Appendix J: Impact Assessment

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1 Introduction

The Liesbeek Leisure Properties Trust (the LLPT or the proponent) operates the River Club in Observatory, Cape Town (which, together with portions of adjacent properties, is collectively referred to as the site - refer to Figure 1, Figure 2 and Section A1 of the Basic Assessment [BA] Report). The River Club is currently operated by the proponent as a commercial facility, mainly for recreational (golfing) activities and conferencing.

The LLPT is proposing to redevelop the site for residential, commercial (including hotel), retail, institutional and associated uses (the project or the development - see Section A2(e) of the BA Report). The River Club (i.e. Erf 151832) is owned by the proponent.

This appendix presents the detailed impact assessment that forms part of, and is reported on in the BA Report compiled for the project. It must be read in conjunction with the BA Report, Environmental Management Programme (EMPr) and any other appendices listed in the BA Report.

1.1 Environmental Impacts Identified

Based on the professional experience of the Environmental Impact Assessment (EIA) team and specialists, legal requirements, the nature of the proposed activity, the nature of the receiving environment and issues raised in the stakeholder engagement process, the following key environmental issues – potential negative impacts and potential benefits – were identified:

- **Air Quality** – potential nuisance from dust during construction;
- **Noise** – potential nuisance from noise during construction;
- **Hydrology** – potential change in flood hazard at surrounding properties;
- **Freshwater ecology** – potential loss of, and changes to the quality or functioning of freshwater habitats within the project Area of Influence;
- **Fauna** – potential faunal species mortalities, and changes in faunal habitat quality and connectivity;
- **Flora** – potential changes in floral species composition at the site and adjacent areas;
- **Socio-economic** – potential wealth creation, employment and increased income, skills development, increased government revenue, densification, gentrification and change in public amenity value of the site;
- **Traffic** – potential delays to road users;
- **Heritage** – potential loss or damage to palaeontological and architectural resources, loss of structures with heritage value, and change in the heritage value of the site and surrounding sites; and
- **Visual** – potential altered sense of place and visual intrusion.

1.2 Alternatives Assessed in the EIA

During the prefeasibility phase of most projects various development alternatives are investigated. Furthermore, the EIA Regulations, 2014 require that all BA processes must identify and describe “alternatives to the proposed activity that are feasible and reasonable”. Depending on the specific project circumstances, the following alternatives may be considered:

- Site Alternatives;
- Design Alternatives;

- Land Use Alternatives;
- Process Alternatives; and
- The No-Go Alternative.

In the case of the River Club Redevelopment project, various alternatives have been considered during the BA process, many of which were eliminated for technical reasons (refer to Section E of the BA Report).

The following layout alternatives for the development are assessed in Sections 2.1 to 2.10.

1.2.1 The Riverine Corridor Alternative (Preferred Alternative)

Approximately 150 000m² of floor space, including retail, office, residential (including inclusionary housing), hotel, places of instruction and community uses (see Figure 3 of the BA Report). Developed areas of the site (including roadways) will be raised above the 100-year flood elevation.

The proposal provides for a wide riverine corridor along the route of the existing canal running adjacent to the eastern boundary of the site (see Figure 13 and Figure 14 of the BA Report). The old, degraded Liesbeek River channel on the western edge of the site will be largely infilled and landscaped with a vegetated stormwater swale (see Figure 15 of the BA Report). An 'ecological corridor' and open space will extend across the site in an east-west direction, connecting the rehabilitated riverine corridor and the stormwater swale.

Alongside the transformed riverine corridor there will be pedestrian and cycle paths, as well as viewing and seating areas where the public can enjoy the amenity of this rehabilitated water course. The South African Astronomical Observatory (SAAO), with its heritage features, and the Raapenberg Wetland & Bird Sanctuary, with its associated flora and fauna, will become more accessible to the public as a result of the riverine corridor upgrade.

This alternative has been found to be financially feasible to the proponent (subject to detailed costings on infrastructure, contributions, market appetite/ tenant demand and acceptable funding structure).

1.2.2 The Island Concept Alternative (Alternative 1)

This alternative is largely the same as the Riverine Corridor Alternative. The only difference is the rehabilitation and extended setback along the original Liesbeek River channel and the retention of the canal (i.e. the existing watercourses adjacent to the site will remain largely unchanged) – see Figure 4, Figure 16, Figure 17 and Figure 18 of the BA Report.

This alternative has been found to be financially feasible to the proponent (subject to detailed costings on infrastructure, contributions, market appetite/ tenant demand and acceptable funding structure).

1.2.3 No-Go Alternative

The No-Go Alternative has been considered in the BA in accordance with the requirements of the EIA Regulations, 2014. The No Go Alternative entails no change to the status quo, in other words, the site would continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so.

1.3 Integration of Studies into the BA Report and Review

The completed specialist studies and their findings have been integrated into the BA Report. The key findings of each specialist study were evaluated in relation to each other to provide an overall and integrated assessment of the project impacts.

SRK has considered the suite of potential impacts in a holistic manner and in certain instances, based on independent professional judgment and this integrated approach, may have altered impact significance ratings provided by the specialist (see specialist studies attached as Appendix G to the BA Report).

Specialists have made recommendations for the management of impacts, and the BA team has assessed these recommendations.

1.4 Impact Rating Methodology

The assessment of impacts was based on specialists' expertise, SRK's professional judgement, field observations and desk-top analysis.

The significance of potential impacts that may result from the proposed project was determined in order to assist decision-makers (typically a designated competent authority or state agency, but in some instances, the proponent).

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in the table below.

Table 1-1: Criteria used to determine the Consequence of the Impact

Rating	Definition of Rating	Score
A. *Extent* *– the area over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g. the site and adjacent watercourses)	1
Regional	The region, e.g. The catchment of metropolitan area	2
(Inter) national	Western Cape and beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration*** *– the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Table 1-2: Method used to determine the Consequence Score

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

Table 1-3: Probability Classification

Probability– *the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

Table 1-4: Impact significance ratings

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally, the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Table 1-5: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

Authorities should consider the impact significance rating in their decision-making process based on the implications of ratings ascribed below:

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity/development.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity/development.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity/development.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity/development.
- **HIGH**: the potential impact **will** affect the decision regarding the proposed activity/development.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended and impacts were rated in the prescribed way both without and with the assumed effective implementation of essential mitigation and optimisation measures.

Negative impacts (with mitigation) rated high or very high are shaded in red, while positive impacts (with optimisation) rated high or very high are shaded green.

For the sake of brevity, only **key** (i.e. non-standard essential) mitigation measures are presented in impact rating tables (later in this section), with a collective summary of all recommended mitigation measures presented at the end of discipline.

2 Impact Assessment

2.1 Potential Air Quality Impact

2.1.1 Introduction

This assessment is based on the professional assessment of the Environmental Assessment Practitioner (EAP), through previous experience with similar projects, desktop investigation and ground-truthing.

2.1.2 Assessment of Impact: Construction Phase

One potential direct Construction Phase noise impact was identified:

- A1: Nuisance from dust.

2.1.2.1 Potential Impact A1: Nuisance from Dust and Exhaust Emissions

The Riverine Corridor Alternative and the Island Concept Alternative

The main potential direct effect on air quality during the Construction Phase is the release of pollutants – primarily dust and exhaust emissions - into the atmosphere. This has the potential to cause health and nuisance effects.

Construction is proposed in six phases and is expected to take between three and five years, over seven years (phases may not run consecutively), commencing with service provision (including bridges).

Although it is expected that the highest levels of dust emissions will occur during major earthworks, the potential for dust generation during construction activities is difficult to quantify and is dependent on the type and intensity of activities taking place, soil and substrata type, topographical features, precipitation, wind speed and direction as well as the shape, size, density and moisture content of the particles.

At the site, dust emissions are expected to be higher during the hot and windy summer months, when dust is likely to disperse off site and create a nuisance, especially in communities located close to the site.

Dust deposition levels are expected to be higher in areas in close proximity to construction activities, i.e. within 500 m of the working face, than areas further away. Sensitivity to dust within 500 m the construction site is considered high, since there are residential and commercial (office) areas located in close proximity (within 200 m). However, total dust deposition is expected to be below the DEA guideline of 600 mg/m^2/day for residential areas at the site boundary, and therefore health effects are not anticipated. Nuisance may, however, occur from visual soiling of clean surfaces, such as cars, windows, and household washing. Airborne dust can also affect visibility in the immediate vicinity.

Vehicle exhaust emissions from construction vehicles are an additional source of air pollution. Pollutants emitted include Carbon Dioxide (CO_2), Carbon Monoxide (CO), hydrocarbons, Nitric Oxide (NO_x), Sulphur Dioxide (SO_2) and particulate matter. The quantity of emissions is likely to vary through the Construction Phase. Compared with emissions from the existing vehicular traffic (noting that the site is close to two busy roads, the Liesbeek Parkway and the M3), construction related exhaust emissions are considered to be very low, localised and insignificant.

The impact is assessed to be of ***very low*** significance with and without the implementation of mitigation (Table 2-1).

Table 2-1: Significance of nuisance from dust

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Med-term 2	**Very Low 4**	Definite	**VERY LOW**	-ve	High
Essential mitigation measures: • Apply wet suppression methods (watering) to prevent dust generation from all disturbed and exposed areas and main site roads. • Minimise material handling and the frequency of disturbance of stockpiles to minimise wind erosion. • Implement a speed limit of 30km/hr on all unpaved roads on site. • Minimise travel distances on site through appropriate construction site layout and design. • Reduce the extent of exposed areas in which wind-blown dust may be generated. • Implement a grievance mechanism and respond to complaints about air quality (and other complaints).								
With mitigation	Local 1	Low 1	Med-term 2	**Very Low 4**	Probable	**VERY LOW**	-ve	High

This impact can be managed to a *moderate* degree, and is completely *reversible* in that it will cease at the completion of construction activities.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no air quality impacts are anticipated.

2.1.3 Mitigation Measures: Potential Air Quality Impact

Essential air quality mitigation measures during **construction** are as follows:

- Apply wet suppression methods (watering) to prevent dust generation from all disturbed and exposed areas and main site roads;
- Minimise material handling and the frequency of disturbance of stockpiles to minimise wind erosion;
- Implement a speed limit of 30km/hr on all unpaved roads on site;
- Minimise travel distances on site through appropriate construction site layout and design;
- Reduce the extent of exposed areas in which wind-blown dust may be generated; and
- Implement a grievance mechanism and respond to complaints about air quality (and other complaints).

2.2 Potential Noise Impact

2.2.1 Introduction

This assessment is based on the professional assessment of the EAP, through previous experience with similar projects, desktop investigation and ground-truthing.

2.2.2 Assessment of Impact: Construction Phase

One potential direct Construction Phase noise impact was identified:

- A1: Nuisance from noise.

2.2.2.1 Potential Impact A1: Nuisance from Noise

The Riverine Corridor Alternative and the Island Concept Alternative

Noise pollution results from unwanted or excessive noise with potential effects that range from causing a nuisance to more harmful effects such as sleep disturbance, high stress levels and, in extreme cases, hearing loss. Noise can also affect animals by interfering with their communication and navigation patterns. Generally, animals tend to move away from anthropogenic noise sources, thereby affecting their movement patterns, distribution and available habitat.

Large equipment/vehicles utilised on site during the Construction Phase and for the transportation of fill material to site will be the main contributors to noise generation.

Sound and noise are measured in units of dB. Three dB(A) is the smallest perceptible change in sound pressure level for a person of normal hearing sensitivity and therefore any noise level increase lower than this would have no impact. An increase of five dB(A) would be noticeable, and an increase of 10 dB(A) would correspond to doubling of the subjective loudness of noise and typically would elicit a significant community response.

Distance, atmospheric conditions, interference from other objects and ground effects also play an important role in the resulting noise levels. For example, “hard” ground promotes transmission of sound, thus producing louder sound levels farther from the source.

The closest sensitive noise receptors to the site are located further than 100 m to the east, however ambient noise from vehicles on Liesbeek Parkway is high, and the Malta Sports fields will attenuate transmission of noise to the closest sensitive receptors. Noise is therefore expected to be below guideline noise levels for *urban districts with main roads* (DDA, 2016) when construction takes place at the south-west of the site. Noise is expected to be insignificant when construction takes place at all other locations at the site. The impact is therefore considered to extend over the short-term only, and be low in intensity.

The impact is assessed to be of ***very low*** significance with and without the implementation of mitigation (Table 2-2).

Table 2-2: Significance of nuisance from noise

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Both Alternatives								
Without mitigation	Local 1	Low 1	Med-term 2	**Very Low** **4**	Probable	**VERY LOW**	-ve	High
Essential mitigation measures: • Prohibit noisy construction activities at night and confine to normal working hours where possible. • Ensure that construction equipment is in good working order and properly maintained.								
With mitigation	Local 1	Low 1	Med-term 2	**Very Low** **4**	Probable	**VERY LOW**	-ve	High

This impact can be managed to a *moderate* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no noise impacts are anticipated.

2.2.3 Mitigation Measures: Potential Noise Impact

Essential noise mitigation measures during **construction** are as follows:

- Prohibit night-time construction activities and confine to normal working hours; and

- Ensure that construction equipment is in good working order and properly maintained.

2.3 Potential Surface Water Hydrology Impact

2.3.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Surface Water Hydrology Impact Assessment undertaken by Aurecon (see Appendix G3 of the BA Report). The purpose of the study was to assess the potential impacts of the project on flooding at neighbouring properties, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the Surface Water Hydrology Impact Assessment were to:

- Verify the existing floodlines and compare these results with previous studies conducted in the Salt River Catchment;
- Assess potential impact of alterations made to the Passenger Rail Agency of South Africa (PRASA) Marshalling Yard and the railway line bridges crossing the Salt River canal on the flow regime in the Salt River upstream of PRASA (i.e. at the River Club);
- Assess the significance of the potential direct and indirect impacts of the redevelopment on surface water hydrology (flooding);
- Identify and describe potential cumulative surface water impacts resulting from the redevelopment in relation to proposed and existing developments in the surrounding area;
- Recommend mitigation measures to minimise impacts and enhance benefits associated with the redevelopment;
- Address comments by stakeholders relating to surface water impacts; and
- Identify any applicable legislation and/or licence/permit applications that may be required, and briefly describe requirements (if applicable).

The assessment is based on the review of existing information and complex surface water hydrology modelling, including PCSWMM and HEC-RAS, SRK / City of Cape Town (CoCT) models and a Digital Terrain Model (DTM) to undertake 2D modelling.

For the purposes of the study, twelve key monitoring points were selected to represent areas where any impacts of the proposed developments would be realised / be of concern (see Figure 2-1). These monitoring points were used to assess the potential effects on surface water hydrology of raising the site under the following scenarios (for various flood return intervals):

- Status quo (no development);
- Status quo with widened Salt River Canal;
- Status quo with sea level rise;
- Status quo with PRASA overland route closed;
- Status quo with PRASA overland route closed and bridges obstructed;
- Post-development (River Club only);

- Post development with Two Rivers Urban Park (TRUP)[1] and the PRASA upgrades implemented;
- Post development with TRUP and the PRASA upgrades implemented with widened Salt River Canal;
- Post development with TRUP and the PRASA upgrades implemented with the PRASA overland escape route blocked;
- Post development with TRUP and the PRASA upgrades implemented with the PRASA overland escape route blocked and bridges obstructed; and
- Post development with TRUP and the PRASA upgrades implemented with sea level rise.

The study reached the following conclusions that are pertinent to the development of the River Club (assuming TRUP and the PRASA upgrades have been implemented):

- The runoff from the site would have no impact on the flood levels as peak runoff from the site would occur between one and three hours before the peak flow in the adjacent rivers (Liesbeek and Black Rivers) and, therefore, runoff has an insignificant impact on the flows in the adjacent rivers;
- Flooding currently occurs (i.e. regardless of the redevelopment of the River Club) in the adjacent urban area for storms more frequent than 1:5 to 1:10 year return interval flood events from local **overland flows** only (that occur when the local stormwater runoff exceeds the capacity of the stormwater system);
- The development of the River Club (as well as the TRUP and the PRASA upgrades) may increase the extent of inundation from overland flow at the:
    - SAAO;
    - Valkenberg wetland; and
    - Malta Sports Fields to a limited extent[2];
- The development of the River Club (as well as the TRUP and the PRASA upgrades) may increase inundation from overland flow at the SAAO;
- Regarding the SAAO:
    - Buildings at the SAAO would not be flooded during a 1 year return interval flood event;
    - Some buildings at the SAAO lie within the 1:5 year flood plain, and are therefore expected to flood periodically;
    - During a 1:2 year return interval flood event, water elevations would increase by less than 5 cm. Land surrounding buildings at the SAAO would be flooded, including a building on the south-west of the property that is not currently flooded by an event of this frequency;
    - During a 1:5 year return interval flood event, three buildings at the south-west west of the SAAO are flooded under current conditions, however floodwater elevations would increase by ~ 12 cm following development in the catchment;

[1] The authors od the Surface Water Hydrology Impact Assessment (Aurecon) have confirmed that their modelling of the development including TRUP and development at Erf RE 26423 represents a conservative assessment of potential changes in flood hazard (i.e. new flood levels would be lower without any building on this site).

[2] It is Aurecon's view that the change in extent is exaggerated by the computational and design of the model, and that the increase in water surface elevation that has been modelled is insignificant.

- For the 1:0.5 year and 1:1 year return interval flood events, the combined effect of the development, the TRUP and the PRASA upgrades on increased flood elevations would be small throughout the catchment;
- The greatest increases in water levels would be in the immediate vicinity of the River Club at monitoring Points 5 to 12 – with the maximum expected increase in water level of up to 13 cm for all 1:5 year to 1:100 year return interval floods[3] - noting modelling uncertainties, Aurecon conclude that this increase is relatively small;
- For the 1:50 to 1:100 year return interval floods, flood levels (elevations) will increase at properties that would be affected by flooding to some extent whether the additional developments take place or not;
- The increase of flood levels will lead to a limited increase in the extent of inundation for flood events between the 1:50 and 1:100 year return intervals at the following locations only:
    - The PRASA site; and
    - Near the Observatory Swimming Pool south of the site;
- The increase in the extent of flooding at the PRASA site (which is expected to occur less than once every 50 years) is unlikely to compromise any infrastructure that is not already affected by flooding, other than railway lines;
- The increase in flood levels at the Observatory Swimming Pool would not be significantly different to the existing flooding regime;
- Volumetric flow would increase from increased discharge volume from the Liesbeek Canal at the following locations only:
    - Peak flow and total flow will increase at the western bank of the Salt River by 7% and 4% respectively; and
    - Peak flow will increase at the western bank of the Black River at the site by 24%;
- The increase in flow volume at the western bank of the Salt River would take place a few minutes earlier than the current situation, and would have little effect on the extent of inundation (and is therefore considered to be insignificant by Aurecon);
- The anticipated increase in peak flow at the Black River at the site is from stormwater currently directed over the site from the Liesbeek River, down the original course of the Liesbeek which will be directed into the rehabilitated Liesbeek Canal after the site is infilled. The increase in flow is significant, will take place over a few hours, and will increase flood levels locally along the (rehabilitated) Liesbeek Canal;
- Closing of an existing overland floodwater escape route over the PRASA site would have an insignificant effect on the extent of inundation during a storm event, unless downstream bridges were obstructed (in which case closing the escape route over PRASA would increase inundation);
- The extent of flooding is not significantly affected by tidal influence (assuming a 1:10 year storm surge with a 1:100 year flood event);

[3] If the River Club were to be developed in isolation Aurecon estimate the maximum increase is surface water elevations would be differ by between 0 cm and 3 cm).

- Sea level rise would lead to flooding in the lower parts of the catchment during (major) storm events regardless of whether the development went ahead or not; and
- Widening of the Salt River Canal and removing the hydraulic constraints posed by the bridges would reduce the maximum water surface level by between 10 cm and 80 cm, but would have little impact on the extent of inundation, except at the Malta Sports Fields and at the PRASA site.

Figure 2-1: Monitoring points used for comparing different scenarios

2.3.2 Assessment of Impact: Operational Phase

One potential direct operational phase impact on flood hazard was identified:

- SW1: Change in flood hazard at surrounding properties.

2.3.2.1 Potential Impact SW1: Change in Flood Hazard at Surrounding Properties

The Riverine Corridor Alternative and the Island Concept Alternative[4]

The CoCT's '*Floodplain and River Corridor Management Policy*' (CSRM, 2009) considers the hazard that flooding may pose to life and property. The hazard posed by floodwaters is determined by the ability of the public to wade or gain vehicular access, and the stability of structures such as dwellings or boundary walls. If these are likely to be seriously compromised, the area is considered to be in

[4] Note that only the Riverine Corridor Alternative was modelled by Aurecon as this is seen to be a worst case (/conservative) assessment of potential impacts from changes to surface water hydrology: infilling of the old course of the Liesbeek is thought to reduce attenuation at and adjacent to the site, which is partially offset by the rehabilitation of the Liesbeek Canal.

the “High Hazard Zone” (and floods pose a risk to people and structures here). Figure 2-2 illustrates that an area is considered to be located within the High Hazard Zone if water depth exceeds 0.8 m and water velocity exceeds 2 m/s.

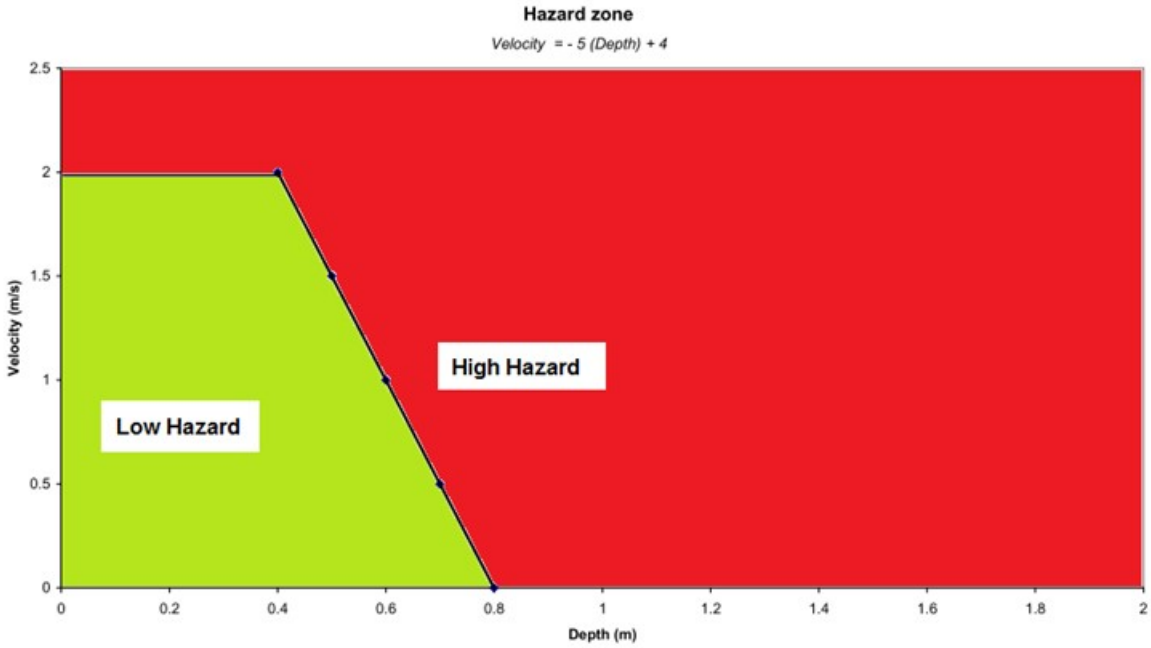


Figure 2-2 Flood Hazard Zones

Development at the River Club, TRUP and will increase flood depths and / or velocity at the following locations:

- The PRASA site;
- SAAO;
- Valkenberg Wetland;
- Malta Sports Fields / Hartleyvale Sports Complex;
- Near the Observatory Swimming Pool south of the site;
- Western bank of the Salt River; and
- Western bank of the Black River (Riverine Corridor Alternative only).

