Zitholele Consulting
Reg. No. 2000/000392/07

PO Box 6002 Halfway House 1685, South Africa
Building 1, Maxwell Office Park, Magwa Crescent West
c/o Allandale Road & Maxwell Drive, Waterfall City, Midrand
T : 011 207 2060 **F** : 086 674 6121 **E** : mail@zitholele.co.za

Basic Assessment Report for the proposed Installation of Battery Energy Storage System (BESS) at the Hex Substation near Worcester, Western Cape

Report No: 18047-04-Rep-001-Hex BAR-Rev0

Submitted to:

Department of Environmental, Forestry and Fisheries
Environment House,
473 Steve Biko,
Arcadia,
Pretoria,
0083
South Africa

Submitted on behalf of:

Eskom Holdings SOC Ltd
Eskom Road
Brackenfell
7560

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DOCUMENT APPROVAL

ACTION	DESIGNATION	NAME	DATE	SIGNATURE
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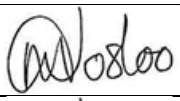
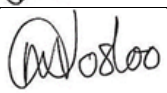
Reviewed	Environmental Divisional Manager	Dr Mathys Vosloo	20 September 2019	
Approved	Environmental Divisional Manager	Dr Mathys Vosloo	20 September 2019	

RECORD OF REVISIONS

Date	Revision	Author	Comments
20/09/2019	Rev 0	Tebogo Mapinga	

EXECUTIVE SUMMARY

Eskom Holdings SOC Limited (herein to as Eskom) is proposing to install grid-scale battery storage at various Eskom Distribution sites in the different Operating Units (Western Cape (WC), Eastern Cape (EC), Northern Cape (NC) and KwaZulu Natal (KZN) OU). The Battery Energy Storage Solutions BESS Project will be implemented in 2 phases with a total of 1440 MWh of battery storage per day.

This application pertains to the proposed installation of Grid-Scale Battery Storage and the construction of associated infrastructures at the existing Hex Substation in the Western Cape Province which forms part of the Worcester Group 3 (herein referred to as the "Project"). The project site is located on Erf 20640 and Erf 16127 near Worcester, Western Cape Province. This project forms part of the World Bank funding set of criteria for the Major Build program and requires a carbon friendly alternative to be implemented by Eskom as an alternative to the Kiwano CSP project, which has been terminated by Eskom.

Description of the Planned Activities

Eskom proposes to install grid-scale battery storage at the existing Hex Substation site, mainly as opportunity for capital deferment, which would otherwise require Eskom to embark on normal network strengthening through building new networks and major refurbishments. The proposed development will also include the following infrastructures:

- Network integration equipment (e.g. power cables, control cables, isolators, circuit breakers, transformers, etc.) will be required to connect the new BESS to existing infrastructure at the substations.
- Additional fencing may be required, security equipment, lighting, and/or control room upgrades.
- Where possible, the BESS containers will be placed on the existing substation platform. Where there is insufficient space, the substation platform will be extended (compacted fill, earth protection layer and stone chip) to accommodate the BESS containers.
- Existing access roads to the substations may also need to be lengthened, realigned or upgraded to ensure easy access to the BESS, specifically for low-bed trucks during construction to deliver and install the BESS containers onto the platform.
- A temporary laydown area and site camp will be required during construction.
- Underground cables connecting the BESS to the substation and feeder bay extensions.
- Storm-water management measures to be implemented on site.
- Installation of lightning masts.

Table 1-1: Provides a description of the project components

	DESCRIPTION
Battery Storage Capacity	Approximately 20MWh, while the required storage of a maximum volume of 500m³ of electrolyte
Number of Battery Modules	74
Associated Infrastructure	Transformer- LV/MV Step-up Transformers - The BESS installation steps up the converters output from a possible 1 400V CA to 1kV via the BESS modules intermediate transformers. It must be noted that the preferred connection voltage is 11kV (or 22k or 33kV dependant on substation MV busbar voltage) but if this is not achievable, alternative voltage levels (e.g., 6.6kV) may be offered. The maximum possible transformer rating using the present methodologies of construction is a 5MVA for voltage ranges 400V/11k, 400/22k or 400/33Kv. - Concrete foundation - Cabling between the battery modules - Air conditioners - Internal access Roads
Temporary Infrastructure (required for the Construction Phase)	Laydown Area Construction camps Construction compound and temporary site offices Temporary Access Roads

Project Location

Hex Substation is located on Erf 20640 and Erf 16127 which is situated in an industrial area on the outskirts of Worcester close to the Hex River. The site falls within the jurisdiction of the Breede Valley Local Municipality. The footprint required for the proposed development is approximately 1.5ha in extent. Refer to

