Part C Chapter 3 Beets Street Hybrid Flood Alleviation Concept Note

Prepared by AIVIA for Drakenstein Municipality and the GIZ

Version 1

31 October 2024

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Abbreviations

BA – Basic Assessment

CAPEX – Capital Expenditure

CCAP - Climate Change Action Plan

CFRPS - Community Flood Risk Perception Study

DFFE – Department of Forestry, Fisheries and the Environment

DM - Drakenstein Municipality

DWS - Department of Water and Sanitation

EA – Environmental Authorisation

EAP - Environmental Impact Assessment Practitioner

ECO - Environmental Control Officer

ECSA - Engineering Council of South Africa

EIA - Environmental Impact Assessment

EPWP - Expanded Public Works Programme

FAES – Flood Alleviation Ecosystem Services

HGM - Hydrogeomorphic

HFA - Hybrid Flood Alleviation

IDP - Integrated Development Plan

KPA – Key Performance Area

KPIs - Key Performance Indicators

LCA - Landscape Character Assessment

LiDAR – Light Detection and Ranging

MMC - Members of the Mayoral Committee

NEMA – National Environmental Management Act

NbS – Nature-based Solutions

NGO - Non-governmental Organisation

NPO - Non-profit Organisation

OHSA – Occupational Health and Safety Act

OPEX – Operational Expenditure

PCSWMM – Personal Computer Storm Water Management Model

PDO - Pre-determined Objective

PES – Present Ecological State

PPP – Public-Private Partnerships

PSOC – Personnel Specification Occupational Classification

SACPLAN – South African Council for the Planners

SAGC - South African Geomatics Council

SDBIP - Service Delivery and Budget Implementation Plan

SDF - Spatial Development Framework

SDG – Sustainable Development Goals

SOP - Standard Operating Procedure

DM SSN – Drakenstein Municipality Smart Safety Network

TLB – Tractor-Loader-Backhoe

WET-Health – Wetland Health

WULA – Water Use Licence Application

Project Summary: Beets Street

Project rationale, objectives and approach of project

The Mbekweni Catchment is drained by the Mbekweni, Kleinbosch and Dal Rivers, which discharge into the Berg River.

The Mbekweni, Kleinbosch and Dal Rivers all pass through the proposed Beets Street Site. The Mbekweni River flows through the site after passing through upstream areas beyond the urban edge, moving southwest through the Newtown residential area along Newton and Rand Streets. It enters the proposed site north of Vlakkeland Road, running parallel to Beets Street towards the south, converging just south of Vlakkeland Road. A drainage channel of the Mbekweni River also flows from the Vlakkeland Residential Development, and passes through a channelled valley-bottom wetland located on the proposed project site, immediately south of Vlakkeland Road. After converging to the east of Jan van Riebeeck Drive the Mbekweni River passes underneath the road through a set of culverts, converging with the Kleinbosch River into the Mbekweni Canal. The Kleinbosch River crosses the proposed site after passing through the upstream agricultural areas in the east, past the Vlakkeland Residential Development. Crossing underneath Jan van Riebeeck Drive the Kleinbosch River reaches the confluence with Mbekweni River to the west of Jan van Riebeeck Drive. The Dal River flows through the southern edge of the site, crossing over the to the Mbekweni Catchment from the Groenheuwel Catchment, flowing east to west through a largely undeveloped area.

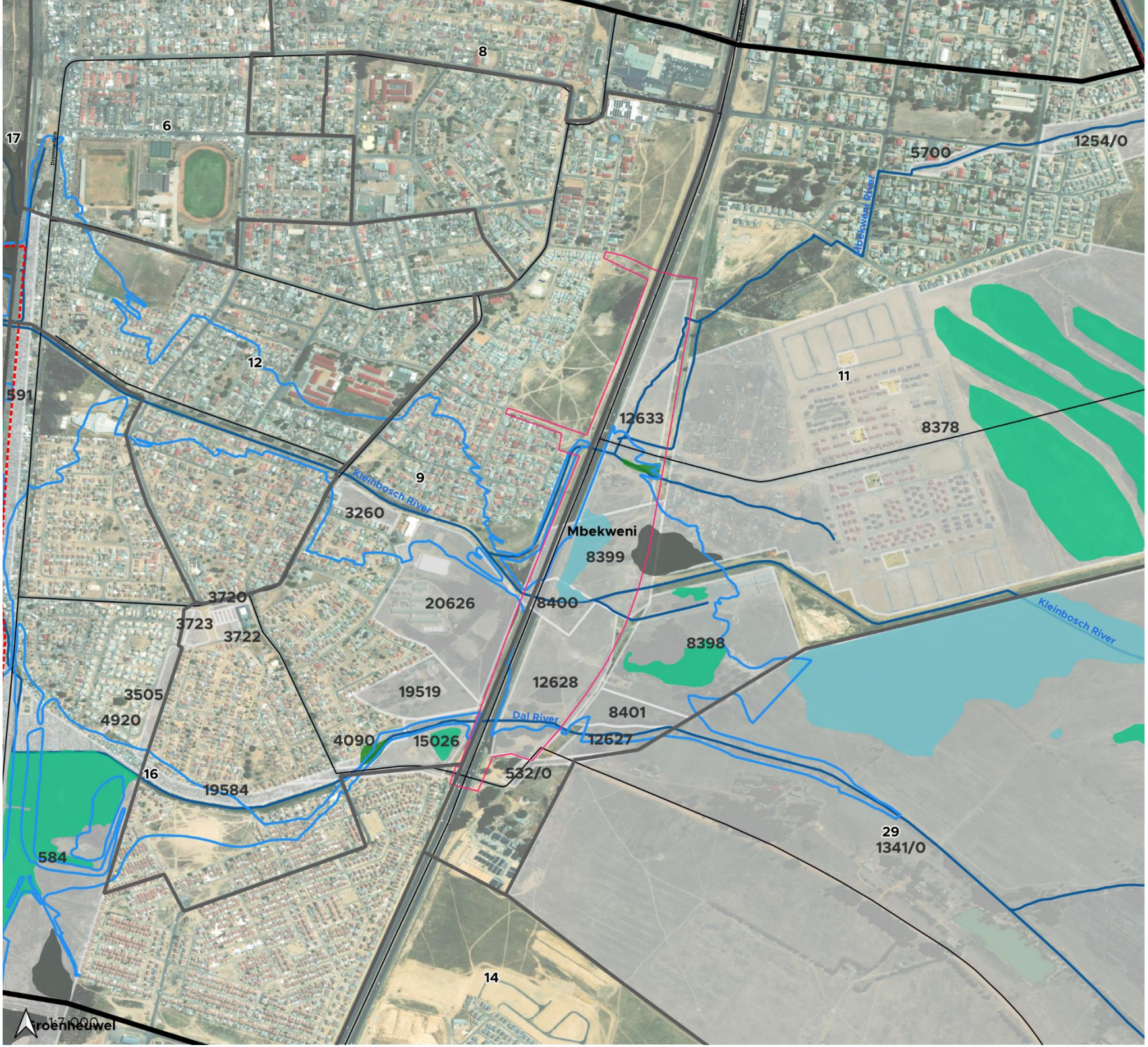
The Beets Street Hybrid Flood Alleviation (HFA) Project is located in **Ward 11** of the Drakenstein Municipality's Mbekweni Catchment. Earmarked in the DM's SDF for Green Space, the project concept proposes the use of a combination of stormwater ponds, constructed wetlands, swales, and vegetated areas to manage flooding while offering valuable community recreational spaces. The integration of stormwater attenuating sports fields, riparian vegetation, and green infrastructure elements provide multifunctional interventions that combines flood risk reduction with ecological and social benefits. The integration of well-designed entrances and pedestrian pathways aims to connect the key ecological and recreational nodes, and enhances accessibility, community value and placemaking.

The 100-year flood extents modelled by the Status Quo PCSWMM indicates that the residential areas adjacent to the Drommedaris and Mbekweni Canals are susceptible to flooding. Jan Van Riebeeck Drive is also susceptible to overtopping, which will result in the flooding of the residential area downstream. This area could experience flood depths up to 0.5m in the 100-year flood. The residential areas at the downstream end of the two canals are exposed to potential flood depths up to 2m near end of the Drommedaris Canal and 1m near the end of the Mbekweni Canal.

The Beets Street project concept includes the follow:

- Gateway entrances,
- Pedestrian pathways,
- Play park,
- Stormwater ponds and constructed wetlands,
- Stormwater attenuating sports fields and swales,
- Integration of existing channels and rehabilitation of riparian zones, and
- Solid waste management.

The primary benefit of the proposed interventions at Beets Street is that flood risk will be reduced through a reduction in modelled flood depths, specifically at the downstream end of the two canals. The reduction in flood depths in the residential areas immediately downstream of Jan Van Riebeeck Drive is negligible, however, with flood depths seeing a reduction of 0.25m to 0.5m at the downstream end of the two canals. The optimisation of the proposed Beets Street attenuation facilities to achieved increased capacity could result in the further reduction of flood exposure, specifically in the downstream residential areas.



Beets Street - Jan v Riebeek

- Roads
- Watercourses
- Urban Edge (2024)
- Catchment Boundaries
- Site Boundary
- Affected Erven

Wetlands

- Channelled valley-bottom
- Depression
- Floodplain
- Seep
- 100yr Floodline
- Ward Boundaries

Alignment With Municipal Objectives

The project aligns with all municipal objectives. It is particularly relevant to Strategic Objective 4, given the strong alignment with maintenance and provision of infrastructure for sustainable service delivery.

Municipal Strategic Objective	Alignment
To ensure good governance and compliance.	X
To ensure financial sustainability to meet statutory requirements.	X
To ensure an efficient and effective organisation supported by a competent and skilled workforce.	X
To provide and maintain the required physical infrastructure and to ensure sustainable and affordable services	X
To plan, promote investment and facilitate economic growth.	X
To facilitate, support and promote social and community development.	X

Key Performance Areas (KPAs) and Pre-Determined Objective (PDOs)

Key Performance Areas (KPAs) refer to the areas within the business unit for which an individual or group is logically responsible. Pre-Determined Objectives (PDOs) are the areas identified as important or crucial, where a result will assist in the achievement of the set objectives or goal (DM IDP, 2024:67).

It is recommended that this project be located within **KPA 4: Infrastructure and Services**, under **PDO 23: Transport, Roads, and Stormwater. This is directly aligned with the Strategic Objective *to provide and maintain the required physical infrastructure and to ensure sustainable and affordable services.***

Estimated total project cost

The following table provides a summary of the estimated costs associated with the project.

Cost Category	CAPEX vs OPEX	Total Amount (ZAR)
Planning and Design Cost	CAPEX	9 236 232,31
Construction and Implementation Costs	CAPEX	99 607 956,00
Operation and Maintenance Costs	OPEX	2 712 159,12
Miscellaneous Costs	CAPEX/OPEX	350 000,00
Grand Total		**111 906 347,43**

The estimated total project cost is based on information available at the time of developing the concepts. The Planning and Design costs must be further refined upon the final determination of the specialist studies required. Construction and Implementation Costs as well as Monitoring and Maintenance Costs will be further refined based on the detailed designs. As the engineering design progresses, refined

estimates can be prepared by the Quantity Surveyor / Cost Estimating Consultant. This would consider local and context specific considerations for the various items.

Drakenstein's Prioritisation Project and Capital Expenditure Criteria

CRITERIA FOR PRIORITISATION		
1	Is **legislation regulating this project?**	
	Legislation regulates this project. A non-exhaustive list of national legislation is provided. The Constitution of the Republic of South Africa, 1996; The National Water Act, 1998 (Act No. 36 of 1998); The National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998); The Municipal Systems Act, 2000 (Act No. 32 of 2000); The Disaster Management Act, 2002 (Act No. 57 of 2002); The Water Services Act, 1997 (Act No. 108 of 1997), Spatial Planning and Land Use Management Act (Act No. 16 of 2013), Climate Change Act (Act No. 22 of 2024); Republic of South Africa (2000). Promotion of Equality and Prevention of Unfair Discrimination Act. Act No 4 of 2000. Chapter 5, Section 28; Additional provincial and local legislation and by-laws may also be applicable.	**Y**
2	Will this project **enhance service delivery (roads and storm water, electricity, water, sanitation, and refuse)?**	
	This project will enhance service delivery (roads and storm water, water, sanitation, and refuse). The project seeks to achieve flood risk reduction benefits through the development of hybrid flood alleviation interventions - leveraging nature-based solutions as complementary to more conventional 'grey' service delivery approaches. Sustainable Urban Drainage Systems (SUDS) present an approach to stormwater/runoff management that aims to reduce downstream flooding, enhance infiltration into the ground, remove pollution, improve the quality of stormwater, reduce pollution in water bodies, and improve biodiversity. SUDS encourages natural drainage processes by circulating water back into the water cycle rather than just collecting and detaining it, recognising the importance of it as a resource. The processes identified in the proposed project constitutes SUDS which focuses on managing flow quantity, quality, amenity, and biodiversity. In addition, the interventions can form a natural part of open spaces in a settlement and contribute to the quality of the environment and the aesthetics of a neighbourhood (DHS, 2019). The project therefore serves to facilitate more resilient stormwater management services, and serves to protect communities and municipal and private infrastructure through flood risk reduction.	**Y**

CRITERIA FOR PRIORITISATION		
	The site will include public refuse bins to be collected at regular intervals, particularly along pedestrian pathways, within the park and at the sports fields. The development of the site will also be accompanied by improved solid waste management, improving the health of communities and the cleanliness of the City. The PCSWMM results undertaken for the DM HFA Project (AIVIA, 2024) show that the Beets Street current flooding situation for the 100-year return period that the area could experience flood depths up to 0.5m. The residential areas at the downstream end of the two canals are susceptible to flood depths up to 2m near the end of the Drommedaris Canal and 1 m near the end of the Mbekweni Canal. **It is therefore essential that flood alleviation measures be introduced in this area to improve stormwater management and alleviate flood risk.** The concept incorporates the existing wetland areas and aims to restore and maintain the optimal condition of these wetlands to achieve the optimal FAES. This includes ensuring the provision of the full FAES potential available from the on-site floodplain wetlands (very high flood attenuation ecosystem services are possible when in optimal condition) and channelled valley bottom wetlands (high flood attenuation and water quality enhancement ecosystem services are possible when in good condition). Well-functioning wetlands also offer water treatment benefits and will achieve improved water quality. The optimal ecological condition is referring to the Present Ecological State (PES) that was modelled in the Ecological, Infrastructure and Land Use Assessment Report (Ecological, Infrastructure and Land Use Assessment, AIVIA, 2024).	
3	Is this **project an essential service?**	
	This project is an essential service. The project supports essential service delivery functions related to roads, stormwater, water, sanitation and refuse removal. It will also provide essential community facilities and supports the reduction of flood risk experienced by the community. The modelling results show that the Mbekweni Canal does not have sufficient capacity to convey the 100-year flood. The residential areas on both sides of the Canal are vulnerable to flooding and are anticipated to experience flood depths of up to 1m. **It is therefore essential that flood alleviation measures be introduced in this area to alleviate flood risk.**	**Y**
4	Will the execution of this project **stimulate investment in the local economy?**	

CRITERIA FOR PRIORITISATION		
	The project will lead to the creation of permanent and temporary jobs linked to Planning and Design, Construction and Implementation, and Operation and Maintenance phases of the project. The improved urban environment and showcasing of successful implementation with community buy-in may serve to improve investor confidence in the area. The estimated level of investment in the planning, design, and construction phase of this project is expected to create approximately **215 indirect jobs in the national economy**, stemming from the input materials required for the project. **Expected expenditure will induce about 320 jobs** in the economy as project workers spend their wages. Many of these jobs will be in Drakenstein if local suppliers are used. It is estimated that this investment will yield 1.68 times the initial amount, resulting in **a contribution to the national economy of about R185 million**. Wages paid by construction firms during the construction phase will also stimulate economic activity and lead to investment.	**Y**
5	Will this project **enhance the quality of life of our local community and be for the benefit of the local community?**	
	The project aims to enhance the quality of life the local community and be for the benefit of the local community. Flood Risk Reduction will serve as a direct benefit improve the health, safety and well-being of surrounding communities. Recreational co-benefits are achieved through the incorporation of sports fields, a play park and pedestrian movement routes. The community noted that restorative and sporting spaces are required and suggested that pleasant and well-maintained open spaces would provide the recreational benefits that are much needed by the community. The incorporation of signage along pathways and entrances can further enhance the education and awareness opportunities to be attained through the development of the site.	**Y**
6	Will this **project lead to permanent job creation?**	
	The project components will include opportunities for job creation for local communities during the construction phases and operation and maintenance phases. The operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members through voluntary project stewardship, the leveraging of the enhanced public works programme (EPWP), as well as other job creation opportunities. Secondary effects of expenditure	**Y**