With regards to changes in flood hazard from these changes to surface water hydrology from infilling the site (as well as the development of TRUP and PRASA upgrades), Aurecon conclude the following:

- The flood hazard will not change at the Valkenberg Wetland or SAAO (but see Section 2.9.3.2);
- Increased flooding at PRASA may increase the extent of Low Hazard flooding here for flood return events of 1:50 years or less frequent, and is not expected to have an impact on property or safety; and
- An increase in flood velocity at the confluence of the rehabilitated Liesbeek Canal and Black River will create localised and isolated High Hazard Flood zones for flood return events of 1:50 years or less frequent along the western banks of the rehabilitated Liesbeek Canal (Riverine Concept Alternative only);

- Increased flooding south of the site near the Hartleyvale Sports Complex may increase the extent of High Hazard Flood zones for flood return events of 1:50 years or less frequent at:
  - One lane of the Liesbeek Parkway; and
  - A localised area around the complex itself.

Regarding the areas where the extent of the High Hazard Flood zone is expected, and noting that:

- Increased flooding at the western bank of the Liesbeek River is localised, and the probability of damage to property and a decline in public safety is low;
- Increased flooding at the Liesbeek Parkway, although localised, has a higher probability of affecting public safety (especially road users); and
- Increased flooding at the Hartleyvale Sports Complex has a low probability of threatening property and human safety as flooding here is localised and the area would be flooded under current conditions (but at a slightly lower depth). It is also unlikely that the complex would be used during a flood event of this magnitude.

The impact is assessed to be of ***low*** significance and with the implementation of mitigation is reduced to ***very low*** significance (Table 2-3).

Table 2-3: Significance of increased flood hazard

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local	Medium	Long-term	**Medium**	Possible	**LOW**	-ve	Medium
	1	2	3	**6**				
Essential mitigation measures: • Raise the Liesbeek Parkway locally to eliminate potential High Hazard flooding at the Observatory Public Swimming Pool (at 33°56'14.80" S, 18°28'34.13" E).								
With mitigation	Local	Low	Long-term	**Low**	Improbable	**VERY LOW**	-ve	Medium
	1	1	3	**5**				

This impact is manageable to a limited degree, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility. If no other developments were to take place in the catchment, and climatic variables were to remain constant, surface water hydrology in the catchment would not change – in other words, the catchment would continue to be flood prone, and low probability risks of localised increases in flood hazard from the development would be avoided.

2.3.3 Mitigation Measures: Potential Surface Water Hydrology Impact

Essential faunal mitigation measures during **design** are as follows[5]:

- Raise the Liesbeek Parkway locally to eliminate potential High Hazard flooding at this location (at 33°56'14.80" S, 18°28'34.13" E).

[5] This mitigation measures are in addition to project design elements that already form part of the project description. These design elements are listed in Section H (c) of the BA Report.

2.4 Potential Freshwater Ecology Impacts

2.4.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Biodiversity Impact Assessment undertaken by Freshwater Consulting Group (see Appendix G2 of the BA Report). The purpose of the study was to assess the potential impacts of the project on aquatic ecosystems (rivers and wetlands) and flora and fauna, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the freshwater component of the study were to:

- Undertake a desktop study and site survey in order to characterise and delineate wetlands, pans and aquatic ecosystems at and surrounding the site and assess their function, PES and recommended ecological category (REC);
- Place freshwater ecosystems in a regional context;
- Describe freshwater ecosystem dependent fauna and flora species present;
- Map wetlands in terms their ecological sensitivity and functional value;
- Comment on sensitivity in terms of ecologically important habitats, ecological corridors and linkages with other ecological systems on and adjacent to the site;
- Assess the significance of the potential direct and indirect impacts of the redevelopment on freshwater ecosystems;
- Identify and describe potential cumulative freshwater ecology impacts resulting from the redevelopment in relation to proposed and existing developments in the surrounding area;
- Recommend mitigation measures to minimise impacts and enhance benefits associated with the redevelopment;
- Address comments by stakeholders relating to freshwater ecology impacts; and
- Identify any applicable legislation and/or licence/permit applications that may be required, and briefly describe requirements (if applicable).

The assessment is based on the review of existing information, derived though a literature search and various field assessments.

The specialist notes that during the course the assessment, the proposed development footprint and layout of both development alternatives have undergone a number of changes, largely as a result of extensive, iterative feedback into the project by biodiversity specialists and other members of the design team. Ecologically sensitive areas have largely been avoided, and the incorporation of ecological setback areas and faunal movement corridors are already in accordance with biodiversity specialist requirements.

This iterative design process also allowed for the strategic selection of opportunities that would enhance ecosystem function, quality or sustainability, while affording various development opportunities. To some extent, then, the development alternatives considered in the study already include a substantial level of mitigation, and the significance of the impacts considered in this section reflect this. Implementation of key aspects of the design as currently proposed is therefore essential (refer to Section H (c) of the BA Report), and the freshwater ecologist must approve changes in the project footprint or the treatment of setbacks.

2.4.2 Assessment of Impacts: Construction Phase

Two potential direct construction phase impacts on freshwater ecology were identified:

- FE1: Water contamination and deterioration of habitat quality.
- FE2: Loss of riverine wetlands along the Black River margin.

2.4.2.1 Potential Impact FE1: Water Contamination and Deterioration of Habitat Quality

Construction of bridges over the Black and Liesbeek Rivers, and rehabilitation of the Liesbeek Canal (Preferred Alternative) would all require full or partial diversion of rivers and (in the case of the Liesbeek) wetland flows. Furthermore, excavations at the site will need to be dewatered, and construction activities will be intense over the medium-term. Services will also be installed through the original course of the Liesbeek River (for both alternatives).

Aspects of construction could affect water and habitat quality in the following ways:

- Localised temporary loss of degraded riverine habitat;
- Temporary suspension of (already limited) riverine function;
- Erosion;
- Sedimentation;
- Contamination from hazardous substances (for example, hydrocarbon spills and cement); and
- Pollution from litter.

The Riverine Corridor Alternative

Although the Liesbeek Canal is ecologically sterile, the sensitive Raapenburg Wetlands would be at risk of contamination (especially sedimentation) and degradation during rehabilitation of this area, particularly if the river were to flood during construction.

The impact is assessed to be of ***medium*** significance and with the implementation of mitigation is reduced to ***low*** (Table 2-4).

Table 2-4: Significance of water contamination and deterioration of habitat quality

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	High 3	Med-term 2	**Medium 6**	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Implement good housekeeping practices for the management of hazardous substances and waste as specified in the EMPr. • Conduct bulk earthworks in freshwater systems in the dry season (or in direct consultation with a faunal specialist). • Divert the Liesbeek River flow away from the Raapenburg Wetland during canal rehabilitation. • Reinstate the berm at the Raapenburg Wetland that was breached to allow low-flows to enter this feature. • Establish good quality vegetation cover in rehabilitated freshwater systems (80% cover within one year of the commencement of each intervention).								
With mitigation	Local 1	Medium 2	Med-term 2	**Low 5**	Probable	**LOW**	-ve	Medium

This impact can be managed to a *high* degree, and is *reversible*.

The Island Concept Alternative

The impact is assessed to be of ***low*** significance and with the implementation of mitigation is reduced to ***very low*** (Table 2-5).

Table 2-5: Significance of water contamination and deterioration of habitat quality

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Local 1	Medium 2	Med-term 2	**Low 5**	Probable	**LOW**	-ve	Medium
Essential mitigation measures: • Implement good housekeeping practices for the management of hazardous substances and waste as specified in the EMPr. • Conduct bulk earthworks in freshwater systems in the dry season (or in direct consultation with a faunal specialist). • Establish good quality vegetation cover in rehabilitated freshwater systems (80% cover within one year of the commencement of each intervention).								
With mitigation	Local 1	Low 1	Med-term 2	**Very Low 4**	Probable	**VERY LOW**	-ve	Medium

This impact can be managed to a *high* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, construction within watercourses (and landscaping and rehabilitation) will not take place, and impacts associated with these activities will be avoided, and the benefits of rehabilitation would be forgone.

2.4.2.2 Potential Impact FE2: Loss of Riverine Wetlands along the Black River

The Riverine Corridor Alternative and the Island Concept Alternative

The initial construction of the Berkley Extension Black River Bridge, and the eventual widening of the bridge (at some stage in the future by the CoCT) will lead to the infilling of portions of both the eastern and western riverbanks, and the loss of a section of fringing *Phragmites australis* (reedbed) wetlands along the western riverbank.

Although this wetland type is well represented along the Black River and in other rivers in Cape Town, it forms part of an Ecological Support Area (ESA), and is therefore ecologically important locally.

The impact is assessed to be of ***medium*** significance and is reduced to ***very low*** with mitigation (Table 2-6).

Table 2-6: Significance of loss of riverine wetlands along the Black River

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Reinstate marginal wetlands disturbed during construction on the banks of the Black River by grading the disturbed bank to a slope of 1:4 or flatter and replanting it with appropriate indigenous wetland and riverine vegetation.								
With mitigation	Local 1	Low 1	Med-term 2	**Very Low 4**	Definite	**VERY LOW**	-ve	Medium

This impact can be not be managed, but is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the Black River Bridge will not be built in the foreseeable future, and the temporary loss of well represented wetland (that forms part of an ESA) will be avoided.

2.4.3 Assessment of Impacts: Operational Phase

Five potential direct operational phase impacts on freshwater ecology were identified:

- FE3: Changes to habitat quality and ecological functioning of the Liesbeek Canal.
- FE4: Changes to habitat quality and ecological functioning of the original course of the Liesbeek River.
- FE5: Changes to habitat quality and ecological functioning of the Raapenburg Wetland.
- FE6: Contamination of the Liesbeek and Black Rivers.
- FE7: Changes to habitat quality in rehabilitated areas.

2.4.3.1 Potential Impact FE3: Changes to Habitat Quality and Ecological Functioning of the Liesbeek Canal

The Riverine Corridor Alternative

The rehabilitation of the Liesbeek Canal will increase biodiversity, increase habitat heterogeneity and improve ecological functioning by:

- Providing areas for colonisation by fish larvae, other aquatic larvae and nymphs of various riverine insects during periods of inundation;
- Providing floodplain habitat for birds and aquatic fauna;
- Ameliorating water quality;
- Providing ecologically diverse terrestrial habitat; and
- Providing refuge for mobile terrestrial fauna during high flood levels.

The above changes in river habitat quality would dramatically improve river habitat in this reach of river, from a Present Ecological State (PES) of Category F to at least a Category D (and possibly a Category C).

The impact is assessed to be of ***medium*** (+ve) significance and is increased to ***high*** with the implementation of mitigation (Table 2-7).

Table 2-7: Significance of changes to habitat quality and ecological functioning of the Liesbeek River Canal

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	High 3	Long-term 3	**High 7**	Possible	**MEDIUM**	+ve	Medium
Essential mitigation measures: • Appoint an Environmental Control Officer (ECO) with experience in construction work involving or in proximity to freshwater ecosystems to monitor all works involving canal rehabilitation and /or landscaping of adjacent areas on a weekly basis.								
With mitigation	Local 1	High 3	Long-term 3	**High 7**	Probable	**HIGH**	+ve	Medium

This impact (+ve) does not require management, and is not readily *reversible*.

The Island Concept Alternative

Retention of the canal and the allowance of an improved recreational buffer area, planting of the upper canal and possible introduction of gabion planters along the canal margins will improve habitat quality and ecological functioning to a limited extent.

The impact is assessed to be of ***very low*** (+ve) significance and no further mitigation is necessary (Table 2-8).

Table 2-8: Significance of changes to habitat quality and ecological functioning of the Liesbeek River Canal

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Possible	**VERY LOW**	+ve	Medium
Essential mitigation measures: • No further mitigation is necessary.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Possible	**VERY LOW**	+ve	Medium

This impact (+ve) does not require management, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and the rehabilitation of watercourses will not take place in the foreseeable future (long-term).

2.4.3.2 Potential Impact FE4: Changes to Aquatic Habitat Quality and Ecological Functioning of the Original Course of the Liesbeek River

The original course of the Liesbeek River fronting the site is an ESA and a protected area. The channel is steep, and shows signs of historic and ongoing disturbance. The channel itself is a transformed and disturbed aquatic habitat.

The Riverine Corridor Alternative

Infilling of the original course of the Liesbeek River and the conversion of this area into a stormwater swale with recreational and ecological function will affect the habitat quality functioning of this system as follows:

- The loss of 2.25 ha of permanent standing water wetland habitat;
- The loss of 0.37 ha of ESA;
- The loss of stormwater attenuation function;
- The creation of shallow swale wetlands (assumed to be < 300 mm deep) on the infilled area;
- The creation of occasional weirs in the swales to allow longer term ponding of water; and
- The creation of valuable terrestrial habitats (that will connect to the rehabilitated canal corridor).

The above changes in river habitat quality would remove the PES of Category E on this stretch of river.

The impact is assessed to be of ***medium*** significance and with the implementation of mitigation is reduced to ***low*** (Table 2-9).

Table 2-9: Significance of changes to aquatic habitat quality and ecological functioning of the original course of the Liesbeek River

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	High
Essential mitigation measures: • Plant terrestrial and swale areas with appropriate local indigenous vegetation; • Re-establish Renosterveld vegetation in the swale, and link Renosterveld vegetation patches to create continuous ecological corridors as far as possible; • Limit grassed/lawned areas in the swale as far as possible; and • Get signoff of the landscape plan by a botanist, freshwater ecologist and faunal ecologist.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	-ve	Medium

This impact does not require management, and is not readily *reversible*.

The Island Concept Alternative

The rehabilitation of the eastern bank of the original course of the Liesbeek River as it fronts the site (by reshaping the channel banks and planting them as wide, indigenous vegetated wetland margins, with improved faunal accessibility in and out of the wetlands) would improve the habitat quality and diversity of the channel substantially.

The above changes in river habitat quality would improve river habitat in this reach of river, from a PES of Category E to a Category D.

The impact is assessed to be of ***low*** (+ve) significance with and without mitigation (Table 2-10).

Table 2-10: Significance of changes to habitat quality and ecological functioning of the original course of the Liesbeek River

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	Medium
Essential mitigation measures: • Plant wetland margins and buffer areas with appropriate local indigenous vegetation for at least 15m from the watercourse edge; • Link landscaped areas to create continuous ecological corridors as far as possible; and • Get signoff of the landscape plan by a botanist, freshwater ecologist and faunal ecologist.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	Medium

This impact (+ve) does not require management, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and the rehabilitation of watercourses will not take place in the foreseeable future (long-term).

2.4.3.3 Potential Impact FE5: Changes to Habitat Quality and Ecological Functioning of the Raapenburg Wetland

The Raapenburg Wetland is highly sensitive to changes (increases) in flow. Changes to surface water hydrology at the site (from infilling) have the potential to increase the height, frequency or duration of floods at the Raapenburg Wetland, with consequent negative ecological effects (such as

the expansion of low-importance vegetation at the expense of what are assumed to be more natural remnants of past seasonal Renosterveld wetlands).

The wetland is hydrologically connected to the Liesbeek Canal at a surface elevation of 2.5 mamsl, equating to a flood recurrence interval of between 1:0.5 and 1:1 years – i.e. it floods more frequently than annually.

The Riverine Corridor Alternative

The Surface Water Hydrology Impact Assessment found that the infilling of the site would lead to 1 – 2 cm increases in water levels for high frequency events (1:0.5 – 1:1 year return interval events), and in some cases a decrease in flood levels would occur (because of the additional attenuation capacity provided by the rehabilitated canal corridor). The development the Riverine Corridor Alternative would therefore have a negligible effect on increased flood frequency in the Raapenburg Wetlands.

The impact is assessed to be of ***insignificant*** and no mitigation is necessary (Table 2-11).

Table 2-11: Significance of changes to habitat quality and ecological functioning of the Raapenburg Wetland

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	Medium
	N/A	N/A	N/A	**N/A**				
Essential mitigation measures: • No mitigation is necessary.								
With mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	Medium
	N/A	N/A	N/A	**N/A**				

This impact does not require management, and is *irreversible*.

The Island Concept Alternative

The Surface Water Hydrology Impact Assessment found that the infilling of the site would lead to 1 – 2 cm increases in water levels for high frequency events (1:0.5 – 1:1 year return interval events). The development the Island Concept Alternative would therefore have a negligible effect on increased flood frequency in the Raapenburg Wetlands.

The impact is assessed to be of ***insignificant*** and no mitigation is necessary (Table 2-12).

Table 2-12: Significance of changes to habitat quality and ecological functioning of the Raapenburg Wetland

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	Medium
	N/A	N/A	N/A	**N/A**				
Essential mitigation measures: • No mitigation is necessary.								
With mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	Medium
	N/A	N/A	N/A	**N/A**				

This impact does not require management, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, no changes to surface water hydrology are anticipated and occasional flooding of the Raapenburg Wetland would continue.

2.4.3.4 Potential Impact FE6: Contamination of the Liesbeek and Black Rivers

The Riverine Corridor Alternative and the Island Concept Alternative

The development will produce sewage, and there is a risk that sewage will spill or leak into the adjacent aquatic ecosystems. In the event of a spill or leak, sewage is likely to report to the low-lying main east-west recreational buffer area and the original course of the Liesbeek River, and could lead to:

- Nutrient enrichment and organic loading, leading to elevated Biological Oxygen Demand levels, and potentially resulting in oxygen stress to sensitive aquatic organisms, particularly in hot weather conditions; and
- Bacterial contamination of open space areas with aesthetic and human health effects.

The location of pump stations in plenum chambers in the basements (as is proposed) will reduce this risk. Moreover, the new sewer mains from the development would cross through the landscaped swale (Alternative 1) or remediated Liesbeek channel, but not across the Liesbeek canal or Black River, other than in an existing pipeline. These measures should reduce the frequency of spills or leaks, as well avoiding highly sensitive environmental features.

The following aspects of the development could also lead to contamination of the Liesbeek and Black Rivers:

- Seepage or runoff from gardens / open space areas polluted with fertilisers or effluent (from the use of grey water or treated effluent) entering freshwater environments;
- Stormwater runoff from roads and parking areas polluted with heavy metals and hydrocarbons;
- Runoff from stormwater systems where waste has been (illegally) disposed; and
- Discharges of chlorinated or salt water from swimming pools – chlorine from pool water discharges forms highly toxic chloramines in water with elevated ammonia concentrations.

Sustained (unanticipated) low-level pollution from the above sources would contribute to the ongoing eutrophication of the lower Liesbeek River and natural channel downstream of the development, encouraging the growth of aquatic weeds and other vegetation, and indirectly increasing the need for maintenance measures associated with high levels of aquatic ecosystem disturbance. While the Black River would show low sensitivity to such impacts, given its current high levels of nutrient concentrations, the discharge of additional pollutants into the river would be counter to the urgent need to improve water quality in this system to more ecologically sustainable levels (i.e. PES Category D or better).

Periodic, accidental flows of contaminated water that enter water courses could result in episodes of acute toxicity – such inflows would however be most likely to be associated with sewage leaks / overflows, unless they stemmed from illegal discharges of seriously contaminated water. In the case of the former, preventative design mitigation measures have already been implemented as far as possible to address and contain pump failure impacts at source, and large scale overflows are considered possible but unlikely to occur at a level where they will cause ecosystem failure.

The impact is assessed to be of ***medium*** significance and with the implementation of mitigation is reduced to ***low*** (Table 2-13).

Table 2-13: Significance of contamination of the Liesbeek and Black Rivers

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Take corrective action to prevent recurrence and clean up any spills; • Select water wise indigenous plants for landscaping in open spaces and private gardens; • Limit the extent of lawns as far as possible; • Use sewage and effluent treated to reduce phosphorous and total ammonia for irrigation only; • Do not use grey water / treated effluent for irrigation in recreational buffer areas or ecological corridors; • Locate sewer manholes in open space areas where overflows can be easily detected; and • Direct discharges from swimming pools into the sewerage system.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	-ve	Medium

This impact can be managed to a *high* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site would continue to be used for low intensity commercial recreation and conferencing, and it is assumed that the site would continue to discharge low-toxicity pollution into adjacent degraded environments (e.g. from fertilisers used at the golf course).

2.4.3.5 Potential Impact FE7: Changes to Habitat Quality in Rehabilitated Areas

The Riverine Corridor Alternative and the Island Concept Alternative

During operations, activities at the site and poor maintenance could degrade areas rehabilitated during construction, offsetting many of the anticipated ecological benefits. Activities at the site, and poor maintenance could lead to the following changes in rehabilitated environments:

- Simplification of planted vegetation (and the expansion of grassed areas);
- Development encroachment into rehabilitated areas;
- Blocking of faunal pathways;
- Incision and channelization of the low flow channel in the rehabilitated Liesbeek Canal;
- Proliferation of invasive plant species;
- Disturbance from increased human traffic in sensitive and rehabilitated areas; and
- Predation by domestic animals.

The impact is assessed to be of ***low*** significance and with the implementation of mitigation is reduced to ***insignificant*** (Table 2-14).

Table 2-14: Significance of changes to habitat quality in rehabilitated areas

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Strictly implement the EMPr during operations. • Audit compliance with the EMPr once every two years during operations.								
With mitigation	N/A N/A	N/A N/A	N/A N/A	**N/A** **N/A**	N/A	**INSIGNIFICANT**	-ve	Medium

This impact can be managed to a *high* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, freshwater environments at the site would not be rehabilitated by the proponent, and there would be no ecological gains that could be lost through poor management of freshwater environments.