Table 1-2: Description of the proposed site

	DESCRIPTION
Farm Name	Erf 20640 and Erf 16127
SD Code	Erf 20640 C0850004000206400000 Erf 16127 C0850004000161270000
Development Footprint	1.5ha
Co-ordinates	Laydown Area Corner Co-ordinates 33° 38’0.32”S 19° 28’32.84”E 33° 38’1.10”S 19° 28’34.47”E 33° 38’3.91”S 19° 28’29.91”E 33° 38’4.83”S 19° 28’31.59”E

	<u>Laydown Area Central Co-ordinates</u> 33° 38'2.60"S 19° 28'32.14"E <u>Battery storage area Corner Co-ordinates</u> 33° 38'2.54"S 19° 28'36.89"E 33° 38'5.00"S 19° 28'34.90"E 33° 38'6.07"S 19° 28'36.77"E 33° 38'7.87"S 19° 28'35.31"E 33° 38'9.62"S 19° 28'38.40"E 33° 38'5.39"S 19° 28'41.84"E <u>Battery storage area Central Co-ordinates</u> 33° 38'6.07"S 19° 28'38.57"E
Municipality	Breede Valley Local Municipality
District Municipality	Cape Winelands District Municipality
Ward Number	Ward 8
Land Zoning	Industrial
Access to the site	The project site can be accessed via an existing access road off Louis Langa Street.
Nearest Towns	~1.15km from Zweletemba and ~1.67km from Worcester

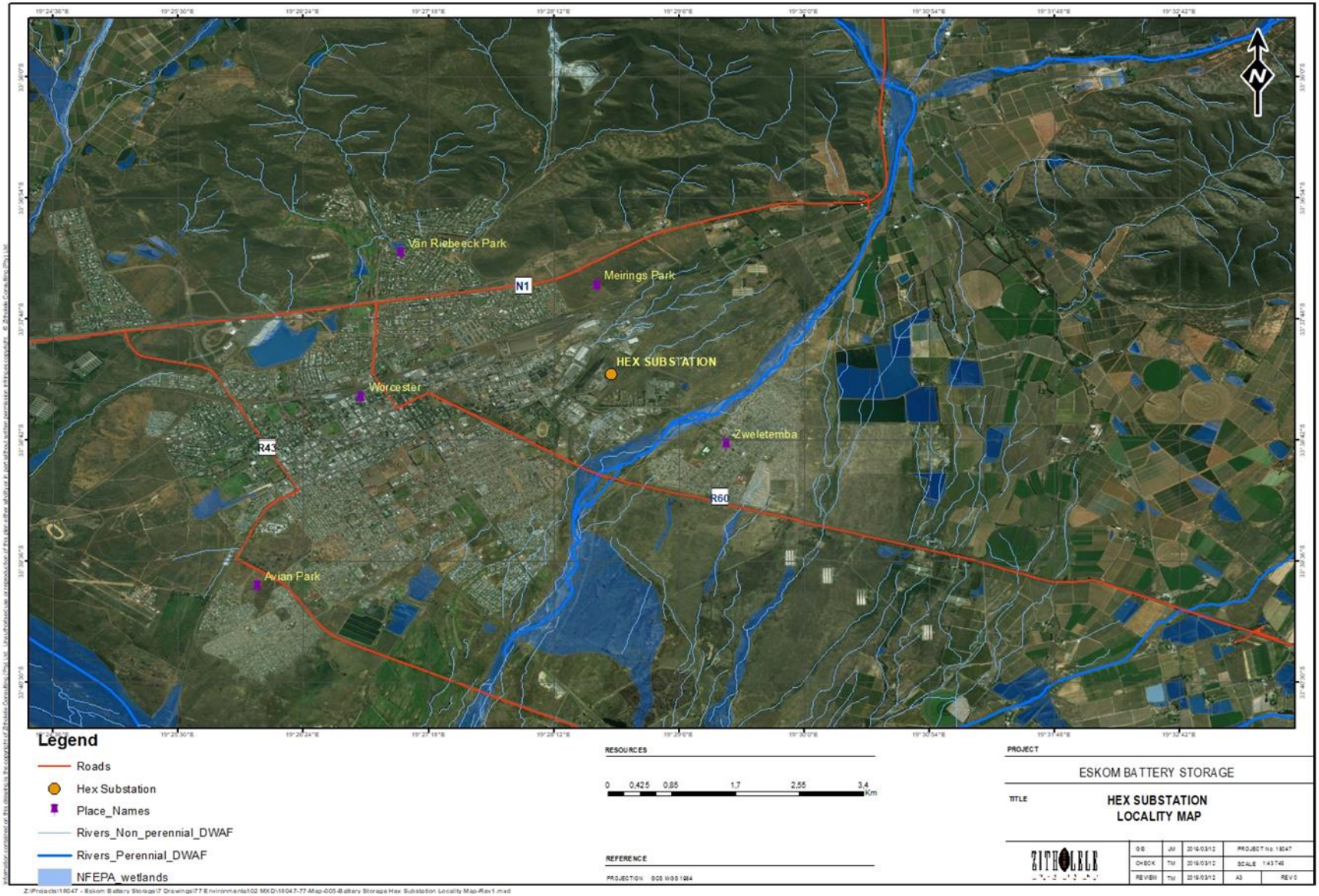


Figure 1: Locality Map

Alternatives Assessed

The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects are considered. The details pertaining to each alternative considered, as well as the technical preference are provided below:

- Impact Assessment of **Technology Alternative 1- Solid State Batteries (Lithium-ion) (Preferred Alternative)**: A lithium-ion (Li-ion) battery is a rechargeable electrochemical battery. Rather than a single electrochemical couple like nickel-cadmium, "lithium-ion" refers to a wide array of chemistries in which lithium ions are transferred between the electrodes during the charge and discharge reactions.
  A Li-ion cell is comprised of three main components; cathode and anodes electrodes, and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when charging. When the battery is charging, lithium ions flow from the positive metal oxide electrode to the negative graphite electrode. When the battery is discharging the reverse flow of ions takes place.
  Li-ion battery cells contain two reactive materials capable of electron transfer chemical reactions. The reaction is facilitated through electric contact or direct contact, through wire. Ion exchange must take place to maintain overall charge neutrality as electrons are transferred.
- Impact Assessment of **Technology Alternative 2 – Redox Flow Batteries**: Three flow battery systems are considered: vanadium flow batteries, zinc-bromine flow batteries and iron-chromium flow batteries. Flow batteries consist of external tanks filled with electrolyte, which flows through an electrochemical cell or reaction stack. Environmental impacts for batteries are dependent on a number of influencing factors. Location of battery technologies will need to be considered due to the coastal regions increasing susceptibility to corrosiveness. Redox Flow Batteries (RFB) are a class of electrochemical energy storage technology. It entails a chemical reduction and oxidation reaction that stores energy in liquid electrolyte solutions, which flows through a battery of electrochemical cells during charge and discharge.

Comparative Assessment of Alternatives

Technology Alternative 1 (Preferred)

As with all battery technologies, the extraction of specific elements and the production of chemicals that form an important basis of the energy storage process have significant environmental impacts. However, lithium ion batteries require both lithium and an additional heavy metal (typically cobalt or manganese) for the reactions needed to store energy.

The installation of the lithium ion batteries will result in the following Positive impacts:

- Reduced reliance on fossil fuels as energy is being stored.
- No release of emissions or effluent as a result of the energy storage process.
- Minimal impacts associated with noise generation.
- No additional natural resources required for operation.
- Lithium ion batteries require low maintenance.
- No intensive loss of visual quality (technology not extremely large and cumbersome).

The impacts of most concern with the operation of lithium ion batteries are associated to the use of hazard substances in the form of lithium and heavy metals. However, being a closed system the risks associates to hazardous substances are mainly related to the storage during construction, leakages and the disposal of the hazardous waste at the end of life. Although the occurrence of these impacts may not be highly probable, the severities of such impacts are a cause for concern.

The largest concern associated with li-ion batteries is the possibility of thermal run-away and resulting fire. Most new systems employ sophisticated and integrated battery management systems to limit the battery operation to within safe parameters and prevent thermal runaway.

Technology Alternative 2

Much research has been conducted comparing Vanadium Redox Flow Batteries to Lead Acid Batteries. The overall consensus it that Vanadium Flow Redox Batteries are preferred according to most assessment aspects, including environmental impacts. Since it is a low maintenance technology and no heavy metals are used in this technology, there are fewer environmental impacts. The largest environmental concerns are, however, associated to the extraction of the chemicals and construction of the holding tanks. Mostly due to the types of material used and the large portions of land required. A positive aspect is that no waste is generated during operation due to the system having the capability to perform cycles indefinitely. Vanadium is reusable; therefore disposal presents little environmental impacts. The electrolyte used, in this case sulphuric acid, may present the most concern when a plant is decommissioned.

The installation of the Vanadium Redox Flow Batteries will result in the following Positive impacts:

- Vanadium has a high economic value and can be recycled.
- Largest sources of vanadium are found in South Africa.
- Vanadium is taken up by most flora and fauna and is very soluble.
- This battery type does not require the use of heavy metals.
- Fewer emissions than lead acid batteries, reducing global warming potential.
- Reduced reliance on fossil fuels as energy is being stored.
- No additional natural resources required for operation.

- No release of effluent as a result of the energy storage process.
- Minimal impacts associated with noise generation.
- Redox flow batteries have a longer lifespan than conventional batteries and generally require little maintenance as it is a self-discharging system.