CRITERIA FOR PRIORITISATION		
	in the local economy will also create permanent jobs in the local and national economy. A high-level estimate of permanent direct and induced jobs is provided in the Job Creation Potential Section C3.7. The proposed intervention in Beets Street is expected to create approximately 2 permanent jobs in maintenance from the following jobs: Foreman, Mower operators, Planters, Driver and General worker. It is important to note that the 2 permanent jobs are a collection of fractions of jobs, therefore, there are more job types than jobs. The estimated level of investment in the planning, design, and construction phase of this project is expected to create approximately 215 indirect jobs in the national economy, stemming from the input materials required for the project. Expected expenditure will induce about 320 jobs in the economy as project workers spend their wages. Many of these jobs will be in Drakenstein if local suppliers are used. See also the Job Creation Potential Section C3.7.	
7	Is this project labour intensive/ will this project lead to **temporary job creation?**	
	The project components will include opportunities for job creation for local communities during the construction phases and operation and maintenance phases. The operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members through voluntary project stewardship, the leveraging of the enhanced public works programme (EPWP), as well as other job creation opportunities. Secondary effects of expenditure in the local economy will also create permanent jobs in the local and national economy. A high-level estimate of permanent direct and induced jobs is provided in the job estimates. The proposed intervention in Beets Street is expected to create approximately 26 job-years in the design and construction phase. During the design phase, approximately eight temporary jobs-years will be created, nearly all of which involve highly skilled positions in professional firms (Engineering, Landscape Architecture, Planning, and Scientific Services). The 18 job-years created in the construction phase will include three highly skilled job years, 10 semi-skilled job-years, and five low-skilled job-years. All these positions will qualify as green jobs except seven semi-skilled jobs, comprising guards for 24-hour site security. All maintenance jobs will qualify as	**Y**

CRITERIA FOR PRIORITISATION		
	green jobs. Other semi-skilled jobs include excavator operators, Tractor Loader-Backhoe (TLB) operators, dump truck operators, planters, and gabion basket makers. See also the Job Creation Potential Section C3.7.	
8	**Will this capital expenditure / project generate significant additional revenue for the municipality?**	
	The project is not likely to generate significant additional revenue for the municipality. However, the components of the project provide essential basic services to communities and aim to respond to the need for flood risk reduction in the area. As such, the benefit of this project includes the protection of municipal and private infrastructure, the protection of livelihoods and community assets, and may result in cost savings due to improved infrastructure maintenance and management. This infrastructure does not sit in any of the trading services departments and is therefore not a direct revenue generator. Some elements may have access charges, but these revenues will be small. They are likely to have operating cost reduction impacts on both water services and solid waste services. Natural water treatment services provided by these interventions will reduce water treatment costs for water abstracted from the Berg River. The net effect is likely an increased surplus or reduced deficit in water services and solid waste management and reduced operating costs in stormwater management.	**N**
9	Will this **project improve the aesthetic appearance of the city / town?**	
	The project seeks to achieve an improved urban realm and placemaking to support the functionality and improvement of the urban environment. This will be achieved through the introduction of pedestrian movement corridors, the creation of safe and accessible public spaces, including sports fields, and the promotion of urban integration. Located along the well-utilised Jan van Riebeeck Drive, the project site is clearly visible to a wide range of commuters, and as such the development of the site will make the user experience more pleasant, given the aesthetic improvements, specifically the creation of actively used open space on-site. The development of the site will also be accompanied by improved solid waste management, improving the health of communities and the cleanliness of the City.	**Y**
10	Will the execution of this project **contribute to the social upliftment of the community?**	

CRITERIA FOR PRIORITISATION		
	Recreational benefits are achieved through the incorporation of sports fields, a play park and pedestrian movement routes. The community noted that restorative and sporting spaces are required and suggested that pleasant and well-maintained open spaces would provide the recreational benefits that are much needed by the community. The activation of the site can also offer job creation opportunities for surrounding communities.	**Y**
11	Does this project comply with the **developmental directions of the municipality's spatial development framework?**	
	The project aligns with the developmental directions of the municipality's spatial development framework. Activating this area though the development of multi-functional open spaces aligns with the DM SDF 2024, which has designated the Beets Street Site as Green Space. The project will allow for the protection and active use of green space and will also assist in ensuring that current sites earmarked for green/open space remain undeveloped and are able to serve as permeable surfaces. This is particularly critical given that land use change was found to be a key driver for changing catchment hydrology.	**Y**
12	**Must this project be implemented now?**	
	The project is essential to achieve the required flood risk reduction outcomes necessary to alleviate flooding. See also Point 2 in this table.	**Y**
13	**Is there a time factor involved for this capital expenditure / project that will negatively influence any other capital expenditure / project or foreign investment in infrastructure?**	
	The project forms part of the broader Drakenstein Municipality Hybrid Flood Alleviation Programme, and this project was identified as part of the Stage 1 Priority/ Catalytic Projects.	**Y**

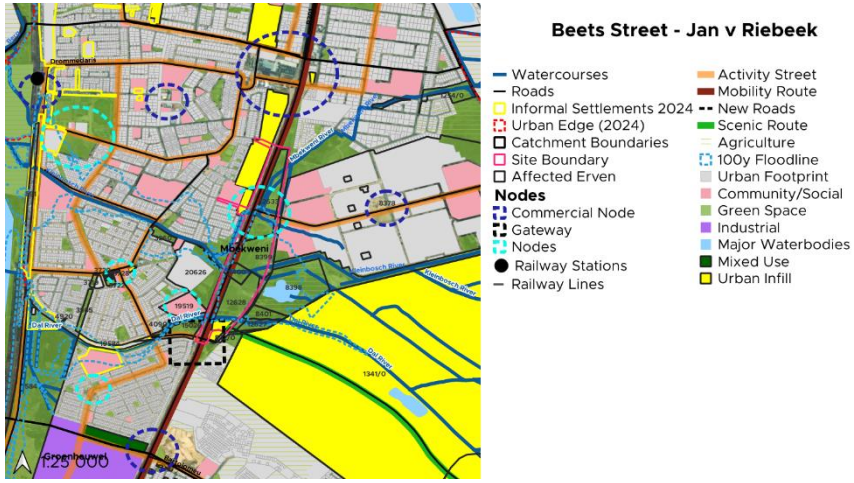
C3.1.Informants: Beets Street HFA Project

Urban Context

The site is bounded by the **Hawequas Mountain range eastwards** and the **Paarlberg mountainous outcrop westwards,** both of which are clearly visible from almost all points on the site. The project site is located on **Erf: 557, 21806, 532/0, 12628, 8400, 2316, 12633, 156, 13176, 8399, and 8359**. The site is situated in Ward 11 (2021 Wards), within the 2024 Urban Edge in an area earmarked in the SDF for **Green Space** and has been identified as having a **Peri-urban lowland character.** The node shown is a general node in the SDF. *General Nodes indicate areas and/or intersections of a general higher urban focus, which are not overrepresented or dominated by commercial land uses (refer to the 'Commercial Node' spatial element in Part C Chapter 3 Map 1). The more dominant land uses associated with a 'General Node' could be Community/Social (refer to 'Community/Social' spatial element in Part C Chapter 3 Map 1) and Logistical Hub land uses. These nodes are strategically located in areas along high-uses routes where a concentration of activities and a mix of land uses should be encouraged, appropriate to the character of the area (DM SDF, 2024)*.

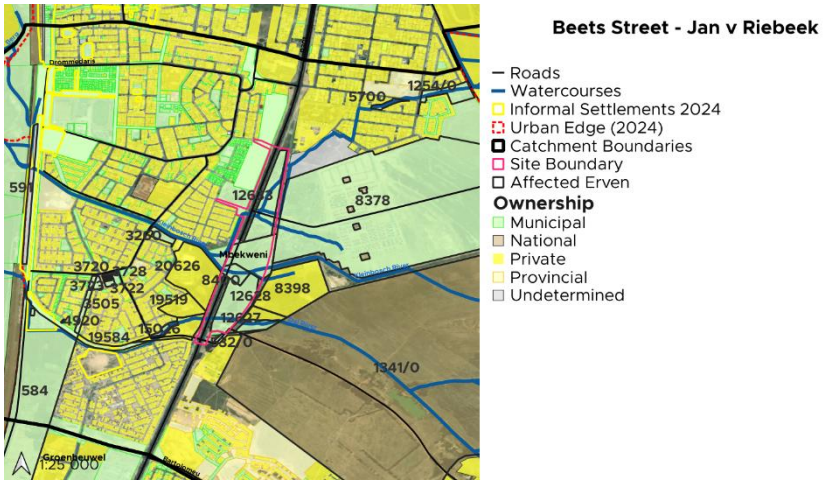
Nine properties (Erf 557, 21806, 532/0, 12628, 8400, 2316, 12633, 156, 8399) on which the site is located are **municipal-owned**, and the site is approximately **106,60 hectares** in size. This site is located within the 1:20yr, 1:50yr and 100yr floodline.

The site is bounded by **Beets Street in the east – a secondary service road, and** Jan van Riebeeck Drive – a dual carriageway class 2 road - on the west. Jan van Riebeeck Drive is currently a barrier, with pedestrian crossings 800m apart. However, it could be considered as a key opportunity to promote urban connectivity through pedestrian movement supported by appropriate traffic calming measures.



Part C Chapter 3 Map 1. The site in the context of the DM SDF

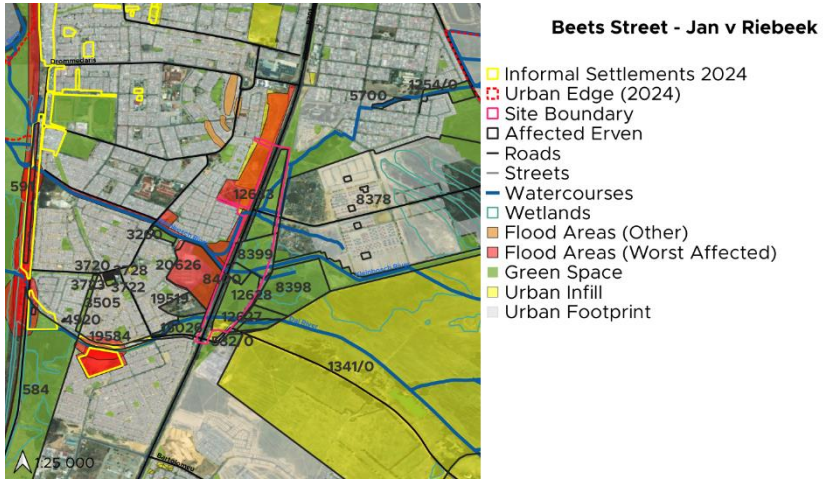
The topography of the landscape is relatively flat. The project site is located downstream from the Vlakkeland residential development in the east. The constructed phase of the Vlakkeland residential development does not include space for recreation and restoration and is primarily residential. **The site therefore presents an opportunity to develop recreational sports fields and other recreational components to serve the communities located east of Jan van Riebeeck Drive**.



Part C Chapter 3 Map 2. Land Ownership

In July 2024, a Community Flood Risk Perception Study (Community Flood Risk Perception Study Report (Phase 2) AIVIA, 2024) was undertaken with community members from wards (9, 11, 12, 16, 19, 21, 22, 24, 25, and 28 – based on the DM 2021 ward boundaries). Community Flood Risk Perception is defined as the understanding of **community and individual experiences of flooding including the causes, impacts and perspectives on required flood alleviation interventions** and as such, the fieldwork findings of the study are inherently subjective. As part of this session, community members were asked to identify the areas where they personally experienced the worst flooding impacts. They were then asked to identify any other flooding areas they were aware of. This data was mapped during the participation sessions and subsequently digitised. The areas identified by the CFRPS participants are shown in Part C Chapter 3 Map 3 and reflect the experiences of the community (and are therefore subjective and based only on the views of the participants of the session).

The Community Flood Risk Perception participants identified the area west of Jan van Riebeeck Drive as a major flooding area, and the development of **this Beets Street Site provides an opportunity to alleviate flooding west of the Beets Street Site**, which may also serve to address the downstream flooding affecting communities, including the protection of the planned municipal human settlements project on Erf 557. The residents of the Mbekweni Catchment experience high levels of socio-economic vulnerability, therefore, a reduction in flooding will protect lives, livelihoods, homes and belongings.



Part C Chapter 3 Map 3. Flood Areas identified by CFRPS Participants

Informal small-scale farming (livestock grazing - pigs, goats, sheep and cows) areas are also located on the east of the site. This settlement is likely to severely impact the river's water quality due to inadequate levels of service to the growing settlement population. The site itself is used on a weekly basis for religious practices. There is also an area of the site that is currently used by privately owned businesses running panel beating services on site.

There are many desire lines suggesting that community members walk the shortest route across existing open land to roadways to reach the next settlement, school or work.

Landscape Character Assessment

The DM HFA LCA identified this area as having a **"Peri-urban lowland"** character type.

Dominant landcover & Landscape elements include:

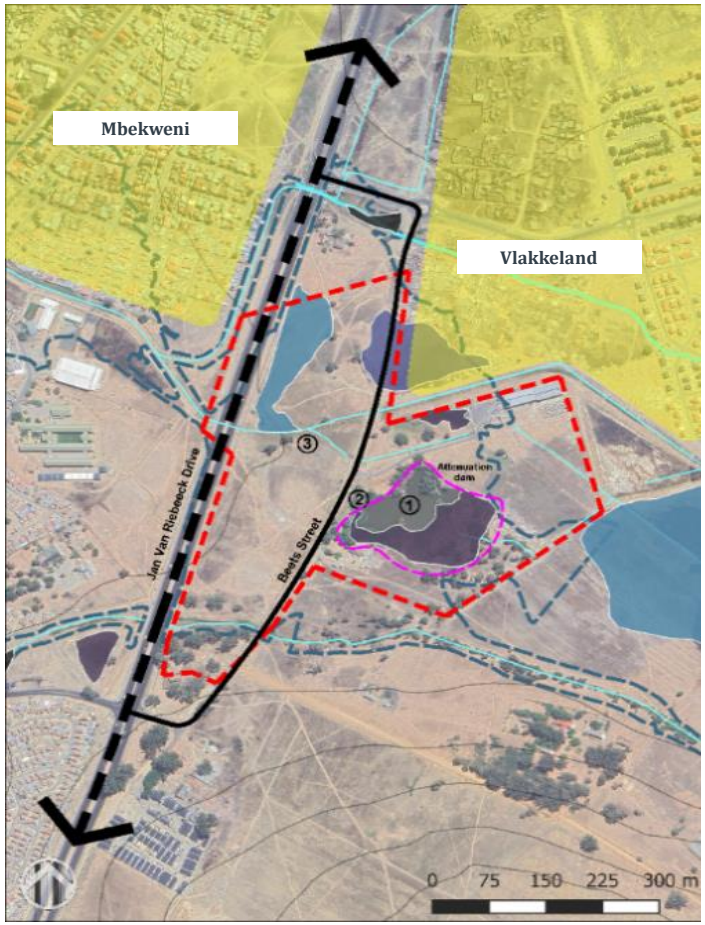
- Tall, mature trees,
- Riparian vegetation on embankments,
- Historical irrigation dam,
- Desire lines,
- Confluence of several stormwater channels, and
- Large, grassed open tract of land.

The existing pond is surrounded by mature exotic Eucalyptus trees that holds a scenic and historical value to its aesthetic within the Paarl landscape. There is a large tract of open land opposite the detention pond, characterised by low growing vegetation with a scattering of mature Eucalyptus trees.

The scale of the site and the low vegetation create a sense of openness and exposure. Most of the site is at a level lower than the abutting Jan Van Riebeeck Drive, creating a feeling of being in a low point in the landscape.

The landscape can currently be perceived as safe from vandalism given the fencing, lighting and a monitored entrance. The mountainous landscape is of scenic value and partially visible because of existing established trees in the park's landscape. The landscape character of the site is very different in the recreational areas in comparison to the conservation area on Erf 33027, behind Newton on Bo Dal Road. The recreational area has a typical park sense of place with shade-providing trees softening the open expanse of mown lawn, whereas the conservation area is exposed with a mosaic of low growing shrubs and grasses. The overgrowth of the *Commelina sp*. in the waterway smothers the growth of other plants, reducing the biodiversity of the waterway.

There is potential for the river through the park to be restored and rehabilitated by the Natural Resource Management sub-section of the DM's Environmental Management Division, as part of the conservation area. New stormwater attenuation facilities could be accommodated in areas away from the conservation area. There is potential to improve the connectivity between the river and the wetland portion of the conservation area.



Part C Chapter 3 Map 4. LCA: Character Area Map

Part C Chapter 3 Image 1. Photograph showing the irrigation dam with large Eucalyptus trees and the dam previously serviced surrounding farmsteads

Part C Chapter 3 Image 2. Photograph showing Cyperus papyrus (Paper reed) along the dam's embankments

Part C Chapter 3 Image 3. Photograph showing the lowland area of open land with channels and desire lines that exist in the landscape

Part C Chapter 3 Image 4. ***Typha capensis (Bulrush)***

Part C Chapter 3 Image 5. ***Elegia tectorum (Cape thatching reed)***

Part C Chapter 3 Image 6. ***Juncus effusus (Sedge)***

Part C Chapter 3 Image 7. ***Wachendorfia thyrsiflora (Bloodroot)***

Watercourses, Wetlands and Flood Risk

Rivers and Stormwater Infrastructure

The rivers in Mbekweni discharge into the Mbekweni and Drommedaris canals which ultimately discharge into the Berg River beneath the railway line.

The Mbekweni River flows through the site after passing through upstream areas beyond the urban edge, moving southwest through the Newtown residential area along Newton and Rand Streets. It enters the proposed site north of Vlakkeland Road, running parallel to Beets Street towards the south, converging just south of Vlakkeland Road. A drainage channel of the Mbekweni River also flows from the Vlakkeland Residential Development and passes through a channelled valley-bottom wetland located on the proposed project site, immediately south of Vlakkeland Road. After converging to the east of Jan van Riebeeck Drive the Mbekweni River passes underneath the road through a set of culverts, converging with the Kleinbosch River into the Mbekweni Canal.