2.4.4 Mitigation Measures: Potential Aquatic Ecology Impacts

Essential freshwater ecology mitigation measures during **design** are as follows:

- Appoint landscape architects to compile a landscaping and rehabilitation plan that have a proven ability to create landscapes that adequately mimic natural river and wetland environments;
- Compile a landscaping and rehabilitation plan including detailed annotations regarding the ecological landscaping requirements, dimensions and minimum requirements (incorporating essential mitigation for the development;
- Select water wise indigenous plants for landscaping in open spaces and private gardens;
- Incorporate a detailed construction phasing plan into the landscaping and rehabilitation plan taking ecological considerations into account;
- Get signoff of the landscaping and rehabilitation plan by a botanist, freshwater ecologist and faunal ecologist;
- Get signoff of any changes to the project description by a botanist, freshwater ecologist and faunal ecologist;
- Locate sewer manholes in open space areas where overflows can be easily detected
- Limit the extent of lawns as far as possible;
- Limit the extent of lawns in the swale as far as possible (Riverine Corridor Alternative only);
- Link landscaped areas to create continuous ecological corridors as far as possible;
- Compile a detailed costing for implementation of rehabilitation efforts, landscaping and ongoing management, including allowance for acquisition and planting and / or nursery propagation of sufficient local indigenous plants to achieve the required landscaping objectives and emergency rehabilitation (e.g. in the event of a flood); and
- Compile detailed method statements for watercourse construction and flow diversion demonstrating how downstream sedimentation and/or turbidity would be avoided, making allowance for emergency rehabilitation of the Raapenburg Wetland should the Liesbeek River flood during construction.

Additional mitigation measures and monitoring requirements are laid out in the EMPr. Other aspects of the design that are key to the assessment of (pre-mitigation) ecological impacts are listed in Section H (d) of the BA Report.

Essential freshwater ecology mitigation measures during **construction** are as follows:

- Appoint an Environmental Control Officer (ECO) with experience in construction work involving or in proximity to freshwater ecosystems to monitor all works involving canal rehabilitation and /or landscaping of adjacent areas on a weekly basis.
- Workshop implementation of the landscaping and rehabilitation plan with the landscape architects, botanist, freshwater ecologist and faunal ecologist regularly during construction;
- Facilitate frequent on-site inspection of rehabilitation performance by the freshwater ecologist (at least monthly during construction);
- Fence buffers and corridors and restrict access to these areas by construction staff;
- Fence No-Go areas and prevent access to these areas by construction staff;
- Implement good housekeeping practices for the management of hazardous substances and waste as specified in the EMPr;
- Conduct bulk earthworks in freshwater systems in the dry season between January and May (or in direct consultation with a faunal specialist);
- Ensure that the berm at the Raapenburg Wetland that was breached before construction commences at the Liesbeek Canal to allow low-flows to enter this feature is reinstated prior to construction;
- Divert the Liesbeek River flow away from the Raapenburg Wetland during canal rehabilitation;
- Reinstate marginal wetlands disturbed during construction on the banks of the Black River by grading the disturbed bank to a slope of 1:4 or flatter and replanting it with appropriate indigenous wetland and riverine vegetation;
- Plant terrestrial and swale areas with appropriate local indigenous vegetation;
- Re-establish Renosterveld vegetation in the swale, and link Renosterveld vegetation patches to create continuous ecological corridors as far as possible;
- Establish good quality vegetation cover in rehabilitated freshwater systems (80% cover within one year of the commencement of each intervention);
- Place stockpiles more than 20 m from the boundary of all buffers and corridors;
- Protect stockpiles from wind and water erosion;
- Install temporary sediment stilling ponds on flow pathways on the development platform; and
- Rehabilitate areas disturbed by excavation and services installation, to pre-disturbance levels or better.

Essential freshwater ecology mitigation measures during **operations** are as follows:

- Allocate adequate financial and human resources for the long-term management of open spaces including ecological corridors and recreational and ecological buffer areas;
- Take corrective action to prevent recurrence and clean up any spills;
- Use sewage and effluent treated to reduce phosphorous and total ammonia for irrigation only;

- Do not use grey water / treated effluent for irrigation in recreational buffer areas or ecological corridors;
- Direct discharges from swimming pools into the sewerage system;
- Cut reeds manually just above the water level in late summer, and in consultation with a freshwater ecologist;
- Cut reeds across the bank-fill width of watercourses (and not longitudinally);
- Remove cut reeds from watercourses;
- Remove sediment mechanically in consultation with a freshwater ecologist to restore channel capacity only when necessary, and not more frequently than once every five years;
- Restore the design profile of the rehabilitated Liesbeek Canal channel when necessary;
- Revegetate areas that are cleared with locally indigenous vegetation and in consultation with a freshwater ecologist;
- Maintain (clear) faunal culverts regularly;
- Record the required extent of buffer and open space areas, and maintain these areas to achieve the desired level of ecological functioning;
- Establish design guidelines for buffer areas and corridors, including requirements for ecological connectivity and indigenous planting templates;
- Establish rules for the use and management of buffer areas and corridors;
- Establish guidelines for the removal of key invasive alien plant species;
- Prevent access to the Raapenburg Wetland by the public;
- Pursue opportunities to link urban development with ecological areas (e.g., through to provision of boardwalks and bird hides);
- Prohibit domestic cats at the development; and
- Audit compliance with the EMPr once every two years during operations.

2.5 Potential Faunal Impacts

2.5.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Biodiversity Impact Assessment undertaken by Freshwater Consulting Group (see Appendix G2 of the BA Report). The purpose of the study was to assess the potential impacts of the project on aquatic ecosystems (rivers and wetlands) and flora and fauna, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the faunal component of the study were to:

- Conduct a series of site visits / habitat assessments (day and night) and gather information and data sets from other resources to:
    - Identify faunal species at and adjacent to the site in both freshwater and terrestrial habitats;
    - Estimate the population size of faunal species that utilise the site;
    - Identify existing breeding locations for faunal species on the site; and
    - Identify areas on the site used as faunal movement corridors.

- Compile a primarily desktop baseline faunal assessment (informed by habitat assessment) based on known faunal distribution patterns and habitat associations, including:
    - Identification of fauna that are known to or likely to use the site;
    - Indication of whether these include red data species or other taxa of conservation importance;
    - Description of habitat requirements and likely areas of the site they would utilise;
    - Identification of important off-site linkages;
    - Broad comments on the sensitivity of the fauna to development – increased noise, buildings, traffic, construction phase disturbance; and
    - Comment on appropriate development setbacks and design of corridors and buffer areas to address the habitat requirements of conservation worthy taxa / communities.

In addition to the above ToR, the specialist comment considered the connectivity between the Observatory Western Leopard Toad population and other populations in Cape Town e.g. the Cape Flats.

The assessment is based on the review of existing information, derived though a literature search and field assessments.

Implementation of key aspects of the design as currently proposed underpins the assessment of faunal impacts (refer to Section H (d) of the BA Report), and the faunal ecologist must approve changes in the project footprint or the treatment of setbacks.

2.5.2 Assessment of Impacts: Construction Phase

Four potential direct construction phase impacts on fauna were identified:

- FA1: Faunal mortalities.
- FA2: Change in aquatic habitat quality.
- FA3: Change in terrestrial habitat quality.
- FA4: Change in faunal connectivity.

2.5.2.1 Potential Impact FA1: Faunal Mortalities

During construction, construction vehicles will traverse (poor quality) terrestrial faunal habitat, and move within and close to wetlands and watercourses close to the site, and it is inevitable that this will lead to faunal mortalities from collisions. Pitfall fatalities of small faunal species are also possible.

By far the faunal species of greatest concern at the site is the *Endangered* WLT.

The Riverine Corridor Alternative

The impact is assessed to be of ***medium*** significance, and with the implementation of mitigation is reduced to ***low*** (Table 2-15).

Table 2-15: Significance of faunal mortalities

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Regional 2	Medium 2	Med-term 2	**Medium 6**	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Commence rehabilitation of the canal in the first summer after the start of construction. • Phase construction as specified in the EMPr. • Ensure faunal connectivity throughout the construction process.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Probable	**LOW**	-ve	Medium

This impact can be managed to a *high* degree, and is *irreversible*.

The Island Concept Alternative

The impact is assessed to be of ***medium*** significance, and with the implementation of mitigation is reduced to ***low*** (Table 2-16).

Table 2-16: Significance of faunal mortalities

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Regional 2	Medium 2	Med-term 2	**Medium 6**	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Phase construction as specified in the EMPr. • Ensure faunal connectivity throughout the construction process.								
With mitigation	Regional 2	Low 1	Med-term 2	**Low 5**	Probable	**LOW**	-ve	Medium

This impact can be managed to a *high* degree, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and continue to offer poor quality and exposed terrestrial and aquatic environments for fauna at the site with associated hazards. Faunal mortalities anticipated during construction (most notably WLT), however, would be avoided.

2.5.2.2 Potential Impact FA2: Change in Aquatic Habitat Quality

The Riverine Corridor Alternative

This alternative would entail:

- The loss of permanent standing water wetland habitat (the original course of the Liesbeek River where it fronts the site) that may be used as a WLT breeding area; and
- The loss of steep earth riverbanks potentially used as bird nesting sites on the western bank of the original course of the Liesbeek River.

However, this alternative would also entail:

- The creation of improved wetland habitat for aquatic insects and other fauna in shallow swale wetlands in the proposed swale area to the west of the site; and
- The provision of moist shelter and adequate food supplies for amphibians in their non-breeding season.

This alternative also entails the rehabilitation of the Liesbeek Canal. This intervention will improve aquatic habitat quality by providing:

- Areas for colonisation by fish larvae, other aquatic larvae and nymphs of various riverine insects during periods of inundation;
- Floodplain habitat for birds and aquatic fauna;
- Ecologically diverse habitat; and
- Refuge for mobile terrestrial fauna during high flood levels.

The improvement of aquatic habitat quality at the canal, and the provision of improved wetland habitat for aquatic insects and other fauna in shallow swale wetlands in the proposed swale would lead to a net improvement in aquatic habitat quality for fauna, despite the infilling of the original course of the Liesbeek Canal.

The impact is assessed to be of ***very low*** (+ve) significance, and with the implementation of mitigation is increased to ***low*** (Table 2-17).

Table 2-17: Change in aquatic habitat quality

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	+ve	Medium
Essential mitigation measures: • Create at least two artificial wetland ponds, each with a diameter of at least 10 m, in the proposed swale. • Retain a section of steep bank on the western bank of the original course of the Liesbeek River.								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Probable	**LOW**	+ve	Medium

This impact (+ve) can be managed to a *limited* degree, and is *reversible*.

The Island Concept Alternative

Through the rehabilitation of the eastern bank of the original course of the Liesbeek River, this development would entail the creation of improved habitat quality and diversity, but will forgo the benefit of the creation of a large high-quality terrestrial environment for WLTs in this area.

The impact is assessed to be of ***very low*** (+ve) significance, and with the implementation of mitigation is increased to ***low*** (Table 2-18).

Table 2-18: Significance of change in aquatic habitat quality

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	+ve	Medium
Essential mitigation measures: • Plant wetland margins and buffer areas with appropriate locally indigenous vegetation. • Connect the rehabilitated original course of the Liesbeek River to the main east-west faunal corridors with planted landscaped swathes.								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Probable	**LOW**	+ve	Medium

This impact (+ve) can be managed to a *limited* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and continue to offer poor quality and exposed terrestrial and aquatic environments for fauna at the site with associated hazards. Faunal mortalities anticipated during construction (most notably WLT), however, would be avoided.

2.5.2.3 Potential Impact FA3: Change in Terrestrial Habitat Quality

The Riverine Corridor Alternative and the Island Concept Alternative

Both development alternatives would entail the loss of terrestrial habitat. These areas may provide habitat for various indigenous small animals (including the Vulnerable Cape Dwarf Chameleon) and non-breeding habitat for WLTs.

Habitat quality is poor at present and indigenous vegetation is largely absent. The dominance of mowed grass and parking areas on the site provide limited and risky cover opportunities for faunal species.

Both development alternatives include high quality, safe faunal environments integrated into significant areas of landscaped open space, which offsets the loss in the extent of (poor quality) terrestrial habitat at the site to a certain extent. Nevertheless, due to the extent of terrestrial habitat that will be lost, this impact is conservatively assessed to be of negative status.

The impact is assessed to be of ***low*** significance and no further mitigation is necessary (Table 2-19).

Table 2-19: Significance of changes in terrestrial habitat quality

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Definite	**LOW**	-ve	Medium
Essential mitigation measures: • No further mitigation is necessary.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Definite	**LOW**	-ve	Medium

This impact does not require management, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, poor quality terrestrial habitat will be retained, and the provision of improved terrestrial habitat quality will be foregone.

2.5.2.4 Potential Impact FA4: Change in Faunal Connectivity

Although the site currently affords faunal connectivity, access across the site is risky and connectivity is poor. Both development alternatives include:

- North-south links along the Liesbeek Canal and original course of the Liesbeek River;
- East-west links at the south and centre of the site;
- Partial east-west link on the northern property boundary; and
- Faunal movement corridors under roads that cross ecologically important areas.

These design measures are substantial and will mitigate the impact of a loss of faunal connectivity by developing the site. However, both alternatives have the potential to:

- Isolate remnants of the original course of the Liesbeek River north of the site, especially if movement corridors are not designed and landscaped appropriately; and
- Cut off longitudinal connectivity along the lower bank and top of bank of the Black River at the Berkley Road Bridge.

The Riverine Corridor Alternative

Currently the canal offers very limited faunal movement opportunities. The rehabilitation of the canal would extend the zone of connectivity between the original course of the Liesbeek south of the site with the confluence of the canal with the Black River, the proposed east-west corridor through the site, the proposed stormwater swale to the west and the Raapenburg Wetland. This will improve the ability of WLTs (and other fauna) to move to and through the site, as well as on the periphery.

The impact is assessed to be of ***low*** significance (-ve), and with the implementation of mitigation is changed to ***low*** (+ve) (Table 2-20).

Table 2-20: Change in faunal connectivity

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	-ve	Medium
Essential mitigation measures: • Get sign off from a faunal specialist on the final location of culverts under the Link Road crossing through the swale to be constructed in the original course of the Liesbeek River. • Include three additional culverts at the Liesbeek swale crossing of the Berkley Road on the eastern terrestrial margins of the swale to allow faunal movements during flood events (i.e. seven culverts in total). • Install two box culverts above the 1:50 year floodline on each bank of the Black River to facilitate faunal passage through the infilled road structure. • Incorporate planted swathes in the east-west recreational buffer zone between Precinct 1 and Precinct 2 into the rehabilitated canal corridor below the lowest footpath (e.g. by raising the paths in this area).								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	+ve	Medium

This impact (+ ve) does not require management, and is *reversible*.

The Island Concept Alternative

Should the Island Concept Alternative be selected the canal would continue to offer poor faunal connectivity, but faunal connectivity would be facilitated by the proposed east-west corridor between Precinct 1 and Precinct 2 through the site.

The impact is assessed to be of ***medium*** significance and with the implementation of mitigation is reduced to low (Table 2-21).

Table 2-21: Significance of changes in faunal connectivity

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Possible	**MEDIUM**	-ve	Medium
Essential mitigation measures: • Allow the Link Road Bridge and the Berkley Road Bridge to span the rehabilitated watercourse on piers, including buffer areas. • Incorporate planted swathes in the east-west recreational buffer zone between Precinct 1 and Precinct 2 into the recreational buffer area adjacent to the unrehabilitated canal below the lowest footpath (e.g. by raising the footpath here). • Edge pathways in recreational buffer areas with toad barriers.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	-ve	Medium

This impact does not require management, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and continue to offer poor quality across and adjacent to the site, and the provision of improved connectivity afforded by the Riverine Corridor Alternative will be forgone.

2.5.3 Assessment of Impacts: Operational Phase

One potential direct operational phase impact on fauna was identified:

- FA5: Faunal mortalities.

2.5.3.1 Potential Impact FA5: Faunal Mortalities

As well as population fragmentation and changes to faunal connectivity, aspects of the development could lead to faunal mortalities in the following ways:

- Road fatalities –from collisions with vehicles;
- Pitfall fatalities – from being trapped; and
- Fatalities from exposure – from exposure to the elements or predators in hostile terrain.

By far the faunal species of greatest concern at the site is the WLT.

Although design measures have already been incorporated to reduce the risks of toad mortalities, the above risks cannot be fully mitigated, especially considering the additional vehicle and human traffic anticipated at the site. However, toads are currently exposed to large hostile areas and traffic at the site without any protective interventions, and WLT mortalities were observed at the site during field assessments for this study.

The Riverine Corridor Alternative

Currently, the steep western bank of the original course of the Liesbeek River restricts the movement of terrestrial fauna (particularly WLTs) from entering the Liesbeek Parkway. The infilling of this area and the creation of a vegetated swale, although an improvement of habitat quality for the WLT, may allow faunal species to move onto the Liesbeek Parkway increasing mortality rates if movement here is not prevented.

The impact is assessed to be of ***medium*** significance, and with the implementation of mitigation is reduced to ***low*** (Table 2-22).

Table 2-22: Significance of faunal mortalities

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Probable	**HIGH**	-ve	Medium
Essential mitigation measures: • Retain a section of the steep earth bank on the western bank of the original course of the Liesbeek River or install WLT barriers on the western bank of the original course of the Liesbeek River.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	-ve	Medium

This impact can be managed to a *limited* degree, and is *irreversible*.

The Island Concept Alternative

For the Island Concept Alternative, faunal movement along the Liesbeek Canal would remain restricted, and the steep western back of the original course of the Liesbeek River would be retained. This would restrict the movement of faunal species into the site and other dangerous areas, reducing the probability of faunal mortalities.

The impact is assessed to be of ***high*** significance and with the implementation of mitigation is reduced to ***low*** (Table 2-23).

Table 2-23: Significance of faunal mortalities

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Probable	**HIGH**	-ve	Medium
Essential mitigation measures: • Design pathways / walkways to prevent the passage of WLTs into the main development area.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	-ve	Medium

This impact can be managed to a *limited* degree, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and continue to offer poor quality across and adjacent to the site, and the provision of improved connectivity afforded by the Riverine Corridor Alternative will be foregone.

2.5.4 Mitigation Measures: Potential Faunal Impacts

Essential faunal mitigation measures during **design** are as follows[6]:

- Landscape the recreational buffer area between Precinct 1 and Precinct 2 with wide swathes of indigenous planted vegetation that ensure continuous vertical cover along the length of the corridor;
- Establish Renosterveld vegetation in the recreational buffer area between Precinct 1 and Precinct 2;

[6] This mitigation measures are in addition to project design elements that already form part of the project description. These design elements are listed in Section H (d) of the BA Report.

- Include two additional culverts under the road at the banks of the recreational buffer area between Precinct 1 and Precinct 2;
- Ensure that a 5 m corridor is retained between the built development edge on the north-western corner of the development and the Berkley Road Extension road reserve;
- Include an additional three culverts under the extension of Berkley Road onto the site (one between each of the access roads onto the site);
- Install road grids above culverts;
- Landscape the ecological corridor on the southern property boundary with indigenous vegetation to provide a diversity of heights and densities of plants;
- Pull the extent of the fill platform of the Berkley Road Bridge on the eastern bank of the Black River back to at least 5 m from the top of the bank;
- Install reno mattresses between the eastern bank of the Black River and the Berkley Road Bridge;
- Pull the extent of the fill platform of the Berkley Road Bridge on the western bank of the Black River back 20 m from the top of the bank;
- Install two box culverts above the 1:50 year floodline on each bank of the Black River to facilitate faunal passage through the infilled road structure;
- Shape the eastern bank of the Black River (at a gradient of 1:4 or flatter) to a distance of 10 m up and downstream of the Berkley Road Bridge, and vegetate this zone;
- Landscape ecological corridors and recreational buffer areas to provide high quality cover for WLTs, including low and medium height vegetation cover with mixed plant species;
- Integrate physical shelters for WLTs into landscaped areas (such as natural logs, or artificial structures such as pieces of broken pots or ceramic piping cut lengthwise);
- Shape the side slopes of the road running through the recreational buffer area between Precinct 1 and Precinct 2 to be as steep as possible (or introduce physical WLT barriers to prevent WLTs from entering the road surface);
- Design pathways / walkways to prevent the passage of WLTs into the main development area;
- Design pitfall-type structures (drains, stormwater canals, channels, water features and all manhole type structures) to limit access and allow toad escape options;
- Design fencing (if required) to allow faunal movements (i.e. create 300 mm high x 100 mm wide access holes at least every 10m along a length of fence, and do not electrify fencing within 300 mm of the ground);
- For the Riverine Corridor Alternative:
    - Create at least two artificial wetland ponds, each with a diameter of at least 10 m, in the proposed swale;
    - Ensure artificial wetland ponds in the swale retain moisture throughout the year (by building these below the summer water table or by lining these artificial features);
    - Gently slope the sides of artificial wetland ponds (at a gradient of 1:5 or less steep);
    - Vegetate artificial wetland ponds with indigenous wetland vegetation with a range of textures, height and densities;

- Connect artificial wetland ponds to the main east-west faunal corridors with planted landscaped swathes;
- Get sign-off of the final design of artificial wetland ponds by a faunal and aquatic ecologist;
- Retain a section of steep bank on the western bank of the original course of the Liesbeek River or install WLT barriers on the western bank of the original course of the Liesbeek River;
- Get sign off from a faunal specialist on the final location of culverts under the crossing through the swale to be constructed in the original course of the Liesbeek River;
- Include three additional culverts at the Liesbeek swale crossing of the Berkley Road on the eastern terrestrial margins of the swale to allow faunal movements during flood events (i.e. seven culverts in total); and
- Incorporate planted swathes in the east-west recreational buffer zone between Precinct 1 and Precinct 2 into the rehabilitated canal corridor below the lowest footpath (e.g. by raising the paths in this area).

- For the Island Concept Alternative:
  - Allow the Link Road Bridge and the Berkley Road Bridge to span the rehabilitated watercourse on piers, including buffer areas;
  - Plant wetland margins and buffer areas with appropriate locally indigenous vegetation;
  - Connect the rehabilitated original course of the Liesbeek River to the main east-west faunal corridors with planted landscaped swathes;
  - Incorporate planted swathes in the east-west recreational buffer zone between Precinct 1 and Precinct 2 into the recreational buffer area adjacent to the unrehabilitated canal below the lowest footpath (e.g. by raising the footpath here); and
  - Edge pathways in recreational buffer areas with toad barriers.

