Khangela Emoyeni WEF - Aquatic Walkdown Report - Aquatics

Murraysburg, Western Cape and Northern Cape Province

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CLIENT

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Reference	**Khangela Emoyeni WEF**
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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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1 Introduction

The Biodiversity Company was commissioned to undertake the aquatic ecological walkdown for the Khangela Emoyeni Wind Energy Facility. The Khangela Emoyeni Wind Energy Facility is part of the Greater Umsinde Emoyeni Wind Energy Facility (previously Phase 2), which is expected to have a maximum generating capacity of 147 MW. In total, the WEF is expected to have 33 wind turbines. The turbines will be a three-bladed horizontal-axis design with a hub height of up to 160 m and a rotor diameter of up to 180 m. The electricity from the turbines will be transferred via a 33 kV electrical network to a 33 / 132 kV onsite substation. Where feasible and possible this will be underground. The on-site substation will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid. A hardstanding area of up to 45 m by 25 m will be established adjacent to each turbine location. This will be used to provide a platform for cranes to operate during construction (and unscheduled maintenance), as well as a clear area to lay out turbine components prior to erection. Up to three additional temporary laydown areas of up to 150 m by 60 m in size will be required for equipment and component storage during construction. These areas will be levelled and compacted and used for component storage.

The project location is situated 20 km North-East of the town Murraysburg and 14 km North from the R63 within the Beaufort West Renewable Energy Development Zone (Phase 2, REDZ 1) of the Western Cape Province. The western most part of project area also extends into the Northern Cape Province.

A requirement of the EA and the Environmental Management Programme report (EMPr) is the undertaking of an aquatic ecological walkdown for the approved turbines, roads and ancillary infrastructureThe walkdown was undertaken from the 18th until the 24th of April 2022.

The purpose of the aquatic ecological walkdown was to locate and identify any sensitive aquatic ecological habitats. This report only presents the findings from the aquatic ecological walkdown, and should be considered in conjunction with other disciplines, specifically the bat findings. These disciplines will collectively provide the demarcation of aquatic ecological constraints for the larger area.

1.1 Project Description

Khangela Emoyeni Wind Farm (Pty) Ltd is proposing to establish the 147 MW Khangela Emoyeni Wind Energy Facility and associated infrastructure. The Environmental Authorisation (DFFE Ref: 14/12/16/3/3/2/687) for the proposed wind energy facility was granted on 06 September 2018 and amended on 30 March 2021 and the latest amendment on the 07 June 2022. The Khangela Emoyeni Wind Energy Facility and associated infrastructure is located near the town of Murraysburg in the Beaufort West Local Municipality and Ubuntu Local Municipality in the Western Cape and Northern Cape Provinces. The proposed wind energy facility is located within the Beaufort West Renewable Energy Development Zone (REDZ).

The project will include the following infrastructure as authorised:

- Up to 33 wind turbines with a hub height of up to 160m, blade length of 90m and rotor diameter of up to 180m;
- Hard standing area of up to 55m by 35m;

- Temporary Laydown areas of up to 150m by 60m each;
- Temporary turbine laydown areas;
- Electrical cabling and on-site substation;
- Existing farm access tracks and watercourse crossings will be upgraded;
- Internal access roads;
- On-site office compound, including site offices, parking and an operation and maintenance facility including a control room;
- Anemometer masts;
- Security fencing; and
- CCTV monitoring towers.

The following properties have been identified for the Khangela Emoyeni Wind Energy Facility and associated infrastructure:

- Portion 4 (a Portion of Portion 1) of Farm Driefontein No.26;
- Remainder of Farm Swavel Kranse No. 28;
- Portion 1 of Farm Houtkloof No. 29;
- Remainder of Portion 1 of Farm De Hoop No.30;
- Portion 2 of Farm De Hoop No.30;
- Portion 3 (a Portion of Portion 1) of the Farm De Hoop No.30;
- Portion 2 of Farm Swavel Kranse No.28;
- Portion 1 of Farm Klipplaat No.109;
- Potion 3 (a Portion of Portion 2) of Farm Klipplaat No. 109;
- Portion 4 (Portion of Portion 2) of Farm Klipplaat No.109;
- Portion 6 of Farm Klipplaat No. 109;
- Portion 7 of Farm Klipplaat No. 109;
- Remainder of Farm Klipplaat No.109; and
- Remainder of Portion 2 of Farm Klipplaat No.109.

Khangela Emoyeni Wind Farm (Pty) Ltd has commissioned Nala Environmental (Pty) Ltd to undertake the ground truthing and subsequent finalisation of the EMPrs in terms of NEMA EIA Regulations. As per the conditions of the Environmental Authorisations, independent specialist walkthrough's have been undertaken to inform the final layout and final Environmental Management Programme for the wind energy facility and associated infrastructure.

1.2 Terms of Reference

The Terms of Reference (ToR) for this assessment include the following:

- Review of existing information related to the development;
- Conduct an aquatic ecological walkdown for the planned footprint areas;
- Compilation of a report detailing the results of the walkdown:
- Detail and ecological constraints identified for the planned infrastructure; and
- Provide information and recommendations for the micro-siting of relevant infrastructure.
- Provide information to adequately inform any contractors, environmental officers and personnel pertaining to the ecological significance for the area.

1.3 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- The assessment area was based on the spatial file provided by the client and any alterations[1] to the development area subsequent to the site visit may affect the results. The walkdown findings are based on the original layout, with subsequent changes being made as a result of recommendations being made for the original layout;
- The assessment area was based on the spatial file provided by the client and any alterations to the development area subsequent to the site visit may affect the results;
- The field assessment was limited to accessible turbines due to time and weather constraints, where turbines and roads could not be reached, noted were made of similar habitat within the general WEF area;
- The entire buffer corridor was not assessed during the walkthrough due to spatial and temporal constraints, however this footprint is believed to have been adequately assessed;
- Only a single season survey was undertaken, thus no temporal variances have been considered; and
- All regional and site-specific environmental information are contained within the original (submitted) documents and were therefore not repeated within this document. This document focuses only on the very specific mandate and findings of the walkdown and its associated ecosystem evaluations.

[1] A final layout was provided in October 2022 in line with the findings of the walkthrough. The placement of infrastructure in relation to the designated ecological sensitivities has been updated for this report submission.