The Kleinbosch River crosses the proposed site after passing through the upstream agricultural areas in the east, past the Vlakkeland Residential Development. Crossing underneath Jan van Riebeeck Drive the Kleinbosch River reaches the confluence with Mbekweni River to the west of Jan van Riebeeck Drive.

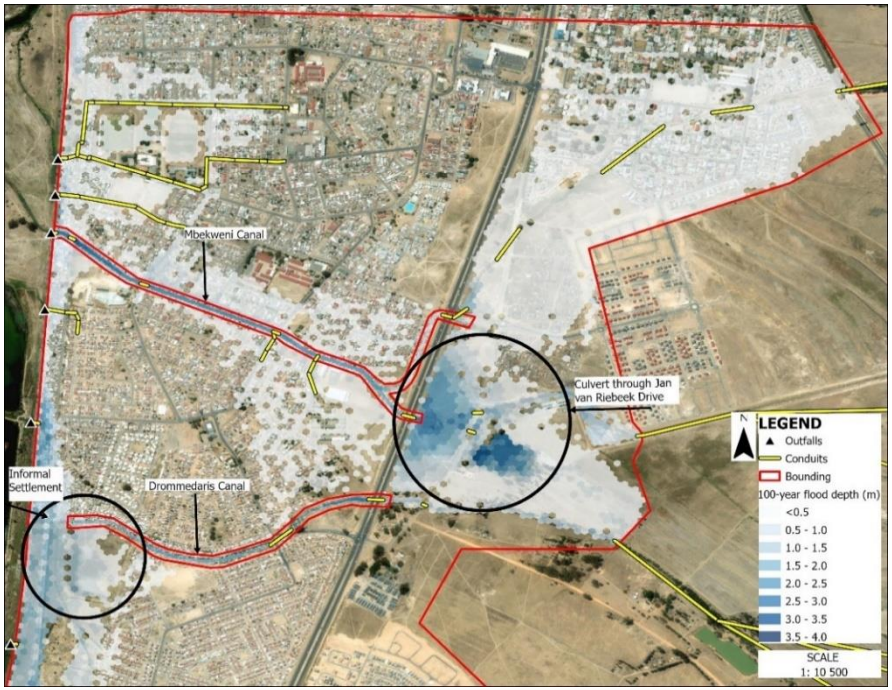
The Dal River flows through the southern edge of the site, crossing over the to the Mbekweni Catchment from the Groenheuwel Catchment, flowing east to west through a largely undeveloped area.

The stormwater is conveyed through unlined channels that divert under roadways with concrete culvert infrastructure, and three culverts are located to the west of the site.

The PCSWMM modelling results

The modelling results show that the Mbekweni Canal does not have sufficient capacity to convey the 5-, 20- and 100-year flood. The residential areas on both sides of the Canal are vulnerable to flooding and are anticipated to experience flood depths of less than 0.5 m for the 5-year event and flood depths of up to 1 m for the 100-year event. The same is true for the Drommedaris Canal where the modelling results also show that the Canal doesn't have sufficient capacity to contain and convey the 100-year flood. The informal settlement at the outlet of the Drommedaris Canal is exposed to flooding for all the return periods considered and is particularly vulnerable to flooding for the 100-year return period with the area experiencing potential flood depths up to 2.5 m deep.

The area east of Jan van Riebeek Drive, including Newton, is anticipated to experience shallow flood depths of less than 0.5 m for the 5, 20- and 100-year flood. For the 100-year flood, flood depths in the order of 3.4 m are observed at the culvert traversing Jan van Riebeek drive, from Beets Street towards the Mbekweni Canal. At the same location, flood depths in the order of 3 m are anticipated for the 20-year flood while the 5-year flood will lead to flood depths of 2.6. The flood depths at the inlet of this culvert together with the expected overtopping of the road indicate that the culvert does not have sufficient capacity to convey the 100-year flood.



Part C Chapter 3 Map 5. Mbekweni catchment zoomed in (100-year flood)

Wetlands

Wetlands offer three flood alleviation ecosystem services (FAES) – namely Flood Attenuation, Streamflow Regulation, and Water Quality Enhancement, where the following ratings apply:

- 0 = absence;
- 1 = poor;
- 2 = moderate;
- 3 = high;
- 4 = very high.

These FAES differ in relation to the position of the wetland relative to the overall catchment. In the DM HFA Programme, the catchments were each divided into upper, middle and lower reaches. The FAES also differ depending on the type of wetland, as different wetland types are able to offer different levels for each respective FAES. The ability of a specific wetland to provide the three FAES in relation to their location in the catchment is detailed in the Ecological, Infrastructure and Infrastructure Assessment (AIVIA, 2024), where the rating of the potential for supply of ecosystem services by a wetland or river, based on hydrogeomorphic (HGM) type, and climatic setting (humid to sub-humid, and semi-arid) is explained. For this study, all scores apply to wetlands and rivers in good condition and the process was adapted from WET- Version 2 (Kotze et al., 2020).

This provides guidance on the nature of intervention that might be required to rehabilitate, restore or protect the wetlands to enable them to offer the maximum FAES as they would if they were in good condition.

The actual condition of the wetland is also known, based on the DM HFA Ecological Assessment, which used the rapid Level 1A WET-Health assessment protocol (MacFarlane et al., 2020) to determine the **Present Ecological State of the hydrology, geomorphology, water quality and vegetation of the wetlands in the three catchments forming part of the DM HFA**. The method is based on the hydrogeomorphic (HGM) approach to wetland typing, providing a PES score for a wetland within each of the four condition modules – hydrology, geomorphology, water quality and vegetation - and a combined overall score for wetland health. The PES score provides a quantitative measure of the extent, magnitude and intensity of deviation from the reference or unimpacted condition, and places the wetland in a wetland health category, A – F. The Level 1A WET-Health assessment uses land cover as a surrogate for the severity or magnitude of an impact, where this is assumed to be linked to land use.

Part C Chapter 3 Table 1. Present Ecological State categories used to define the overall health or integrity of a wetland (from MacFarlane et al., 2020). Colour-coding is according to the River EcoStatus Monitoring Programme of DWS.

CATEGORY	PES SCORES (%)	DESCRIPTION
A	90 – 100	Unmodified, natural.
B	80 – 89	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.
C	60 – 79	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats and biota may have taken place.
D	40 – 59	Largely modified. A large change in ecosystem processes and loss of natural habitats and biota has occurred.
E	20 – 39	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.

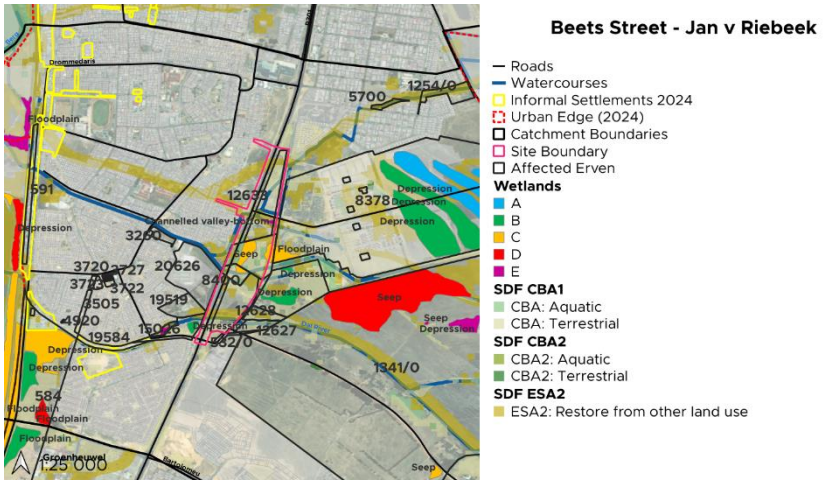
CATEGORY	PES SCORES (%)	DESCRIPTION
F	**0 – 19**	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.

The site contains a seep wetland, floodplain wetland, and a channelled valley bottom wetland:

- **Channelled valley-bottom wetland, running parallel to Vlakkeland Road**. A channelled valley-bottom wetland is a valley-bottom wetland with a river channel running through it. They typically provide the following flood alleviation ecosystem services (FAES): **High flood attenuation (3);** Poor to moderate streamflow regulation (1.5); **High water quality enhancement (3).** This wetland condition is categorised as **PES E**, meaning that **the change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.** The channelled valley-bottom wetland provides high flood attenuation potential. In this case, **the wetland has experienced a great loss in biota, and thus restoration will be required.**
- **Floodplain wetland,** located on the eastern side of the site, extends across Beets Street. Water and sediment input to these wetlands is mainly via overspill from a river channel during flooding. **Floodplain wetlands provide Very high flood attenuation potential (4);** Very poor stream regulation (0.5); and Moderate to high water quality enhancement (2.5). This wetland is currently **moderately modified (PES C).** Given the role of **floodplain wetlands in flood attenuation and water quality enhancement**, their protection is critical. **Given the moderately modified condition, the wetland will require rehabilitation to restore the maximum level of FAES.**
- **Seep Wetland,** located just east of Jan van Riebeeck Drive. Seeps are dominated by the colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Seeps typically provide the following flood alleviation ecosystem services (FAES): A moderate role in flood attenuation (2); **A high potential role in streamflow regulation (3)**; A poor to moderate role in water quality enhancement (1.5). **This seep is moderately modified (PES C). The Seep wetland will require some improvement to allow for the high streamflow regulation to be achieved.**

Part C Chapter 3 Table 2. Flood Alleviation Ecosystem Services Provided by wetlands in relation to the project site based on optimal condition. (Ecological, Infrastructure and Land Use Report, AIVIA, 2024).

HGM types:	Ecosystem services:		
	Flood attenuation	Streamflow regulation	Water quality regulation
Channelled valley-bottom wetland	2	2	3.5
	3	1.5	3
Seep	1.5	3	2
	2	3	2
Floodplain wetland	3.5	1	3
	4	0.5	2.5
Depression	2	1	2
	2.5	0.5	1.5



Part C Chapter 3 Map 6. Wetlands and Watercourses

Informants Summary

The site is located on Erf: 557, 21806, 532/0, 12628, 8400, 2316, 12633, 156, 13176, 8399, and 8359 within the Mbekweni Catchment.

The project site is named after Beets Street, a secondary service road running north–south which forms the eastern boundary of the site.

The site is just **west of the Vlakkeland Residential Development**. It is also west of informal subsistence farming areas. These informal areas are a cause for concern in terms of **water quality.**

The **western boundary** of the site runs along **Jan van Riebeeck Drive, a dual carriageway road, which acts as a physical barrier between the communities on either side of this road**.

On the **west of Jan van Riebeeck Drive**, a mixed-use development is planned for **Erf 557**. The western side of Jan van Riebeeck Drive was also noted as one of the **worst flooding areas in Mbekweni** by participants of the community flood risk perception study when asked to identify the perceived worst flood risk areas within the catchment. The participants of the CFRPS noted that this area was sometimes used by children as a play and sport area, however they deemed the area unsafe due to the fact that the area often experienced the pooling of water.

All three of Mbekweni Catchment's rivers run through the site, originating in the upper reaches of the catchment outside of the urban edge.

The **Mbekweni River** passes across the urban edge, then through the residential neighbourhood of Newton before reaching the site.

The **Kleinbosch River** passes south of the Vlakkeland Residential Development prior to reaching the site. The confluence of the Mbekweni and Kleinbosch are located on the west of Jan van Riebeeck on privately owned land.

The path of the **Dal River** passes through an area that is relatively undeveloped, and the Dal River goes on to flow through the Drommedaris Street Project Site as well.

Existing **stormwater culverts** are located along Jan van Riebeeck Drive in three locations, with slightly different invert levels.

The site, which is designated for green space in the Drakenstein SDF, also includes three wetlands – all three a different type. The ecological assessment undertaken for this project identified a channel valley bottom wetland, a floodplain wetland and a seep.

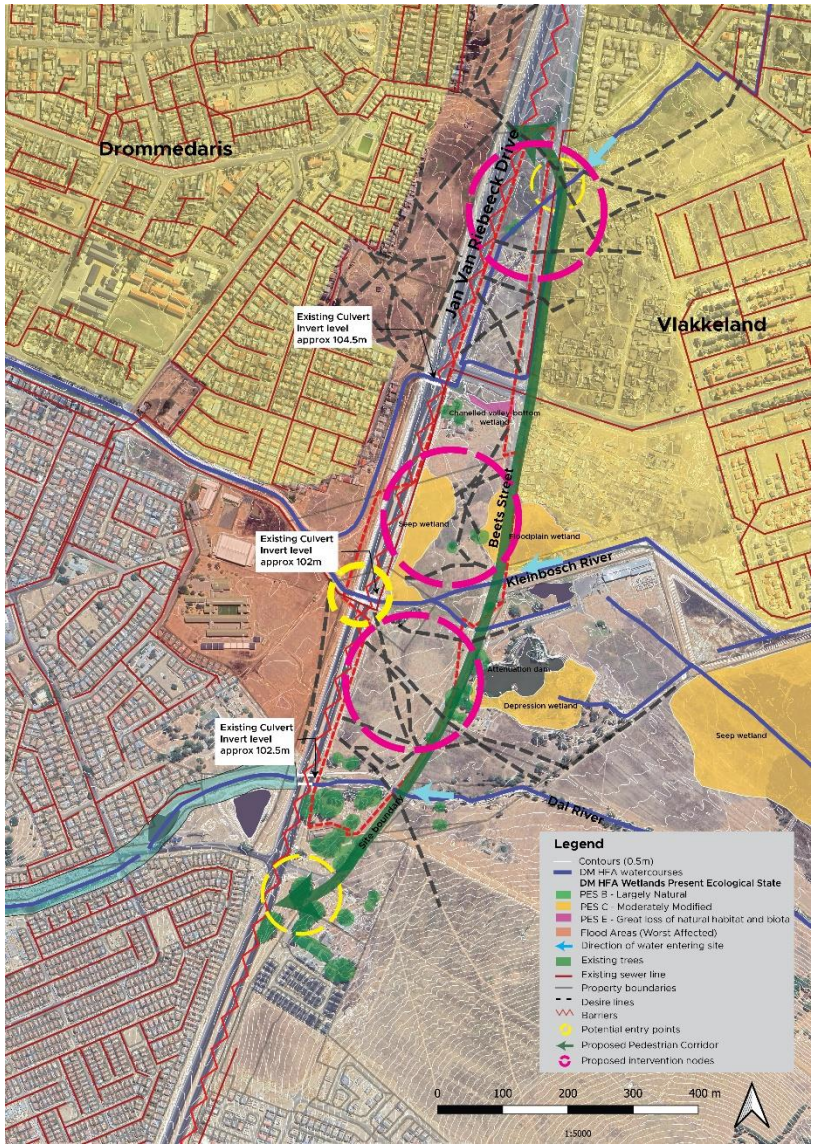
The different types of wetlands are associated with different performance ratings for flood alleviation ecosystem services. The FAES assessed in this project includes flood attenuation, streamflow regulation and water quality. For each wetland type, these services were rated from 1-4, with 3 being 'high FAES' for a particular service, and 4 being very high.

Floodplain wetlands hold the most potential, with optimal condition floodplain wetlands scoring **4 out of 4 in terms of flood attenuation**. This wetland condition is now known to be **moderately modified**, and thus efforts must be made to restore and rehabilitate this wetland.

Channelled valley bottom wetlands have rivers that pass through them, and in this case the wetland is noted as having a PES level E, meaning that loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable. **The FAES potential of this wetland type is significant, as they provide a score of 3 out of 4 for flood attenuation and 3 out of 4 for water quality enhancement when in good condition.**

Seeps offer a **FAES score of 3 out of 4 for streamflow regulation** when in an optimised condition. Generally, these wetlands offer significantly useful FAES in respect of flood attenuation and are thus important opportunities for the site concept. **The wetlands**

therefore provide an opportunity to enhance the flood alleviation ecosystem services as a nature-based solution.



Part C Chapter 3 Map 7. Informants Map

Key Opportunities:

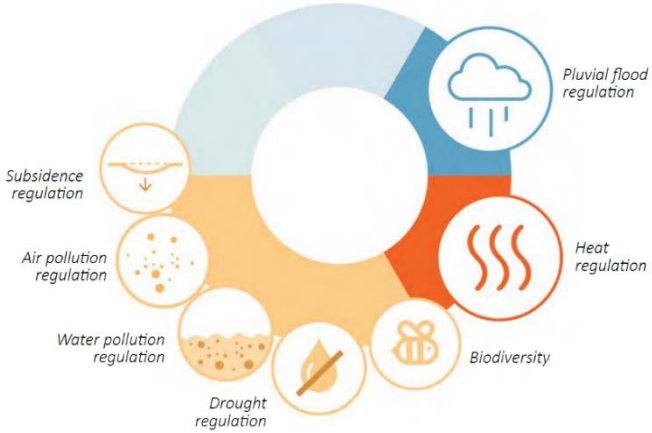
- Opportunity for the development of flood attenuation infrastructure in the form of wetlands and ponds throughout the site (see Informants Map).
- Alignment with SDF Green Space objectives, combined with the opportunity for wetland restoration and the introduction of constructed wetlands (See informants map – pink dashed nodes).
- Opportunity to enhance connectivity and accessibility through the introduction of pedestrian routes along Beets Street and northern and southern gateway entrances (see informants map – yellow dashed node).
- Opportunity to enhance connectivity and accessibility by creating a pedestrian movement route across Jan van Riebeeck Drive.
- Opportunity for play areas and recreation to enhance the urban environment and respond to the need for recreational spaces identified by the participants of the CFRPS (see informants map – pink dashed nodes).
- Address basic service delivery including solid waste management.
- Support River Management of three rivers.