Essential faunal mitigation measures during **construction** are as follows:

- Fence off the vacant property to the north of the site (RE 15334) to prevent faunal movements from this area into the site prior to the start of construction;
- Conduct a faunal search-and-rescue of areas scheduled for construction;
- Relocate rescued fauna to the (fenced-off property) to the north of the site (RE 15334);
- Record the efficacy of all faunal search-and-rescue exercises;
- Landscape the main east-west recreational buffer area in the first summer after the start of construction in direct consultation with a faunal specialist
-
- Link the old Liesbeek channel on one side and the canal corridor on the other side with the fenced buffer zone;
- Raise temporary access roads that cross No-Go areas with pipe culverts to facilitate faunal movements;
- Fence off access roads to create an access zone the excludes fauna;
- Extend pipe culverts by 15 m on each side of access roads through No-Go areas to protrude outside of fenced access zones;

- Designate the Raapenburg Wetland as a No-Go area throughout construction;
- Appoint a faunal specialist to conduct a faunal search-and-rescue (focusing on WLTs) of construction areas prior to the start of each phase of construction;
- Release “rescued” fauna into the undeveloped area to the north of the site during initial phases, and into the main east-west recreational buffer area following the establishment of this area;
- Regularly maintain temporary fences at No-Go areas and site boundaries;
- Rehabilitate the banks of the Black River immediately following the completion of the Black River Bridge;
- For the Riverine Corridor Alternative:
    - Fence the eastern bank of the Liesbeek Canal prior to the start of construction to prevent movement of fauna into the canal zone / into construction sites;
    - Ensure safe passage between the undeveloped area north of the site and the original course of the Liesbeek River during rehabilitation of the canal (so that WLT can access this area);
    - Commence rehabilitation of the canal in the first summer after the start of construction;
    - Landscape the east-west ecological corridor prior to the start of infilling at the original course of the Liesbeek River;
    - Fence the upper end of the planted canal zone (i.e. the top of the 1:100 year floodline) after canal rehabilitation (defined by completion of initial planting at the end of the first summer after project implementation) to prevent movement of leopard toads and other fauna out of the canal zone / into construction sites;
    - Reconnect the faunal refuge area with the rehabilitated canal and infilled landscaped original course of the Liesbeek River once these are complete;
    - Commence the construction of the northern-eastern development portion only after the completion of canal rehabilitation and infilling and landscaping of the original course of the Liesbeek;
    - Fence off active construction areas to prevent faunal movements into these areas until it can be demonstrated that the rehabilitated canal is functioning as an ecological corridor; and
    - Landscape the ecological corridors on the northern and southern property boundaries once the respective development platforms are in place only.
- For the Island Concept Alternative:
    - Commence rehabilitation of the original course of the Liesbeek River during the first summer after the start of construction;
    - Fence active construction areas to prevent faunal movements into these areas;
    - Landscape the main east-west recreational buffer area during summer concurrently with the initial phase of construction;
    - Tie the main east-west recreational buffer area into the rehabilitated bank of the original course of the Liesbeek and close off access to the canal; and
    - Landscape the ecological corridors on the northern and southern property boundaries once the respective development platforms are in place only.

Essential faunal mitigation measures during **operations** are as follows:

- Educate staff, tenants and visitors around the life cycle and conservation status of WLTs, and the rationale behind the protection methods being employed on the site (e.g. through the use of signs and informative posters)

2.6 Potential Floral Impact

2.6.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Biodiversity Impact Assessment undertaken by Freshwater Consulting Group (see Appendix G2 of the BA Report). The purpose of the study was to assess the potential impacts of the project on aquatic ecosystems (rivers and wetlands) and flora and fauna, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the botanical component of the study were to:

- Determine the botanical value of terrestrial areas at the site (including rehabilitation potential);
- Establish and map the location, extent and quality of the Renosterveld / Sand Fynbos on the adjacent (SAAO) site; prepare a list of species found on the site and establish which Red List species (*Moraea aristata* and others) occur here; and
- Assess potential impacts of the proposed development on floral species.

The assessment is based on the review of existing information, derived though a literature search and a field assessment of the site and SAAO.

2.6.2 Assessment of Impact: Construction Phase

One potential direct construction phase impact on flora was identified:

- FL1: Change in floral species composition.

2.6.2.1 Potential Impact FL1: Change in Floral Species Composition

The Riverine Corridor Alternative and the Island Concept Alternative

No areas of floral importance occur at the River Club site, and the development would be highly unlikely to impact negatively on the Dryland Renosterveld vegetation type population at the SAAO, including the Critically Endangered *Moraea aristata* populations. The impact of a loss of indigenous flora is therefore insignificant

The successful integration / reintoduction of terrestrial Renosterveld habitat at the site would be an ecological benefit.

The impact is assessed to be ***insignificant*** and with the implementation of mitigation is increased to ***low*** (+ve) significance (Table 2-24).

Table 2-24: Significance of a change in floral species composition

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	N/A	N/A	N/A	N/A	N/A	**INSIGNIFICANT**	N/A	Medium
	N/A	N/A	N/A	N/A				
Essential mitigation measures: • Integrate Renosterveld habitat into ecological setbacks and corridors.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Possible	**LOW**	+ve	Medium

This impact (+ve) does not require management, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, devoid of indigenous vegetation, and the provision of improved terrestrial habitat quality will be forgone.

2.6.3 Mitigation Measures: Potential Floral Impact

Essential floral mitigation measures during **design** are as follows:

- Integrate Renosterveld habitat into ecological setbacks and corridors.

2.7 Potential Socioeconomic Impacts

2.7.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Socioeconomic Impact Assessment undertaken by Sue Reuther of SRK (see Appendix G4 of the BA Report). The purpose of the study was to assess the potential impacts of the project on the local economy and society, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

A number of other impacts with socioeconomic consequences (including traffic, heritage and visual) and are assessed in separate specialist studies undertaken for the BA. Consequently, the assessment of socioeconomic impacts is more narrowly confined to impacts not assessed elsewhere (e.g. employment, income, housing, etc.).

The ToR for the study were to:

- Define the study area (the area potentially affected socially and / or economically by the proposed redevelopment of the River Club);
- Describe the economic characteristics of the study area and place these in context, based on existing public data;
- Identify the potential social and economic impacts (incl. benefits) associated with the proposed redevelopment of the River Club;
- Assess the significance social and economic impacts of the project, including:
    - Creation of employment and income;
    - Potential impact on the local economy of the capital investment and ongoing government income from the project; and
    - Potential impact on surrounding areas; and

- Recommend appropriate mitigation measures to minimise / reduce negative impacts and enhance benefits.

Literature, internet resources and previous studies relating to the socioeconomic environment of the study area were reviewed to compile a baseline for the affected areas, including the potentially affected community as well as the local (ward) and, where relevant, regional (metropolitan) context. The information was analysed to ascertain the socioeconomic conditions and characteristics of the study area. Potential socioeconomic impacts of the proposed project were identified based on the baseline data, project description, review of other studies for similar projects and professional experience.

2.7.2 Assessment of Impacts: Construction Phase

Two potential direct construction phase impacts were identified:

- SE1: Wealth creation through investment.
- SE2: Increased employment, income and skills development.

2.7.2.1 Potential Impact SE1: Wealth Creation through Investment

The Riverine Corridor Alternative and the Island Concept Alternative

Both layout alternatives have the same development floor area of 150 000 m^2 and land uses, but the estimated capital investment costs (including material and professional fees) differ slightly between the two options, mainly due to different bulk earthworks requirements. Investments are estimated at (subject to detailed cost analysis):

- R3.90 billion for the Riverine Corridor Alternative (at current prices); and
- R3.94 billion for the Island Concept Alternative (at current prices).

It is expected that the development of the River Club will take place over a three – five year construction period, possibly extending over seven years.

Construction of the River Club development will generate:

- Direct economic impacts, through the employment of staff and direct procurement from suppliers, e.g. equipment and contractors;
- Indirect economic impacts, mainly procurement by suppliers and service providers from other businesses; and
- Induced economic impacts, through increased demand from households earning an income from direct and indirect economic impacts.

The direct capital investment for the River Club project of ~R3.9 billion is highly significant for a single project, as the total investment (over ~7 years) represents:

- ~1.4% of Cape Town's GDPR of R283.28 billion in 2015 (WCG, 2016); and
- ~35.5% of the Cape Town's construction sector's contribution of R11.11 billion in 2015 (WCG, 2016).

Dlamini (2012) notes a strong relationship between construction activity and economic growth. As an investment sector, construction has the potential to increase short-term growth and can be regarded as a major component of investment programmes, particularly for developing economies like South Africa. The construction sector provides capital infrastructure, which creates significant employment opportunities for the population and generates further investment in other sectors of the economy through the multiplier effect.

The domestic output sector multiplier for the South African construction industry is 1.9, implying that for every R1 million of extra construction spend, output in the entire economy expands by R1.9 million (National Treasury, 2016)[7]. The River Club development may thus increase total economic output by ~R7.4 billion over the ~7 year construction period, i.e. a supplementary indirect economic boost of R3.5 billion.

The multiplier excludes the additional induced economic output of higher employment on consumption, which is certain to be positive.

Economic growth in Cape Town has slowed since 2010 to 2.5% per annum (WCG, 2016), which is concerning given the high unemployment, poverty and population growth rates in the City. Construction, once the fastest growing industry (albeit off a relatively small base) has slowed to an average of 1.7% per annum in 2010 – 2015. It is expected that the River Club development would contribute significantly to maintaining or increasing growth rates in the sector for the duration of project construction.

The River Club development is one the highest-value single development proposals currently considered in the CoCT.

It is expected that most (~80% of the (bulk) materials and expertise required during construction will be sourced from the Western Cape.

The impact is assessed to be of ***high*** (+ve) significance with and without the implementation of mitigation (Table 2-25).

Table 2-25: Significance of wealth creation through investment

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	High 3	Med-term 2	**High 7**	Probable	**HIGH**	+ve	High
Essential mitigation measures: • Procure goods and services from local, provincial or South African suppliers as far as possible, with an emphasis on Black Economic Empowerment (BEE) suppliers where possible.								
With mitigation	Regional 2	High 3	Med-term 2	**High 7**	Probable	**HIGH**	+ve	High

This impact (+ve) can be managed to a *limited* degree, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. It is expected that some ongoing maintenance investment will continue to be required to upkeep the current facilities, as per the current situation.

2.7.2.2 Potential Impact SE2: Increased Employment, Income and Skills Development

The Riverine Corridor Alternative and the Island Concept Alternative

Employment provides many socioeconomic benefits to employees and their dependants, including:

- Improved material wealth and standard of living;

[7] Construction has the highest domestic output multiplier of all sectors reported by the National Treasury, followed by agriculture, forestry and fisheries and finance, real estate and business services (both of which have a multiplier of 1.7).

- Enhanced potential to invest and improved access to social services such as education and health services;
- Enhanced skills transferred to previously unskilled workers, facilitating employment prospects of such workers; and
- Contribution to a sense of independence, freedom and pride, which may promote a good work ethic.

The project is expected to create various types of employment during the construction phase:

- Direct employment includes contractors building the River Club development and the project management team appointed by LLPT;
- Indirect employment includes other sub-contractors and suppliers; and
- Induced employment includes employment generated by increased spending at businesses and on services by households earning an income from the project (the multiplier effect).

Construction is one of the most labour-intensive sectors in the economy (Tregenna, 2010). LLPT estimates that the project will directly employ on average 5 239 workers during the ~30 months construction period, at times peaking at 8 382 workers. Of these, ~70% will be on site and ~30% will be off site. Total direct construction employment amounts to ~157 170 person-months. A breakdown of requisite skills levels is not available, but the formal Cape Town construction sector employs on average 16% skilled labour, 66% semi-skilled labour and 18% low-skilled labour (WCG, 2016). For the project, this would translate into 816 skilled positions, 3 474 semi-skilled positions and 948 low-skilled positions.

Construction creates and sustains indirect jobs mainly in upstream sectors, e.g. building material and furnishings, as well as in other services provided by contractors, e.g. architects, consultants, security. National Treasury (2016) estimates an employment multiplier of 4.9 for the South African construction sector, implying that for every R1 million of extra construction spend, 4.9 additional jobs are created[8]. This implies that the River Club development may increase total employment by some 19 000 jobs, of which ~13 700 would be indirect and induced for this project. Direct as well as many indirect and induced jobs will be located in the Cape Town region.

Approximately 24% (408 000 people) of the Cape Town labour force was unemployed in 2011 (Census, 2011), while ~268 500 net jobs have been created in the CoCT since 2005, ~28 800 of those in the construction sector (WCG, 2016). The construction sector employed 128 491 workers (or 8.3% of the City's workforce) in 2015 (WCG, 2016).

The creation of ~5 239 direct and possibly ~13 700 indirect and induced jobs would contribute meaningfully towards employment at the regional level, and construction sector employment in particular. The construction sector typically benefits workers with a range of skill levels, but

[8] Construction has the second highest employment multiplier of all sectors reported by the National Treasury, after wholesale, catering and accommodation (5.3) and on par with agriculture, forestry and fisheries (4.9).

A 2006 cidb study estimates multipliers of around 4.2 direct jobs created in the formal sector per R1 million invested, while the construction materials manufacturing and materials distribution sector had a direct job creation multiplier of around 3 persons per R1 million (cidb, 2015).

particularly semi- and low-skilled workers, i.e. the people most in need of employment, income and skill development[9].

The cost of direct employment during the construction period is estimated at some R1.63 billion. The average wage will be above the South African minimum wage of R3 500 in 2017[10], generating (temporary) income for a large number of households.

Direct and indirect employees will support a number of dependants. Based on data from the National Income Dynamics Survey (NIDS, Wave 3), Finn (2015) estimates that the average dependency ratio for earners in South Africa is 1.55 (i.e. each income earner on average supports herself and 1.55 other people). The average ratio varies significantly between 1.0 for non-poor earners and 2.65 for earners in poor households.

Assuming that the 5 239 direct employees support between 1.0 (skilled labour) and 2.65 (semi- and low-skilled labourers) dependants, an additional 12 500 people benefit from income earned by direct employment at the River Club development. Assuming further indirect and induced employment of ~13 700, this could increase the number of benefitting dependants by another ~30 000.

It is anticipated that direct and indirect workers will primarily be recruited from the Cape Town metropole. The opportunities created by the value chain, particularly bulk material supply, are also likely to benefit regional communities most.

Employment numbers are largely determined by industry and market forces; consequently, there are no recommended mitigation measures to further optimise the benefits of the project.

The impact is assessed to be of ***medium*** (+ve) significance with and without the implementation of mitigation (Table 2-26).

Table 2-26: Significance of increased employment, income and skills development

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Medium 2	Med-term 2	**Medium 6**	Probable	**MEDIUM**	+ve	Medium
Essential mitigation measures: • Utilise local labour and contractors as much as possible. • Implement a training programme to upskill local labour.								
With mitigation	Regional 2	Medium 2	Med-term 2	**Medium 6**	Probable	**MEDIUM**	+ve	Medium

This impact (+ve) can be managed to a *limited* degree, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. In this scenario, it is expected that staff numbers would not change significantly from the current situation.

[9] Employment growth within the low and semi-skilled sectors remained relativity stagnant in the Western Cape, increasing by 0.1% and 0.6% per annum respectively from 2005 – 2015, while the skilled sector grew at 0.9& per annum (WCG, 2016).

[10] https://businesstech.co.za/news/finance/156159/its-official-national-minimum-wage-set-at-r3500-per-month.

2.7.3 Assessment of Impacts: Operational Phase

Eight potential direct operational phase impacts were identified:

- SE3: Increased employment, income and skills development.
- SE4: Increased government revenue.
- SE5: Increase in centrally located housing, including inclusionary housing.
- SE6: Densification facilitating improved connectivity, transport systems and TRUP implementation.
- SE7: Change in public amenity value of the site.
- SE8: Increase in property values in surrounding areas.
- SE9: Gentrification in surrounding residential areas.
- SE10: Change in the quality of life in the area.
- SE11: Pressure on service provision.

2.7.3.1 Potential Impact SE3: Increased Employment, Income and Skills Development

The Riverine Corridor Alternative and the Island Concept Alternative

As noted in Section 2.7.2.2, employment provides many socioeconomic benefits to employees and their dependants. The project is expected to create employment during the operational phase:

- Direct employment includes staff appointed or contracted by LLPT to manage the River Club development;
- Indirect employment includes jobs at suppliers of goods and services to those contracted or appointed directly by the LLPT; and
- Induced employment includes employment generated by increased spending at businesses and on services by households earning an income from the project (the multiplier effect).

Direct employment

Approximately 860 people will be directly employed at the River Club development, including office areas (maintenance and cleaning), residential units, retail areas, gym and hotel (and excluding tenants' staff, see Table 2-27).

Table 2-27: Direct employment at the River Club development during operational phase

Employment type	Estimated number of jobs	Estimated annual wage bill
Centre management	19	R11 400 000
Letting team	11	R9 900 000
Security	435	R62 640 000
Cleaning	154	R22 176 000
Maintenance	65	R23 400 000
Landscaping Maintenance	36	R8 640 000
Reception	25	R9 000 000
Hotel staff	77	R36 960 000
Gym staff	38	R18 240 000
Total	**860**	**R202 356 000**

Source: pers. comm. Capex (2017), extrapolated for latest employment estimates

The LLPT estimates the wage bill for direct employment at R200 million per annum (in 2017 Rand) (see Table 2-27), with the average wage at ~R19 600 per month. Based on the discussion in Section 2.7.2.2, the 860 direct and indirect River Club employees are likely to support an additional ~1 700 dependants.

Indirect and induced employment

The commercial and business services sectors provide opportunities primarily for semi-skilled and skilled workers, and have high employment multipliers of 5.3 and 3.1, respectively (National Treasury, 2016). Annual operating expenditure may result in additional indirect and induced jobs. Direct as well as many indirect and induced jobs will be located in the Cape Town region.

Employment at tenants

Prospective tenants at the River Club will also employ people:

- Retail facilities may employ ~320 retail staff[11];
- Office-based business services may employ ~5 000 office workers[12];
- A school will employ teachers; and
- Residents may employ domestic workers.

However, such employment will be driven by external demand for services and products, and in this report is not directly attributed to the River Club development. Tenants attracted to the River Club will probably include a combination of companies / residents relocating from other areas (displacing jobs in those areas) as well as new companies / residents responding to consumption patterns and economic growth (and creating new jobs). Therefore, by virtue of generating critical mass and providing appropriate facilities, the River Club development is likely to induce at least some additional employment by allowing tenants to expand and operate more efficiently, with an assumed marginal net positive effect on employment.

It is anticipated that direct and indirect workers will primarily reside in Cape Town.

Employment numbers are largely determined by industry and market forces; consequently, there are no recommended mitigation measures to further optimise the benefits of the project.

The impact is assessed to be of ***medium*** (+ve) significance with and without the implementation of mitigation (Table 2-28).

[11] Pick n Pay employs on average retail 33 staff per 1 650 m^2 floor space; at this ratio, 16 000 m^2 can accommodate 320 retail staff.

[12] Office workers require on average 15 to 25 m^2 office space; at this ratio, 80 000 m^2 can accommodate 3 200 to 5 300 office workers.

Table 2-28: Significance of increased employment, income and skills development

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	Medium
Essential mitigation measures: • Utilise local labour and contractors as much as possible. • Implement a training programme to upskill local labour.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	Medium

This impact (+ve) can be managed to a *limited* degree, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. In this scenario, it is expected that staff numbers would not change significantly from the current situation.

2.7.3.2 Potential Impact SE4: Increased State and Local Government Revenue

The Riverine Corridor Alternative and the Island Concept Alternative

The River Club development is expected to increase State and local government revenue.

Direct local government (CoCT) revenue derives primarily from property rates and service charges (e.g. for water, electricity, waste removal etc.).

MLC Quantity Surveyors (2017) estimates that annual property rates for the River Club development amount to in the region of R40 million (in 2017 Rand) upon completion of the project, based on the future value of the River Club. These rates would represent ~0.5% of the City's budgeted total revenue from property rates of R8.8 billion in 2017/18. This is significant for a single development. Revenue from property rates accounts for 23% of total budgeted CoCT revenue. The City will also derive revenue from service charges levied on the River Club development.

As the River Club development is expected to result in some increase in surrounding property values, (see Section 2.7.3.6), rates on these properties will also increase local government revenue.

Direct State revenue primarily derives from corporate and personal income taxes.

Direct employment incomes of R200 million per annum (in 2017 Rand) will attract personal income tax on a sliding scale from 18% to 45% (for incomes of more than R75 750 per annum in the 2018 tax year), increasing State revenue. Indirect and induced employment will further increased State revenue.

Revenue from the River Club development will be comparatively more meaningful for local government than the State, as local government budgets are smaller and draw from a smaller base.

Rates and taxes are determined by relevant policies; consequently, there are no recommended mitigation measures to further optimise the benefits of the project.

The impact is assessed to be of ***medium*** (+ve) significance (Table 2-29).

Table 2-29: Significance of increased state and local government revenue

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	Medium
Essential mitigation measures: • None.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	Medium

This impact (+ve) can be managed to a *limited* degree and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. In this scenario, it is expected that current revenue streams to the local government from rates and taxes would not change significantly.

2.7.3.3 Potential Impact SE5: Increase in Centrally Located Housing, Including Inclusionary Housing

The Riverine Corridor Alternative and the Island Concept Alternative

LLPT proposes that 20% of the total floor space (~30 000 m^2) will be allocated for residential use. It is anticipated that the target market will be households earning more than R18 000 per month. However, 20% (6 000 m^2) of residential floor space will be allocated for inclusionary housing. For the purpose of this study, it is assumed that the development will entail at least 600 units of which at least 120 units will be offered below market rental value. If it is assumed that each unit accommodate on average two people, this will provide accommodation for some 1 200 residents.

Demand for centrally located housing has increased in recent years, triggered by a range of factors, including an increase in jobs close to the Central Business District (CBD) and higher traffic volumes into town. The increase in demand for such housing is evidenced by significant appreciation in house prices in areas located in and close to the CBD, and a boom in large-scale inner-city (residential) developments. A study by FNB (cited in moneyweb.co.za) found that Observatory (in the "City Near Eastern Suburbs" sub-region) had the third-highest average year-on-year house price growth in the Cape Town region, trailing the Atlantic Seaboard and the City Bowl.

Average prices in Observatory have increased significantly for houses and apartments (see **Figure 2-3**), despite a large number of new apartments becoming available through new developments.

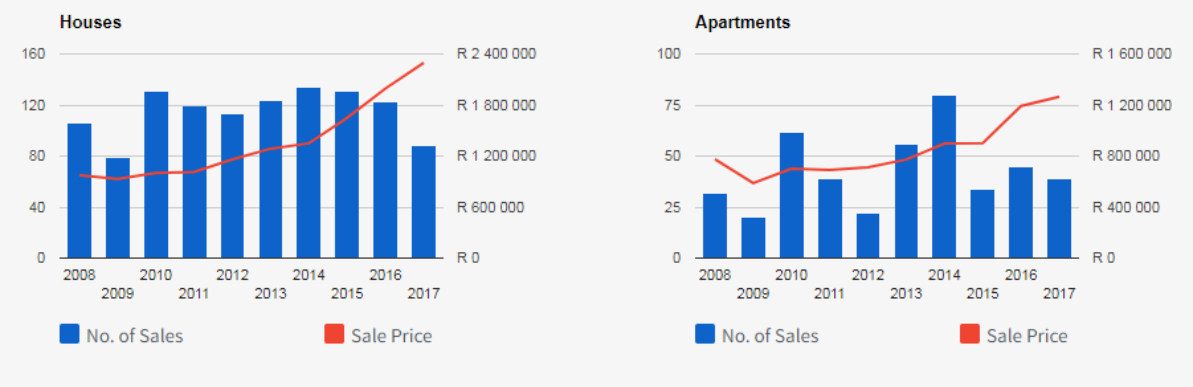


Figure 2-3: Sales trends for Observatory houses and apartments

Source: https://www.property24.com/cape-town/observatory/property-trends/10157

Several apartment blocks have been developed in Observatory in recent years, mainly along Main Road, but also near Black River Park (Figure 2-4). The five main developments recently completed or in development comprise a total of ~766 units[13]. Most of the apartments are aimed at the student market, with a focus on studio, 1-bedroom and 2-bedroom apartments, generally priced above R2 million. The developments form part of a densification strategy and lie within the Cape Town Urban Development Zone (UDZ) identified in 2013 (see Figure 2-4).