The technology Assessed in this Report both present Negative and Positive aspects, and none of them are fatally flawed form an Environmental Perspective, however Technology Alternative 1 is Preferred at this stage mainly based on the level of information that currently available on the type of technology

Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of BESS in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. This, however, is beyond the scope of this study. The current study assesses the cumulative impacts associated with the BESS Project together with similar facilities within the region on the basis of current and best available information, with precautionary assumptions considered.

Considering the findings of the specialist assessment undertaken for the project, the cumulative impacts for the proposed BESS Project will be acceptable, without any unacceptable loss or risks and the majority are rated as being of **moderate-low** significance.

Key Findings of Environmental Impact Assessment

A specialist ecological assessments has been conducted for the proposed Project and a summary of the findings have been included below:

Ecology Assessment

During the field survey conducted, no Red Data Listed species were observed on site. The current ecological state of the proposed development footprint has already been subject to historical disturbances and therefor the floral community structures have already been altered. The proposed development impacts are seen be of minor significance due to the proximity of the site to existing industrial infrastructure. Although soil management is recommended the site is regarded as topographically flat, and stormwater run-off is not thought to be a significant concern. As long as the proposed mitigation measures are implemented on site during construction, the overall impacts associated with the proposed development can be managed to be of low significance.

Overall, the impact of the proposed activity is expected to be LOW as the study site is already heavily impacted by the current and surrounding activities and land use. The activities will further be mitigated to acceptable levels. A summary of the anticipated environmental impacts associated with each of the project lifecycle phases of the proposed project that were identified during the BA Process is presented in Table 8-1 below.

Summary of Pre-Construction, Construction and Operation Phase Impacts

Proposal

Potential impacts:	**Significance rating of impacts (positive or negative):**	**Proposed mitigation:**	**Significance rating of impacts after mitigation:**	**Risk of the impact** and **mitigation not being implemented**
PRE-CONSTRUCTION				
Appointment of construction contractor	**4 – Moderate Positive**	• Ensure that unskilled labour required for the construction and installation of equipment are predominately South Africans from the surrounding communities.	**4 – Moderate Positive**	• No improvement on the unemployment conditions in the area and livelihood of the surrounding communities.
Poor communication about the project creates high expectations about the potential of job opportunities.	**3 – Low (-)**	• Caution with communication so as not to create the expectation of massive job creation	**2- Low (-)**	• Poor communication could lead to disappointment amongst community members, Labour and social unrest. While the project will create employment opportunities – the scale of the project means that not everyone will get employed
Damage to equipment or containers transportation n	**3 – Low (-)**	• Making use of accredited hazardous goods transportation companies. • Equipment properly packaged in line with regulations to facilitate safe handling, transportation and placement. • Inspection of packaging for damage. • Risk assessment to be conducted. • Route planning and obtaining all relevant permits from the local authorities. • Adhere to OEM handling and transportation instructions. • Agreement / contract with HazMat company for first response, site cleanup and rehabilitation. • All MSDS available for the BESS.	**2 – Low (-)**	• This could lead to road accident caused by driver or 3rd party, cargo not being properly secured. • Spillage of electrolytes/ dangerous substances. • Contamination of the soil, ground water and flora.

Clearing of vegetation to accommodate infrastructure and services	**6 - Mod**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; • Rehabilitation of the areas that are impacted by the development outside of the ultimate infrastructure footprint will aid in abating the ecological impacts.	**6 - Mod**	• Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; • This will have limited significance to the due to the site having already been historically subject to impacting features.
Loss of RDL floral species during site clearing.	**0.6 - Low**	• The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral species may be included when vegetation is stripped, suffering loss of individuals; • This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.
Loss and/or displacement of sensitive faunal species.	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas	**0.6 - Low**	• Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to disturbances. • Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.

Destruction of nesting and/or roosting habitat for faunal species.	**4.0 - Moderate**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development; • The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.
Destruction of ground-dwelling and/or sedentary fauna.	**0.6 - Low**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; Avoid indiscriminate destruction of habitat.	**0.6 - Low**	• Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; • Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.
Destruction of sensitive habitat	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.

Disturbance features that alter the vegetation structures	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.7 - Low**	• Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; • The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will also be maintained to avert fire risks.
Habitat fragmentation resulting from infrastructure development.	**0.5 - Low**	• The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the proposed development is therefore insignificant.	**0.4 - Low**	• The proposed development site is embedded within an industrial area and therefore already suffers relatively ecological isolation. An open area occurs to the southeast, but access is hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.
Soil erosion.	**0.3 - Low**	• Topsoil stockpiles should be protected from erosion. Compile and implement the Stormwater Management Plan and the Erosion Management Plan.	**0.3 - Low**	• Soil erosion will take affect any unprotected soils that have suffered disturbances, including unprotected stockpiles of stored topsoil. • Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; • The site is relatively flat, so there will be limited risk of erosion. Stockpiled soils will, however, be at risk of dispersal.

