.	Sasol Pipeline Operations
5.	Mogale City
6.	City of Tshwane
7.	Rand Water
8.	Telkom/Openserve/SENTECH
9.	Eskom
10.	Johannesburg Roads Agency
11.	Joburg Water
12.	City Power
13	PRASA
14	Lanseria Airports Company
15	Gauteng Growth and Development Agency (GGDA)

9.4 Next Steps for Stakeholder Engagement

The public/stakeholders will be notified of the route alignment through newspaper advertisements (Section Newspapers), posters (Section Posters) and through the online platform/website (Section Social Media). The public/stakeholders will be directed to the online platform where additional information is available, such as a copy of the report and interactive maps of the proposed routes. The public will also be afforded the opportunity to make comments or register as an I&APs. Electronic copies of the report and maps will also be available at GMA's offices in Midrand. The public will have 30 days to make comments on the Project. To ensure that all comments are collected, stakeholders are encouraged to make their comments on the online portal on www.gautengrapidrail.co.za.

Issues, concerns and comments received during the Public Comment Period will be formally responded to and recorded in a Comments and Response Report. The Comments and Response Report will serve as an ongoing record of stakeholder comments raised throughout the Stakeholder Engagement process. Consolidating the comments and concerns of stakeholders into broad issues will allow meaningful integration into the route refinement process. The Comment and Response Report will be submitted to the MEC for consideration.

In terms of Section 7 of the GTIA, once the determined route has been published, every application for the establishment of a township, for subdivision of land, for any change of land use in terms of any law or town planning scheme as well as for any authorisation contemplated in the Environment Conservation Act (Act No. 73 of 1989) (ECA) and NEMA, within the route buffer of 400 m, must be accompanied by a written report by a consulting engineering firm approved by the MEC. No application may be granted without consultation with the MEC.

Once the final determined route has been published, the MEC may (in terms of Section 8(1) of the GTIA) cause the Preliminary Design of the future provincial railway line to be carried out in the areas falling within 200 m measured from either side of the centre line of the route.

Once the route has been determined in terms of Section 8 of the GTIA, further studies will be required prior to the commencement of construction activities which include conducting a Scoping and Environmental Impact Reporting process (also referred toas an Environmental Impact Assessment) in terms of the NEMA. This includes more detailed public participation to be undertaken. A more defined route will be proclaimed and land acquisition and expropriation will also be undertaken (involving further public participation) prior to commencement of the construction of the route and associated structures and infrastructure.

10

SUMMARY AND NEXT STEPS

10. SUMMARY AND NEXT STEPS

10.1 Why is this being done?

Investing today in rail route determination is a much-needed planning phase towards ensuring a future-ready Gauteng.

A future-ready Gauteng, means being able to respond to the need, when it arises, without compromising the present. It also means protecting the rights of individuals that may be affected by the process of defining a provincial railway line in Gauteng, without compromising the greater public good.

10.2 What was completed?

This Draft Route Determination Report, comprising of a Preliminary Route Alignment Study and Environmental Investigation Report (Annexure B) was executed in terms of the Gauteng Transport Infrastructure Act, Act No 8 of 2001 ('the GTIA' as amended); with the aim of affording the MEC the authority to determine the route and protect the corridor for the proposed rail extensions.

Information was requested from the municipalities, main roads, bulk service providers, transport operators and development agencies. These inputs have informed the design of the route and station position options.

Options for station positions and route alternatives were investigated along each of the 3 corridors and the optimal station position and route alignment was determined.

The optimal station positions, routes and the rolling stock maintenance depot locations were determined through an MCA which was a systematic, scientific, well-evidenced and, where possible, quantitative method. This empowered the project team to make informed decisions that considered a wide array of factors. The goals and criteria ensured that the outcome transcended an engineering solution to a balanced, optimal solution that considered people, places and the economy.

Station-, route- and the rolling stock maintenance depot-specific goals fell under the overarching strategic goals for the Project; namely:

- Enhancing customer utility.
- Ensuring service sustainability.
- Driving local growth and access to economic opportunities.
- Easing delivery.

The optimal routes, with optimal station positions and rolling stock maintenance depot location are contained in Section 6.7, with detailed drawings of the same, contained in Annexure A.

The Environmental Investigation Report (Annexure B) detailed the outcomes of the environmental screening, with validation against current land use and environmental conditions, as well as the consideration of vertical placement. This assessment, together with the consideration of other criteria, informed the selection of optimal route alignments and station positions. A review of the legislative framework was undertaken, and a permitting strategy was developed to inform next steps.

10.3 What is Required from the Public?

The public is requested to review this preliminary route alignment study report, together with the environmental investigation report, and comment on these proposed routes, to ensure that the public's views are considered in the determination of the final route. The comment period also allows for the municipalities, and infrastructure and service providers/operators/agencies to provide further input, close gaps and highlight potential blind spots that may have been overlooked.

10.4 What is next for the Project?

As per the four-step process for defining a Provincial Railway Line in Gauteng, in terms of the GTIA (as described in Section 1.5 above), the next step in the GTIA process requires a Preliminary Design to further engineer the route alignments, which will assist to provide a better understanding of the specific requirements and the potential impacts of the project.

This will provide a detailed Project description which will serve as a clear basis for engaging with stakeholders and the public, as the project is developed further to the proclamation and expropriation steps. This transparency is crucial for building trust and ensuring that the concerns and suggestions of interested and affected parties are considered in the planning process.

11

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11. REFERENCES

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Annexure A:
Supporting Technical Information

A.1 Optimal Route Drawings

A.1.1 Key Plan of all Routes

A.1.2 Little Falls to Jabulani Route

A.1.3 Cosmo City to Lanseria Route

A.1.4 Cosmo City to Samrand Route

A.1.5 Cosmo City Junction

Annexure B:
Environmental Investigation Report