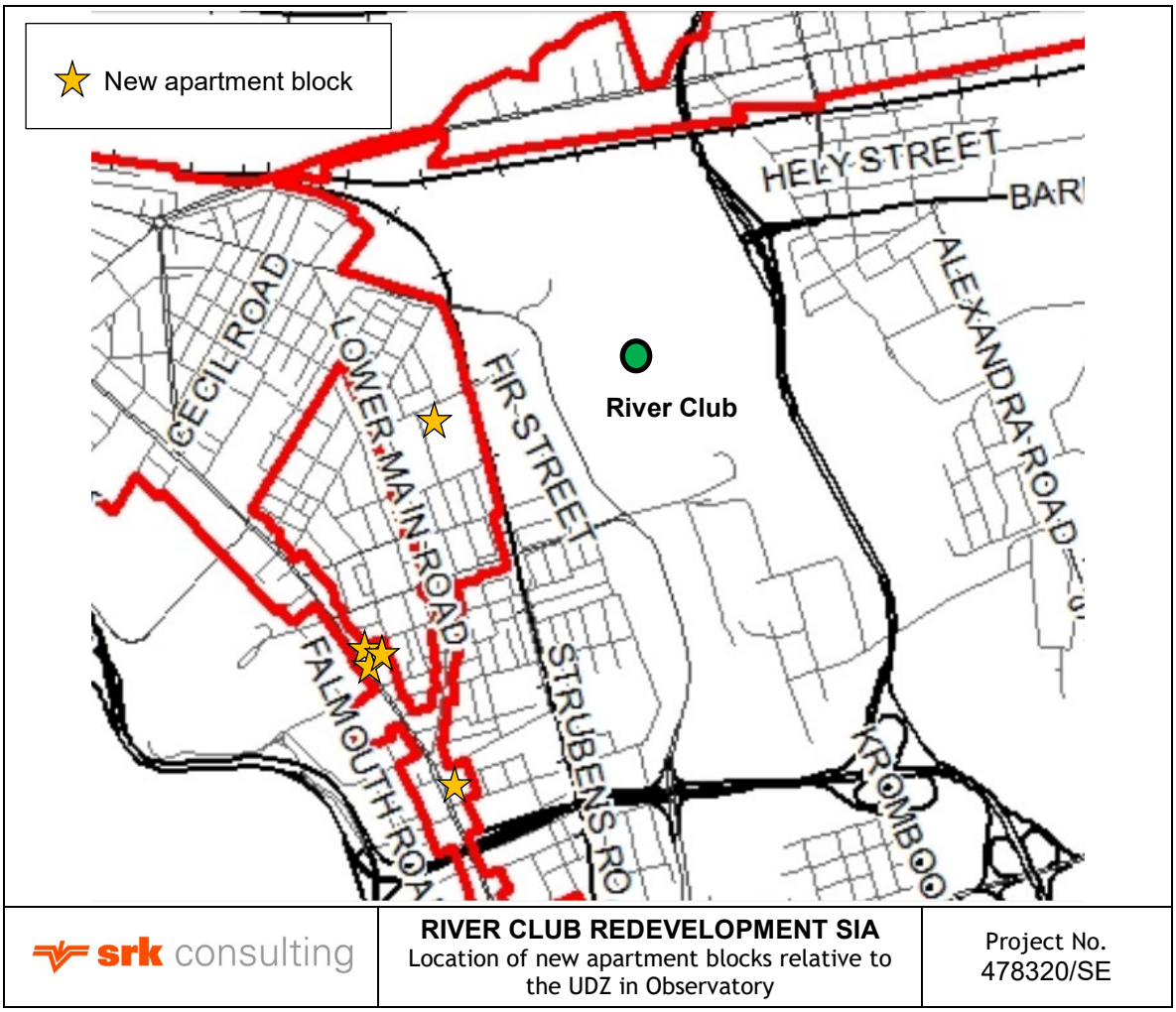


Figure 2-4: Location of new apartment blocks relative to the UDZ in Observatory

Source: various, http://resource.capetown.gov.za/documentcentre/Documents/Maps%20and%20statistics/Central%20CapeTown%20UDZ%20boundaries%20PDF.pdf

The provision of 600 additional units at the River Club thus meets an evident demand for more centrally located housing and is broadly congruent with general residential development trends in Observatory[14]. It would also assist with meeting some of the ever-increasing demand for student housing in the area; students are currently experiencing significant difficulties in securing housing near UCT. The River Club would almost double the number of new residential apartment units in Observatory, significantly adding to housing opportunities available in this sought-after area.

Approximately 6 000 m^2 of total floor space at the River Club will be allocated to inclusionary housing units. Traditionally, "affordable housing" refers to housing with prices or values below the overall

[13] Apartment blocks recently developed or under development in Observatory include The Winchester (105 units), Obscourt (310 units), The Paragon (188 units) The Eden (75 units) and Madison Place (88 units).

[14] It is noted, though, that the River Club falls outside of the UDZ, and thus preferred areas for densification.

open market value, which target below-average incomes. The CoCT recently defined affordable housing to target households with income of R3501 – R18 000 per month (CoCT, 2017).

The CoCT notes that the need for affordable housing in Cape Town (including inclusionary) is significant, and estimates that approximately 650 000 families earning less than R13 000 a month will rely on the State for some kind of housing assistance by 2032 (CoCT, 2017).

Recognising the importance of providing affordable housing in proximity to the city centre, the CoCT has recently identified 11 City-owned sites within 5 km of the CBD for development of ~4 000 affordable housing units. Five sites, accommodating ~half of the envisaged housing units, were made available for private development. Site A is located at Pickwick Road in Observatory (Site A)[15], some 1.5 km from the River Club, and earmarked to accommodate at least 600 social housing units. The Observatory area is thus clearly deemed desirable by the City for affordable housing. None of the other UDZ developments mentioned above includes affordable housing components, and the supply of affordable housing is limited in Observatory, particularly with the increase in general house prices in the area.

The provision of 120 inclusionary housing units at the River Club responds to demand for housing in the area, and is expected to make a meaningful, but relatively small contribution to the provision of affordable housing in the region.

The impact is assessed to be of ***low*** (+ve) significance (Table 2-30).

Table 2-30: Significance of increase in centrally located housing, including inclusionary housing

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	High

This impact (+ve) can not be managed, and is *reversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. No residential units would become available at the River Club. It is likely that densification will continue in Observatory over time, providing additional residential units at other private and possibly public developments.

2.7.3.4 Potential Impact SE6: Densification Facilitating Improved Connectivity, Transport Systems and TRUP Implementation

The Riverine Corridor Alternative and the Island Concept Alternative

Improved Connectivity

At present, the River Club has little connectivity to surrounding areas due to natural and artificial movement barriers, including linear features (M5 motorway, Black River and Liesbeek River canal)

[15] The other four sites are located closer to the CBD, in Woodstock (Site B: 700 units, Site C: 200 units and Site D: 300 units) and Zonnebloom (Site E: 50 units).

and exclusive public land uses (e.g. the SAAO, Valkenberg Hospital and PRASA yard) (see Figure 2-5). Furthermore, as the River Club is privately owned and commercially operated, there is also little connectivity through the River Club site.

As a result, the River Club and surrounding TRUP area effectively isolate areas to the east (Maitland / Pinelands) from those to the west (Observatory). Commuters between those areas have to use either Voortrekker Road to the north or the N2 to the south, located 2 km apart.

The River Club development is expected to catalyse improved linkages in the area through increased population density and demand for various forms of transport, improved security through formalised mixed-use development, landscaping and public presence and large-scale investment in (and commercial cross-subsidisation of) infrastructure and facilities.

As a direct result of the River Club development, public access and movement to and through the site, and integration into the TRUP and the surrounding communities, would be improved (see Figure 2-5) through providing:

- Quality public open spaces along the original course of the Liesbeek River and canal as part of the development[16], facilitating non-motorised transport (NMT) north-south movement along the canal into TRUP areas to the south; and
- A new road linkage through the extension of Berkley Road, facilitating motorised and NMT east-west movement across the Black River and connecting the site to TRUP areas to the east and the surrounding communities.

The River Club development could also catalyse an additional new NMT and public transport link between Station Road and Alexandra Road over the Black River, which was considered as part of the TRUP Draft Concept November 2016[17]; however, as this would not be a direct requirement for / component of the River Club development, the implementation of this link is uncertain at this stage.

Transport Systems

The CoCT has identified the River Club site as an “area-based intervention opportunity” in relation to the Voortrekker Road corridor, and TRUP as a “new development opportunity” within the sphere of influence of the Voortrekker Road corridor (Draft Cape Town MSDF: Technical Supplement F, in Planning Partners, 2017). As such, the site is located in a strategic position for city-wide transport systems.

The increase in demand for various forms of transport from residents, workers and visitors at the River Club, in combination with the improvement in infrastructure connections discussed above, is expected to enable improved private, public and non-motorised transport provision in and beyond the area.

[16] Inspired by Intaka Island at Century City, which transformed from a degraded, inaccessible and inhospitable environment to a thriving mixed-use precinct that has successfully integrated urban development with an ecologically sustainable environment (Planning Partners, 2017).

[17] https://www.westerncape.gov.za/files/161103_3_trup-park_9a_concept_jp_nm_0.pdf

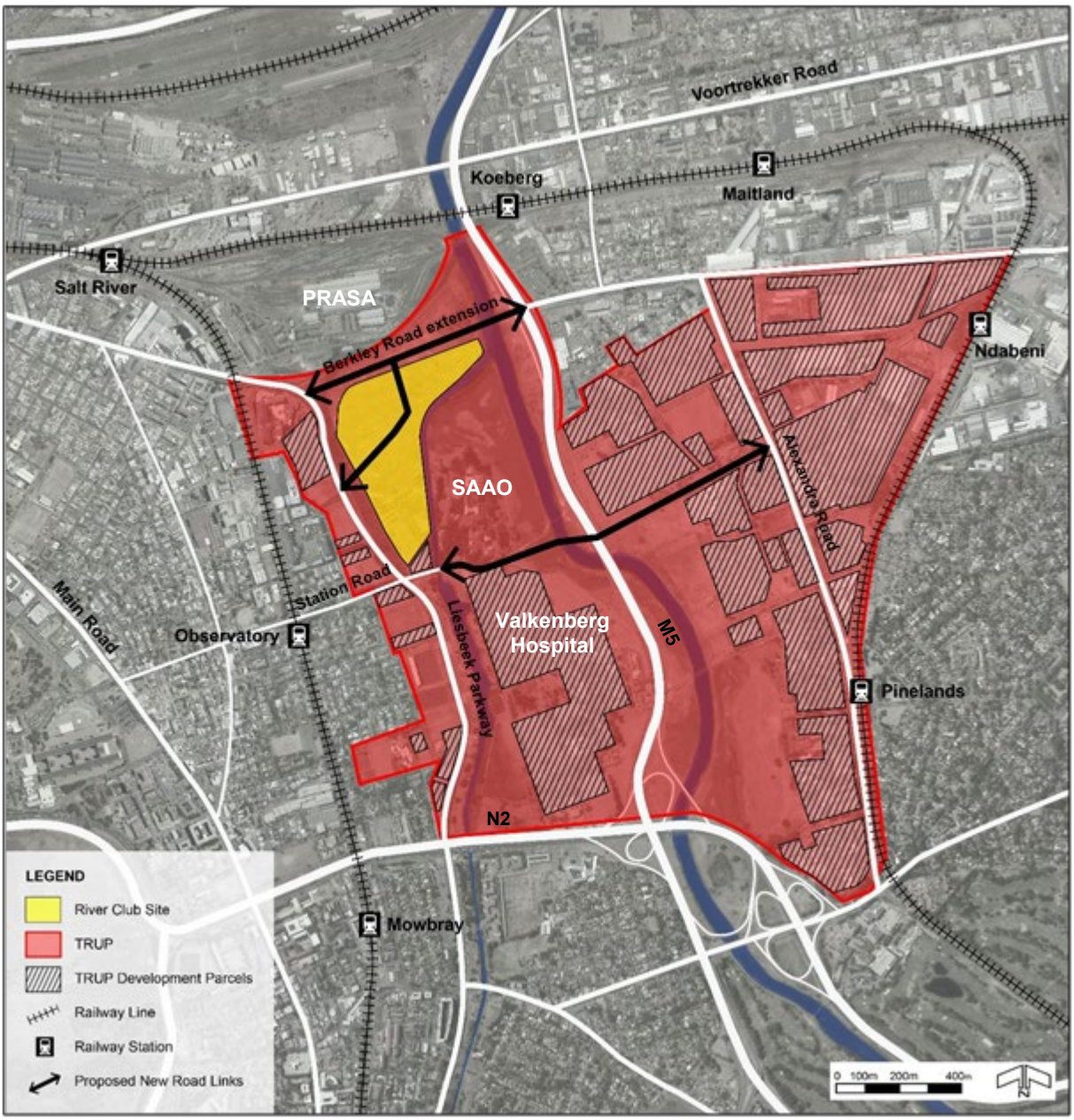


Figure 2-5: Location of the River Club site relative to TRUP and existing road linkages

Source: Planning Partners (2017)

TRUP Implementation

The TRUP is located at the confluence of the Black and Liesbeek Rivers and contains a range of historical and ecological features. The River Club is located in the north-western quadrant of TRUP (see Figure 2-5). Because of its location, environment and history, the CoCT and Western Cape Government (WCG) consider the TRUP area ideal for a mixed-use recreational, residential and commercial development that satisfies a variety of social and ecological needs (WCG, 2017). A key focus is on integrating the city by providing a range of affordable, social and market-related housing as well as recreational opportunities open to all. Approximately 120 ha of the 250 ha TRUP precinct have development potential, and the current vision anticipates that ~20 000 people will eventually live in the area (earthworks, 2017).

While under consideration for more than a decade, progress on the TRUP development has been slow. In recent years the project has again gained some momentum. TRUP was included as a World Design Capital 2014 project, and in January 2016 the CoCT and WCG signed a Memorandum of

Cooperation (MOC) with the Dutch Government to capitalise on its technical expertise for the TRUP Project.

Initial meetings between the River Club and TRUP project teams in 2016 indicate that, while there are differences relating to certain aspects of the TRUP and River Club proposals, the River Club development proposal is largely congruent with the vision of the TRUP project team for the broader site. By demonstrating the feasibility and attractiveness of development in this area, and providing vehicle and NMT movement linkages, successful implementation of the River Club development consistent with the broader TRUP vision, could be the catalyst for the TRUP project. As the largest privately-owned greenfield site in TRUP, the River Club is well positioned to launch the TRUP project.

While the River Club development can enable the opportunities discussed above, delivery will also depend on local and provincial government policies and initiatives (and their implementation), which are not within the mandate of LLPT.

The impact is assessed to be of ***medium*** (+ve) significance (Table 2-31).

Table 2-31: Significance of densification facilitating improved connectivity, transport systems and TRUP implementation

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Possible	**MEDIUM**	+ve	High
Essential mitigation measures: • None.								
With mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Possible	**MEDIUM**	+ve	High

This impact (+ve) can not be managed, and is *reversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so.

The current land-use does not align with the vision for TRUP.

Furthermore, the River Club site would continue to present a physical barrier for NMT systems, and would continue to be a relatively sterile private amenity at a key location within TRUP, and may pose a physical (and financial) impediment to the implementation of TRUP as currently envisaged.

The impact is assessed to be of ***low*** significance (Table 2-32).

Table 2-32: Significance of physical and financial impediments to the implementation of TRUP and the expansion of NMT systems

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The No-Go Alternative								
Without mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Possible	**LOW**	-ve	Medium

This impact cannot be managed, and is *reversible*.

2.7.3.5 Potential Impact SE7: Change in Public Amenity Value of the Site

The Riverine Corridor Alternative and the Island Concept Alternative

The River Club is (currently) a private commercial recreational enterprise comprising a conference and function centre, golf facilities, restaurant and bar. The defining "green" features of the River Club are the driving range and 9-hole "mashie" golf course. Facilities at the club are accessible to the paying public.

As certain rules and restrictions apply to access to the driving range and golf course, the private open space of the River Club serves a specific function and does not allow a range of open space uses (such as walking, running, playing or picnicking) and movement. The private open space at the River Club is thus largely used by golfers.

Loss of the golfing facilities would primarily affect the golfers currently using the site (although even without the proposed redevelopment, the retention of the [private] open space and golfing facilities is not assured).

Approximately 13 ha (including roads and bridges) of the development will be accessible to the public. This equates to 70% of the site. Open space facilities will include high-quality landscaped areas, pathways, lawns, river walks and rehabilitated watercourses (see Footnote 16). Open spaces are primarily located between Precincts 1 and 2, along the Liesbeek canal and Liesbeek Parkway, from where they can be accessed by residents, workers and visitors as well as residents in Observatory and Maitland (via Berkeley Road extension).

The high-quality open space provided by the River Club development will be accessible to a wider public, compared to the current situation. The provision of new high-quality public open space, at the expense of the private open space utilised for golfing, is considered to increase the public amenity value of the site, and represent a net social benefit.

The impact is assessed to be of ***medium*** (+ve) significance (Table 2-33).

Table 2-33: Significance of change in public amenity value of the site

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Probable	**MEDIUM**	+ve	High

This impact (+ve) can not be managed, and is *reversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the operator to do so. In this scenario, access to the private open space will remain largely restricted to golfers utilising the driving range or mashie golf course.

2.7.3.6 Potential Impact SE8: Increase in Property Values in Surrounding Areas

The Riverine Corridor Alternative and the Island Concept Alternative

The potential impact of the River Club development on the value of surrounding properties is multi-faceted and subject to a number of considerations. On the one hand, a perceived reduction in the quality of life and an increase in the supply of housing could reduce property prices. On the other

hand, an increase in the attractiveness of the area through provision of a vibrant urban node and the rehabilitation of watercourses may lead to an increase in investor interest in the area and the value of surrounding properties.

The following factors limit any downside potential of the River Club development on property prices:

- The River Club development is spatially separated from the existing suburbs by major roads and watercourses, and does not directly affect the fabric of the existing neighbouring suburbs;
- The River Club development incorporates residential (and office) units similar to those in other parts within Observatory;
- The demand for housing units in Observatory appears to be robust, as evidenced by the rapid sale of units in recently developed apartment blocks in Observatory, and the additional 600 units are unlikely to saturate the market;
- Transformation of areas within Observatory has been ongoing for some time, e.g. through the construction of several apartment blocks in Observatory, identification of an UDZ in Observatory and designation of a site for affordable housing provision. As these activities are located within, rather than next to, the core residential area of Observatory, it is expected that they will have a more significant influence on property prices (if any) than the River Club development; and
- Property values in Observatory have been rising faster than average City rates for some years, owing to the desirable location near central Cape Town.

The development is therefore unlikely to cause property prices to drop locally.

On balance, the River Club development has the potential to contribute to further increases in surrounding property values, due to the provision of a new node with quality accommodation, office space, facilities, job opportunities and publically accessible open space in a central location. Similar developments in Cape Town (such as Century City, Tyger Valley and the Waterfront precinct) have delivered increases in the value of surrounding properties.

The impact is assessed to be of ***low*** (+ve) significance (Table 2-34).

Table 2-34: Significance of change in property values in surrounding areas

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	Low
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	+ve	Low

This impact (+ve) cannot be managed, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, i.e. the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially viable.

Observatory is expected to further develop and densify in coming years, owing to a demand for centrally located housing and its proximity to UCT, increasing demand for student housing. Depending on the nature of such developments, as well as factors such as economic growth, population growth and governance, property prices are likely to continue increasing in Observatory with sustained and growing demand.

2.7.3.7 Potential Impact SE9: Gentrification in Surrounding Residential Areas

The Riverine Corridor Alternative and the Island Concept Alternative

Gentrification refers to the process of renovation of derelict (inner city) urban neighbourhoods by means of, or resulting in, the influx of more affluent residents, thereby displacing lower-income households / communities and small businesses, unable to afford higher rents and property prices / rates. The low-income former residents often have few means of relocating to nearby areas and are forced to move further away from their places of community, work or schooling, and into less desirable areas.

Areas and communities particularly at risk of and from gentrification are those:

- In well-located but derelict areas, which results in lower property / rental prices compared to surrounding areas;
- With a high proportion of long-term, low-income tenants, who do not benefit from an increase in property values and cannot afford higher rents in their traditional area of residence and community; and
- Where housing stock is owned by few individuals (or public authorities), so that development / renovation, and eviction, can proceed at a faster rate.

The above aspects are mostly not characteristic of Observatory, which is a middle- to high-income suburb, providing opportunities for middle-income households that might have been unable to afford houses in other centrally located but more affluent suburbs: while “quaint”, Observatory cannot be described as derelict. Some 41% of residents in Observatory owned their house in 2011, while 56% rented their dwelling (see Table 2-35), often from individual owners. Rental prices target middle- to high-income households (see Table 2-36) and are on par with those in other centrally located middle- to high-income suburbs. In general, Observatory is at lower risk of gentrification and associated affects than, for example, neighbouring suburbs such as Woodstock, Salt River or Oude Molen.

Table 2-35: Tenure status in Observatory (2011)

Tenure status	Households	% of households
Owned	1 256	41%
Rented	1 728	56%
Other	77	3%
Total	**3 061**	

Source: http://resource.capetown.gov.za/documentcentre/Documents/Maps%20and%20statistics/2011_Census_CT_Suburb_Observatory_Profile.pdf

Table 2-36: Average rental prices in Observatory

Housing type	Average monthly rent	Average bedrooms
Houses	R15 500	3
Apartments	R14 000	2

Source: https://www.privateproperty.co.za/to-rent/western-cape/cape-town/cape-town-city-bowl/observatory/1098

As noted in Section 2.7.3.6, the River Club is expected to contribute (in a fairly moistest extent) to an existing trend of increasing property prices in Observatory by making the area more attractive. This could affect property owners positively, as their property values increase. Increased property prices could also have a negative effect on property owners who cannot afford higher property rates, and tenants who cannot afford higher rents. These will eventually leave the area, leading to some

gentrification. The extent and impacts of gentrification in Observatory are partly mitigated by the fact that middle- to high-income residents have resources that allow them to support some price increases or to relocate elsewhere.