2 Approach

2.1 Spatial Data

Turbine, road and powerline positions were supplied by the client. A 150 m corridor width (total width is 300 m) was considered for the road and powerline routes (MV cables). A 300 m radius was assessed around the substation as well as a 200 m radius around the turbines. These corridors were used as guidelines during the walkdown and ecosystem evaluation phase. GPS accuracy during the field surveys varied from 4 to 15 m. A map representing the total buffer corridor along with the assessed area for the assessment is presented in Figure 2-1. The findings for the turbine and road are discussed in the subsequent sections.

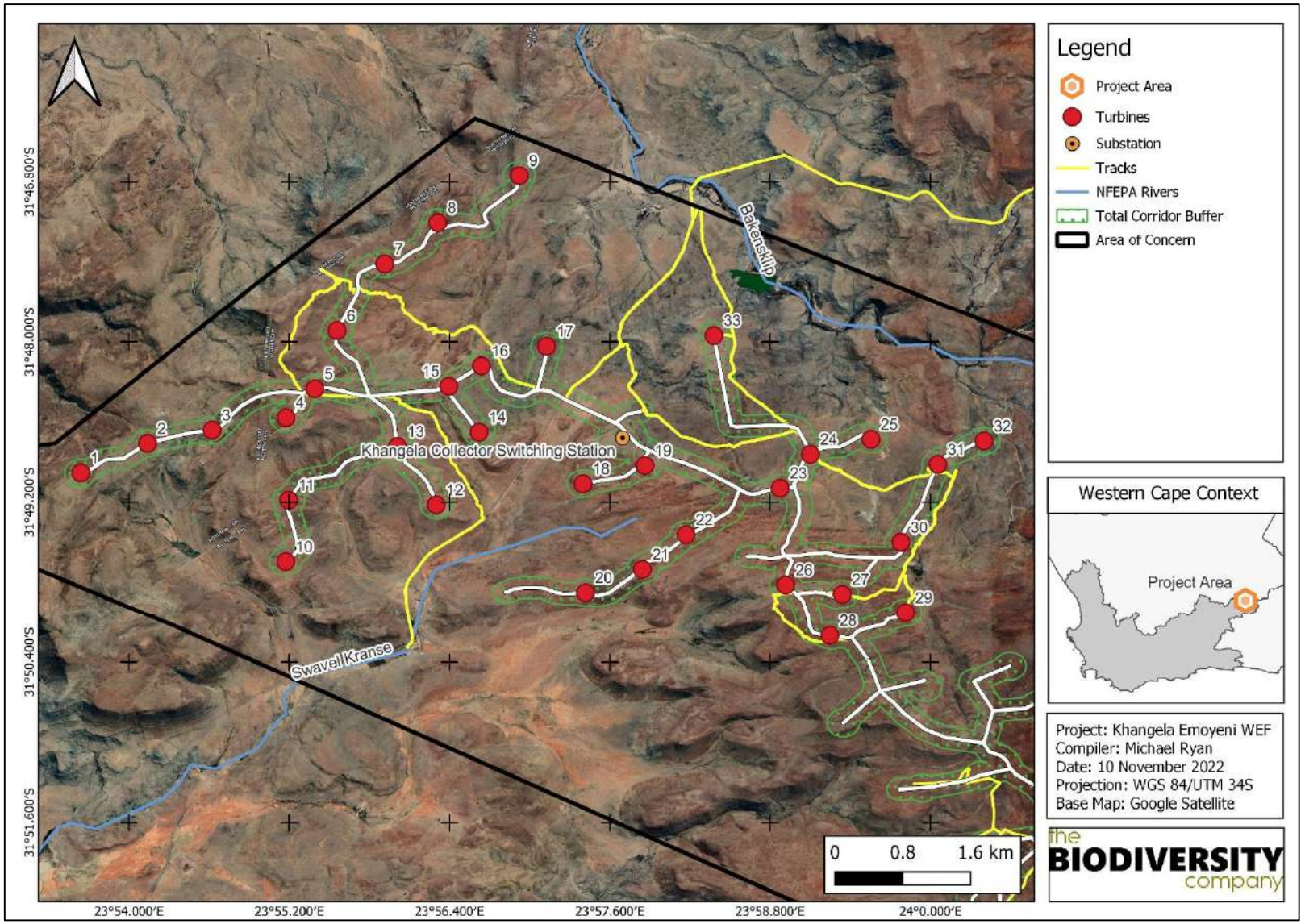


Figure 2-1 Total buffer corridor along with the assessed area for the project area

2.2 Ecological Information

2.2.1 Aquatic Ecology

Table 2-1 presents the defined areas for regulation and the associated legislation that is applicable for the delineated watercourse.

Table 2-1 Area of regulation and the associated legislation

Regulatory authorization required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). Department of Water and Sanitation (DWS)	Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) in accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended. Department of Environmental Affairs and Development Planning (DEA&DP)	Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: The development of: (xii) Infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs— *a)* Within a watercourse; *b)* In front of a development setback; or *c)* If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse. Excluding – dd) where such development occurs within an urban area… Activity 19 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states "The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse."

2.2.2 Sensitive Areas

The legal definition of the extent of a watercourse is defined in the amendment of the General Authorisation for section 21 (c) and (i) water uses. The extent of the watercourse is defined as:

- A river, spring or natural channel in which water flows regularly or intermittently "within the outer edge of the 1 in 100-year floodline or riparian habitat measured from the middle of the watercourse from both banks"; and
- Wetlands and pans "within 500 m radius from the boundary (temporary zone) of any wetland or pan".

An example of the watercourse extent is provided in Figure 2-2. As a result, all available aspects of a watercourse described were considered. Riparian areas have high conservation

value and can be considered most important part of a watershed for a wide range of values and resources. They provide important habitat for a large volume of wildlife and often forage for domestic animals. The vegetation they contain are an important part of the water balance for the hydrological cycle through evapotranspiration. They are crucial for riverbank stability and in preventing erosion within the channel (Elmore and Beschta, 1987). This is especially true for ephemeral systems where due to dry nature of the system, the habitat provided by vegetation within the riparian area are the only existing aspect of the watercourse until thunderstorm events. According to the buffer guidelines the maximum required buffer should be applied to a system (Macfarlane, *et al*., 2014). Due to the scale of the project, main stem rivers classified as NFEPA scale rivers are given a 30 m buffer (Ezemvelo, 2013). The smaller systems which are considered either tributaries or drainage lines were assigned an 18 m buffer according to Dosskey (2000) to protect this habitat type. The delineated riparian areas and associated buffer zones are considered no go areas for any infrastructure such as pillars or towers for the transmission powerline. It is however understood that the line will invariably cross systems which is unavoidable but associated infrastructure should be located outside the riparian buffers in accordance with the precautionary principle. The delineation of the watercourse extents riparian zone observed in the study area are presented in Figure 2-3.