CONSTRUCTION PHASE				
➢ **ECOLOGY**				
Damage to equipment or containers during storage and installation	**6-Mod**	• Inspection of packaging for damage. • Risk assessment to be conducted. • Effective scheduling to limit onsite storage of equipment - site to be ready to readily accept BESS. • Proper supervision is required. • Adhere to OEM handling, transportation and storage instructions. • Agreement / contract with HazMat company for first response, site cleanup and rehabilitation. • All MSDS available for the BESS.	**0.6- Mod**	• This could lead to road accident caused by driver or 3rd party, cargo not being properly secured. • Spillage of electrolytes/ dangerous substances. • Contamination of the soil, ground water and flora.
Clearing of vegetation to accommodate infrastructure and services	**6 - Mod**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; • Rehabilitation of the areas that are impacted by the development outside of the ultimate infrastructure footprint will aid in abating the ecological impacts.	**6 - Mod**	• Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; • This will have limited significance to the due to the site having already been historically subject to impacting features.

Loss of RDL floral species during site clearing.	**0.6 - Low**	• The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral species may be included when vegetation is stripped, suffering loss of individuals; • This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.
Loss and/or displacement of sensitive faunal species.	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas	**0.6 - Low**	• Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to disturbances. • Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.
Destruction of nesting and/or roosting habitat for faunal species.	**4.0 - Moderate**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development; • The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.
Destruction of ground-dwelling and/or sedentary fauna.	**0.6 - Low**	• Limit the footprint to only areas necessary for the construction process;	**0.6 - Low**	• Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph

		• Utilise single access roads only; and • Avoid indiscriminate destruction of habitat.		spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; • Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.
Destruction of sensitive habitat	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.
Disturbance of features that alter the vegetation structures	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.7 - Low**	• Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; • The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will also be maintained to avert fire risks.
Habitat fragmentation resulting from infrastructure development.	**0.5 - Low**	• The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the	**0.4 - Low**	• The proposed development site is embedded within an industrial area and therefore already suffers relatively ecological isolation. An open area occurs to the southeast, but access is

		proposed development is therefore insignificant.		hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.
Soil erosion.	**0.3 - Low**	• Topsoil stockpiles should be protected from erosion.	**0.3 - Low**	• Soil erosion will take affect any unprotected soils that have suffered disturbances, including unprotected stockpiles of stored topsoil. • Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; • The site is relatively flat, so there will be limited risk of erosion. Stockpiled soils will, however, be at risk of dispersal.
Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemicals	**4 - Moderate**	• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.	**0.3 - Low**	• Pollution of water resources and land. • Loss of natural habitats for the biodiversity occurring in the area.

		• Implement suitable erosion control measures.		
Potential Impact Vegetation and habitat disturbance due to the accidental introduction of alien species	**4 - Moderate**	• The Contractor implements suitable methods during the construction phase to limit the introduction and spread of alien invasive plant species. • Promote awareness of all personnel. • The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation. • Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes.	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Vegetation and habitat disturbance due to pollution and littering during construction phase	**4 - Moderate**	• The Contractor should employ personnel on site responsible for preventing and controlling of litter. • Promote good housekeeping with daily clean-ups on site. • During construction, refresher training can be conducted to construction workers with regards to littering, ad hoc veld fires, and dumping. • No fires are allowed on site.	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Loss of habitat of the Marikana thornveld and CBA region	**4 - Moderate**	• Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.

		prevent impact on the surrounding vegetation. • Where possible, natural vegetation must not be cleared and encouraged to grow. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation. • Disturbance of vegetation must be limited only to areas of construction. • Prevent contamination of natural grasslands by any pollution. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site		
Damage to plant life outside of the proposed development site	**4 - Moderate**	• Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by Environmental Control Officer (ECO). • Areas which could be deemed as no go should be clearly marked.	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Disturbance to animals	**4 - Moderate**	• Animals residing within the designated area shall not be unnecessarily disturbed. • During construction, refresher training can be conducted to construction workers with regards to littering and poaching. • The Contractor and his/her employees shall not bring any domestic animals onto site. • Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.	**0.3 - Low**	• Displacement of animals.

Animal passage out of construction site	**4 - Moderate**	• Allow for safe animal passage through and specifically out of the construction site.	**0.3 - Low**	• Loss of animals within the proposed area.
The proposed construction activities may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area	**4 - Moderate**	• Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives.	**0.3 - Low**	• The encroachment of exotic vegetation following soil disturbance.
Increased employment opportunities and economic growth	**4- Moderate**	• Leverage this through procurement policies that favour local suppliers and businesses.	**2- Low**	• Infrastructure development drives economic growth and has a huge multiplier effect. Infrastructure development not only generates employment directly through construction and operations but also creates an industrial base around the development for goods and services to supply the construction workers and activities. These industries would get more entrepreneurs and employ more labour. These workers would purchase more goods from the markets, creating a virtuous cycle.
Creation of temporary skilled and unskilled job opportunities directly on the project	**4- Moderate**	• It is recommended that if practical, a local employment policy is adopted to maximise the opportunities made available to the local labour force (Sourced from nearest towns or within the Breede Valley Local Municipality). • The recruitment selection process should seek to promote gender	**2- Low**	• Creating temporary skilled and unskilled job opportunities.