Poorer neighbouring suburbs, such as Woodstock, Salt River or Oude Molen, are at higher risk of gentrification and associated impacts on residents. However, these suburbs are also more distant and detached / isolated from the River Club site. Property and rental prices in these suburbs are more directly influenced by developments and trends within or closer to the suburbs. Nevertheless, over time and in combination with other urban renewal projects in the wider area, the River Club may well contribute to further gentrification in poorer neighbouring suburbs, which would also affect local independent retail stores in Salt River, Woodstock and Maitland.

As noted above, gentrification can have both positive and negative effects; this study adopts a conservative approach by emphasising any adverse effects.

The impact is assessed to be of ***low*** significance (Table 2-37).

Table 2-37: Significance of gentrification in surrounding residential areas

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	-ve	Low
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	-ve	High

This impact (+ve) cannot be managed, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, i.e. the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the developer to do so.

Observatory is expected to further develop and densify in coming years, owing to a demand for centrally located housing, the popularity of the suburb and its location close to UCT facilities, generating high demand for housing from students. Depending on the nature of such developments, the local community fabric may (continue) changing over time.

2.7.3.8 Potential Impact SE10: Change in the Quality of Life

The Riverine Corridor Alternative and the Island Concept Alternative

The River Club is most closely associated with the suburb of Observatory, as other suburbs to the east, north and south are separated from the River Club site by major highways. Historically, Observatory is a residential suburb, particularly popular with students and artists and known for a bohemian character.

At the site scale, the River Club development presents a significant departure from the current sense of place. At the suburban scale, the office and high-density residential components of the River Club development represent a further, though less pronounced, departure from the current predominantly residential nature of Observatory.

Observatory has experienced an increase in high-density residential and commercial development in recent years. This trend has occurred independently of the proposed River Club development,

and includes the establishment of a number of apartment blocks (see Section 2.7.3.3) and business parks in the area.

Apartment blocks are primarily located along Main Road, though the largest block is positioned on the eastern side of Observatory, near the River Club (see **Figure 2-4**). Business Parks established adjacent to the River Club in recent years include the Black River Park (75 000 m^2 floor area) in Observatory and the M5 Business Park and M5 Freeway Park east of the M5 (see Figure 2-6).

Aspects associated with the River Club development, such as higher-density mixed uses including offices, apartments and retail, are thus no longer inconsistent with the characteristics in the wider area, and are aligned with the City's urban development policies. The River Club development proposal has been enabled to some degree by the ongoing densification in the area. The development will, however, represent a larger and more compact departure from the historic character of the area, on a larger site.

The development does not include incompatible activities (such as industrial activities) that would definitely lower quality of life in the area. Rather, the project will increase 'busy-ness' in the area, create a (vibrant) urban node and publically accessible higher-quality open space system.

The net impact of the above elements on quality of life in the area, and whether this is perceived as positive or negative, will depend on personal values and preferences and likely differ for residents in the area. As such, although the River Club is expected to have a positive impact on the perceived quality of life in the area, this impact is not formally rated and is considered to be ***insignificant***.

srk consulting	**RIVER CLUB REDEVELOPMENT SIA** Location of business parks adjacent to the River Club	Project No. 478320/SE

Figure 2-6: Location of business parks adjacent to the River Club

No-Go Alternative

The No-Go Alternative entails no change to the status quo, i.e. the River Club will continue to be operated as a commercial recreation and conference facility, provided it remains financially feasible for the developer to do so. Based on existing trends it is likely that densification will continue in Observatory over time, with a concomitant change in the overall sense of place and quality of life in the area.

2.7.3.9 Potential Impact SE11: Pressure on Service Provision

The Riverine Corridor Alternative and the Island Concept Alternative

The River Club development will attract and concentrate residents, workers and visitors to the area, with an associated increase in the demand for services such as water, electricity, sewage and refuse removal. The prospective ~1 200 residents at the River Club development would increase the population of Observatory by ~12%, while the number of office workers in the area could double (based on the estimated GLA of surrounding business parks).

The CoCT has advised that the present capacity of the electricity transmission infrastructure is inadequate to supply the River Club development. As such, upgrades to the infrastructure will be required and expenses recouped through service charges. This is standard practice for development in urban areas. Expansion of service capacity beyond the requirements of the River Club could facilitate future development (e.g. of TRUP).

Service infrastructure will be expanded prior to completion of the River Club development to accommodate the development (otherwise the development will not be permitted to proceed), in line with good planning practices, and expenses recouped over time. As such, there is no socio-economic impact, and this impact is not formally rated and is considered to be ***insignificant***.

2.7.4 Mitigation Measures: Potential Socio-Economic Impacts

Essential socio-economic mitigation measures during **construction** are as follows

- Procure goods and services from local, provincial or South African suppliers as far as possible, with an emphasis on Black Economic Empowerment (BEE) suppliers where possible.
- Utilise local labour and contractors as much as possible.
- Implement a training programme to upskill local labour.

Essential socio-economic mitigation measures during operations are as follows:

- Utilise local labour as much as possible.
- Implement a training programme to upskill local labour.

2.8 Potential Traffic Impacts

2.8.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Traffic Impact Assessment undertaken by HJ Taljaard and JHB Conradie of Aurecon (see Appendix G1 of the BA Report). The purpose of the study was to assess the potential impacts of the project on the local traffic network, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Determine the sphere of influence of the site from a traffic point of view;
- Obtain background traffic information for the status quo on the adjacent roadway during the Weekday AM and PM peak hours;

- Evaluate the existing traffic operations at the key intersections/roadways during peak hours;
- Determine the trip generation and distribution of the proposed development;
- Consider the objectives and principles contained in the TRUP manifesto (i.e. TRUP approach to public transport and parking) and the River Club's role within TRUP from an access and parking perspective;
- Assess the significance of the potential direct and indirect impacts of the redevelopment on local and regional traffic and the road network;
- Identify and describe potential cumulative traffic impacts resulting from the redevelopment in relation to proposed and existing developments in the surrounding area; and
- Recommend mitigation measures to minimise impacts and enhance benefits associated with the redevelopment.

Aurecon employed EMME/4 transport modelling software and used previous studies relating to the traffic study area and dedicated traffic counts to model background traffic behaviour (with changes to the road network – see below) and to predict traffic conditions with other proposed developments such as the TRUP initiative and the City's future 2032 Pragmatic Densification land use scenario.

The following traffic scenarios were modelled with various network upgrades:

- 2017 traffic levels without development;
- 2022 traffic levels without development (assuming a 3% traffic growth per annum);
- 2017 traffic levels with Precinct 1 of the proposed development;
- 2017 traffic levels with both Precinct 1 and Precinct 2 of the proposed development, excluding other future developments; and
- 2032 traffic levels with the proposed development in conjunction with TRUP and densification of the sub-region.

The following intersections were included in the study as required by the City's Traffic Engineer (see Figure 2-7):

1. Liesbeek Parkway / Settlers Way on-and-off ramps;
2. Liesbeek Parkway / Observatory Road / Station Road;
3. Observatory / Existing access to the River Club;
4. Liesbeek Parkway / Link Road / New access;
5. Liesbeek / Malta / Berkley;
6. Berkley / Potential New Development access;
7. M5 North / Berkley Road Ramp Terminal;
8. M5 South / Berkley Road Ramp Terminal; and
9. Internal Intersection Precinct 1.

Traffic conditions at intersections were assessed by analysing the quality of traffic service by categorizing traffic flow based on performance measure such as delay time. This measure is referred to as Level of Service (LoS). LoS is graded from A to F, with A being the highest (best) LoS, and F being the lowest (see Table 2-38).

Table 2-38: LoS grades

LoS Grade	Definition
A	Free flow
B	Reasonably free flow
C	Stable flow, at or near free flow
D	Approaching unstable flow
E	Unstable flow, operating at capacity
F	Forced or breakdown flow / demand exceeds capacity

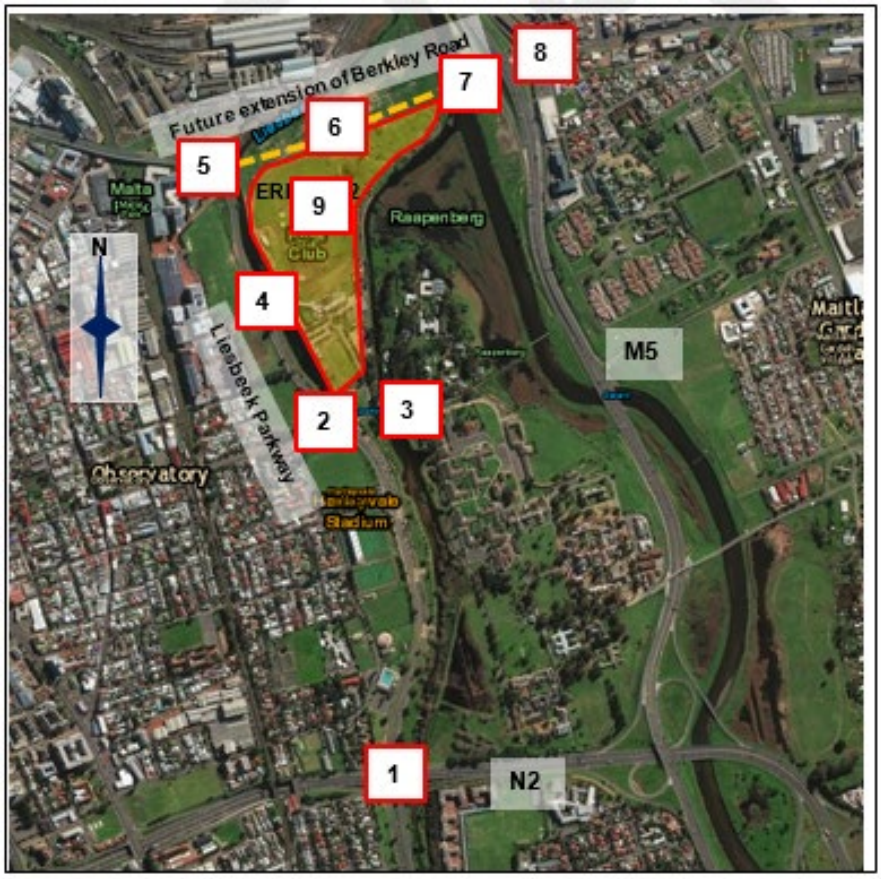


Figure 2-7: Intersections analysed in the TIA

The following road links were included in the study:

- Liesbeek Road: N2 to Station Road;
- Liesbeek Road: Station Road to Link Road;
- Liesbeek Road: Link Road to Malta Road;
- Berkley Road extension: M5 to site access (proposed);
- Berkley Road extension: Site access to Malta Road (proposed);
- Internal road: Berkley Road to Precinct 1 (proposed); and
- Internal road: Precinct 1 to Liesbeek Road (proposed).

Traffic conditions on these links were analysed by Aurecon by assessing their Volume-Demand-to-Capacity Ratio (V/C). The V/C is a measure of the mobility and quality of travel of a section of a road. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). A V/C of less than 1.00 indicates that a roadway is operating within capacity, a V/C of 1.00 indicates

the roadway facility is operating at its capacity (and that congestion is anticipated), and a V/C of more than 1.00 indicates that a roadway is above capacity.

In analysing the LoS at the intersections listed above, and the V/C of road links in the sub-region, the following conclusions were drawn regarding baseline traffic conditions for 2017 and 2022 (i.e. without any further development in the sub-region):

- Liesbeek Parkway south of Station Road (1 lane per direction) currently functions at or above capacity during peak hours (i.e. has a V/C of greater than 1.00 and is congested);
- All other roadways analysed currently operate below capacity at peak hours (i.e. a V/C of less than 1.00);
- M5 North / Berkley Road Ramp Terminal intersection operates at capacity (i.e. a LoS of F) during the PM peak period;
- N2 / Liesbeek Parkway intersection operates at capacity (i.e. a LoS of F) during the AM and PM peak periods; and
- All other intersections analysed operate within capacity (i.e. a LoS of E or better).

In undertaking the Traffic Impact Assessment, Aurecon analysed the a) impacts of the development and future traffic growth assuming that only the upgrades required for the development are implemented, and b) impacts of the development and future traffic growth assuming that the ultimate local road configuration is implemented (at some stage in the future by the CoCT) – see Section 2.8.3.2.

2.8.2 Assessment of Impacts: Construction Phase

Two potential direct construction phase traffic impacts were identified:

- T1: Delays to road users during upgrades to the M5 / Berkley Road and Link Road / Liesbeek Parkway intersections.
- T2: Delays to road users from construction vehicle traffic.

2.8.2.1 Potential Impact T1: Delays to Road Users during Upgrades to Intersections

The Riverine Corridor Alternative and the Island Concept Alternative

Construction will commence with the construction of the Berkley Road extension over the Black River to the site, and the construction of the Link Road extension over the original course of the Liesbeek River to the site. Precinct 1 of the development will commence concurrently with the construction of these bridges. The intersections with these roads and the onramp to the M5 and Liesbeek Parkway respectively will also be upgraded at this time (see Section A4 of the BA Report).

During upgrading of these intersections, significant delays to road users can be anticipated. Construction of each intersection will be completed within one year of the commencement of construction.

The impact is assessed to be of ***low*** significance with and without the implementation of mitigation (Table 2-39).

Table 2-39: Significance of delays to road users during upgrades of intersections

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	High 3	Short-term 1	**Low 5**	Definite	**LOW**	-ve	High
Essential mitigation measures: • Implement appropriate traffic accommodation stages when upgrading the M5 / Berkley Road and Link Road / Liesbeek Parkway intersections.								
With mitigation	Local 1	High 3	Short-term 1	**Low 5**	Definite	**LOW**	-ve	High

This impact can be managed to a *limited* degree, and is *reversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the Liesbeek Parkway and M5 Berkley Road intersection would continue to operate at or above their design capacity.

2.8.2.2 Potential Impact T2: Delays to Road Users from Construction Traffic

The Riverine Corridor Alternative and the Island Concept Alternative

Materials, equipment and construction staff will be delivered to and from the site throughout the seven-year construction period.

Deliveries to and from the site along will be on Liesbeek Parkway until the bridge over the Black River is opened to construction traffic. Sections of this roadway are already congested during peak traffic periods.

A significant proportion of construction traffic will comprise vehicles delivering 260 000 m^3 of fill material to the site over two 8-month periods, requiring approximately 36 truckloads per day using 10 m^3 trucks.

Construction traffic is likely to affect road users in the sub-region significantly throughout the seven-year construction period.

The impact is assessed to be of ***high*** significance and is reduced to ***medium*** with the implementation of mitigation (Table 2-40).

Table 2-40: Significance of delays to road users during upgrades of interchanges

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	High 3	Med-term 2	**High 7**	Definite	**HIGH**	-ve	High
Essential mitigation measures: • Haul materials and equipment outside of peak traffic periods. • Implement appropriate traffic accommodation stages at M5 / Berkley Road and Link Road / Liesbeek Parkway intersections.								
With mitigation	Regional 2	Medium 2	Med-term 2	**Medium 6**	Definite	**MEDIUM**	-ve	High

This impact can be managed to a *limited* degree, and is *reversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and most roadways and intersections would continue to operate at or above their design capacity.

2.8.3 Assessment of Impacts: Operational Phase

Two potential direct operational phase traffic impacts were identified:

- T3: Delays to road users from development related traffic following the partial upgrade of road network (i.e. those upgrades required for the development); and
- T4: Changes to travel times following the full upgrade of the road network.

2.8.3.1 Potential Impact T3: Delays to Road Users from Development Related Traffic

The Riverine Corridor Alternative and the Island Concept Alternative

Aurecon have estimated that Precinct 1 of the River Club development will generate an additional 645 and 1 673 trips during the AM and PM peak traffic periods respectively, and the full development (Precinct 1 and Precinct 2) will generate an additional 2 197 and 2 660 trips during the AM and PM peak traffic periods respectively.

The following road infrastructure / road upgrades will be implemented by the developer (so that the road network surrounding the site can accommodate traffic from both Precinct 1 and Precinct 2 of the development) prior to the commencement of operations in Precinct 1:

- The upgrade of the Berkley Road / M5 intersection;
- The single carriageway extension of Berkley Road into the development;
- The two-lane extension of Link Road over the Liesbeek River into the development;
- The upgrade of the Link Road / Liesbeek Parkway Intersection;
- The dualling of Liesbeek Parkway between Station and Link Road;
- The optimisation of traffic signal phasing; and
- A two-lane road (other than at intersections, where three or four lanes will be required) linking the Berkley Road extension and the Link Road extension through the development (essentially connecting traffic to the east and west of the site).

Without any other road upgrades or traffic calming measures, organic traffic growth, additional trips generated by Precinct 1 and the creation of a thoroughfare through the development would have the following effects on the road network in the sub-region by 2022:

- The vehicle link between the Liesbeek and the M5 through the development would operate at or above capacity from both development and non-development traffic at the start of operations; and
- The (single carriageway) Liesbeek Parkway between the N2 and Station Road will continue to operate at or above capacity but at slightly improved LoS due to Observatory/Salt River destination traffic using the link road through the development instead of via the N2 / Liesbeek parkway south of the development.

However, with the implementation of traffic calming measures on the link road through the development, it is expected that:

- The vehicle link between the Liesbeek and the M5 through the development, and the Berkley Road extension to the development, would operate at capacity;
- The a) Link Road and Liesbeek Parkway, b) Station Road and Liesbeek Parkway, and c) Berkley Road and M5 intersections will operate at an acceptable LoS for both the AM and PM peak periods;

- The Berkley Road and M5 onramp intersection will operate at an acceptable LoS for both the AM and PM peak periods; and
- The (single carriageway) Liesbeek Parkway (south of the Station Road and North of Link Road intersections) will continue to operate at or above capacity but at slightly worse LoS.

Residual effects on road users from traffic generated by Precinct 1 of the development can be summarised as follows:

- Reduced LoS on the already "at capacity" Liesbeek Parkway between Link Road and Malta Road, and between Station Road and the N2, and the extension of AM and PM peak periods.

Noting that the Liesbeek Parkway already operates at capacity, the traffic engineers assess that travel times will not increase significantly despite the extension of peak periods (i.e. roads will remain congested, and significant additional delays are not anticipated). The engineers further note that the upgrade (dualling) of the Liesbeek Parkway is already required due to current traffic conditions / volumes (i.e. the road operates at capacity and is congested).

Furthermore, during off-peak periods, new road infrastructure provided by the development (i.e. the new link between Berkley Road and Liesbeek Parkway) can reduce travel times between the M5 and Observatory by between 20% and 40%.

Additional trips generated by Precinct 2 of the development would have the following effects on the road network in the sub-region by 2022, assuming traffic calming measures on the link road through the development are retained:

- The Link Road / Liesbeek Parkway, Station Road / Liesbeek Parkway and Berkley Road / M5 intersection will operate at an acceptable LoS for both the AM and PM peak periods;
- The Berkley Road extension between the site access point and the M5 offramp will operate at capacity with extended peak periods;
- The development link road between the Liesbeek and the M5 through the development would operate at capacity with extended peak periods; and
- The (single carriageway) Liesbeek Parkway (south of the Station Road and North of Link Road intersections) will continue to operate at or above capacity but at slightly worse LoS.

Residual effects from traffic generated by Precinct 1 and Precinct 2 of the development can be summarised as follows:

- Reduced LoS on the already "at capacity" Liesbeek Parkway between Link Road and Malta Road, and between Station Road and the N2, and the extension of AM and PM peak periods.

Noting that the Liesbeek Parkway already operates at capacity, the traffic engineers assess that travel times will not increase significantly despite the extension of peak periods (i.e. roads will remain congested, and unacceptable additional delays on road users are not anticipated). Aurecon further notes that the upgrade (dualling) of the Liesbeek Parkway is already required due to current traffic conditions / volumes (i.e. the road currently operates at capacity and is congested).

Furthermore, during off-peak periods, new road infrastructure provided by the development (i.e. the new link between Berkley Road and Liesbeek Parkway) can reduce travel times between the M5 and Observatory by between 10% and 40%.

Although some additional delays to road users are anticipated during peak periods (particularly users of Liesbeek Parkway), the proposed development will assist the long term planning (and functioning) of TRUP by providing public access from the west into TRUP from the suburb of Observatory. The development would also provide densification, thereby assisting the CoCT in

meeting population thresholds that support the efficient functioning of an expanded public transport system (as is the intention of the City to promote densification and public transport and to discourage private vehicle use). Congestion may also prompt road users to switch to public transport.

The net impact is assessed to be of ***high*** significance and is reduced to ***medium*** with the implementation of mitigation (Table 2-41).

Table 2-41: Significance of delays to road users from development related traffic following the partial upgrade of road network

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Definite	**HIGH**	-ve	High
Essential mitigation measures: • Optimise signals at the intersection of Station Road and Liesbeek Parkway. • Upgrade the Link Road and Liesbeek Parkway intersection during Phase 1. • Dual Liesbeek Parkway between the Link Road and Station Road intersections during Phase 1. • Upgrade the M5 and Berkley Road intersection during Phase 1. • Implement traffic calming measures on the link road through the development. • Upgrade the intersection at the main entrance to the development on Berkley Road during Phase 3 (or in earnest during the initial phase of construction). • Provide a high quality non-motorised transport network. • Facilitate public transport routes through the development. • Provide taxi drop-off points. • Provide Uber bays.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	High

This impact cannot be managed, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the Liesbeek Parkway and M5 Berkley Road intersection would continue to operate at or above their design capacity.

2.8.3.2 Potential Impact T4: Changes to Travel Times following the Full Upgrade of the Road Network

The Riverine Corridor Alternative and the Island Concept Alternative

In assessing the current capacity of the road network in relation to existing demand, additional traffic from the development and future traffic growth, Aurecon have assessed that the following infrastructure upgrades and interventions, are already, or will be required at some point in the future, regardless of whether the development of the River Club proceeds or not:

- The dualling of the Liesbeek Parkway between the N2 and Malta Road;
- The four lane extension of Berkley Road between the M5 and Malta Road;
- The upgrade of the intersection between the Liesbeek Parkway and the N2; and
- The consideration (and selected implementation) of significant additional public transport services.

These upgrades and the implementation of public transport services are already required given current demand, or will be required in the future from generic demand growth, and are therefore the responsibility of the CoCT for implementation.

The CoCT has requested that the LLPT apply for the necessary environmental approvals to implement these upgrades as part of the environmental application (BA) process for the redevelopment of the River Club. The CoCT will be financially responsible for the implementation of at some point in the future. Aspects of the long-term road upgrades that require environmental approval include the following:

- The dualling of the Liesbeek Parkway between the N2 and Malta Road into the original course of the Liesbeek River;
- The widening of the Berkley Road Bridge over the Black River; and
- The construction of a four-lane crossing of the extended Berkley Road over the Liesbeek River.