The informants are shown in Part C Chapter 3 Map 7 and Beets Street Concept Note Annexure 1.

There is significant attenuation potential on this site. This could take the form of the re-establishment of wetlands within the flat landscape rather than channels to slow down the flow of stormwater, allow nutrient absorption, filtration, and to connect the floodplain which includes vegetated islands with high marsh and low marsh to accommodate plant species and seasonal inundation.

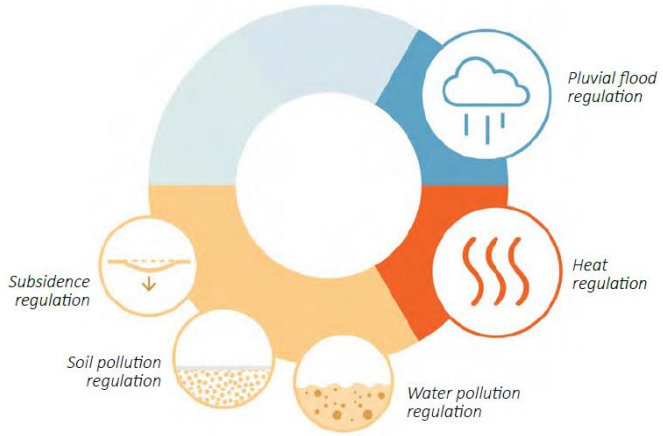
C3.2.Concept Design: Beets Street HFA Project

Water currently enters the site via the Mbekweni, Kleinbosch and Dal waterways from the east, flowing through the site in a westerly direction. The stormwater is conveyed through unlined channels that divert under roadways with concrete culvert infrastructure, and three culverts are located to the west of the site. The project aims to slow down the flow of water through the site through the introduction of hybrid infrastructure to achieve flood attenuation. The project uses a combination of stormwater ponds, constructed wetlands, swales, and vegetated areas to manage flooding while offering valuable community recreation spaces. The stormwater attenuating sports field, riparian vegetation, and green infrastructure elements provide a multifunctional approach that blends flood risk reduction with ecological and social benefits. The integration of pedestrian pathways and well-designed entrances further enhances the site's accessibility and community value.



Part C Chapter 3 Figure 1. Functions of Open Spaces (Source: World Bank, 2021).

There are several functions and benefits associated with the components of the concept. Part C Chapter 3 Figure 1 provides a summary of the functions associated with Open Green Spaces, given that the improvement and activation of existing green spaces to function as effective recreation spaces is a primary focus of the project. Part C Chapter 3 Figure 2 shows the functions of bioretention areas, which *'can be adapted to a variety of urban environments. It can take many forms and shapes for different functions and contexts. Bioretention basins, vegetated swales, rain gardens, retention ponds, infiltration trenches, and detention ponds are some examples of bioretention systems. Depending on the stormwater volume to be collected, a water retention area can be either dry or wet.'* (World Bank, 2021: 141).



Part C Chapter 3 Figure 2. Functions of bioretention areas including detention ponds/ stormwater attenuation facilities (Source: World Bank, 2021).

Concept Design Community Workshops were held on 17 October and 18 October 2024, where community participants were given the opportunity to provide input to the concepts. The input is reflected in the discussion of the concepts in this section, and where possible these have been reflected in the updated concept design or the description of the components linked thereto.

Part C Chapter 3 Image 8. Community Engagement Session held 17 October 2024 at the Mbekweni Community Hall (Source: AIVIA, 2024)

The Beets Street Concept Layout

The Beets Street Concept Layout is shown in Part C Chapter 3 Map 8. The Concept Layout includes the following components:

- Gateway Entrances
- Pedestrian Pathways
- Play Park
- Stormwater Ponds and Constructed Wetlands
- Stormwater Attenuating Sports Fields and Swales
- Integration of Existing Channels and Riparian Vegetation for Bank Stabilisation
- Solid Waste Management

MBEKWENI CATCHMENT

Beets Street
Landscape Concept Plan

1:2000 on A1 or 1:4000 on A3
Date: 30 October 2024

0 100 200 300 400m

DRAKENSTEIN MUNISIPALITEIT • MUNICIPALITY • UMASIPALA

AVIA

C40 CITIES FINANCE FACILITY

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ARLA Consulting Landscape Architects

Components of the Concept Layout Design

Gateway Entrances:

Gateway entrances mark the first point of contact with the area and serve as a key connection point between the site and its surrounding environment, enhancing the community's connection with the project site. The entrance points will include **lighting and signage** to mark the entrance and provide **educational information** related to the project.

Part 3 Chapter 3 Image 1. Gateway Entrance with signage at the Paarl Arboretum (Source: AIVIA, 2024)

Part 3 Chapter 3 Image 2. Entrance to Green Point Urban Park

The site includes gateway entrances at strategic points along the north-south axis, providing access to the recreational spaces and the stormwater management areas:

- **Gateway Entrance 1 (West)** is located at the north of the site and serves to connect the site to the areas to the west of Jan van Riebeeck Drive to the site, with the **proposed pedestrian bridge or crossing**.
- **Gateway Entrance 1 (East)** is the north-eastern gateway entrance, which creates connectivity between the site and the surrounding communities in the east, including the Vlakkeland community.
- **Gateway Entrance 2,** with a recommended pedestrian connection to promote connectivity east-west across Jan van Riebeeck Drive. The location of this pedestrian crossing is informed by existing desire lines, which suggest that movement across this mobility-oriented dual carriageway is already being

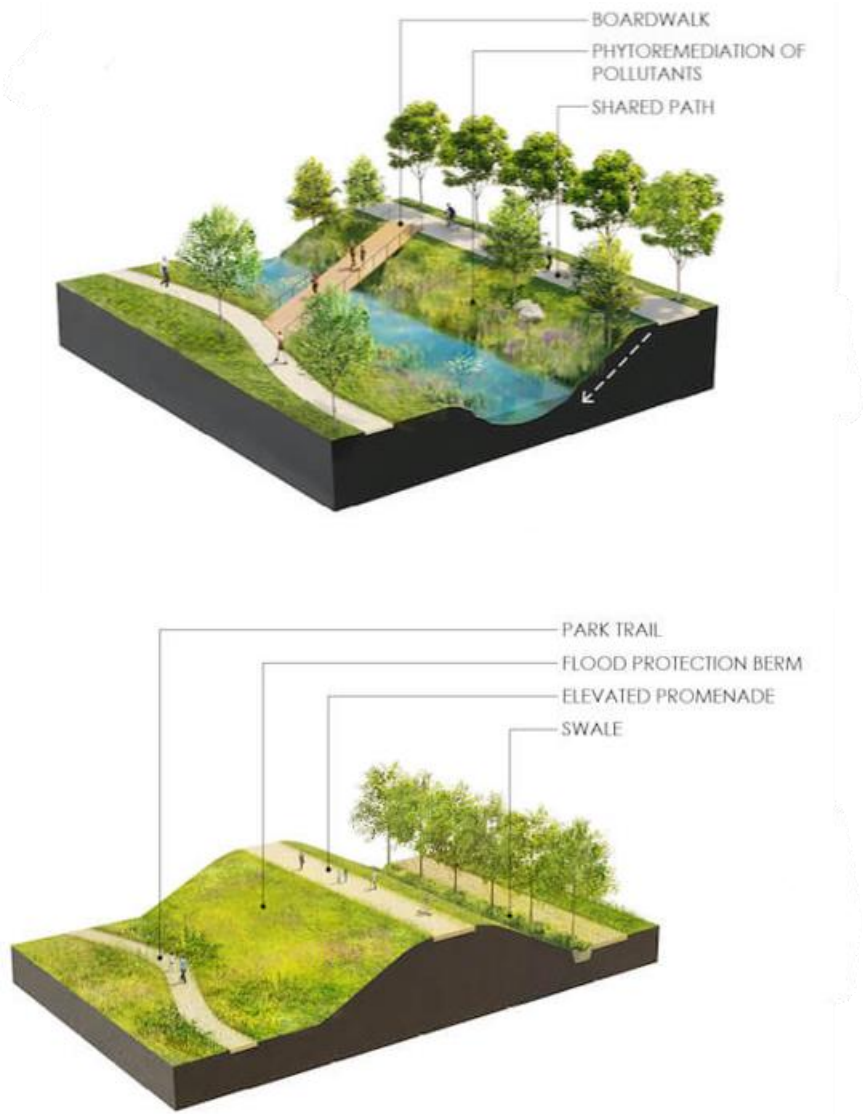
accessed by pedestrians. The crossing would thus serve to address the safety risks posed by the crossing of this road.

- **Gateway Entrance 3 (East and West)**, located along the Kleinbosch river, promoting east-west movement through the site and connecting the surrounding communities to the sports fields proposed both north and south of this Gateway.
- **Gateway Entrance 4 (East and West),** located along Jan van Riebeeck Drive (west) and Beets Street (East) is located in the **far South of the site, connecting the west of the site to Ring Road (Silimela Drive).**

Pedestrian Pathways

Pedestrian pathways promote access and the connection between the key nodes and features. A network of pedestrian pathways is proposed throughout the site, connecting the features of the site. These pathways will enhance public access to green spaces while ensuring that the area remains functional for flood management during rainy periods**. The pathway is envisaged to include lighting as well as signage.**

The pedestrian pathway routes run north-south along Beets Street, north-south along Jan van Riebeeck Drive, with the east to west pedestrian linkages located above the northern sports field, and below southern sports field, and along Vlakkeland Road.



Part C Chapter 3 Figure 3. Illustration of Pedestrian Pathways (Tzifa, A., & Nikolaidou, S. 2020)

Part C Chapter 3 Figure 4. Pedestrian Pathways

Community Participation Inputs – Entrances and Gateways:

During the engagements with the community, the creation of a low wall/ physical barrier was proposed along the sections of Jan van Riebeeck Drive to assist in guiding foot traffic to pre-defined crossings across Jan van Riebeeck Drive and to create a visual boundary for the site. The community further proposed that the approach to the low wall/ physical barrier be aesthetically pleasing and accommodate local materials and local art to activate the edge and enhance the interface of the site with the surrounding environment, particularly given its prominent location along Jan van Riebeeck Drive.

Key Community ideas and inputs:

- Low-wall or fencing along Jan van Riebeeck Drive to direct foot traffic to assigned crossings.
- Creating an aesthetically pleasing boundary of the site

Play Park

A play park will be established on the northern edge of the Beets Street site, providing a dedicated recreational space for the community, designed to integrate seamlessly with the surrounding green infrastructure and flood management features.

Part C Chapter 3 Figure 5. Example of a Play Park: Mouille Point Play Park

Community Participation Inputs – Park:

The participants of engagement sessions in the Mbekweni Wards noted that parks in this area would be welcomed, and that they should include a **culturally sensitive planting strategy**, where specific plants from the isiXhosa and Sotho cultures for example are used within the planting strategy. Community participants recommended that further engagement would be required with a broader set of stakeholders in order to ascertain the appropriate planting and landscaping strategy to ensure its compliance with environmental regulations. The community participants also noted that the **park should include appropriate surfacing**, making the park safer for children. Participants also expressed an interest in gym equipment and noted that all materials should consider the threat of vandalism. As such, the community noted that a phase of community mobilisation must precede any construction work to encourage active and passive surveillance for the park and the site as a whole.

Participants also requested that the park be well lit during the evening to promote safety.

Key Community ideas and inputs:

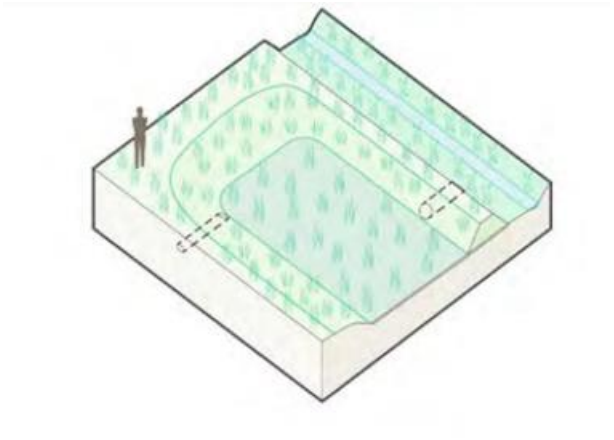
- Culturally sensitive planting strategy to increase familiarity and increase the likelihood of ownership and perception of beauty.
- Appropriate hard and soft surfaces in relation to play equipment to promote safety for children.
- Lighting to promote safety.
- Use of play equipment materials resistant to vandalism

Stormwater Ponds and Constructed Wetlands

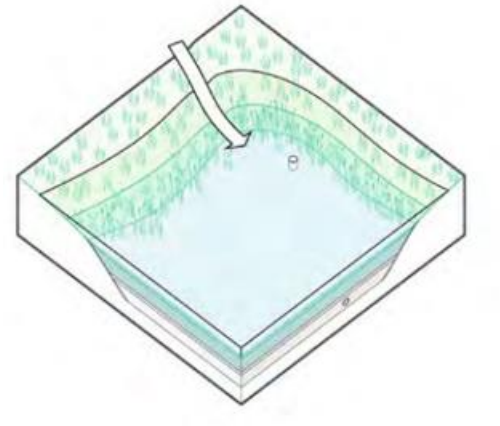
A series of stormwater ponds and constructed wetlands are proposed throughout the site, guided by the existing wetlands located on site. These will serve as stormwater detention basins, temporarily holding water during heavy rainfall events and **slowly releasing it back into the system** to prevent flooding.

The proposed stormwater ponds and constructed wetlands should be vegetated with native riparian plants to naturally filter the water, improve water quality, and support local biodiversity while being resilient enough to withstand dry periods. The vegetation will stabilise the pond edges and enhance the overall aesthetic of the area, creating multi-functional spaces that blend flood control with ecological value. These stormwater ponds and constructed wetlands should incorporate an educational component through the introduction of signage to allow the site to exhibit the benefits of nature-based solutions.

The network of stormwater ponds and constructed wetlands is to be located throughout the site as shown on the Concept Plan. The northern-most stormwater pond includes a sediment forebay. Moving southwards, a constructed wetland is proposed, followed by another stormwater pond before reaching Vlakkeland Road, which divides the site into a northern and southern section. A constructed wetland is proposed Immediately south of Vlakkeland Road, aligned to the existing channelled valley-bottom where the Mbekweni River reaches the site from the east and north. Another stormwater pond is then proposed south of the channelled valley-bottom wetland, which linked to the Keinbosch River and proposed for expansion to extends toward south-western boundary of a proposed sports field. The constructed wetland connects with a stormwater pond, and wetland in the south of the site, where the Dal River passes through the site.



Part C Chapter 3 Figure 6. Illustration of a Stormwater Pond (World Bank, 2021)



Part C Chapter 3 Figure 7. Illustration of a Constructed Wetland (World Bank, 2021)

Part C Chapter 3 Figure 8. Stormwater Pond at Fulham Road Michells Plain

Part C Chapter 3 Figure 9. Stormwater Pond in relation to pedestrian pathways

Part C Chapter 3 Figure 10. Constructed Wetland

Community Participation Inputs – Ponds and Wetlands

Participants from the Mbekweni Wards supported the proposals for the ponds and wetlands as a flood alleviation strategy. Participants noted that the Beets Street site includes a number of low points which they referred to as a 'holes,' and participants noted that in some cases, these holes were created due to sand mining. It was reported by the participants that the Vuka Mbekweni NPO were considering creating ponds in these areas, and they were therefore satisfied with the proposal as it will address existing issues.

Key Community ideas and inputs:

- Support for the constructed wetlands and ponds

Stormwater Attenuating Sports Fields and Swales:

To provide recreational opportunities to the community, the concept layout for the site includes proposed sports fields. Sports fields designed to attenuate stormwater is included as a central feature of the site. The field is slightly sunken to allow for water collection during rainfall events, acting as an additional flood storage area. During dry periods, the field is intended to be fully usable for recreational sports and community events.

These sports fields are located along the pedestrian corridor on the east of the site, north and south of the Kleinbosch River.

A precedent example provided by the City of Cape shows an example of this intervention, whereby a field was upgraded with sports fields surrounded by swales, and the transformation of this area acts as an asset to the community.

Part C Chapter 3 Figure 11. iThemba Labantu Centre (Source: Plan prepared by Design Space Africa and provided by City of Cape Town Catchment Stormwater and River Management Branch)

Part C Chapter 3 Figure 12. The site of iThemba Labantu Centre prior to construction (Source: Plan prepared by Design Space Africa and provided by City of Cape Town Catchment Stormwater and River Management Branch)

Part C Chapter 3 Figure 13. iThemba Labantu Centre Basketball Field post-construction (Source: Plan prepared by Design Space Africa and provided by City of Cape Town Catchment Stormwater and River Management Branch)

Part C Chapter 3 Figure 14. iThemba Labantu Centre Soccer Field post-construction (Source: Plan prepared by Design Space Africa and provided by City of Cape Town Catchment Stormwater and River Management Branch)

Part C Chapter 3 Figure 15. iThemba Labantu Centre Soccer post-construction (Source: Plan prepared by Design Space Africa and provided by City of Cape Town Catchment Stormwater and River Management Branch)

The sports fields will be surrounded by swales, which are shallow, vegetated channels designed to capture and convey stormwater. Swales will further assist in managing excess surface runoff from the sports field and surrounding areas, reducing the risk of flooding and promoting water infiltration.