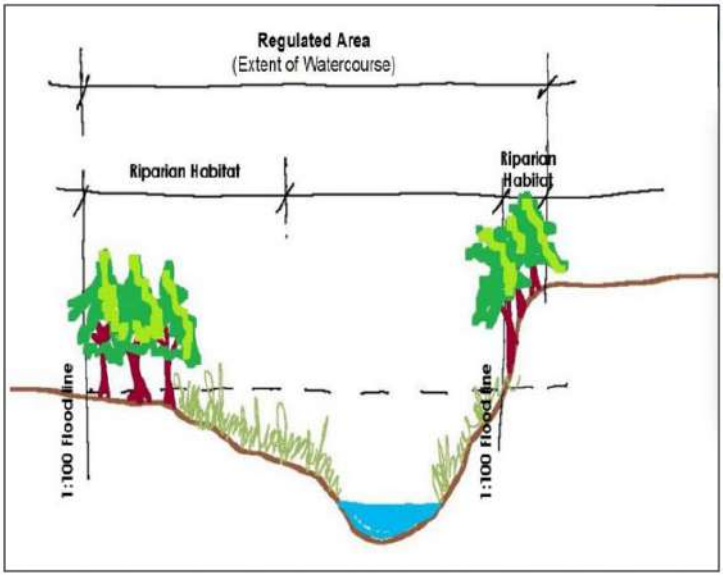


Figure 2-2 The extent of a watercourse (DWA, 2012)

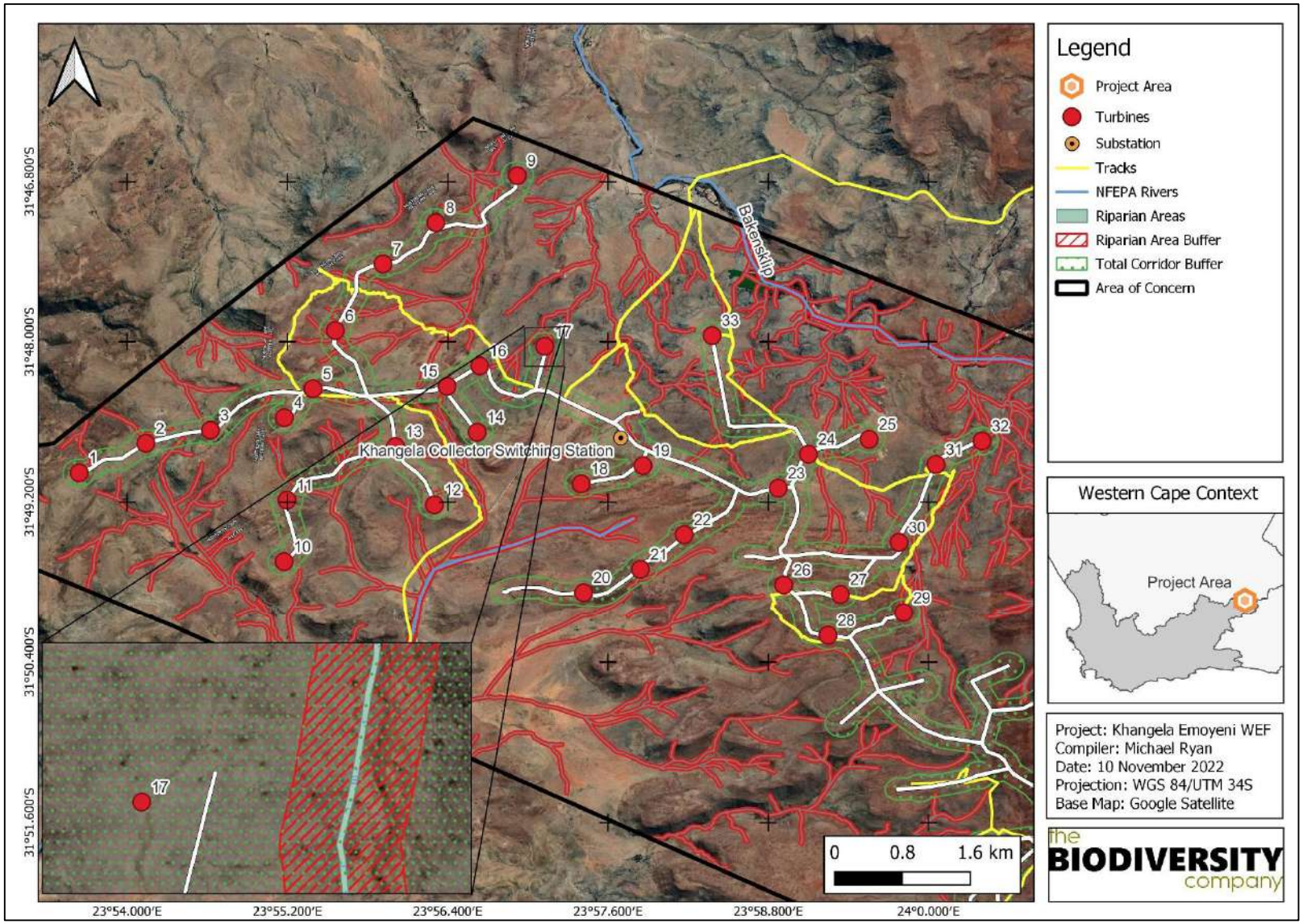


Figure 2-3 Riparian delineation and associated buffer of the watercourses associated with the project area

2.3 Walkdown

The specialist ecologists traversed the planned footprint areas searching for ecologically sensitive habitats and any species of conservation concern within the corridor. Each accessible turbine position was visited on foot and evaluated according to the potential impact on the surrounding ecosystems. Each accessible road route between turbines was inspected and evaluated.