		equality and should aim to optimise the employment of women wherever possible. • Efforts need to be employed to enhance indirect local employment/entrepreneurship opportunities by supporting local entrepreneurs as far as possible, where appropriate.		
Temporary increase in traffic disruptions and movement patterns during the construction phase	**6- Moderate**	• Standard working hours to be implemented during the construction phase, and/or as any deviation that is approved. • Construction vehicles must be roadworthy, and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues. • All construction vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs and control measures along the main access roads to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be visible at all times. • Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules. • All roads used by the project Developer and its contractors must be maintained in good working order during the construction phase. • It is recommended that a Community Liaison Officer be appointed to	**1- Low**	• If mitigation measures are not implemented, the traffic disruptions will continue to impact the surrounding businesses and the nearby communities.

		implement as the proposed grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process		
Nuisance impacts in terms of temporary increase in noise and dust, or the wear and tear on access roads to the site	**5- Moderate**	• Dust suppression measures must be implemented for heavy vehicles on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues. • It is recommended that a Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	**2- Low**	• If mitigation measures are not implemented the propose development will generate dust and noise and will continue to impact the surrounding businesses and the nearby communities.
Termination of temporary employment	**6 Moderate**	• N/A	**6-Moderate**	• Loss of temporary employment.
Safety and security	**4-Moderate**	• Waste streams must be identified and documented. • Waste management plan must be implemented. • Accredited waste facilities to be contracted for accepting / recycling the waste. • Working hours should be kept between daylight hours during the	**1- Low**	• This increase the risk of a fire outbreak which will have an impact on the substation and the personal working within the premises.

		construction phase, and/or as any deviation that is approved by the relevant authorities. • The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction periods. • Access in and out of the construction camp should be strictly controlled • No open fires are permitted outside of designated areas. • Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff. • A comprehensive employee induction programme would cover land access protocols, fire management and road safety. • The contractor should have personnel trained in first aid on site to deal with smaller incidents that require medical attention • It is recommended that a Community Liaison Officer should be appointed to implement a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process • It is recommended that a Stakeholder Engagement Plan be compiled and implemented for the construction phase of the project.		

Disturbance, damage, destruction or sealing-in of fossil remains preserved at or beneath the ground surface within the development area, most notably by bedrock excavations during the construction phase.	**1-Low**	• Monitoring of all substantial bedrock excavations for fossil remains by ECO, with reporting of substantial new palaeontological finds to SAHRA for possible specialist mitigation.	**1-Low**	• Will result in the permanent loss of any heritage features.
During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.	**1-Low**	• No mitigation measures are required as no sites were identified. It is recommended that a chance find procedure should be implemented for the project.	**1-Low**	• Will result in the permanent loss of archaeological and paleontological material or objects
Soil and water contamination due to the handling and storage of dangerous goods during the construction and operation phases.	**6-Moderate**	• Any spillages of dangerous substances must be contained as soon as possible, and remedial and clean-up actions initiated immediately. • Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken throughout the life cycle of the project. • Appropriate spill kits must be available on site. • Maintenance vehicles must have access to spill kits. • An emergency spill response plan must be developed for implementation during the construction and the operational phase. Personnel should be suitably trained to attend to any spills that may occur.	**1-Low**	• May result in a fire or explosion and the contamination of soil and ground water.

		• A fire management plan must be developed for implementation during the construction and the operational phase. Personnel must be suitably trained to manage any fires which may occur on site. • Flammable substances must be stored in enclosed containers away from heat, sparks, open flames, or oxidizing materials. • Develop a monitoring and leak detection procedure for monitoring of the chemical spillages. •		
OPERATION PHASE				
Vegetation transformation for areas that are routinely maintained.		• The peripheral area of the substation will be routinely maintained to avert the fire risks and therefore any emergent exotic vegetation can be simultaneously managed		• Routine disturbances of vegetation will result in transformation of the structures, with an expected increase in abundance of pioneering species; • The relatively small spatial scale tends to render this impact insignificant.
➢ **Storage and handling of Hazardous Substances**				
Storing and handling of dangerous chemicals	**4 - Moderate**	• Storage of chemicals to be limited to appropriate and secure facilities on site and access limited to authorised personnel only; • Storage in secure containers to ensure/limit the potential for the occurrence of leakages; • Storage area to be bunded with an appropriate volume capacity to protect from environmental	**3 - Low**	• Spillages of dangerous chemicals from inadequate and unprotected storage facilities and/or spillages during routine operations will contaminate soils and lead to chemicals (heavy metals) becoming bio-available to enter into the food chain; • Chemical leachates could contaminate groundwater and/or be transported to surface water ecosystems via surface water runoff.

		contamination should accidental leakages occur; • Transferal of chemicals to batteries should be done according to best practice guidelines to limit spillage. • A fire management plan must be developed for implementation during the construction and the operational phase. Personnel must be suitably trained to manage any fires which may occur on site. • Should spillage occur, the ECO must be informed immediately, and a clean-up operation immediately commenced. Contaminated soils must be cleared and removed for disposal at a registered waste site capable of disposal of the chemicals.		