Assuming:

- Generic demand growth (including additional traffic from the development), and that the CoCT are successful in implementing and promoting sufficient public transport services;
- The above upgrades are implemented (at some stage in the future by the CoCT);
- The intersection of the N2 and Liesbeek Parkway is upgraded; and
- The intersection between Station Road and Liesbeek Parkway is upgraded.

Aurecon anticipate the following changes in the road network functionality in the future:

- The LoS at the following intersections intersection will be improved;
    - N2 and Liesbeek Parkway; and
    - M5 and Berkley Road;
- The LoS at the following intersections will reduce, but will remain within capacity;
    - Link Road and Liesbeek Parkway; and
    - Station Road and Liesbeek Parkway;
- Liesbeek Parkway will operate within capacity; and
- The Berkley Road extension will operate at capacity (will be in high demand immediately).

These upgrades will reduce travel times between the M5 and Observatory, and on Liesbeek Parkway, and the Berkley Road extension forms part of the CoCT's traffic master planning for the sub-region which will improve access to the Central Business District from the east, and is anticipated to be of significant benefit to road users (and City functioning).

As the upgrades described in this section are not required for the development, they will only be implemented at some time in the future when finances become available to the CoCT (for example, from development contributions from other developments in the area). The probability of this impact (benefit) occurring in the foreseeable future is assessed to be low.

The impact (benefit) is assessed to be of ***medium*** (+'ve) significance and no further mitigation is possible (Table 2-42).

Table 2-42: Significance of changes to travel times following the full upgrade of the road network

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Possible	**MEDIUM**	+ve	High
Essential mitigation measures: • No further mitigation is required.								
With mitigation	Regional 2	Medium 2	Long-term 3	**High 7**	Possible	**MEDIUM**	+ve	High

This impact cannot be managed, and is *irreversible*.

No-Go Alternative

The No-Go Alternative entails no change to the status quo, and the Liesbeek Parkway and M5 Berkley Road intersection would continue to operate at or above their design capacity. It is anticipated that the CoCT will, in their own capacity, apply for the necessary environmental approvals to widen the Liesbeek Parkway and extend Berkley Road over the site at some point in the future.

2.8.4 Mitigation Measures: Traffic Impacts

Essential traffic mitigation measures during **design** are as follows:

- Optimise signals at the intersection of Station Road and Liesbeek Parkway.
- Upgrade the Link Road and Liesbeek Parkway intersection during Phase 1.
- Dual Liesbeek Parkway between the Link Road and Station Road intersections during Phase 1.
- Upgrade the M5 and Berkley Road intersection during Phase 1.
- Implement traffic calming measures on the link road through the development.
- Upgrade the intersection at the main entrance to the development on Berkley Road during Phase 3 (or in earnest during the initial phase of construction).
- Provide a high quality non-motorised transport network.
- Facilitate public transport routes through the development.
- Provide taxi drop-off points.
- Provide Uber bays.

Essential traffic mitigation measures during **construction** are as follows:

- Haul materials and equipment outside of peak traffic periods.
- Implement appropriate traffic accommodation stages at M5 / Berkley Road and Link Road / Liesbeek Parkway intersections.

2.9 Potential Heritage Impacts

2.9.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Heritage Impact Assessment undertaken by Timothy JG Hart (archaeologist) and Stephen Townsend (architect, statutory planner and conservationist) (see

Appendix G5 of the BA Report). The purpose of the study was to assess the potential impacts of the project on heritage resources, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Provide a historical overview of the site in its broader regional context;
- Identify and analyse the heritage resources on the site and place this in a regional context, including a more detailed assessment of any specific points of interest or/and relevance (heritage resources include structures, visual attributes, landscape features and archaeological features;
- Formulate statements of heritage significance at site and precinct scale in addition to the context in terms of the heritage criteria;
- Outline heritage design indicators which should inform the development proposals;
- Rate the heritage impacts (direct, indirect, cumulative) based on a professional opinion and the prescribed EIA methodology; and
- Provide environmental management and monitoring measures to be included in the EMPr.

The assessment is based on the review of existing information, derived though a literature search and various site assessments.

During the course the assessment, the proposed development footprint and layout of both development alternatives have undergone a number of changes, largely from extensive, iterative feedback into the project by heritage specialists and other members of the design team.

To some extent, then, the development alternatives considered in the study already include a substantial level of mitigation, and the significance of the impacts considered in this section reflect this (where they are not specific to either viable alternative). Implementation of key heritage indicators and aspects of the design (as articulated in the Urban Design Framework that forms part of the HIA) is therefore essential (refer to Section H (c) of the BA Report).

Furthermore, the HIA is compiled with the key assumption that the Berkley Road extension across the River Club Island will be undertaken in the foreseeable future regardless of the development of the River Club (and therefore form part of the baseline heritage landscape from which heritage impacts are assessed).

2.9.2 Assessment of Impacts: Construction Phase

Two potential direct construction phase impacts on heritage resources were identified:

- H1: Loss or damage to palaeontological and archaeological resources.
- H2: Loss of structures on the site with heritage value.

2.9.2.1 Potential Impact H1: Loss or Damage to Palaeontological or Archaeological Resources

While the entire Liesbeek River valley has not been surveyed for archaeological material, many parts of the Observatory section have been examined. The River Cub itself was previously surveyed by the ACO, who have also observed excavations for new structures on the neighbouring SAAO site. Furthermore, comprehensive trial excavations have taken place at Valkenberg and at the Varsche River, and excavations for renovation of the Hospital were monitored.

The archaeological material that has been found during these excavations relates entirely to the VOC period and thereafter.

Despite the major works near the site (including canalisation of the river), no graves or human remains have been reported or are lodged according to the skeleton register at either Iziko Museum or the UCT medical school which have been the official repositories of such finds since both institutions were established. The nearest recorded of remains of pre-colonial people and archaeological sites are from close to the Salt River estuary in Milnerton.

Khoikhoi people burial methods are described and are archaeologically well documented. Therefore, if the site and surrounding area were once used as a burial ground it is extremely likely that remains would have already been discovered during previous excavations in the area.

Furthermore, the site has undergone extensive surface disturbances (e.g. it has been infilled).

It is therefore very unlikely that any significant archaeological or palaeontological resources will be uncovered during construction. It is however possible, although still unlikely, that during excavation of the western wall of the Liesbeek Canal (Riverine Concept Alternative only) and foundations of the Berkley Road bridge archaeological or palaeontological resources may be uncovered – but the discovery of human remains is extremely unlikely. **The Riverine Corridor Alternative**

The impact is assessed to be of ***very low*** significance with and without the implementation of mitigation (Table 2-4).

Table 2-43: Significance of loss or damage to palaeontological or archaeological resources

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	-ve	High
Essential mitigation measures: • Implement monitoring and chance-find procedures for archaeological and palaeontological material during excavations of the western bank of the Liesbeek Canal as it fronts the site (as specified in the EMPr).								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Improbable	**VERY LOW**	-ve	High

This impact can be managed to a *high* degree, and is *irreversible*.

The Island Concept Alternative

The impact is assessed to be **insignificant** and no mitigation is necessary (Table 2-5).

Table 2-44: Significance of loss or damage to palaeontological or archaeological resources

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Island Concept Alternative								
Without mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	High
	N/A	N/A	N/A	**N/A**				
Essential mitigation measures: • No mitigation is necessary.								
With mitigation	N/A	N/A	N/A	**N/A**	N/A	**INSIGNIFICANT**	-ve	High
	N/A	N/A	N/A	**N/A**				

This impact does not require management, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, excavation of the western bank of the Liesbeek Canal would not take place, and low probability, low intensity impacts associated with the loss of or damage to palaeontological and archaeological artefacts would not arise.

2.9.2.2 Potential Impact H2: Loss of Structures at the Site with Potential Heritage Value

The Riverine Corridor Alternative and the Island Concept Alternative

Although the main River Club building and approach to it play an important part in the overall setting of the site, it has been added to and changed considerably, and is of low heritage significance.

Buildings at the site are assigned Heritage Grade IIIC – buildings and/or sites whose significance contributes to the character or significance of the environs that should only be protected if the significance of the environs is sufficient to warrant protective measures. The heritage consultants do not believe that the site, or buildings at the site, warrant protective measures.

The impact is assessed to be of ***low*** significance with and without the implementation of mitigation (Table 2-2).

Table 2-45: Significance of loss of structures at the site with heritage significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Definite	**LOW**	-ve	High
Essential mitigation measures: • Photograph all structures on site for archive creation.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Definite	**LOW**	-ve	High

This impact cannot be managed, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and buildings at the site will be retained.

2.9.3 Assessment of Impacts: Operational Phase

Two potential direct operational phase impacts on heritage resources were identified:

- H3: Change in historical character of the site.
- H4: Change in heritage value Liesbeek River floodplain at the site.
- H5: Changes in historical setting of the SAAO.

2.9.3.1 Potential Impact H3: Change in Historical Character of the Site

Topographically, the current sense of place at and along the section of the Liesbeek River at the site is that of a wide flat floodplain, greatly transformed by the frequent changes in land-use. Wetlands have been transformed to farmland, then to various institutional uses and to modern suburbia. Nevertheless, the floodplain, Liesbeek and Black Rivers, their confluence and the remnants of the Salt River estuary still exist today.

Locally the floodplain between the spine to the east of the site (the SAAO) and the foot-slopes of Devils Peak can be divided into three parallel strips:

- To the far west (of the site), a strip of sports fields interrupted by roadways, major sports facilities/structures, avenues of trees and vehicular bridges;

- The wide Liesbeek Parkway running through the middle of the floodplain; and
- The Liesbeek River floodplain that widens and splits into a (now defunct) natural channel, and an artificial canalised reach to create the River Club site.

The Riverine Corridor Alternative and the Island Concept Alternative

The Liesbeek River was a partially fortified early frontier, and an important pre-colonial river crossing (the Vaarsche Drift) was located close to or at the site. The confluence with the Black River is thought to be the site of early confrontations that signalled the eventual fragmentation of the Khoekhoe nation. The floodplain was also a key site in early farming. The site and its immediate context is therefore historically significant.

Although no tangible remnants of the actual places of conflict, forts, outposts or graves survive, the Liesbeek River and floodplain are of ecological importance, and the topography of the area remains. People, including First Peoples groups, experience cultural value from the character, ecology, history, and awareness of the historical import of the floodplain and Liesbeek River.

The site, although transformed, is one of the last open remnants of the floodplain. The character of the site will be transformed by the development. This transformation is seen by the heritage consultants in the context of the already significantly transformed floodplain, the degraded nature of the site, and the future development of the Berkley Road extension, which will radically affect the reading and character of the site regardless of the proposed development[18]. The intensity of the impact on the historical character of the site is therefore considered to be low.

The impact is assessed to be of ***low*** significance with or without the implementation of mitigation (Table 2-45)[19].

Table 2-46: Significance of change in historical character of the site

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Definite	**LOW**	-ve	High
Essential mitigation measures: • Commemorate or memorialise the Vaarsche Drift. • Educate tenants and the public accessing the site of the historical significance of the surrounding area (e.g. by erecting information boards at various locations at the site).								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Definite	**LOW**	-ve	High

This impact cannot be managed and is *irreversible*.

No-Go Alternative

[18] Berkley Road extension was originally indicated as a Proclaimed Main Road (MR149), in terms of the Roads Ordinance 1949 (Ordinance 12 of 1949), in Provincial Gazette 385 of 1968 (i.e. item 27 in an extract of the Provincial Gazette). The Berkley Road extension has since appeared on the CoCT's Road Network Plan on numerous occasions, including that adopted in 1997, as well as the latest version published in the Comprehensive Integrated Transport Plan (CITP) 2018 – 2023.

[19] SRK has assessed the visual impact of the change of sense of place to be of medium significance following mitigation. The heritage specialists have assessed the change of sense of place to be of "medium to high" significance, and conclude that there will be a "low" significance impact on the historical character, and an overall net positive heritage impact on the character of the site following the restoration of the Liesbeek River floodplain (following rehabilitation of the Liesbeek Canal).

In the case of the No-Go Alternative, the rehabilitation of the canalised portion of the Liesbeek River would not take place, and the heritage value of the site would not be affected.

2.9.3.2 Potential Impact H4: Change in Heritage Value of the Liesbeek River Floodplain at the Site

South of the site, the Liesbeek River floodplain is relatively narrow, but has both ecological value and public amenity value as a more natural and publicly accessible corridor. Immediately south of the site the river has been diverted into an ecologically sterile canalised reach that flows to the east of the site. The public movement corridor along the river also terminates here. The artificial channel merges with the Black River immediately northeast of the site. The original course of the river is located to the west of the site, was infilled (~1952), dredged (~1990), and is now fed by backwaters of the Black River and stormwater, and is ecologically degraded. The site forms an artificial island between the old and new reaches of the Liesbeek River in a transformed landscape.

The Riverine Corridor Alternative

By rehabilitating the canalised reach of the Liesbeek River to the east of the site, providing an ecologically viable floodplain, and extending the public movement corridor along the river through the site, the riverine corridor as a historical, topographical and ecological determinant of the current urban townscape is extended and reinforced. Furthermore, the public amenity derived from the river is enhanced.

Although the sense of place of the site will be transformed (see Section 2.9.3.1 and Section 2.10.3.1), by extending the riverine corridor to the south of the site the heritage value of the site (and corridor itself) will be enhanced in a number of ways:

- The historical significance of the river would be restored by defining and enhancing it's (albeit "new") course;
- The ecological functioning of the river would be improved; and
- The public amenity value of the river course would be extended and enhanced, and the public would be exposed to the SAAO.

The impact is assessed to be of ***medium*** (+ve) significance and no further mitigation is necessary (Table 2-46).

Table 2-47: Significance of change to heritage value of the Liesbeek River floodplain at the site

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	+ve	High
Essential mitigation measures: • No further mitigation is necessary.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	+ve	High

This impact (+ve) cannot be managed and is *irreversible*.

The Island Concept Alternative

For the Island Concept Alternative the ecological and cultural benefits of defining and enhancing the Liesbeek River Corridor will be foregone.

The impact (+ve) is therefore assessed to be ***not significant***.

No-Go Alternative

In the case of the No-Go Alternative, the rehabilitation of the canalised portion of the Liesbeek River would not take place, and the heritage value of the riverine corridor would not be enhanced (Riverine Corridor Alternative only).

2.9.3.3 Potential Impact H5: Change in Historical Setting of the SAAO

The most significant heritage resource close to the site is the SAAO, which has Grade I heritage status due to its scientific history. The core historic structure at the SAAO (built 1822) is centrally situated on the site, and is surrounded by a number of structures of ages ranging from 19th century staff buildings, telescope domes, to late 20th century structures.

The SAAO was built on this raised spine of land (east of the site) so that it could visually signal midday to the Castle of Good Hope (where the 12 O'clock signal gun was located before 1900) and Table Bay where mariners could observe the fall of the time ball in order to set their chronometers. After 1900 when the signal gun was relocated to Signal Hill, this view-line also became functionally important. Views from the SAAO to the Castle and Table Bay, which were central to the functioning of the Observatory, are now obscured by development. Signal Hill remains visible from certain vantage points at the SAAO, though have not been of any functional importance to the operation of the SAAO since the beginning of the 20th century. The line of sight between the SAAO and Signal Hill is therefore of no current functional value, although it is historically interesting.

Although the SAAO's heritage significance derives mainly from its scientific history, and most structures at the SAAO are obscured from the River Club by trees (the best views of the SAAO complex are from across the Black River further to the east) the boundary of the SAAO with the site, as well the historic landscape within which the SAAO is located, is considered to be sensitive to development.

The Riverine Corridor Alternative

The setback of the development from the SAAO boundary was one of the key informants of the alternative evolution of the Riverine Corridor Alternative. This alternative mitigates impacts on the SAAO as far as practically possible by stepping back development by~40m from the existing canal and rehabilitating (and therefore softening) the river course, while ensuring the financial viability of the development (i.e. developing the minimum amount of floor area, or bulk required). Nevertheless, substantial development at the River Club site will detract from the historic landscape of this site.

In the long-term, the activation of the western bank of the Liesbeek canal and the creation of the movement corridor here may create opportunities for the SAAO to further rehabilitate the river course and the public at the River Club Development, with the potential to celebrate the heritage of this historically significant complex.

Although the heritage specialists assess a positive impact on the historical setting of the SAAO due to the activation and rehabilitation of the Liesbeek Canal, SRK has conservatively assessed that the development may, on balance, lead to a low intensity negative impact on the SAAO. Therefore, as the site is of national heritage significance the impact is assessed here to be of ***high*** (negative) significance (Table 2-47)[20].

[20] The floor of "Building 3" at the SAAO (which has heritage value) would be inundated about once in 5 years to a depth of about 27 cm (about 12 cm deeper than the current depth of flooding). This will not affect the flood hazard rating at the SAAO, but the increased depth of flooding during 1:5 year return flood events may increase the costs of occasional flood repairs. This is not considered to be a heritage impact.

Table 2-48: Significance of change in historical setting of the SAAO

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	National 3	Low 1	Long-term 3	**High 7**	Probable	**HIGH**	-ve	High
Essential mitigation measures: • Encourage integration of the future development with the SAAO and facilitate opportunities to commemorate this historic facility.								
With mitigation	National 3	Low 1	Long-term 3	**High 7**	Probable	**HIGH**	-ve	High

This impact cannot be managed and is *irreversible*.

The Island Concept Alternative

This alternative allows for the rehabilitation of the eastern bank of the original course of the Liesbeek River, which has inherent, although much diminished, ecological value. In order to setback from this boundary and to remain financially viable, the River Club development would encroach on and dominate the SAAO to a far greater extent than is the case for the Riverine Corridor Alternative. Furthermore, the comprehensive rehabilitation of the river corridor on the SAAO boundary would not take place, and this would largely forgo possible future integration between these two sites.

Although the heritage specialists assess that the intensity of the impact on the historical setting of the SAAO is medium, as the site is of national heritage significance the impact is assessed to be of ***very high*** significance (Table 2-47).

Table 2-49: Significance of change in historical setting of the SAAO

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The Riverine Corridor Alternative								
Without mitigation	National 3	Medium 2	Long-term 3	**Very High 8**	Probable	**VERY HIGH**	-ve	High
Essential mitigation measures: • No further mitigation is possible.								
With mitigation	National 3	Medium 2	Long-term 3	**Very High 8**	Probable	**VERY HIGH**	-ve	High

This impact cannot be managed, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, further transformation of the historic landscape of the SAAO would not take place, but activation of the river edge on the boundary of the SAAO, and opportunities for integration staff and public at the River Club development would be foregone.

The impact is assessed to be of ***very low*** significance (Table 2-47).

Table 2-50: Significance of change to historical setting of the SAAO

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
The No-Go Alternative								
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Possible	**VERY LOW**	-ve	Medium

This impact cannot be managed, and is *reversible*.

2.9.4 Mitigation Measures: Potential Heritage Impacts

Essential heritage mitigation measures during **design** are as follows[21]:

- Commemorate or memorialise the Vaarsche Drift.

Essential heritage mitigation measures during **construction** are as follows

- Photograph all structures on site for archive creation.
- Implement monitoring and chance-find procedures for archaeological and palaeontological material during excavations of the western bank of the Liesbeek Canal as it fronts the site (as specified in the EMPr).
- Educate tenants and the public accessing the site of the historical significance of the surrounding area (e.g. by erecting information boards at various locations at the site).
- Encourage integration of the future development with the SAAO and facilitate opportunities to commemorate this historic facility.

2.10 Potential Visual Impacts

2.10.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Visual Impact Assessment undertaken by Scott Masson of SRK (see Appendix G6 of the BA Report). The purpose of the study was to assess the potential impacts of the project on visual resources, and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Collect and review required data, including data on topography, vegetation cover, land-use, and other background information;
- Conduct fieldwork, including an extensive reconnaissance of the study area, particularly the proposed development site and affected viewpoints;
- Undertake visual ‘sampling’ using photography from viewpoints within approximately 2km of the site to illustrate the likely zone of influence and visibility;
- Undertake a mapping exercise to define the visual character of the study area and identify sensitive areas;
- Determine the zone of influence;
- Determine the likely distance at which visual impacts will become indistinguishable from key viewpoints;
- Rate the impacts (direct, indirect, cumulative) on the visual environment and sense of place based on a professional opinion and the prescribed EIA methodology;
- Identify and recommend mitigation measures for the reduction of the significance of negative visual impacts; and
- Provide environmental management and monitoring measures to be included in the EMPr.

[21] This mitigation measure is in addition to project design elements that already form part of the project description. These design elements are listed in Section H (c) of the BA Report.

The assessment is based on the review of existing information, derived though a literature search and various site assessments.

During the course of the assessment, the proposed development footprint and layout of both development alternatives have undergone a number of changes, largely from extensive, iterative feedback into the project by members of the design team, including the visual specialist.

The development alternatives considered in the study already include a substantial level of mitigation, and the significance of the impacts considered in this section reflect this. Implementation of aspects of the design (as listed in the VIA) is therefore essential (refer to Section H (c) of the BA Report).

2.10.2 Assessment of Impacts: Construction Phase

One potential direct construction phase impacts on visual resources was identified:

- V1: Altered sense of place.

2.10.2.1 Potential Impact V1: Altered Sense of Place

The Riverine Corridor Alternative and the Island Concept Alternative

Visual impacts will be generated by construction activities such as vegetation stripping and earthworks (which can cause scarring), and from construction infrastructure, plant and materials on site (e.g. site camp, cranes and stockpiles). The high number of trucks transporting fill material and other construction material to the site will also contribute to an altered sense of place (increased visual clutter, noise). Dust generated at the site will be visually unappealing and may further detract from the visual quality of the area.

Such impacts are typically limited to the immediate area surrounding the construction site and the construction period.

Loss of sense of place is expected during construction, especially in the foreground i.e. closer to Liesbeek Parkway and the M5, since construction and the change in the state of the site (scarring, construction equipment, construction traffic and dust generation) is incongruent with the current nature of the site *viz*. green open space and use of the site *viz.* recreation.

Construction will be undertaken in phases, commencing from the south of the site and advancing north. Construction activities will reduce the sense of place over the medium-term due to the duration of construction activities.

The impact is assessed to be of ***low*** significance with and without the implementation of mitigation (Table 2-2).

Table 2-51: Significance of altered sense of place

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Med-term 2	**Low** **5**	Definite	**LOW**	-ve	High
Essential mitigation measures: • Limit and phase vegetation clearance and the footprint of construction activities to what is absolutely essential. • Consolidate the footprint of the construction camp(s) to a functional minimum. Screen the construction site camp with materials that blend into the surrounding area.								
With mitigation	Local 1	Medium 2	Med-term 2	**Low** **5**	Definite	**LOW**	-ve	High

This impact can be managed to a *limited* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no visual impacts are anticipated.