Swales

Swales are shallow grass-lined/vegetated channels used for stormwater drainage and infiltration (DHS, 2019). The channels are typically comprised of flat bases, sloped sides and are usually dry during non-rainfall periods. These provide alternative drainage interventions to hard-lined roadside gutters and pavements, offering aesthetic and recreational advantages. Additionally, the vegetated cover protects soil from wind and water erosion, reduces runoff rates, and enhances water quality through filtration processes with the potential to capture nutrients (DHS, 2019). Swales will be located around the sports fields, where the low flow can be treated, to slow down the water and to allow for infiltration.

Part C Chapter 3 Figure 16. Planted swale at Mitchells Plain District Hospital

Community Participation Inputs – Stormwater Attenuating Sports fields and swales

The participants of the workshop noted that the community is in need of play areas and sports fields. It was noted that rugby, soccer, cricket and netball are popular sports, and consequently the multi-purpose sport fields were supported by the participants.

The participants also noted that there is a need for seating areas around the sports fields to accommodate spectators.

Key Community ideas and inputs:

- Support for the stormwater attenuating sports fields
- Need for seating areas around sports fields
- Formalisation of the informal cricket pitch

Integration of Existing Channels and Riparian Vegetation for Bank Stabilisation:

The existing stormwater channels are integrated into the new design, connecting to the proposed stormwater ponds and swales. This creates a comprehensive water management system that maximises the site's capacity to handle excess rainwater during storms while maintaining ecological integrity.

The existing channels should be rehabilitated and bordered by suitable riparian vegetation. This vegetation helps to stabilise the banks, reduce erosion, and provide natural filtration of stormwater before it enters the ponds or downstream systems. The riparian zone could also serve as a biodiversity corridor, supporting local wildlife and connecting different ecological areas within the site.

Solid Waste Management

The site will include public refuse bins at regular intervals, particularly along pedestrian pathways, within the park and at the sports fields. The cleaning of the site may make use of local labour through programmes such as the Expanded Public Works Programme (EPWP).

The project includes a sediment forebay in the northern-most stormwater pond which serves to capture and remove sediment, debris, and contaminants from the incoming water flows. Therefore, a litter trap has not been included in the concept design as it serves a similar function to the forebay.

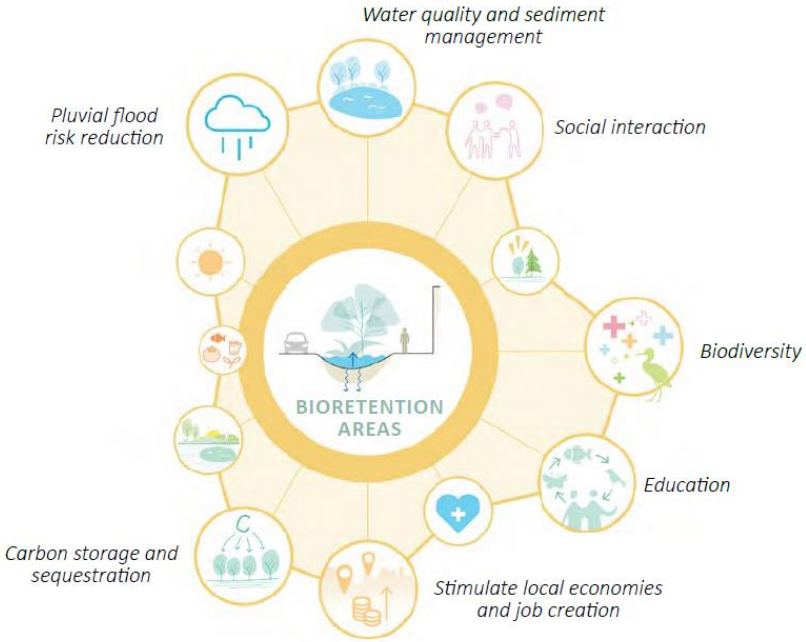
Part C Chapter 3 Figure 17. Riparian Vegetation for Bank Stabilisation (Source: World Bank, 2021)

C3.3.Benefits and Impact Potential: Beets Street HFA Project

The primary objective and benefit to be achieved from this project is Flood Risk Reduction, aligned to the overarching programme objective of building flood resilience. It is critical that flood risk reduction measures are not developed in isolation from the broader urban and natural environment and community context. As such, these four **interrelated** areas – 1) **Flood Risk Reduction**, **2) Urban Management and Open Space Optimisation**, **3) Adaptation and Climate Resilience**, and **4) Community Empowerment and Participation** are identified as four broad groups of benefits that should be sought to give effect to the programme objectives at the project level.

A multitude of benefits can be achieved via the creation and enhancement of open green spaces and bioretention areas. These are summarised in Part C Chapter 3 Figure 18 **and** Part C Chapter 3 Figure 19**, and are further explained in the context of this project.**

Part C Chapter 3 Figure 18. Benefits of Open Green Spaces (Source: World Bank, 2021).



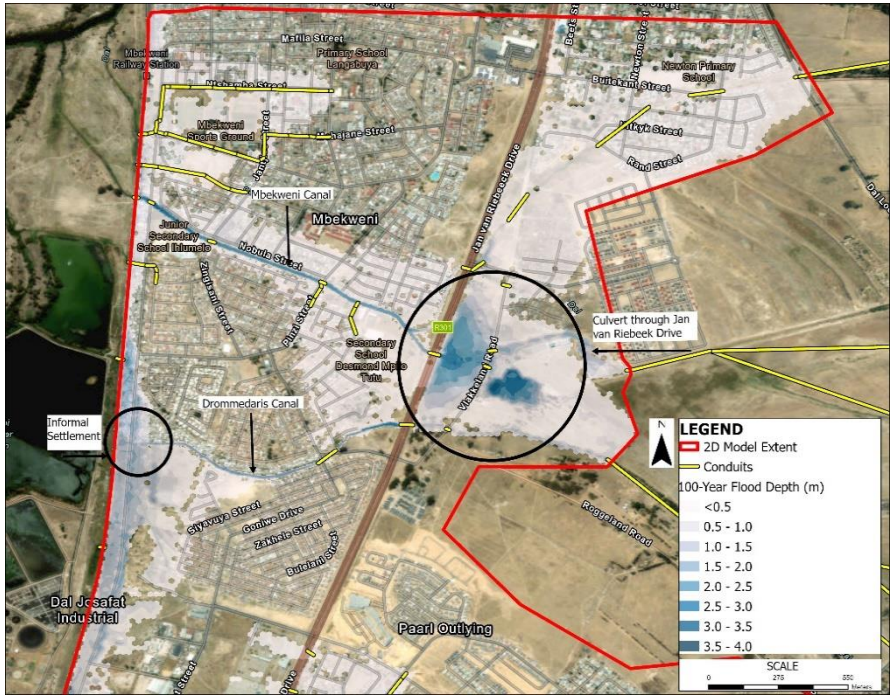
Part C Chapter 3 Figure 19. Benefits of Bioretention Areas (Source: World Bank, 2021).

Improved Stormwater Management and Flood Risk Reduction Potential

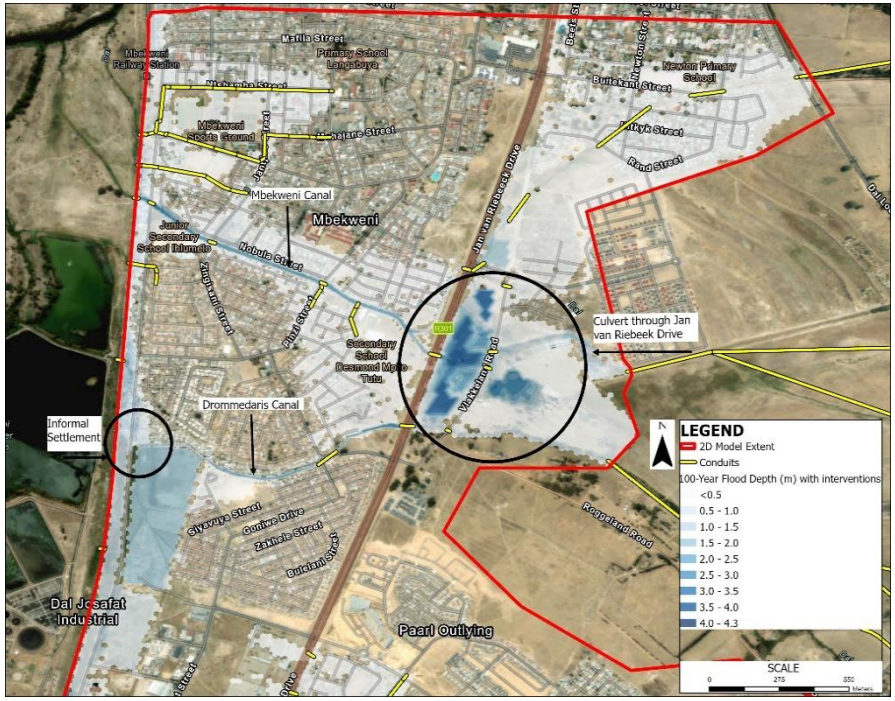
The Beets Street current flood exposure based on the Status Quo PCSWMM, indicates that the residential areas immediately downstream of Jan Van Riebeeck Drive are susceptible to flooding when Jan Van Riebeeck Drive is overtopped. The Drommedaris and the Mbekweni Canals are expected to spill their banks just downstream of Jan Van Riebeeck Drive and flows into the residential area. This is expected for the 5-, 20-, and 100-year return periods although the extent and inundation depths will vary increasing substantially for the 20- and 100-year return periods. This is a result of the limited capacity of the Drommedaris and Mbekweni Canals to convey higher order floods. The ground levels slope down in a northerly direction from Drommedaris Canal to the Mbekweni Canal, therefore the flow that leaves the banks of the Drommedaris Canal flows through the residential area and into the Mbekweni Canal to the north.

The downstream end of the Drommedaris Canal discharges into a canal parallel to the railway and ultimately discharges into the Berg River via a culvert through the railway line. The downstream end of the Mbekweni Canal discharges into the Berg River via a culvert underneath the railway line. Both downstream areas of these canals are residential areas. The area between the railway line and Drommedaris Street consists of an informal settlement and a large portion of this area is low lying and would experience flooding.

The proposed intervention at Beets Street entails the development of a series number of stormwater ponds and constructed wetlands between Jan Van Riebeeck Drive and Beets Street. These ponds and wetlands aim to establish a formal flood attenuation facility and enhance the natural stormwater attenuation capacity of the site between Jan Van Riebeeck Drive and Beets Street. In addition, the lowering of the area will enable the three culverts beneath Jan Van Riebeeck Drive to work together to drain the area.



Part C Chapter 3 Map 9. Current Flood Extent (1:100yr)

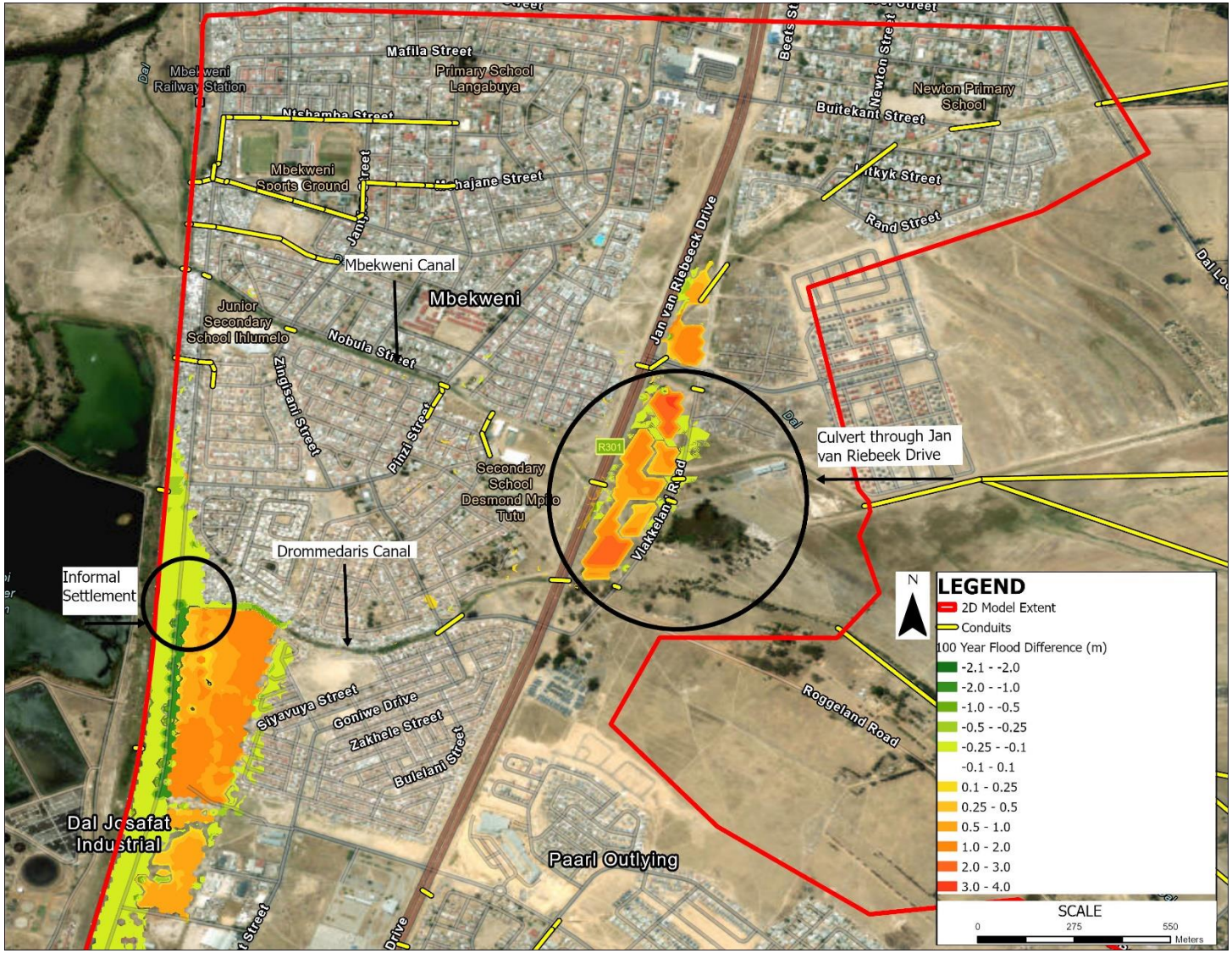


Part C Chapter 3 Map 10. Flood Extent (1:100yr) after intervention

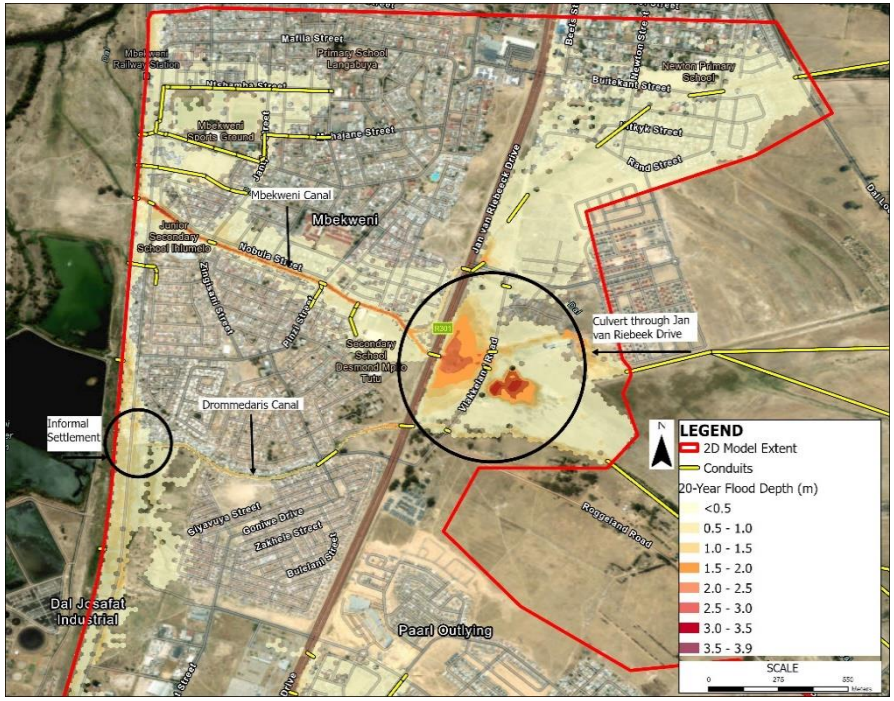
The Beets Street status quo for the 100-year flood indicates that the residential area adjacent to the Drommedaris and Mbekweni Canals is exposed to flooding. Jan Van Riebeeck Drive is also susceptible to overtopping which will result in flooding of the residential area downstream. This area could experience flood depths up to 0.5m in the 100-year flood. The residential areas at the downstream end of the two canals are exposed to potential flood depths of up to 2m near the downstream ends of the Drommedaris Canal and 1m near the downstream ends of the Mbekweni Canal.

The impact of the proposed intervention at Beets Street is that the flooding depth is reduced compared to the current situation, specifically at the downstream end of the two canals. The reduction in flood depths in the residential area immediately downstream of Jan Van Riebeeck Drive is negligible however there is a flood depth reduction of 0.25m up to 0.5m at the downstream end of the two canals under the 100-year flood scenario. This can be seen in Part C Chapter 3 Map 11 which shows the decrease in flood depth (*light* green to *dark* green) and increase in flood depth (*yellow* to red).