As much as possible of the roads and turbine layout was assessed on foot and by 4x4 vehicle. Tracks and waypoints are indicated in Figure 2-4. Findings are presented in Table 2-3. A refined sensitivity map was then drawn up and can be seen in **Error! Reference source not found.** for the aquatic aspects of the project. The Site Ecological Importance (SEI) for aquatic ecosystems were initially identified and pre-delineated largely based on aerial imagery from late 2021. These main habitat types were then refined based on the field coverage and data collected during the survey. Three habitat units are delineated for the project area based on their geomorphology: Perennial watercourses and Ephemeral watercourses.

Due to the scale of the project, watercourses were grouped together with the defining feature decided on to separate watercourses being the presence of surface flow. Those watercourses which have surface flow are predominantly main stem rivers considered as NFEPA rivers based on scale not sensitivity by the GIS layer. These systems are known as perennial rivers. The majority of watercourses within the project area however lack surface flow and are predominantly smaller systems which compromise the tributaries and drainage lines of the main stem systems. These systems are known as ephemeral rivers. The two delineated habitat types have each been allocated a sensitivity category, or SEI, and this breakdown is presented in Table 2-2 below.

Table 2-2 Site Ecological Importance assessment summary of the habitat types delineated within the project area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Perennial watercourses	Low	Very High	Medium	Medium	Medium
Ephemeral watercourses	Very Low	High	Low	Low	Medium

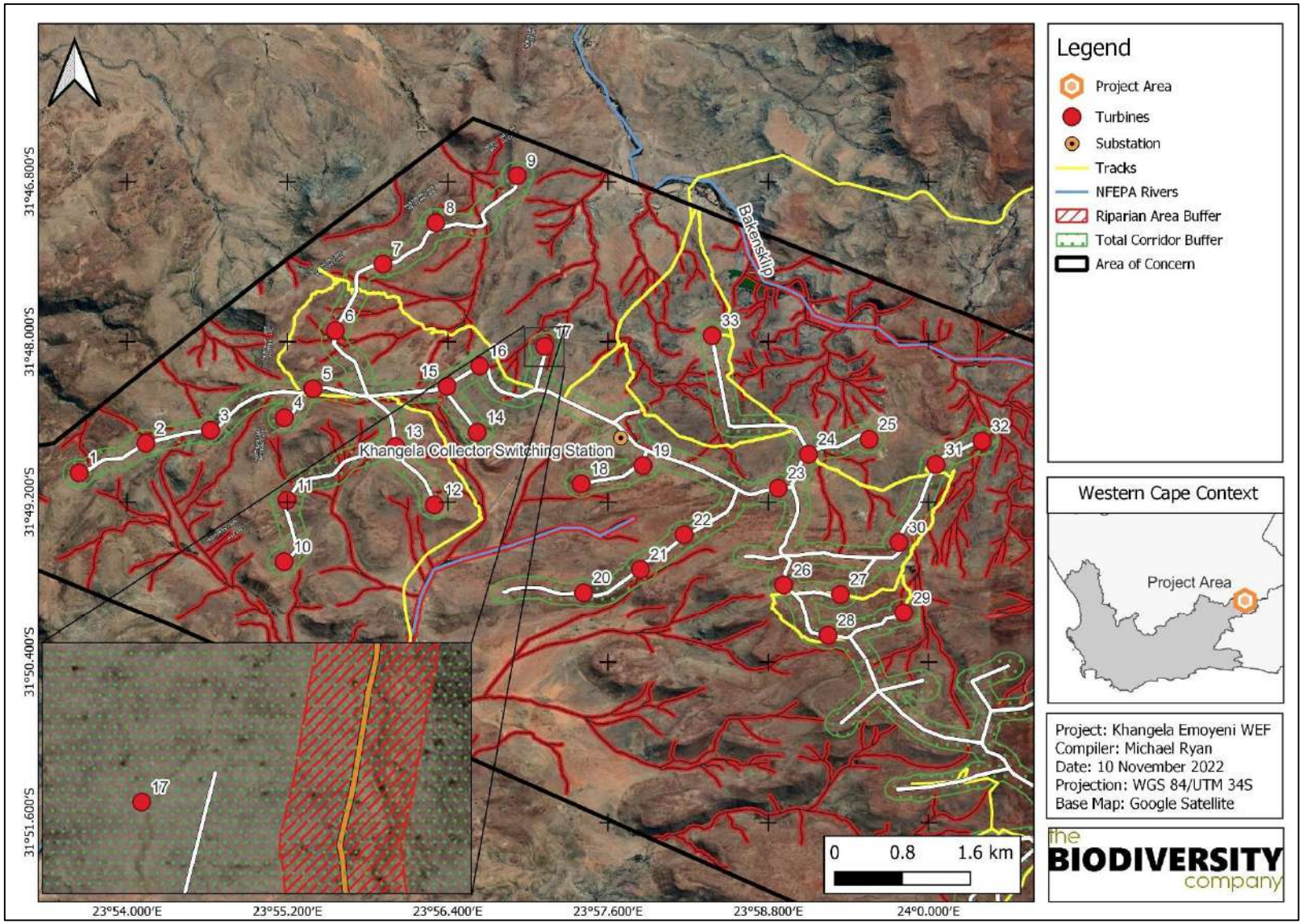
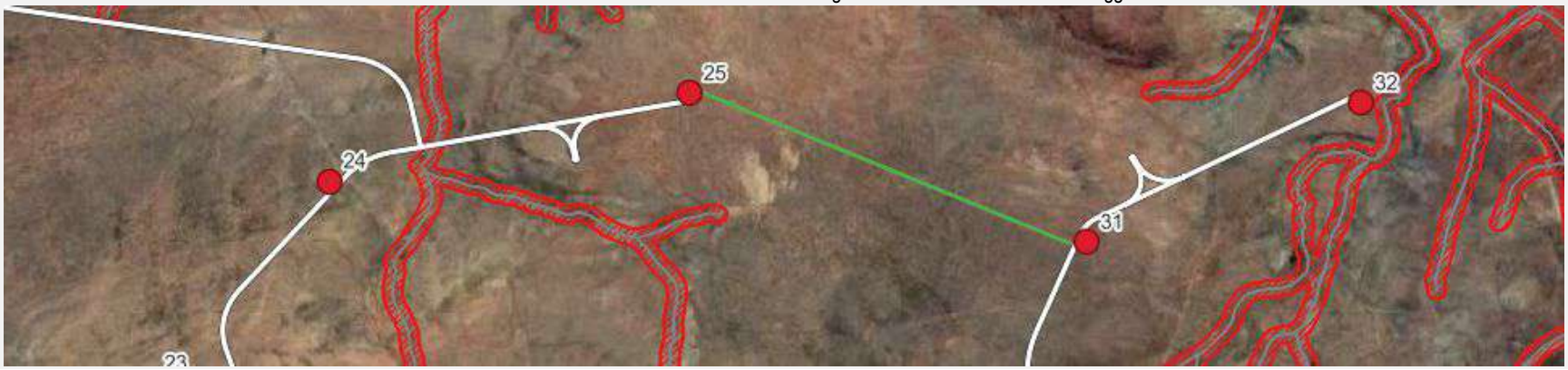
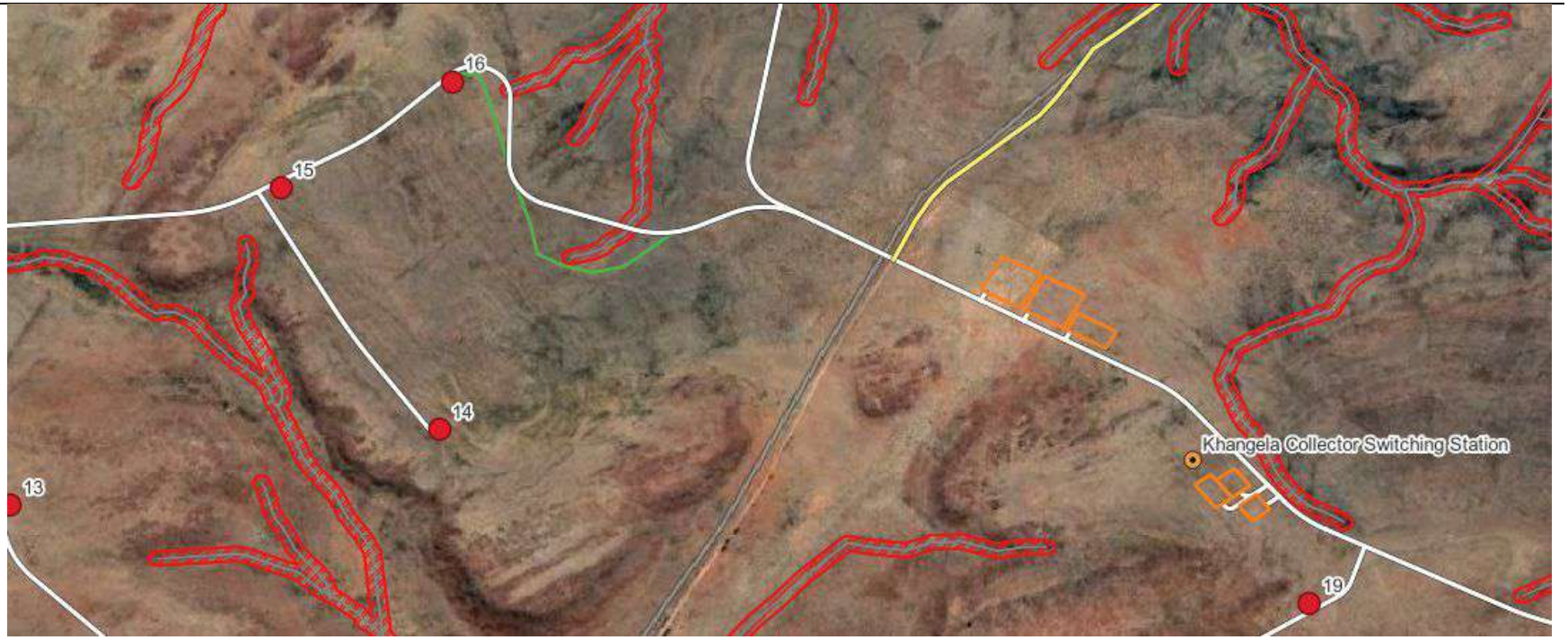