Overall Recommendation

The findings of the specialist study undertaken in support this EIA to assess both the benefits and potential negative impacts anticipated from the Project conclude that the significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. As such the authorisation of the project for development will meet the objectives of sustainable development and is supported by the EAP.

The confidence in the Basic Assessment undertaken is acceptable. Taking into consideration the above and based on the nature and extent of the Project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the Basic Assessment, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the proposed BESS Project can be managed and mitigated to an acceptable level. The information provided as part of the BA process, and specifically within this BA report, is sufficient to enable the DEA to make an informed and defendable decision. The layout plan as presented in this report has been informed by the findings of the specialist study and available information (refer to Appendix B for the Layout Map). The facility in its current position results in an acceptable level of loss and is considered to be the preferred layout and environmentally acceptable.

The following conditions would be required to be included within an authorisation issued for the Project:

Construction

- The footprint of the impact should be kept to a minimum and unnecessary disturbance to habitats should be controlled.
- Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- All mitigation measures detailed within the Environmental Management Programme (EMPr) as contained within Appendix M of this report are to be implemented.

Operations

- On-going monitoring programme should be established to detect and manage alien species within the site for the duration of the operation phase.
- The operation phase EMPr must be implemented and used to ensure compliance with environmental specifications and management measures.

The EAP recommends the following general conditions to be included:

- Environmental authorisation (EA) will be subject to the implementation of mitigation measures and conditions stipulated within the EMPr and this Basic Assessment Report.
- Construction must commence within a period of 2 years
- EA will be valid for the life of the BESS, subject to revisions and amendments through legislated procedures as the need arise.
- Eskom must continue to investigate mechanisms for waste reduction or minimisation, especially relating to the re-use of Batteries. This has the potential to unlock further economic benefits for local communities living near Hex Substation stations.

As such, Zitholele Consulting as the EAP recommend that this project is awarded an EA from the DEA.

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LIST OF ACROYNYMS

Acronym	Description
BA	Basic Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage Solution
CA	Competent Authority
CSP	Concentrating Solar Power
DOW	Department of Energy
DPE	Department of Public Enterprise
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
MW	Megawatts
NEMA	National Environmental Management Act 107 of 1998 (as amended)
NEMWA	National Environmental Management Waste Management Act 59 of 2008
NT	National Treasury
NWA	National Water Act 36 of 1998
OHS	Occupational Health and Safety Act 85 of 1993
OU	Operating Units
PAIA	Promotion of Access to Information Act 2 of 2000
PPP	Public Participation Process
WUL	Water Use Licence

GLOSSARY OF TERMS

Term	Description
Alien species	A species that is not indigenous to the area or out of its natural distribution range.
Alternatives	Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.
Assessment	The process of collecting, organising, analysing, interpreting and communicating information which is relevant.
Basic Assessment Process	As defined by Nema
Biological diversity	The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.
Commence	The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.
Construction	Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity as per Regulations GNR 544, 545 and 546 of June 2010. Construction begins with any activity which requires Environmental Authorisation.
Cumulative impacts	The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.
Direct impacts	Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

'Do nothing' alternative	The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.
Drainage	A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present.
Ecosystem	A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Endangered species	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.
Endemic	An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.
Environment	the surroundings within which humans exist and that are made up of: i. The land, water and atmosphere of the earth; ii. Micro-organisms, plant and animal life; iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
Environmental assessment practitioner:	An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.
Environmental impact	An action or series of actions that have an effect on the environment.

Environmental management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental management programme	An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.
Habitat	The place in which a species or ecological community occurs naturally.
Heritage	That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).
Hazardous waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.
Indigenous	All biological organisms that occurred naturally within the study area prior to 1800
Indirect impacts	Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Interested and affected party	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Pollution	A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.
Rare species	Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".
Red data species	Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the

	South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).
Riparian	The area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
Significant impact	An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.
Waste	Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister.
Watercourse	As per the National Water Act means - (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
Wetlands	land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

1 INTRODUCTION

Eskom Holdings SOC Limited (herein to as Eskom) is proposing to install grid-scale battery storage at various Eskom Distribution sites in the different Operating Units (Western Cape (WC), Eastern Cape (EC), Northern Cape (NC) and KwaZulu Natal (KZN) OU). The Battery Energy Storage Solutions BESS Project will be implemented in 2 phases with a total of 1440 MWh of battery storage per day.