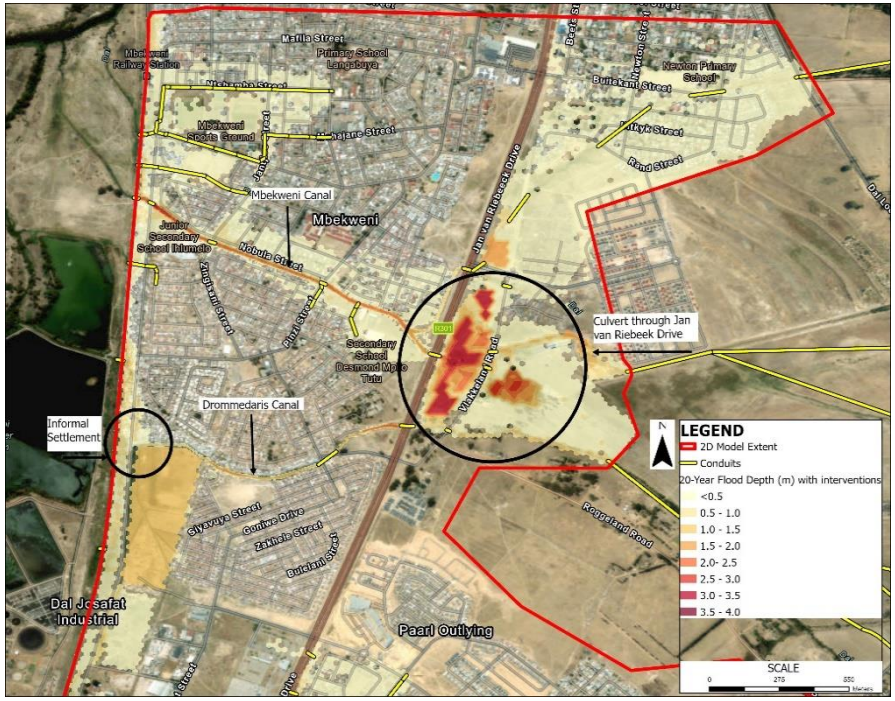
The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. Optimisation of the proposed attenuation capacities and function on the Beets Street site could result in further flood reduction, specifically in the residential areas.



Part C Chapter 3 Map 11. Difference in Current Flood Extent vs After Intervention Flood Extent (1:100yr)



Part C Chapter 3 Map 12. Current Flood Extent (1:20yr)



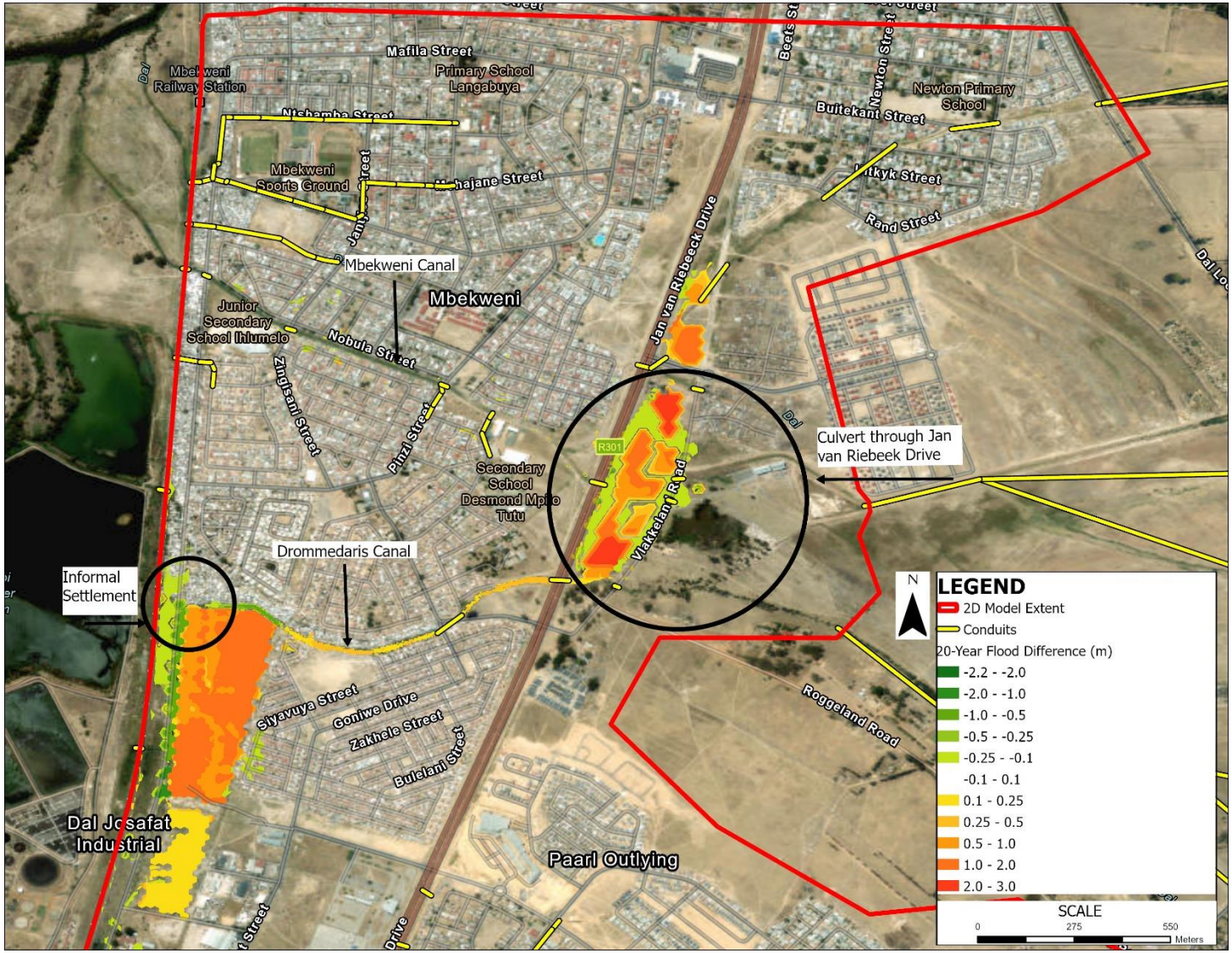
Part C Chapter 3 Map 13. Flood Extent (1:20yr) after intervention

The Beets Street current flooding situation for the 20-year flood indicates that the residential area adjacent to the Mbekweni Canal is exposed to flooding. Jan Van Riebeeck Drive appears to not overtop in the 20-year flood. The upstream reach of the Drommedaris Canal appears to have capacity to accommodate the 20-year flood. The Mbekweni Canal, however, appears not to have sufficient capacity to accommodate the 20-year flood as it is shown to overtop along the reach immediately downstream of Jan Van Riebeeck Drive. This residential area could experience flood depths up to 0.5m in the 20-year flood. The residential areas at the downstream end of the two canals are exposed to flood depths up to 1.5m near the downstream ends of the Drommedaris Canal and 1m near the downstream ends of the Mbekweni Canal.

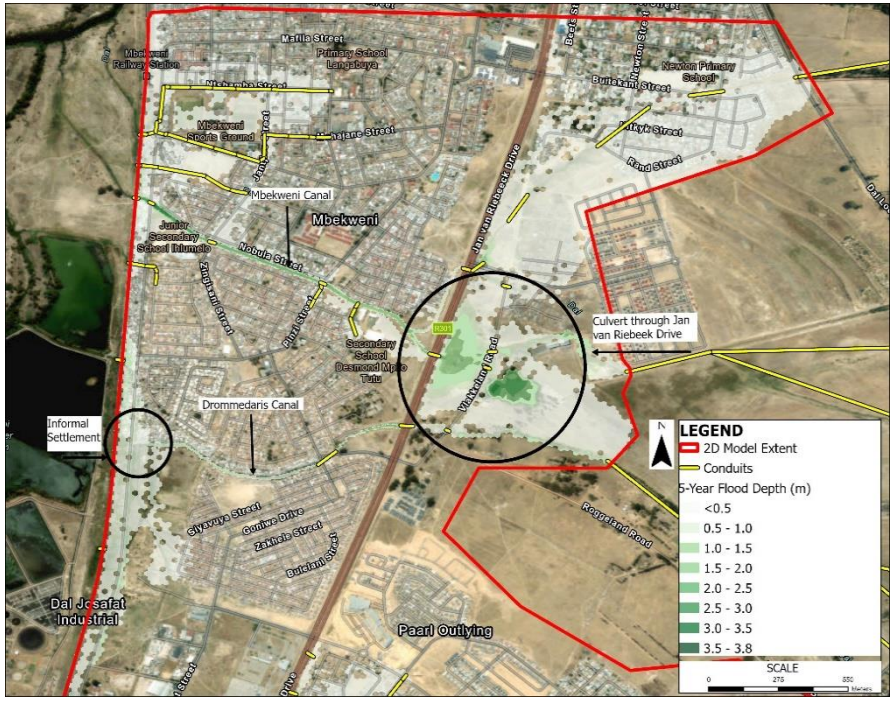
The impact of the proposed intervention at Beets Street is that the flooding depth is reduced compared to the current situation, specifically at the downstream end of the Drommedaris Canal. The reduction in flood depth in the residential area immediately downstream of Jan Van Riebeeck Drive is negligible; however, there is a flood depth

reduction of up to 0.5m at the downstream end of the Drommedaris Canal. This can be seen in Part C Chapter 3 Map 14 which shows the decrease in flood depth (*light* green to *dark* green) and increase in flood depth (*yellow* to red).

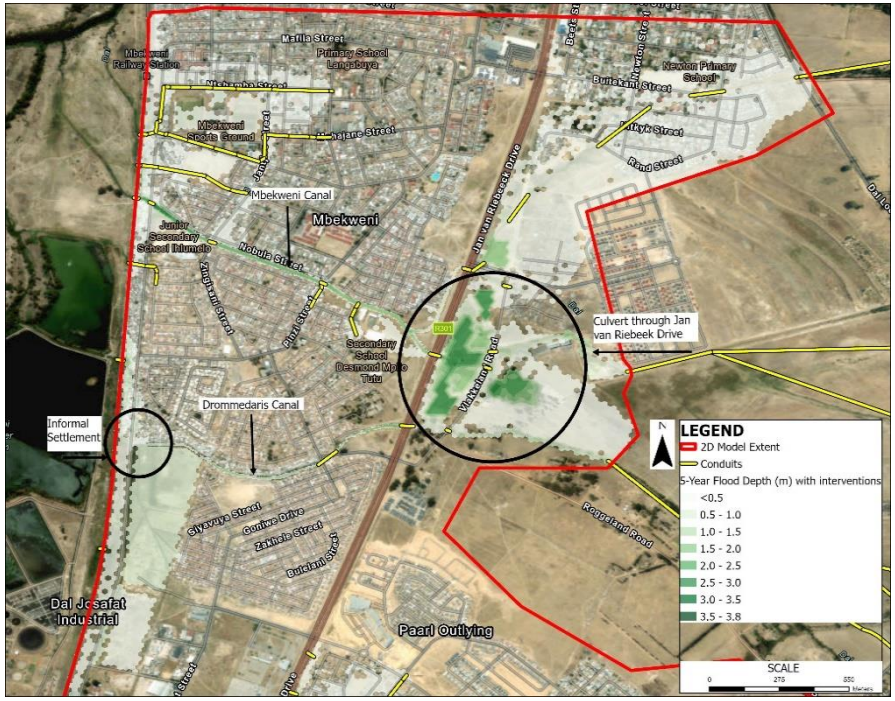
The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. Optimisation of the proposed attenuation capacities and function on the Beets Street site could result in further flood reduction, specifically in the residential areas.



Part C Chapter 3 Map 14. Difference in Current Flood Extent vs After Intervention Flood Extent (1:20yr)



Part C Chapter 3 Map 15. Current Flood Extent (1:5yr)



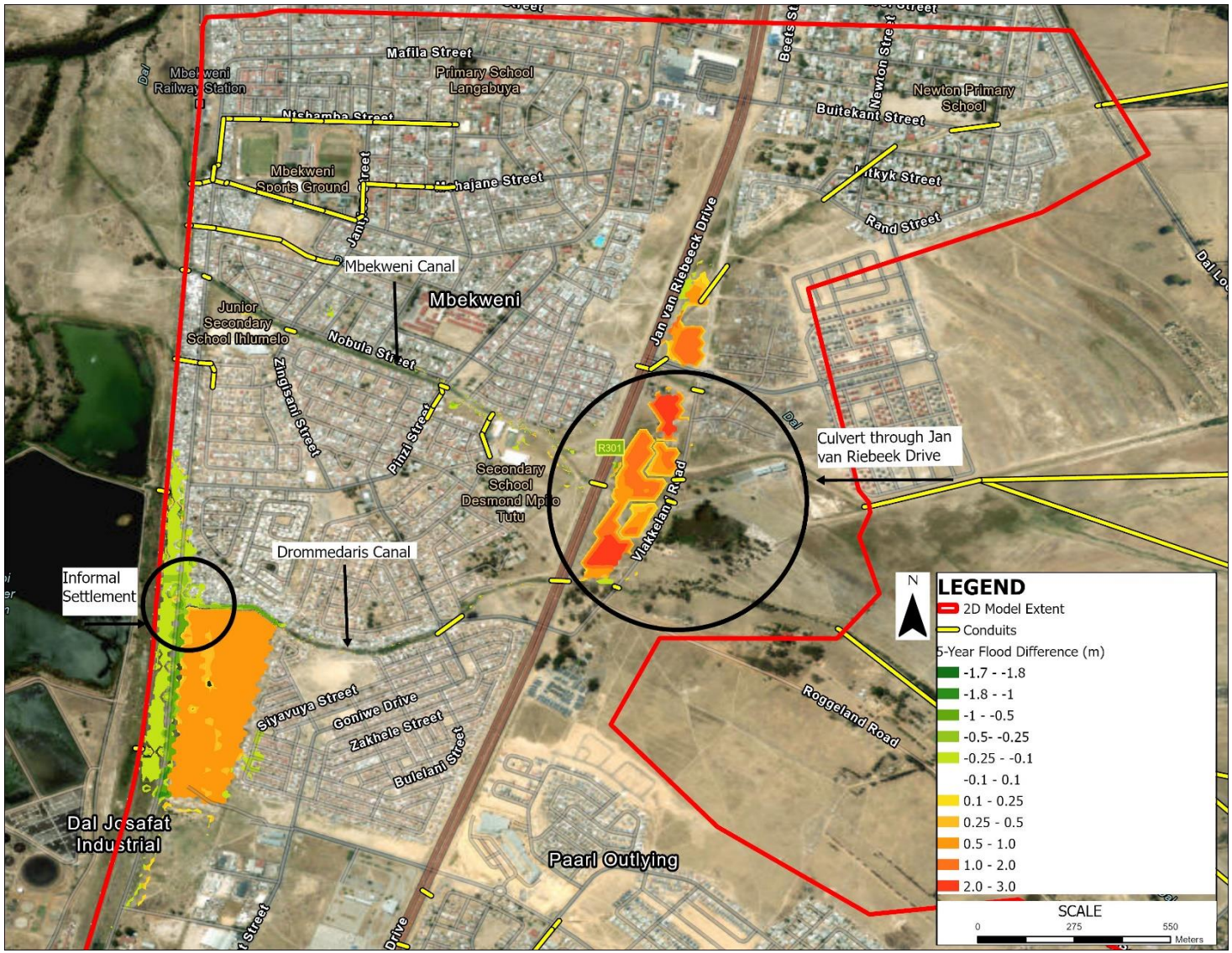
Part C Chapter 3 Map 16. Flood Extent (1:5yr) after intervention

The Beets Street current flooding situation for the 5-year flood indicates that the residential area adjacent to the Mbekweni Canal is exposed to flooding. Jan Van Riebeeck Drive appears not to overtop in the 5-year flood. The upstream reach of the Drommedaris Canal appears to have capacity to accommodate the 5-year flood. The Mbekweni Canal, however, appears not to have capacity to accommodate the 5-year flood as it is shown to overtop along the reach immediately downstream of Jan Van Riebeeck Drive. This residential areas could experience flood depths up to 0.5m in the 5-year flood. The residential areas at the downstream end of the two canals are exposed to flood depths up to 1.0m near the downstream ends of the two canals.

The impact of the proposed intervention at Beets Street is that the flooding depth is reduced compared to the current situation, specifically at the downstream end of the Drommedaris Canal. The reduction in flood depth in the residential area immediately downstream of Jan Van Riebeeck Drive is negligible; however, there is a flood depth

reduction of up to 0.5m at the downstream end of the Drommedaris Canal. This can be seen in Part C Chapter 3 Map 17 which shows the decrease in flood depth (*light* green to *dark* green) and increase in flood depth (*yellow* to red).

The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. Optimisation of the proposed attenuation capacities and function on the Beets Street site could result in further flood reduction, specifically in the residential areas.


Mafila Street
Primary School Langabuya
Mbekweni Railway Station
Ntshamba Street
Mbekweni Sports Ground
Mbekweni Canal
Mbekweni
Junior Secondary School Ihlumelo
Nobula Street
Zingisani Street
Pinzi Street
Secondary School Desmond Mpilo Tutu
R301
Viakkelani Road
Jan van Riebeeck Drive
Culvert through Jan van Riebeek Drive
Drommedaris Canal
Informal Settlement
Siyavuya Street
Goniwe Drive
Zakhele Street
Buiselani Street
Dal Josafat Industrial
Paarl Outlying
Roggeland Road
Buitekant Street
Newton Primary School
Rand Street
N
LEGEND
2D Model Extent
Conduits
5-Year Flood Difference (m)
-1.7 - -1.8
-1.8 - -1
-1 - -0.5
-0.5- -0.25
-0.25 - -0.1
-0.1 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 2.0
2.0 - 3.0
SCALE
0
275
550
Meters

Part C Chapter 3 Map 17. Difference in Current Flood Extent vs After Intervention Flood Extent (1:5yr)

Urban Management and Open Space Optimisation

Recreation and Accessibility for all users:

The entrance points are located at several points across the site to maximise physical accessibility to surrounding communities. Access from both sides of Jan van Riebeeck Drive is proposed to enhance usability of the site. During the detailed design of the site components, **universal accessibility principles should be applied to ensure that the site accommodates all non-motorised transport users and people with physical disabilities.** The site should also be designed such that there is legibility for children and adults.