Figure 2-4 The Wind turbines as well as the associated roads for the Khangela WEF indicating turbines visited.

Table 2-3 Summary Site specific comments and recommendations on the turbines for Khangela WEF.

Turbine/ Road	Comments and recommendations
24-25-Road	Findings: This road crosses through a drainage lines and associated buffer. Sensitivity: This site is considered a Medium SEI. Recommendations: The current road route is abandoned after the fork which leads to turbine 25 with the green route between 31 and 25 suggested as an alternative to access the turbine. 
16 – 19 Road	Findings: This road between turbine 19 and turbine 16 crosses through a drainage line and associated buffer. Sensitivity: This site is considered a Medium SEI. Recommendations: The route between turbine 19 and turbine 16 should be slightly altered to avoid the drainage line and associated buffer as presented by the green route.

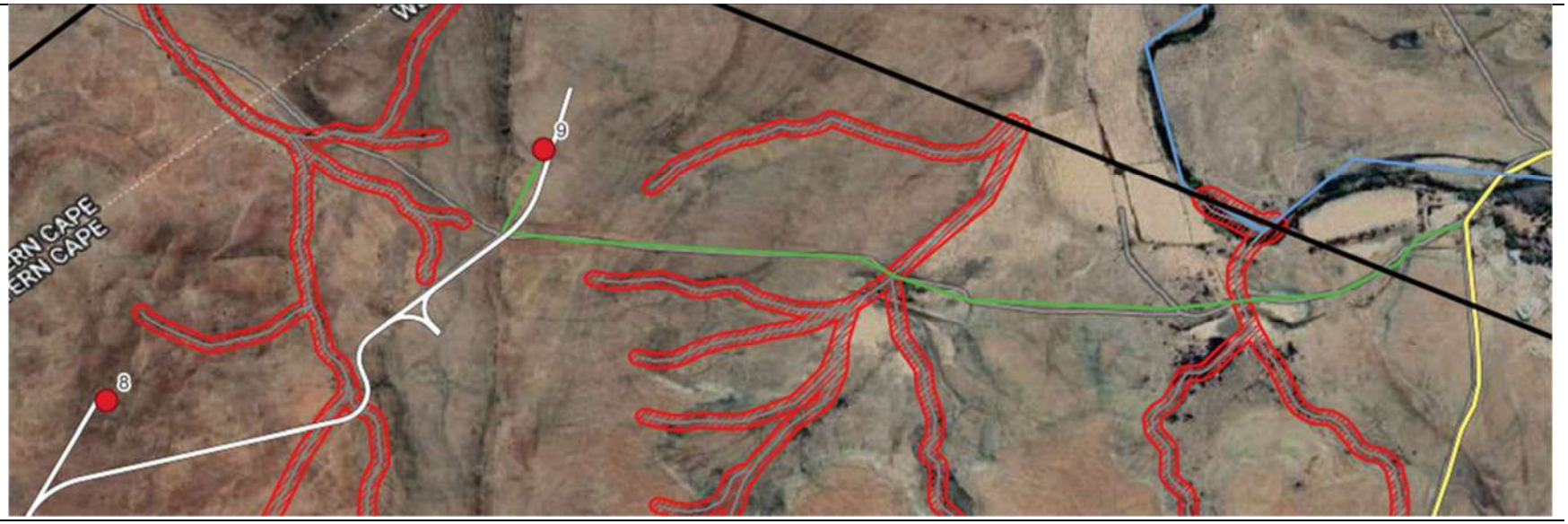
	
5 – 7 Road	Findings: The road between turbine 5 and 7 crosses through multiple drainage lines and associated buffer. Sensitivity: This site is considered a Medium SEI. Recommendations: The current road route is abandoned with multiple alternative routes suggested in order to provide access to both turbines. A route has been suggested from turbine 5 to turbine 6 and then from 6 to 7. The existing route between turbine 13 and 5 requires a slight realignment to avoid the drainage line and associated buffer.

Findings: The route between turbine 8 and turbine 9 crosses a drainage lines and associated buffers.

8 – 9 Road

Sensitivity: This site is considered a Medium SEI.

Recommendations: The green route diversion between the two turbines is suggested for the road to avoid the drainage lines. This is an existing road which could be used.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2.4 Observations

The following are observations made in the general area during the walkdown, these are discussed below due to the nature of the occurrence of these fauna and flora being ubiquitous throughout the area:

- The turbine 17n of the WEF of the original layout was intended to encroach on aquatic habitat has been realigned as per turbine 17 of the final layout and no longer encroaches on the watercourse;

- Multiple intended roads between particular turbines are intended to encroach on aquatic habitat as outlined in Table 2-3, with alternative routes suggested. These suggestions don't take other sensitivity layers into account and the associated layers should be consulted before route approval.

3 Risk Assessment

A risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998) to investigate the level of risk posed by the proposed project, namely the WEF and powerline. The risks posed by the proposed development to watercourses within the project areas are provided in the following tables for scenarios with and without mitigation. Three levels of risk have been identified and determined for the overall risk assessment, these include low, medium and high risk. High risk areas are associated with watercourses that will be directly impacted on by the proposed developments. Medium risk refers to watercourses that are either on the periphery of the infrastructure and at an indirect risk, or watercourses that could be avoided if feasible. Low risk areas are watercourses beyond the project area that would be avoided. No high risks are expected for the WEF development. This distinction is primarily based on infrastructures proximity to a watercourse with each potential risk further unpacked in the relevant sections.

3.1 WEF

A final design layout is presented in Figure 3-1 which indicates the locations of all turbines, substations, ancillary infrastructure, roads, and powerline routes (MV cables). No watercourses are directly affected by the proposed turbine footprint areas, with all the proposed turbines, substations, ancillary infrastructure (construction camp and laydown areas) being beyond the recommended 30 m buffer area. A number of watercourse systems are traversed by the proposed road network associated underground cabling, and these crossings will be a key consideration for the risk assessment.

During construction (and without mitigation) the clearing and preparation of the crossing areas will lead to the disturbance and degradation of watercourse vegetation, altering the hydrological regimes for these systems. These hydrological changes would potentially result in erosion of the systems. The clearing of these crossing areas, including portions of the larger road network and operation of vehicles/equipment may lead to increased sediment loads and contamination of watercourses and eutrophication of watercourse systems with human sewerage and litter. It is also observed that all non-essential aspects for the project not required to cross a watercourse adhere to 30 m buffer areas.

The constructed crossings may likely result in prolonged alterations to the hydrology of the surface run-off of the systems, but this is only expected for the wet season period. The concentrated flows may result in erosion of the downstream reaches. The continued use of the roads for access may continue to increase sediment loads and hydrocarbon contamination of watercourses. The management of stormwater is important for the minimisation of impacts to the receiving watercourses. Risks associated with decommissioning the road infrastructure centre on vegetation degradation from vehicle access and increased bare surfaces, runoff and potential for erosion from the removal of the infrastructure. A number of mitigation measures are provided in Table 3-1 which would, if implemented effectively, reduce the significance of all anticipated impacts to a more acceptable level. It is therefore recommended that all mitigation measures are implemented so that all eleven risks throughout the life of the WEF (construction, operation and decommission) remain Low. It is however noted that the only aspect of the project which will infringe on the delineated watercourses is the roads and powerline routes (MV cables) at selected points. As avoidance could not be implemented, this linear infrastructure will represent a moderate risk.

Due to the Moderate post-mitigation risks identified for the proposed road crossings, it is the opinion of the specialist that the proposed development of the WEF will warrant a full Water Use Licence Application (WULA) for the powerline routes (MV cables) of the project, with a General Authorisation considered appropriate for all other aspects.