2.10.3 Assessment of Impacts: Operational Phase

Three potential direct operational phase impacts on visual resources were identified:

- V2: Altered sense of place caused by the change in character of the site.
- V3: Visual intrusion.
- V4: Altered sense of place and visual quality caused by light pollution at night.

2.10.3.1 Potential Impact V2: Altered Sense of Place caused by the Change in Character of the Site

The Riverine Corridor Alternative and the Island Concept Alternative

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Tourism can sometimes serve as an indicator of sense of place insofar as it is often the uniqueness (and accessibility) of a space/place which attracts tourists.

It is often the case that sense of place is linked directly to visual quality and that areas/spaces with high visual quality have a strong sense of place. However, this is not an inviolate relationship and it is plausible that areas of low visual quality may have a strong sense of place.

The site itself does not necessarily have an immediately recognisable sense of place although the River Club building is a distinguishable landmark on the site.

The sense of place of the study area is strongly influenced by the rivers, and an “island” of green open space in a highly developed and evolving urban environment[22] of mixed land use.

The dramatic views of Devils Peak and its dominant east-facing ridgeline also add to the sense of place of the study area.

The relationship of receptors in the study area to place is likely to be predominantly cognitive or narrative. For example, receptors in the area may have chosen to live or locate their business in the study area because they were enticed by the green open space or scenic characteristics of the area (rivers, mountain views, Raapenberg Sanctuary, Observatory hill) within a wholly transformed urban environment. Or, a person visiting the area may have a narrative connection to the area through the cultural/historic aspects of the landscape. Although these aspects are mostly intangible, the visitors may have learned of their significance through historical accounts or stories (e.g. the history of the Khoikhoi nation, or the Observatory).

It is plausible that many receptors may consider the study area to have a “negative” sense of place (e.g. receptors experience a sense of discomfort in a harsh, windy environment). However, for the purposes of this assessment and taking the precautionary principle into account, it is assumed that the study area has an overall “positive” sense of place to receptors, and that receptors derive significant value from the site as an open space area.

The development will change the character of the site to a highly developed site, with pockets of open space. Although the site is surrounded by urban development, due to its size, location at the confluence of the Liesbeek River and Black River, and long-term status as a green open space, the

[22] For instance, the Black River Park (developed between 2003 and 2006) was a departure from the predominantly residential nature of Observatory.

change in character may be experienced as a strong visual contrast for surrounding (urban) receptors and frequent visitors to the area.

The impact is assessed to be of ***high*** significance and with the implementation of mitigation is reduced to ***medium*** (Table 2-51).

Table 2-52: Significance of altered sense of place

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	High 3	Long-term 3	**High 7**	Definite	**HIGH**	-ve	High
Essential mitigation measures: • Retain visual links to the Black River by reducing visual clutter. • Use large trees and vegetated berms to reduce the scale of buildings. • Utilise (westerly) views towards Devils Peak in building orientation. • Express each building unit individually where buildings are linked together (with architectural details – insets, overhangs, range of visually compatible materials). • Arrange above-ground parking bays (if required) in small groups rather than in large, unbroken lots.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	High

This impact cannot be managed, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no visual impacts are anticipated.

2.10.3.2 Potential Impact V3: Visual Intrusion

The Riverine Corridor Alternative and the Island Concept Alternative

Structures at the site will be visually intrusive and in some cases obtrude receptors' views of visual resources from surrounding vantage points. Visual resources are features which are aesthetically pleasing and enhance the visual landscape of an area. Visual resources also provide visual / scenic value to receptors.

The following visual resources have been identified for the site and surrounds:

- Liesbeek River, the Black/Salt River, and the banks of these rivers;
- Raapenberg Bird Sanctuary;
- Observatory hill and the Observatory complex;
- Alexandra Mill;
- Existing (large) trees, albeit exotic; and
- Devils Peak.

Views of Devils Peak from the M5 freeway and immediately adjacent vantage points (e.g. M5 Park and Alexandra Institute) may be compromised by new large buildings introduced in the foreground. Similarly, views from Black River Park will likely change from that of an open green expanse across to the Black/Salt River, to large built structures in the foreground. The intrusion or obtrusion of receptor's views may reduce the scenic value of the site and its immediate surrounds to those receptors.

Unavoidably, the proposed development will significantly transform the site and very immediate surrounds. The visual impact may be lessened to the extent that the proposed development is

congruent with surrounding land uses, mainly the commercial and industrial activities towards the north of the site rather than the more informal layout of the buildings to the south of the site.

The proposed development will be highly visible to receptors in the foreground (e.g. people in Black River Park, users of Liesbeek Parkway and the M5), but visibility will reduce substantially in the middleground and background because of the effective visual screening provided by the buildings adjacent to the site.

The impact is assessed to be of ***low*** significance with and without the implementation of mitigation (Table 2-52).

Table 2-53: Significance of visual intrusion

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	High 3	Long-term 3	**High 7**	Definite	**HIGH**	-ve	High
Essential mitigation measures: • Retain visual links to the Black River by reducing visual clutter. • Use large trees and vegetated berms to reduce the scale of new buildings on site. • Utilise (westerly) views towards Devils Peak in building orientation. • Express each building unit individually where buildings are linked together (with architectural details – insets, overhangs, range of visually compatible materials). • Arrange above-ground parking bays (if required) in small groups rather than in large, unbroken lots.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	High

This impact can not be managed, and is *irreversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no visual impacts are anticipated.

2.10.3.3 Potential Impact V4: Altered Sense of Place caused by Light Pollution at Night

The Riverine Corridor Alternative and the Island Concept Alternative

It is assumed that lighting will be extensively used by the proposed development (e.g. street lighting, outdoor lighting etc.). Although existing ambient lighting levels in the area are high, the development will increase light pollution at night or skyglow in the area and may alter night-time sense of place. Skyglow is a form of light pollution and refers to the brightening of the sky above populated areas. Skyglow cannot always be avoided and is always more noticeable in a previously unlit area, but is compounded by poor external lighting design and lighting fixtures that allow the upward spread of light into the atmosphere.

Lighting is not easily screened by vegetation, and receptors' experience of the impact is more intense.

The impact is assessed to be of ***medium*** and with the implementation of mitigation is reduced to ***low*** (Table 2-53).

Table 2-54: Significance of altered sense of place caused by light pollution at night

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Both Alternatives								
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium 6**	Definite	**MEDIUM**	-ve	High
Essential mitigation measures: • Limit lighting only to essential activities and facilities. • Direct lighting inwards and downwards to avoid light spillage and trespass. • Fit external lights with reflectors ("full cut-off" luminaires) to direct illumination downward and inward to the specific illuminated areas.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Definite	**LOW**	-ve	High

This impact can be managed to a *limited* degree, and is *reversible*.

No-Go Alternative

In the case of the No-Go Alternative, the site will continue to be used as a commercial recreational and conference facility, and no visual impacts are anticipated.

2.10.4 Mitigation Measures: Potential Visual Impacts

Essential visual mitigation measures during **design** are as follows[23]:

- Investigate the material and tree planting palettes used for the landscaping along Liesbeek Parkway to extend the green movement corridor along Liesbeek Parkway adjacent to the site.
- Utilise (westerly) views towards Devils Peak in building orientation.
- Retain visual links to the Black River by reducing visual clutter.
- Use large trees and vegetated berms to reduce the scale of new buildings on site.
- Express each building unit individually where buildings are linked together (with architectural details – insets, overhangs, range of visually compatible materials).
- Design access roads to be as narrow as possible.
- Pave access roads with attractive materials.
- Arrange above-ground parking bays (if required) in small groups rather than in large, unbroken lots,
- Screen parking bays with buildings and vegetation as far as possible.
- Avoid the use of glass or material with a high reflectivity in building designs.
- Incorporate visually permeable green or black fencing (if required) into low walls.

Essential visual mitigation measures during **construction** are as follows

- Limit and phase vegetation clearance and the footprint of construction activities to what is absolutely essential.
- Consolidate the footprint of the construction camp(s) to a functional minimum. Screen the construction site camp with materials that blend into the surrounding area.

[23] These mitigation measures are in addition to project design elements that already form part of the project description. These design elements are listed in Section H (c) of the BA Report.

- Clearly demarcate construction areas and dedicated access points to minimize disturbance to surrounding receptors.
- Avoid excavation, handling and transport of materials which may generate dust under high wind conditions.
- Keep construction sites tidy and confine all activities, material and machinery to as small an area as possible.

Essential visual mitigation measures during operations are as follows:

- Use vegetation to break up large expanses of hard surface.
- Plant trees to reduce the perceived heights of buildings.
- Avoid visual clutter:
  - Minimise commercial signage;
  - Fix signs to walls or buildings rather than be free-standing;
  - Utilise low signs as they are less visually intrusive; and
  - Situate utilities (pipelines, cables) underground.

3 Cumulative Impacts

3.1 Introduction

Anthropogenic activities can result in numerous and complex effects on the natural and social environment. While many of these are direct and immediate, the environmental effects of individual activities (or projects) can combine and interact with other activities in time and space to cause incremental or aggregate effects. Effects from disparate activities may accumulate or interact to cause **additional** effects that may not be apparent when assessing the individual activities one at a time (Canadian Environmental Protection Agency, no date). Cumulative effects can also be defined as the total impact that a series of developments, either present, past or future, will have on the environment within a specific region over a particular period of time (DEAT IEM Guideline 7, Cumulative effects assessment, 2004).

The International Finance Corporation (IFC) states that environmental assessment should include consideration of *"… cumulative impacts of existing projects, the proposed project and anticipated future projects."* For the purposes of this report, cumulative impacts are defined as **'direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors'**.

Cumulative impacts can be distinguished as follows:

- **Cumulative Impacts of Existing Activities:** It is reasonably straightforward to identify significant past and present projects and activities that may interact with the project to produce cumulative impacts, and in many respects, these are taken into account in the descriptions of the biophysical and socio-economic baseline; and
- **Potential Cumulative Impacts of Future Activities:** Relevant future projects that will be included in the assessment are defined as those that are 'reasonably foreseeable', i.e. those that have a high probability of implementation in the foreseeable future; speculation is not sufficient reason for inclusion. Such projects may include those for which EAs have already been granted, that are currently subject to Environmental Authorisation (EA) applications or that have been identified in an IDP of the relevant local municipality.

To define the level of cumulative impact, it is critical to look beyond the geographical boundaries and environmental impacts of a single development on the environment and consider the area of influence of the specific project as well as other developments currently in or proposed in the area and their understood impacts and area of influence. It may be that impacts experienced as a result of a single development are not considered to be significant, but when considered as part of a cumulative impact assessment, these require mitigation.

The assessment methodology proposed in this section of the report seeks to provide a practical means of assessing cumulative impacts as part of the environmental impact assessment and minimises deviations from the methodology proposed for the project specific impact assessment. Key considerations for the application of this methodology are:

- The cumulative impact assessment will need to be undertaken with consideration given to developments that may have contributed to cumulative effects in the past, may be contributing or are anticipated to contribute in the foreseeable future. This needs to be relevant to the timeframe within which impacts are to be experienced as a result of the project itself (i.e. all phases for which the project specific impact assessment is being undertaken). Given that the baseline environment will already be impacted on by the historical and current contributors to the cumulative impact, it is only necessary when undertaking the cumulative impact assessment to place an emphasis on an identified future cumulative baseline environment;
- Cumulative impacts may not be applicable to all specialist disciplines. Specialists will advise and justify where they believe the project related impacts will be confined to the project area and not subject to or contributing to impacts in the broader area of influence as a whole. For example, if the project area is confined to a water catchment which is not anticipated to be impacted on by other developments (past, present or foreseeable future) then a cumulative impact assessment need not be considered for this environmental aspect;
- A cumulative impact assessment will need to be undertaken for a specific area of influence which will be determined by the impact itself and the baseline environment in which it is proposed. This will vary across specialist disciplines and therefore a single area of influence for the cumulative impact assessment cannot be set and will be advised by the specialist concerned;
- The baseline environment for the project will differ from the baseline that is considered for a cumulative impact assessment where a number of projects may be implemented within a region in the future and all contributing to a cumulative baseline; and
- The cumulative impact assessment can only be undertaken where information is readily available to do so and as such will only be an initial assessment of the likely cumulative impact in terms of knowledge available at the time of the assessment.

3.1.1 Cumulative Impact Assessment

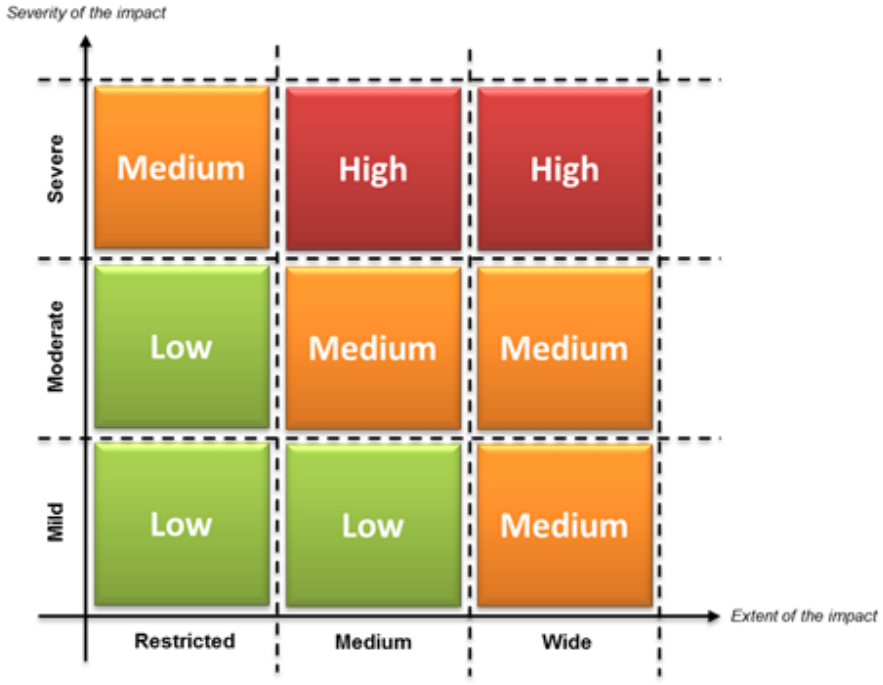
The IFC (2012) defines Cumulative Impact Assessment as a process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers over time, and (b) proposing tangible measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible. The key task is to ascertain how the potential impacts of a proposed development might combine, cumulatively, with the potential impacts of the other human activities and other natural stressors such as droughts or extreme climatic events.

For the most part, cumulative effects or aspects thereof are too uncertain to be quantifiable, due mainly to a lack of data availability and accuracy. This is particularly true of cumulative effects arising from potential or future projects, the design or details of which may not be finalised or available and

the direct and indirect impacts of which have not yet been assessed. Given the limited detail available regarding such future developments, the analysis will be of a more generic nature and focus on key issues and sensitivities for the project and how these might be influenced by cumulative impacts with other activities.

3.1.1.1 Cumulative Impact Significance Rating Methodology

Figure 3-1 presents the matrix used to evaluate the cumulative impacts of the project. This matrix presents the relationship between two quantities; severity of impacts (importance and magnitude) and extent of impact (geographic size). The severity of the impact is rated as severe, moderate or mild, and wide, medium and restricted with respect to impact extent. The result of the assessment, which is either, high, medium or low, presents the overall significance.



srk consulting	TORMIN MINE EXPANSION EIA EVALUATION MATRIX	Project No. 478320

Figure 3-1: Evaluation matrix for cumulative impacts

By systematically applying the cumulative impact significance rating methodology, it is possible to assign a rating to each of the identified cumulative impacts.

3.1.1.2 Cumulative Hydrological Impact

The surface water hydrology impact assessment assessed the impacts of the development assuming that with the TRUP and the PRASA upgrades implemented, and allowing for sea level rise. Hardening of the catchment, the canalisation of rivers, and urban development in the floodplain (especially the railroad bridges), has changed the hydrological dynamics of the catchment. These changes have increased flood peaks, flow velocity and the depth and extent of inundation in the catchment. As result, frequent flooding occurs in the area.

The study found that if the River Club, TRUP and PRASA upgrades were all to be developed, changes in flood elevations would be similar to those attributed solely to the River Club development, i.e. the cumulative impact of TRUP and PRASA upgrades would be low if the River Club were to be infilled. However, the surface water hydrologists note that if the River Club were

not to be infilled, the impact of these developments on surface water hydrology (flood inundation) would be more pronounced.

The catchment is already prone to flooding, and infilling of the will persist but is unlikely to extend high flood hazard zones significantly.

The severity of cumulative impacts on hydrology in the catchment are rated as *mild*, and is assessed to be of a *medium* extent.

The cumulative impact is thus assessed to be of ***low*** significance.

3.1.1.3 Cumulative Freshwater Ecology Impacts

Extensive urbanisation of the catchment, canalisation, wetland drainage and industrial development of Paarden Eiland have effectively led to the complete separation of the Diep River from the Salt River system, and canalisation has resulted in this section of the river being little more than a concrete sewer. The Black River is now perennial, owing much of its volume to effluent from the Athlone and Borchard's Quarry Waste Water Treatment Works, and in summer, virtually all of the flows in the river now comprise sewage effluent and stormwater runoff from the surrounding areas. The high levels of nutrient enrichment in the Black River, coupled with permanent, slow flowing, deep water have resulted in a proliferation of various exotic aquatic plants in the river.

Upstream of the River Club, the Black River also once formed part of an extensive wetland of which the Vincent Palotti wetlands, the Valkenberg wetlands and the Raapenberg wetlands are the only remnants. However, the Black River is also abutted by extensive reedbed wetlands along its left hand bank downstream of the N2. These wetlands, although locally impacted, still have high functional importance as wetlands that are large enough to provide wetland habitat in an increasingly urbanised environment. These wetlands are listed as ESA.

The Liesbeek River flows through progressively more urbanised areas, and most of the lower reaches of the river downstream of Kirstenbosch are channelised and/or canalised (i.e. a mixture of concrete and earth canals). Just upstream of the site, river flows in an unlined channel, but is diverted again into a concrete canal east of the site before discharging into the Black River.

The now defunct westerly (original) channel remains a feature between Liesbeek Parkway and site, but now cut off from the main river channel upstream of the site. This channel provides a transformed and disturbed aquatic habitat, is a protected area, and the eastern banks of the are listed as an ESA.

Although most are freshwater environments are transformed and are mostly of limited ecological value, local stresses on freshwater environments, particularly from contamination, are expected to persist in the long-term.

The severity of cumulative impacts on freshwater ecology in the catchment is rated as *mild* and is assessed to be of a *medium* extent.

The cumulative impact is thus assessed to be of ***low*** significance.

3.1.1.4 Cumulative Faunal Impacts

The key faunal impacts considered in this assessment is the change in faunal habitat, and fatalities. Of greatest concern of the faunal species thought to occur at the site is the WLT.

The WLT is endemic to the Western Cape of South Africa and is endangered. The biggest threats to this species are that of habitat loss from urbanisation, and the introduction of alien predators; while mortalities, particularly from collisions with vehicles, places pressure on individual populations.

Although threats to this species are expected to persist in the long term, most (if not all) locally important WLT breeding sites are known, and are afforded some form of protection. The severity of cumulative impacts on WLTs in the catchment is therefore rated as *medium* and is assessed to be of a *medium* extent.

The cumulative impact is thus assessed to be of ***medium*** significance.

3.1.1.5 Cumulative Traffic Impacts

The traffic impact assessment assessed the impacts of the development in conjunction with annual traffic growth, TRUP and densification of the sub-region.

The study found that Liesbeek Parkway south of Station Road (one lane per direction) currently functions at or above capacity during peak hours (i.e. has a V/C of greater than 1.00 and is congested) and that M5 North / Berkley Road Ramp Terminal intersection operates at above capacity (i.e. a LoS of F) during the PM peak period. The local road network is therefore already somewhat congested, requiring upgrades (most notably the dualling of Liesbeek Parkway and the full extension of Berkley Road between the M5 and Malta Road).

Anticipated delays will be reduced by upgrades that both the CoCT and the LLPT will make to the road network, and the number of private vehicles on public roads is anticipated to reduce with the drive towards, and the incentivisation of public transport.

The severity of cumulative traffic impacts in the area is rated as *mild* and is assessed to be of a *medium* extent.

The cumulative impact is thus assessed to be of ***low*** significance.

3.1.1.6 Cumulative Socio-Economic Impacts

Most economic benefits tend to be cumulative in nature: the more economic activity, the more employment and wealth creation, and the higher the multiplier effects. Specific negative social and economic impacts are more easily isolated to a single project, area, or community.

Property and rental prices in these suburbs are influenced by developments and trends within suburbs. Observatory has experienced an increase in high-density development in recent years, including the development of apartment blocks and business parks in the greater area. Due to increasing demand for centrally located housing and strong price growth in the CBD and Atlantic Seaboard, interest has shifted to areas beyond but close to the CBD, and property prices have increased significantly in Observatory in recent years. Furthermore, a number of projects planned in the areas adjacent to the River Club (e.g. TRUP) may drive gentrification.

The development and densification of areas beyond but close to the CBD is expected to persist in the long term, and this will lead to a particular risk to poorer suburbs, such as Woodstock, Salt River or Oude Molen.

The severity of cumulative traffic impacts in the area is rated as *moderate* and is assessed to be of a *medium* extent.

The cumulative impact is thus assessed to be of ***medium*** significance.

3.1.1.7 Cumulative Visual Impacts

The area has experienced an increase in high-density development (commercial and residential) in recent years, owing to the proximity of the site to the CBD and good connectivity to a number of highways and major roads. Recent developments include the Black River Park and the redevelopment of the M5 Business Park.

Although some densification is expected to occur locally (e.g. TRUP), which will continue to alter the visual landscape, the relatively limited availability of developable areas this close to the CBD will limit the intensity of the impact in the long term.

The severity of cumulative visual impact in the area is rated as *moderate* and is assessed to be of a *restricted* extent.

The cumulative impact is thus assessed to be of ***low*** significance.

3.1.1.8 Cumulative Heritage Impacts

The floodplain of the Liesbeek River is recognised to have heritage significance because of its agricultural history and history of conflict. The sense of place of the floodplain between Kirstenbosch and the confluence with the Black River has been almost entirely transformed by the iterative changes of land-use. Wetlands have been transformed to farmland, then to various institutional uses and to modern suburbia, and the site, although of no known specific significance, is one of the last remnants of the wide-open floodplain.

Similar to cumulative visual impacts, some development is expected to occur locally (e.g. TRUP), which will continue to alter the (already transformed) heritage landscape, but the relatively limited availability of developable areas in the Liesbeek River floodplain and immediately surrounding areas will limit the intensity of the cumulative impact in the long term.

The severity of cumulative heritage impact in the area is rated as *moderate* and is assessed to be of a *restricted* extent.

The cumulative impact is thus assessed to be of ***low*** significance.

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