Recreational benefits are achieved through the incorporation of sports fields, a play park and pedestrian movement routes. The community noted that restorative and sporting spaces are required and suggested that pleasant and well-maintained open spaces would provide the recreational benefits that are much needed by the community. The activation of the site can also offer job creation opportunities for surrounding communities.

National Strategic Framework on Universal Design and Access - Principles of Universal Design:

- **Equitable use -** Design that is useful and marketable to persons with diverse access needs.
- **Flexibility in use** - Design that accommodates a wide range of individual preferences and access needs.
- **Simple and intuitive use** - Design that is easy to understand regardless of the user's experience, knowledge, language, skills or concentration level (in loco use).
- **Perceptible information** - Design that communicates necessary information effectively to the user regardless of ambient conditions or the users sensory access needs.
- **Tolerance for error** - Design that minimises hazards and adverse consequences of accidental or unintended actions.
- **Low physical effort** - Design that can be used efficiently and comfortably and with a minimum of fatigue or struggle.
- **Size and space for approach and use** - Design that provides appropriate size and space for approach, reach, manipulation and use regardless of the user's body size, posture or mobility.

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Spatial Alignment and Improved Land Use Management:

Land use change will have a significant impact on catchment hydrology and flood risk. Development is associated with an increase in impermeable surfaces which will contribute to increased runoff and peak discharges in the absence of attenuation interventions. Activating this area though the development of **multi-functional open spaces** aligns with the DM SDF 2024, which has designated the Beets Street Site as Green Space. The project will allow for the protection and active use of green space and will also assist in ensuring that current sites earmarked for green/open space remain undeveloped and are able to serve as permeable surfaces. This is particularly critical given that land use change was found to be a key driver for changing hydrology.

Service delivery through stormwater management and Sustainable Urban Drainage Systems (SUDS)

The project seeks to achieve flood risk reduction benefits through the development of hybrid flood alleviation measures - leveraging nature-based solutions as complementary to more conventional 'grey' service delivery approaches. SUDS present an approach to stormwater/runoff management that aims to reduce downstream flooding, enhance infiltration into the ground, remove pollution, improve the quality of stormwater, reduce pollution in water bodies, and improve biodiversity. SUDS encourages natural drainage processes by circulating water back into the water cycle rather than just collecting and detaining it, recognising the importance of stormwater as a resource. The processes identified in this section constitutes SUDS which focus on managing flow quantity, quality, amenity, and biodiversity. In addition, interventions can form a natural part of open spaces in a settlement and contribute to the quality of the environment and the aesthetics of a neighbourhood (DHS, 2019). The project therefore serves to facilitate more resilient stormwater management services and serves to protect communities and municipal and private infrastructure through flood risk reduction.

Placemaking and improvement to the aesthetic appearance of the city

The project seeks to achieve an improved urban realm and placemaking to support the functionality and improvement of the urban environment. This will be achieved through the introduction of pedestrian movement corridors, the creation of safe and accessible public spaces, including sports fields, and the promotion of urban integration. Located along the well-utilised Jan van Riebeeck Drive, the project site is clearly visible to a wide range of commuters, and as such the development of the site will make the user experience more pleasant, given the aesthetic improvements and the creation of actively used open space on-site. The development of the site will also be accompanied by improved solid waste management, improving the health of communities and the cleanliness of the City.

Ecological Restoration and Rehabilitation and Water Quality Improvement

The concept incorporates the existing wetland areas and aims to restore and maintain the optimal condition of these wetlands to achieve the optimal FAES. This includes ensuring the provision of the full FAES potential available from the on-site **floodplain wetlands** (**very high flood attenuation** ecosystem services are possible when in optimal condition) and **channelled valley bottom wetlands** (**high flood attenuation** and water quality enhancement ecosystem services are possible when in good condition). Well-functioning wetlands also offer water treatment benefits and will achieve **improved water quality**. It will also serve to **create and restore habitats for biodiversity**.

Urban Cooling and Air Quality

In urban areas, green infrastructure such as parks, green roofs, and urban wetlands help to cool surrounding areas by providing shade and reducing the urban heat island effect. This improves air quality and liveability, creating more pleasant environments for residents while also reducing energy demand for cooling.

Carbon Sequestration

Nature-based solutions, particularly those involving reforestation and wetland creation and restoration, act as carbon sinks, helping to mitigate climate change by sequestering carbon dioxide from the atmosphere. This not only supports local climate goals but also contributes to global efforts to reduce greenhouse gas emissions.

Education and awareness

The incorporation of signage along pathways and entrances can further enhance the education and awareness opportunities to be attained through the development of the site.

Solid Waste Management

Improved solid waste management aims to support a clean and healthy environment and limits the maintenance requirements arising from blockages of stormwater infrastructure resulting from litter.

Adaptation and Climate Resilience - Toward a climate resilient pathway

Drakenstein's Climate Change Action Plan (CCAP) includes a series of climate change objectives. The Beets Street Hybrid Flood Alleviation Project will support the following DM climate change objectives:

- Water security and efficiency
- Climate resilient and low carbon development
- Biodiversity and ecosystem management
- Public health
- Disaster management
- Building response capacity through improved coordination and awareness

In addition, the DM HFA identified the following core requirements for responsiveness to projected climate change:

- **Responsiveness to the changing catchment hydrology**
- **Responsiveness more extreme drought and flood cycles**
- **Responsible land use management to protect ecological infrastructure and enhance urban permeable surfaces.**

The Beets Street Hybrid Flood Alleviation Project is responsive to these requirements, whereby the hybrid solutions for the project includes:

Wetland Restoration/Construction, to improve resilience to droughts and floods: Wetlands act as natural water storage areas, absorbing and holding water during periods of excessive rainfall. In times of drought, they maintain local moisture levels, helping to stabilise surrounding ecosystems. **The creation of stormwater ponds and the utilisation of sports fields provide a similar benefit,** providing climate change adaptation benefits through storage and absorption capabilities at times of heavy rainfall, reducing peak flows and decreasing flood risk while also improving water quality. These interventions also provide adaptation benefits at times of drought as they increase infiltration and groundwater recharge, while also providing water storage potential.

Improved drainage networks and riverbank rehabilitation, to improve resilience to address changing catchment hydrology: In urban areas, hybrid measures include upgrading drainage systems while integrating natural features such as bio-swales and permeable surfaces that manage water flow more sustainably. At the Beets Street site, the proposal incorporates the principles of Sustainable Urban Drainage in the design through hybrid, nature-based solutions. The planting of riparian vegetation for bank stabilisation provides climate change adaptation benefits through erosion control, water quality improvement, increasing infiltration rates and making the catchment more **resilient to both drought and heavy rainfall**. The use of groundcover vegetation also protects soil from becoming overly compacted, maintaining its ability to absorb water during storm events.

The active use and protection of open space and the retaining of permeable surfaces in urban areas is responsive to the need for sound land use management that will have a positive impact on the hydrology of the catchment and achieve carbon sequestration benefits.

Sustainable Development Goals

The Beets Street interventions align with the following Sustainable Development Goals (SDGs):

- SDG 6: Clean Water and Sanitation – through flood alleviation, stormwater management and solid waste management
- SDG 11: Sustainable Cities and Communities – through green infrastructure, increased climate resilience and the development of community recreational spaces
- SDG 13: Climate Action – Climate change adaptation through flood risk reduction
- SDG 15: Life on Land – Ecological restoration and the planting of riparian vegetation

Illustrated through the above-listed SDGs, the site has high sustainable development potential that promotes climate change adaptation through a reduction in flood risk. The project has been developed allowing for an expansion of the Beets Street site intervention in upstream parts of the Berg River Catchment to promote flood alleviation benefits downstream.

Community empowerment and improved quality of life for local communities

The project will offer direct benefits to the local community given its strategic location and the intended use of this site as a recreational and green space to serve residential communities on the east of Jan van Riebeeck Drive. The project offers the opportunity for meaningful engagement across a range of stakeholders.

- **Ward Councillors and Ward Committees:** These municipal structures should be leveraged as intermediaries with local communities and to support the attainment of community accountability.

- **NGOs and NPOs:** The NGO and NPO sectors should be mobilised to support the project, and consideration should be given to the establishment of a community programme to facilitate 'eyes on the street.' In Mbekweni, community organisations such as **Vuka Mbekweni and Mbekweni Eco-Club** have been identified as key stakeholders that could support the meaningful engagement of the community within the developmental process.

- **Youth and adult education and awareness** should be facilitated. Schools and other educational institutions could be encouraged to visit the site for educational purposes, supported by appropriate signage with educational materials. Schools in proximity to the site include **Desmond Tutu Secondary School and Mbekweni Primary, both located west of Jan van Riebeeck Drive**.

- **Job Creation Potential:** Project implementation will provide opportunities for job creation for local communities during the construction phases and operation and maintenance phases. While the construction phase job creation is set to be applicable only in the short term, the operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members through voluntary project stewardship, the leveraging of the enhanced public works programme (EPWP), as well as other job creation opportunities. See also the Job Creation Potential Section C3.7.

C3.4.Project Lifecycle Stages and Duration: Beets Street HFA Project

The following sections provide an overview the typical phases of a project including:

- **Planning and Design of the Project**
- **Construction and implementation**
- **Operation and Maintenance**

This Section also provides an overview of the typical studies that may be required in relation to the Beets Street project. The typical phases of a project lifecycle include:

Planning and Design of the project

This includes detailed feasibility studies, and the detailed design of the project. Importantly, this phase in the project lifecycle should see the meaningful engagement of potential project beneficiaries (local communities) and, ensure that they are adequately engaged in the ideation of solutions so that the stakeholder input is a key informant to the project components.

The following activities typically form part of this Phase:

Feasibility Study and Initial Assessments

A **Basic Assessment** or full **Environmental Impact Assessment**. This may also include other specialist studies across a range of disciplines. The final list of specialist studies required should be determined during the feasibility study process, and can be guided by the Department of Forestry, Fisheries and Environment's (DFFE) Screening Tool. **The results of the screening tool are contained in Appendix: Beets Street DFFE Screening Tool Results.**

The environmental application (BA or EIA) as well as the Land Use Application forming part of the Permitting and Regulatory Approvals) will include a legally required public participation process. In order to maximise the opportunity for participatory planning, it is proposed that the project include additional stakeholder engagement (beyond the legally required public participation processes) to engage community members on a continuous basis in order to continue to the engagement process that has commenced in the design of the DM HFA Programme though the Community Flood Risk Perception Study (July 2024), and the Concept Design Community Workshop (October 2024).

Engineering design and planning

This will include the detailed design of the proposed hybrid flood alleviation infrastructure and other elements of the site layout. f

Landscape Design and planning

Landscape design and planning of hard and soft surfaces and river rehabilitation components of the site layout will be designed as part of this process.

Permitting and Regulatory Approvals

This refers to the relevant approvals necessary to proceed with the development. This will typically include **Land Use Applications (See Land Use Appendix) –** The details of the land use application can be determined during the preapplication meeting with the municipality, and the land use approval is typically contingent upon the completion of all specialist studies. The regulatory approvals will also include a **Water Use Licence Application (WULA).** The nature of the project is likely to trigger a full WULA (as opposed to a General Authorisation). From time to time, the WULA process triggers additional specialist studies.

Additional approvals could be required throughout various phases, and specifically highlighted at this point in the sequence due to the development and environmental approvals that will likely be necessary from with the municipality and from the relevant competent authorities.

Part C Chapter 3 Table 3. Specialist studies required for the Project (subject to refinement) as part of the Planning and Design Phase of the Project

Feasibility Study and Assessment	Beets Street
Environmental Authorisation (EA) (Basic Assessment or Environmental Impact Assessment)	Assumes a Basic Assessment. Detailed requirements to be determined by the competent authority. Full EIA will incur a greater cost. Specialist studies may include those listed below. The specialist studies will require confirmation from the local authority.
Geotechnical Investigation	
Topographical Surveys	
Urban Planning and Landscape Architecture	
Traffic Impact Assessment or Statement	Will require a Traffic Impact Assessment.
Heritage Impact Assessment	
Visual Impact Assessment (Level 3)	
Terrestrial Biodiversity Assessment	
Freshwater Impact Assessment (Aquatic Biodiversity Assessment Report)	
Constructed wetland technical assessment and planning (Treatment Wetland Specialist)	Will inform the Aquatic Biodiversity Assessment Report.
Botanical Assessment	
Waste Management Impact Assessment	
Detailed Flood Study	

Feasibility Study and Assessment	Beets Street
Stakeholder Engagement/Consultation Services	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Assumes 80-120 days of professional time.
Project Management (Feasibility Studies and Assessments)	
Engineering and Design	
Stakeholder Engagement/Consultation Services and Socio-economic Assessment	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Socio-economic Assessment can also be included.
Project Management (Engineering and Design)	
Water Use License Application (WULA)	A full WULA is assumed.
Land Use Application(s)	Detailed requirements (and therefore cost) to be determined based on requirements set out by the local authority.
Project Management (Permitting and Regulatory Approvals)	
Detailed Design (Landscape Architectural Design)	
Tender Documentation (Landscape Architectural Design)	
Project Management (Landscape Architecture)	

Construction and Implementation

This refers to the on-site construction of infrastructure and the delineation of space through landscaping, planting and movement corridors.

The following activities typically form part of this Phase:

- Site Preparation
- Construction of Infrastructure (e.g. levees, storm drains)
- Installation of Nature-Based Solutions (e.g. wetlands, green infrastructure)
- Planting and Vegetation
- Materials and Equipment
- Transport and Logistics
- Construction Supervision and Oversight

For this project, the following components were incorporated into the cost estimates where applicable:

- Earthworks
- Erosion protection
- Flood walls / dykes
- Culverts and outlets
- Hard Landscape works
- Soft Landscape Works
- Riverine rehabilitation
- Site establishment
- Professional fees (Site staff)
- Contingencies

Operation and Maintenance

Critical to the long-term success of the project, operation and maintenance efforts will be required from a wide range of stakeholders. This may include the involvement of community members through voluntary project stewardship, the leveraging of the Enhanced Public Works Programme (EPWP), as well as other job creation opportunities.

The following activities typically form part of this Phase:

- Maintenance of Infrastructure (e.g. stormwater systems)
- Maintenance of Nature-Based Solutions (e.g. replanting, erosion control)
- Reporting and Evaluation
- Labour Costs (Monitoring & Maintenance)

This also includes:

- Legal and Insurance Costs
- Administrative and Overhead Costs

Project Duration

The project location is on municipal-owned and managed public open space. It is estimated that the project construction and implementation can be completed by year 3. It Is recommended that a detailed phasing plan be developed during the detailed design of the project. The starting year will be dependent upon the prioritisation of the DM HFA Stage 1 projects to be undertaken by the Drakenstein Municipality.

Project Phase	Y1	Y2	Y3	Y4	Y5
Planning and Design:					
Construction and Implementation					
Operation and Maintenance (on-going)					
Stakeholder Engagement and Community Participation					

C3.5.Institutional Capacity, Alignment and Resource Requirements: Beets Street HFA Project

Projects related to transformative adaptation and integrated planning are multi-disciplinary – requiring the buy-in and investment from a wide range of municipal and other stakeholders to achieve successful implementation and long-term project sustainability. The following table sets out the typical resources required during each phase of the project. This list is not exhaustive.

Part C Chapter 3 Table 4. Anticipated specialist inputs during the project lifecycle phases.

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Project Manager (Professionally registered engineer/ Professionally registered urban planner / Professionally registered construction project manager	Oversee the delivery of the project, may require professionally registered engineer or urban planner (Detailed Design); Professionally Registered Engineer or Construction Project Manager (Construction and Implementation).			
Professionally Registered Environmental Impact Assessment Practitioner (EAP)	Undertake EIA or BA; coordination of relevant specialist studies; Undertake and oversee the WULA process.			
Environmental Control Officer (ECO)	An EAP may also be required for Environmental Compliance during construction and operation phases.			

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Professionally Registered Geotechnical Engineer (ECSA)	Geotechnical investigations.			
Professionally Registered Land Surveyor (SACG)	Conduct topographical survey.			
Professionally Registered Town Planner (SACPLAN)	Oversee site design, provide urban planning specialist input, conduct the land use application, provide project management or support services to the project manager.			
Professional Registered Engineers (ECSA)	Detailed flood study (stormwater engineer); Roads Engineer (Traffic Impact Assessment)			
GIS Specialist	Undertake mapping and spatial analysis			
Heritage Practitioner	Heritage Impact Assessment and associated studies.			
Professionally Registered Landscape Architect	Visual Impact Assessment			
Ecologist	Terrestrial Biodiversity Impact Assessment; Freshwater Impact Assessment			
Ichthyologist	Specialist study in relation to fish			

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Treatment Wetland Specialist	Provision of technical details of the design of treatment wetlands			
Botanist	Botanical Assessment			
Waste Management Specialist	Waste Management Impact Assessment			
Public Participation Professional	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Socio-economic Assessment can also be included.			