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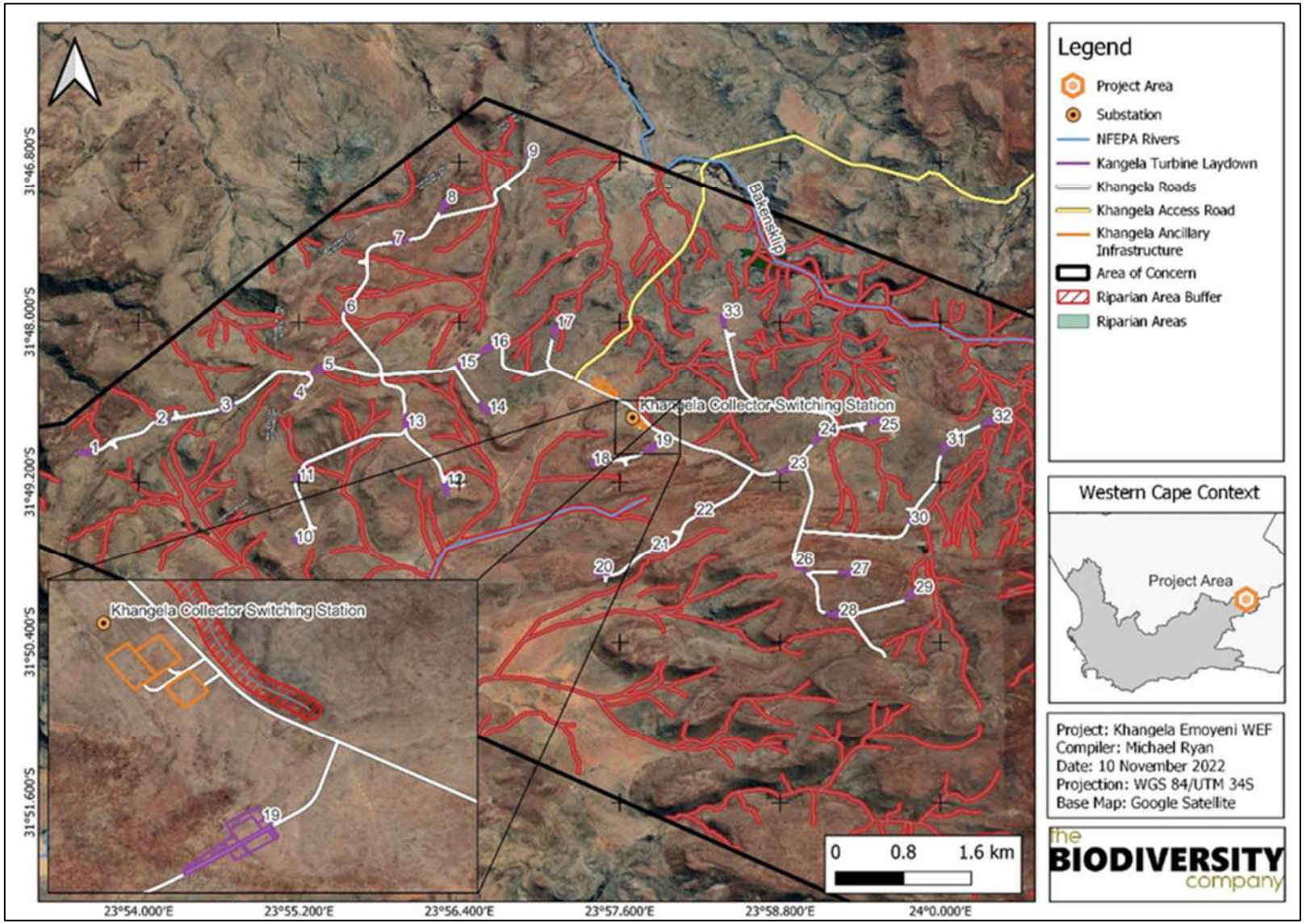

Figure 3-1 Final layout of all infrastructure associated with the Khangela Emoyeni WEF

Table 3-1 DWS Risk Impact Matrix for the proposed WEF (Andrew Husted Pr Sci Nat 400213/11)

Activity	Aspect	Impact	Mitigation Scenario	Severity: Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
Construction																			
Site clearing and preparation	Clearing of vegetation and stripping and stockpiling topsoil as well as storage of equipment.	Direct loss, disturbance, and degradation of watercourses.	Without	3	2	3	3	2.8	3	2	7.8	3	2	5	1	11	85	M	• Minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area. • Educate staff and relevant contractors on the location and importance of the identified watercourses through toolbox talks and by including them in site inductions as well as the overall master plan. • Begin construction of the structures furthest down the system, working up the catchment. • Restrict all construction related activities to the structure footprint area. • Access construction areas by means of the shorted or least intrusive route through the watercourse. Prioritize existing routes where possible.
			With	2	2	2	2	2	2	1	5	2	2	5	1	10	50	L	• Adhere to the prescribed watercourse buffers. Restrict all non-essential activities (e.g. cement mixing and equipment watercourse machinery storage) to outside of watercourses and their prescribed buffers. • Request the watercourse spatial data, load it onto a GPS and use it to mark out the positions to plan for the required activities to reduce the disturbance footprint and the unnecessary clearing of vegetation. • Demarcate the construction area as well as the prescribed 32 m buffer on the ground (e.g. painted wooden poles). • Construct as far as possible during

Activity	Aspect	Impact	Mitigation Scenario	Severity						Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale										
																			winter when flow volumes are lowest. This will reduce impacts to watercourses due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time. • Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • Minimize unnecessary clearing of vegetation. • Landscape and re-vegetate all denuded areas as soon as possible.
			Without	3	3	3	3	3	3	2	8	3	3	5	1	12	96	M	• Keep cleared and excavated area neat and tidy. Separate topsoil and sub-soil, and backfill in same order. • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • Mixing of concrete must under no circumstances take place in any watercourse or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished. • Do not situate any of the construction material laydown areas within any watercourse. • No machinery should be allowed to parked in any watercourses. Only machinery and equipment required to be in the watercourses is permitted, and must be operational. • Ensure topsoil is spread back over the cleared area. • Flatten and lightly till (no deeper than 30
		Increased bare surfaces, runoff and potential for erosion	With	2	2	1	1	1.5	2	2	5.5	2	2	5	1	10	55	L	

Activity	Aspect	Impact	Mitigation Scenario	Severity: Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																			cm) excavated / cleared areas to encourage vegetation establishment as soon as possible.
		Degradation of watercourse vegetation and the introduction and spread of alien and invasive vegetation	Without	1	1	3	2	1.8	3	2	6.8	3	3	5	1	12	81	M	• Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • The use of herbicides is not recommended in or near watercourses (opt for mechanical removal). • Appropriately stockpile topsoil cleared from the project area. This can be used for rehabilitation of the intervention areas. • Clearly demarcate construction footprint, and limit all activities to within this area. • Minimize unnecessary clearing of vegetation. • Landscape and re-vegetate all denuded areas as soon as possible.
			With	1	1	2	1	1.3	2	2	5.3	3	1	5	1	10	53	L	
Installation of infrastructure	Site excavation and installation of material and structures	Increased sediment loads to downstream reaches and altered hydrology	Without	4	4	3	3	3.5	3	2	8.5	3	3	1	3	10	85	M	• See mitigation for increased bare surfaces, runoff, and potential for erosion • Re-instate topsoil and lightly till disturbance footprint. • Prioritise construction during the dry season, starting with the structure furthest down the system. • Excavations must only be made on a need basis and not left open. Excavations must preferably be either filled with gabions or backfilled within a day of the cut. • Structure should be dredged as construction progresses up the catchment and excessive sediment deposition is evident at a structure. • Implement rehabilitation of the areas as soon as possible for each structure,
			With	2	3	2	2	2.3	2	2	6.3	3	2	1	2	8	50	L	