In addition to the requirements in Part C Chapter 3 Table 4, which will typically be supplied by specialists, the DM will require the internal institutional capacity to support the successful delivery of the project through its lifecycle phases. The recommendation is therefore that this team be formed on the basis of the Departments, Divisions, and Sections that formed part of the DM HFA Programme design. This will therefore include, but not be limited to, the following:

Part C Chapter 3 Table 5. Recommended Municipal representation and roles

Municipal Representation	Typical Role
Environmental Manager/ EAP	Programme Co-ordinator; Environmental Expertise, Guidance on Land Use Application
Roads and Stormwater Engineer	Municipal Project Manager, Rodas and Stormwater Division, Guidance on Land Use Application, Construction Project Management

Municipal Representation	Typical Role
Spatial Planner	Spatial planning inputs, Guidance on Land Use Application
Land Use Planner	Land Use Planning inputs, Guidance on Land Use Application
Supply Chain Management Practitioner	Support with Supply Chain related activities in the procurement of services and materials
Water and Sanitation Engineer	Provide inputs on water and sanitation related matters
Parks section representative	Guidance and support in relation to the establishment of public parks and sport facilities, input and oversight of operation and maintenance of planting and fields.
Solid Waste Management	Responsible for the planning and operation of a site-based solid waste management strategy.
EPWP, Projects, Programmes and Funding	
Portfolio Councillors	
Ward Councillors and Committee Members	Support to mobilise the community.

Part C Chapter 3 Table 6. Suggested Stakeholders and Roles

Other stakeholders	Typical Role
Provincial Government	Competent Authority for relevant permitting and approvals

Other stakeholders	Typical Role
National Government	Department of Water and Strategy
NGOs	Intermediary Support

In order to achieve the mainstreaming and integration of this project, the following additional recommendations are offered:

- Programme Coordination role should be fulfilled by the Environmental Section;
- Project Management for each of the Stage 1 DM HFA Priority Project should be championed by Stormwater Management and be situated within the stormwater management plan.

The coordinator and Project Manager should also develop project specific operation plan to develop detailed roles and responsibilities for each of the identified stakeholders. The way forward should include:

- Adopting the DM HFA Programme as part of the Stormwater Master Plan
- Assigning the programme to a KPA 4 and PDO 23
- Development of a detailed Implementation Plan for each of the Stage 1 DM HFA Projects, and aligning the project with additional PDOs
- Development of a detailed schedule of responsibilities per stakeholder at all stages of the project lifecycle
- Ensuring on-going community engagement and participatory planning.

Alignment With Municipal Objectives:

The project aligns will all municipal objectives. It is particularly relevant to Strategic Objective 4, given the strong alignment with infrastructure provision.

Part C Chapter 3 Table 7. Project Alignment with Municipal Strategic Objectives

Municipal Strategic Objective	Alignment
To ensure good governance and compliance.	X
To ensure financial sustainability to meet statutory requirements.	X
To ensure an efficient and effective organisation supported by a competent and skilled workforce.	X
To provide and maintain the required physical infrastructure and to ensure sustainable and affordable services	X
To plan, promote investment and facilitate economic growth.	X
To facilitate, support and promote social and community development.	X

Key Performance Areas (KPAs) and Pre-Determined Objectives (PDOs)

KPAs refer to the areas within the business unit for which an individual or group is logically responsible. PDOs are the areas identified as important or crucial, where a result will assist in the achievement of the set objectives or goal (DM IDP, 2024:67).

It is recommended that this project be located within **KPA 4: Infrastructure and Services**, under **PDO 23: Transport, Roads, and Stormwater. This is directly aligned with the Strategic Objective *to provide and maintain the required physical infrastructure and to ensure sustainable and affordable services.***

C3.6.Cost Estimates: Beets Street HFA Project

This section provides cost estimates for the Beets Street HFA Project. These estimates are based on the draft concepts and are indicative fees only. The construction and implementation costs are dependent on the outcomes of the Design and Planning process. The detailed costing of the Design and Planning process will be dependent upon the outcomes of the preapplication meeting and the requirements for feasibility studies, approvals and licenses as set out by the relevant competent authorities. *It is important to note that a Quantity Surveyor / Cost Estimating Consultant should be appointed to determine more accurate Construction and Implementation Costs. This would take into account local and context specific considerations for the various items. As the engineering design development progresses, refined estimates can be prepared by the Quantity Surveyor / Cost Estimating Consultant.*

Part C Chapter 3 Table 8. Estimated project costing

BEETS STREET COSTING		
Design and Planning Costs		
Item Description	**Estimated Cost (ZAR)**	**Comments (if any)**
Feasibility Study and Initial Assessments	2 615 751,60	
Detailed Engineering Designs and Tender Documentation	4 888 959,80	No complexity factor has been applied
Detailed Landscape Architectural Design and Tender Documentation	1 434 520,91	
Permitting and Regulatory Approvals	297 000,00	
Subtotal	**9 236 232,31**	

BEETS STREET COSTING

Construction and Implementation Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Earthworks	20 642 500,00	1m imported fill over entire site area
Erosion protection	6 375 000,00	
Flood walls/dykes	-	
Culverts and outlets	3 000 000,00	
Hard landscape works	6 446 850,00	Proposed playground; Pedestrian pathways; Gateway entrance
Soft landscape works	17 262 000,00	Multi-purpose field, Attenuation Pond edge around the fields, Meadow grasses
Riverine rehabilitation	5 564 100,00	Existing wetland to be retained, Stormwater attenuation pond, Constructed wetland, Seasonal wetland, Dal river overtops, Proposed wetland
Total (1)	59 290 450,00	
Site establishment	11 858 090,00	20% of Total (1)
Total (2)	71 148 540,00	
Professional fees	14 229 708,00	20% of Total (2)
Contingencies	14 229 708,00	20 %
Subtotal	**99 607 956,00**	

Operation and Maintenance Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Maintenance of Infrastructure (e.g., stormwater systems)	1 992 159,12	Recurring maintenance costs (Annual)

BEETS STREET COSTING		
Maintenance of Nature-Based Solutions (e.g., replanting, erosion control)	570 000,00	Cost for the first year. The first year of maintenance would be the most intensive, thereafter (especially once 80% plant cover has been achieved) maintenance cost should reduce by one third.
Reporting and Evaluation	150 000,00	Annual reviews, audits
Subtotal	**2 712 159,12**	

Other Miscellaneous Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Community Awareness, Skills Transfer and Education Campaigns	**350 000,00**	Detail of scope/cost to be defined at the discretion of the local authority
Subtotal	**350 000,00**	

Grand Total	111 906 347,43

Total Estimated Cost (Summary)

TOTAL ESTIMATED COST (SUMMARY) – BEETS STREET		
Cost Category	**Total Amount (ZAR)**	**CAPEX vs OPEX**
Planning and Design Cost	9 236 232,31	CAPEX
Construction and Implementation Costs	99 607 956,00	CAPEX
Operation and Maintenance Costs	2 712 159,12	OPEX
Miscellaneous Costs	350 000,00	CAPEX/OPEX

TOTAL ESTIMATED COST (SUMMARY) – BEETS STREET	
Grand Total	111 906 347,43

Additional notes

The Design and Planning costs for the engineering design and tender documents can be split according to the ECSA guideline on Civil engineering projects (here): refer to Table 1 in the document.

Cost of the Works		Basis of Fee Calculation		Total (Primary fee plus secondary fee)
For projects up to R850 000		Lump Sum or Time Basis		
Where the cost of the works:		Primary fee	Secondary fee	
Exceeds	But does not exceed			
850 000	1 899 000	106 300	15%	
1 899 000	9 347 000	237 400	12%	
9 347 000	19 066 000	982 400	10.5%	
19 066 000	47 372 000	1 857 000	9.5%	
47 372 000	94 960 000	4 121 400	7%	
94 960 000	572 000 000	7 065 000	6.5%	
572 000 000		33 233 200	6%	

The portion of what is included in the design stage and what is included in the construction stage can be determined by using ECSA guidelines again (here) for civil engineering projects. These are as follows in terms of the engineering design split. Stage 1-4 could be classified as engineering design. Stages 5 and 6 are the construction monitoring and close-out of the project.

Stage	Stage of Services Civil: Engineering Projects:	Typical percentage points for each stage
1	**Inception**	5
2	**Concept and Viability**	25
3	**Design Development**	25
4	**Documentation and Procurement**	25
5	**Contract Administration and Inspection**	15
6	**Close-Out**	5
		100%

C3.7.Job Creation Potential: Beets Street Hybrid Flood Alleviation Project

This section of the report provides an analysis of the Job Creation Potential for the Project.

The table shows the temporary and permanent jobs created by the project, temporary jobs are measured in job years, which are defined in the table, while permanent jobs are counted as jobs. An assessment is made of the jobs created as to how many constitute green jobs, in terms of the DFFE's definition. The table also provides an estimate of **direct Jobs per skill level, as well as indirect and induced jobs,** for the given level of investment estimated**.** The job seekers are based on the Drakenstein Municipality's database of job seekers dated to October 2024.

Part C Chapter 3 Table 9. Job Creation Potential.

BEETS STREET DM HFA PROJECT										
Site: Beets Street			**Total direct jobs**	**Direct Jobs per skill level** *Direct jobs are the extra jobs created in the delivery (design, construction/development) of an output and the operation of that output for the duration of its expected life. These direct jobs can be both temporary and permanent.*						**Estimated investment**
	Component	**Disciplines**		**Skilled (PSOC Level 3 and 4)**	**Semi-skilled (PSOC Level 2)**	**Low-skilled (PSOC level 1)**	**Green skilled**	**Green semi-skilled**	**Green low-skilled**	

BEETS STREET DM HFA PROJECT										
Temporary *A temporary job means an employment opportunity created, for a limited time span, typically during the design and development of the infrastructure, project of program.* **(Job years)** *A job-year is a measure of the proportion of time a job is created for. One job year means one job for one year.*	Planning and design	Civil engineering (multiple disciplines), Landscape architects, Planner, EIA practitioner, Technical environmental specialists, Lawyer, Geotechnical engineer, Surveyor, Electrical engineer, Quantity surveyor	8	8	0	0	8	0	0	R9 236 232.31
Temporary (Job years)	Construction and implementation	Civil engineer, Landscape architect, Planner, Scientific specialist, OHSA officer, EC officer, Quantity surveyor, Site manager, Foreman, Site agent, Excavator operator, TLB Operator, Dump truck operator, Planter, Security, General worker	18	3	10	5	3	3	5	R99 607 956.00

BEETS STREET DM HFA PROJECT										
Permanent *Means a full-time equivalent position which endures beyond the development phase of the intervention, through the expected useful life of the infrastructure, plan or program.*	Maintenance and miscellaneous	Foreman, Mower operators, Planters, Driver, General worker	2	0	1	1	0	1	1	R3 062 159.12
Total			28	12	11	6	12	4	6	R 111 906 347.43
Jobseekers in ward			112							
Jobseekers in ward and adjacent ward			2223							
Indirect jobs *Indirect jobs are the jobs created to supply inputs into the output creation to provide inputs that the project requires.*			215							
Induced jobs *Induced jobs are the jobs created in all sectors by the increase in household spending created by the wages paid in the direct jobs and indirect jobs created, following the initial increase in demand in the given sector.*			320							
Discussion	• The proposed intervention in Beets Street is expected to create approximately 26 job-years in the design and construction phase and 2 permanent jobs in maintenance. During the design phase, approximately eight temporary jobs-years will be created, nearly all of which involve highly skilled positions in professional firms (Engineering, Landscape Architecture, Planning, and Scientific Services). All of these positions will qualify as green jobs.									

BEETS STREET DM HFA PROJECT	
	• The 18 job-years created in the construction phase will include three highly skilled job years, 10 semi-skilled job-years, and five low-skilled job-years. All these positions will qualify as green jobs except seven semi-skilled jobs, comprising guards for 24-hour site security. All maintenance jobs will qualify as green jobs. Other semi-skilled jobs include excavator operators, Tractor Loader-Backhoe (TLB) operators, dump truck operators, planters, and gabion basket makers. • There is a significant job seekers database for the ward (11) and adjacent wards (9, 29, 7, 8) where the Beets Street Intervention will take place. The low-skilled jobs could be sourced entirely from the ward and adjacent wards, with the potential for upskilling these workers into the roles of security guards, planters, and gabion basket makers. • The estimated level of investment in the planning, design, and construction phase of this project is expected to create approximately **215 indirect jobs in the national economy**, stemming from the input materials required for the project. **Expected expenditure will induce about 320 jobs** in the economy as project workers spend their wages. Many of these jobs will be in Drakenstein if local suppliers are used. It is estimated that this investment will yield 1.68 times the initial amount, resulting in **a contribution to the national economy of about R185 million**. • Since the infrastructure does not fall under any trading services departments, it is not a direct revenue generator. However, some elements may have access or hire charges (such as braai facilities and sports facilities). Some maintenance and rehabilitation costs for infrastructure will be reduced.

C3.8.Barriers and Risks: Beets Street Hybrid Flood Alleviation Project

The following register summarises the risks identified across the various phases of the project. The risks and mitigation measures should be refined as part of further design phases.

Part C Chapter 3 Table 10. Barriers and Risks.

Phase of project lifecycle	Risk	• Mitigation Measures
Planning and Design	**Community:** Lack of community buy-in and support.	• Community participation during all phases of the project. • Consideration of the development of social compact. • Mobilisation of NGOs and NPOs to support the initiatives. • Ward Councillor and Ward Committee mobilisation to ensure an understanding of the local context and to promote meaningful engagement with community members.
Planning and Design	**Community:** Lack of meaningful engagement.	• Community participation during all phases of the project. • Ward Councillor and Ward Committee mobilisation to ensure an understanding of the local context and to promote meaningful engagement with community members. • Hosting events to raise awareness on the project.
Planning and Design	**Political:** Political acceptance.	• Gaining political buy-in through engagement with relevant political stakeholders and explaining the potential project impact and benefit.
Planning and Design	**Institutional:** Lack of transversal collaboration.	• Defining roles within each department for undertaking the project, and development Key Performance Indicators (KPIs) to create accountability for these responsibilities.

Phase of project lifecycle	Risk	• Mitigation Measures
		• Development of Standard Operating Procedures (SOPs) for each of the relevant department to provide a clear overview of their roles and responsibilities.
Planning and Design	**Approvals**: The pedestrian crossings will need to be approved during planning which can be a timely process.	• Submission of pedestrian approvals in a timely manner.
Construction and Implementation	**Safety and security**: There is potential for safety and security concerns posed to workers during the construction and maintenance of the project.	• Ensuring the presence of law enforcement during construction and implementation to mitigate potential safety and security concerns. • Involvement of the Drakenstein Municipality Smart Safety Network (DM SSN) to enhance security on site. •
Operation and Maintenance	**Solid waste management**: Solid waste dumping and solid waste management.	• SOPs to be developed for the Solid Waste Management Department, outlining roles and responsibilities.
Operation and Maintenance	**Safety and Security**: Non-motorised Transport (NMT) users may be at risk when crossing at this site.	• Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers. • Development of speed reduction zones. • Development of raised pedestrian crossings for speed reduction.
Operation and Maintenance	**Safety and Security**: Risk of Drowning	• Ensuring adequate lighting, particularly around the wetland. • Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site.

Phase of project lifecycle	Risk	• Mitigation Measures
		• Patrols at the site to be undertaken by law enforcement officers. • Ensure that the ponds are dry in summer.
Operation and Maintenance	**Safety and Security**: Vandalism and theft of intervention materials.	• Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers. • Involvement of the Drakenstein Municipality Smart Safety Network. • Use of construction materials that have no commercial/resale value.
Operation and Maintenance	**Safety and security: The community members are concerned about safety and security at this site.**	• Ensure adequate lighting in the area. • Directional signage and clearly demarcated entrances to guide community members. • • Ensure the paving of pathway surfaces. • Mobilising community/ neighbourhood watches at the site. • Organise taxi services to drop off community members at their homes. • The removal of dumping sites to make the area more visible to hinder criminal activity.
Operation and Maintenance	Social acceptance/ ownership	• Involvement of Mayoral Committee Members (MMCs) in the project to enhance communication to community members, to provide local knowledge and to provide a representation of community members and concerns. • Development of Public-Private Partnerships (PPP) to develop a sense of ownership. • Inclusion of the project in budgeting processes. • Enhance job creation potential for community members as part of the operation and maintenance of the intervention. • Host events to spread knowledge and awareness on the project.

Phase of project lifecycle	Risk	• Mitigation Measures
Operation and Maintenance	**Community**: There is concern from the community around Mbekweni children not welcoming children from Vlakkeland in sports facilities.	• Constructive engagements between Vlakkeland, Mbekweni and surrounding neighbourhoods to share the use of this site. • Community participation during all phases of the project. • Consideration of the development of social compact.
Other	Small-scale farmers use the site for grazing and may not comply with instructions to stop animals grazing in areas where there is sensitive biodiversity.	• Engagement with farmers during all phases of the project. • Allocating grazing sections away from sensitive biodiversity. • Fencing of sensitive areas to prevent access. • Informal Farming Committee Ward can manage the time and access for grazing.
Funding	Cost of implementation and ongoing maintenance.	• Integration of the project into the Service Delivery and Budget Implementation Plan (SDBIP) to receive priority funding allocation and increased visibility to potential funders. • Integration of the project into the IDP.
Land invasion	Potential for land invasion	• Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers.

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