Activity	Aspect	Impact	Mitigation Scenario	Severity						Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale										
																			prioritise that vegetation has re-established. • Ensure culverts are correctly installed and set if required. Maximum size culverts are preferred, and the number of culverts should span the width of the channel. Avoid concentrating flows through a minimum number of culverts.
		Contamination of watercourses with hydrocarbons due to machinery leaks and eutrophication of watercourses with human sewerage and other waste.	Without	2	3	2	3	2.5	3	2	7.5	3	3	1	3	10	75	M	• Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the watercourse. • Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter. • Provide appropriate sanitation facilities during construction and service them regularly. Alternatively provide off-site facilities for staff. No indiscriminate use of the watercourse area for ablutions may be permitted.
			With	1	2	1	2	1.5	2	2	5.5	3	2	1	2	8	44	L	
		Contamination of watercourse with concrete.	Without	2	4	2	3	2.8	2	2	6.8	3	3	1	1	8	54	L	• It is preferable that pre-fabricated materials be used, with no pouring of concrete within the watercourse areas. All manufacturing must be undertaken beyond the buffer area.

Activity	Aspect	Impact	Mitigation Scenario	Severity						Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale										
			With	1	2	1	2	1.5	2	2	5.5	3	2	1	1	7	39	L	• All materials and structures must be stored beyond the buffer, and only brought into the watercourse for installation. Short-term storage (, 1 day) in a cleared area is permissible.
	Backfilling of excavations	Disruption of watercourse soil profile and alteration of hydrological regime	Without	3	2	2	2	2.3	2	3	7.3	3	3	1	3	10	73	M	• Ensure that topsoil is appropriately stored and re-applied during backfilling and landscaping of the area. • Make sure that the soil is backfilled and compacted to accepted geotechnical standards to avoid conduit formation around the structures i.e. gabion baskets
			With	1	1	1	1	1	2	3	6	2	2	1	2	7	42	L	
Operation																			
Operation of the WEF.	Hardened surfaces.	Potential for increased stormwater runoff leading to Increased erosion and sedimentation.	Without	3	3	3	3	3	4	2	9	3	3	5	2	13	117	M	• Design and implement an effective stormwater management plan. • Promote water infiltration into the ground beneath the turbines • Release only clean water into the environment. • Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in). • Re-vegetate denuded areas as soon as possible. • Regularly clear drains. • Minimise the extent of concreted / paved / gravel areas. • A covering of soil and grass (regularly cut and maintained) below turbines is ideal for infiltration. If not feasible then gravel is preferable over concrete or paving. • Avoid excessively compacting the ground beneath the solar panels.
			With	2	2	1	1	1.5	2	2	5.5	1	2	5	1	9	50	L	

Activity	Aspect	Impact	Mitigation Scenario	Severity						Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale										
	Crossings	Altered surface flow dynamics leading to Increased erosion and sedimentation	Without	2	2	2	2	2	4	2	8	2	2	5	2	11	88	M	• Design and Implement an effective stormwater management plan. • Install energy dissipaters at discharge areas. • Stabilise banks susceptible to erosion/collapse with gabion baskets or bank stabiliser blankets
			With	1	2	1	1	1.3	2	2	5.3	1	1	5	1	8	42	L	
	Contamination.	Potential for increased contaminants entering a watercourse.	Without	2	4	3	3	3	4	2	9	3	3	5	2	13	117	M	• Where possible minimise the use of herbicides to control vegetation. If herbicides must be used do so well prior to any significant predicted rainfall events.
			With	2	2	2	2	2	2	2	6	1	2	5	1	9	54	L	
Closure																			
Decommissioning of the facility.	Rehabilitation.	Potential loss or degradation of nearby watercourses through inappropriate closure.	Without	3	3	4	3	3.3	3	3	9.3	4	4	5	1	14	130	M	• Develop and implement a rehabilitation and closure plan. • Appropriately rehabilitate the project area by ripping, landscaping and re-vegetating with locally indigenous species.
			With	2	2	2	2	2	3	2	7	2	2	1	1	6	42	L	

3.2 Recommendations

The following are recommendations made in support of the water resource assessment:

- Avoid the delineated watercourse and buffers areas where feasible;
- A competent Environmental Control Officer (ECO) must oversee the construction phase of the project; and
- Crossing designs should be informed by hydrological demands of the systems, limiting impacts to flow regimes and enabling connectivity across the systems.

3.3 Impact Statement

No watercourses are directly affected by the proposed turbine footprint areas, with all the proposed turbines being beyond the recommended 30 m buffer area. A number of watercourse systems are traversed by the proposed road network, and these crossings will be a key consideration for the risk assessment. Due to the Low post-mitigation risks identified for selected aspects for the proposed road crossings, it is the opinion of the specialist that the proposed development of the WEF should warrant a General Authorisation in terms of water use licensing. If the road and powerline routes (MV cables) are not relocated outside the watercourse extent, then assigned mitigation is not implemented which results in a moderate risk for the WEF and the requirement for a full Water Use Licence Application (WULA). The most up to date layout indicates that these road and powerline routes (MV cables) will traverse certain watercourses which despite other mitigation measures suggested will result in moderate risks. Therefore, a full Water Use Licence Application (WULA) will be required for the road and powerline routes (MV cables), with a General Authorisation considered appropriate for all other aspects. Provided the appropriate authorisation is granted from the Department of Water and Sanitation with all mitigation measures suggested other than avoidance of the watercourses due to technical constraints, then the final layout following the findings of the walkthrough and evaluation of the original layout is considered acceptable.

4 References

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