This application pertains to the proposed installation of Grid-Scale Battery Storage and the construction of associated infrastructures at the existing Hex Substation in the Western Cape Province which forms part of the Worcester Group 3 (herein referred to as the "Project"). The project site is located on Erf 20640 and Erf 16127 near Worcester, Western Cape Province. This project forms part of the World Bank funding set of criteria for the Major Build program, and requires a carbon friendly alternative to be implemented by Eskom as an alternative to the Kiwano CSP project, which has been terminated by Eskom.

A detailed Project Description is included in **Section 2** of the Report.

1.1 Project Background

On 31 May 2016 the Eskom Board proposed the cancellation of the Kiwano Concentrating Solar Power (CSP) project. Subsequently, Eskom engaged with the National Treasury (NT), the Department of Public Enterprises (DPE), the Department of Energy (DOE) and the project funders between June and December 2016. It was clear that there would be no Government support for the cancellation of the loan agreements with the project funders, due to the negative impact it would have on the Government and Eskom's reputation. Furthermore, it would negatively impact on Eskom and the Country's ability to attract funds for future capital projects. The 'brown' (coal) component of the loan agreement could also not be split from the 'green' (renewable) component, as this was the basis for the WB approval of the Eskom Investment Support Project for its Major Build program at Kusile and Medupi.

In light of the above, Eskom proposed to the World Bank, in a letter dated 27 January 2017 that it would investigate suitable alternative projects to replace the CSP project. The World Bank accepted Eskom's proposal and affirmed that Eskom provide a well-founded commitment to the World Bank in April 2017 with regards to the alternative project technology, size and cost of the project, and whether the targeted deadline of December 2019, could be met.

After a high-level need identification investigation, Eskom has proposed Battery Energy Storage Solutions (BESS) to meet the requirements set out by the World Bank.

The BESS Project will be implemented in 2 phases with a total of 1440 MWh of battery storage per day. Various Eskom Distribution sites in the different Operating Units (Western Cape (WC), Eastern Cape (EC), Northern Cape (NC) and KwaZulu Natal (KZN) OU) are identified for this rollout.

Phase 1 of the project is to achieve an installation of 800MWh Distributed Battery Storage by December 2020. Phase 2 is to install 640 MWh of Distributed Battery Storage with 60 MW of Distributed Solar Photo Voltaic (PV) by December 2021.

This group of applications for Environmental Authorisations are only for Phase 1, as these are sites owned by Eskom. Phase 2 sites are in the planning phase and will require land acquisition and the necessary land use approvals.

Eskom proposes installing BESS at existing distribution substations to strengthen the electricity distribution network and address current voltage and capacity constraints. In some instances, the BESS may defer the capital requirements for current network strengthening. Eskom initially identified a total of 24 substation sites, now revised to 6 sites, in the Western Cape where the BESS could be implemented with a total (proposed) BESS size of 148.5 Megawatts (MW) and a total capacity of 459 Megawatt per Hours (MWh).

The following criteria were considered in the selection of suitable sites for the BESS:

- Proximity of load customers to existing or confirmed future renewable generators (the World Bank requested that sites be identified where the batteries can be charged by renewable projects).
- Situations where the distribution network will see notable benefits from the introduction of BESS, via one of the following mechanisms:
    - Reduction in electricity supply losses;
    - Peak load reduction resulting in thermal load reduction on critically loaded network components;
    - Peak load reduction allowing for deferment of capital strengthening or mitigation of negative effects on the local economy for already delayed capital strengthening;
    - Reduction in loading / congestion of upstream High Voltage networks;
    - Improvement of local network attributes and quality of supply; and
    - Peak load reduction where the peak load is concurrent with national system peak (i.e. winter evenings);
- Availability of sufficient Medium Voltage connection capacity for the BESS; and
- Availability of sufficient space at the substation for installation of the BESS containers.

1.2 Details of Environmental Assessment Practitioner

Eskom appointed Zitholele Consulting (Pty) Ltd (herein referred to as Zitholele) to undertake the regulatory Environmental Authorisation (EA) processes for the proposed Project. This document deals with the Environmental Impact Assessment process for the proposed Project

Zitholele Consulting (Pty) Ltd. is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource Management, Environmental and Waste Services, Communication (public participation and awareness creation) and Livelihoods and Economic Development. Zitholele Consulting (Pty) Ltd has no vested interest in the proposed project and hereby declares its independence as required in terms of the EIA Regulations. Table 1-1Error! Reference source not found. provides the Environmental Assessment Practitioner (EAP) details.

Table 1-1: Details of the Environmental Assessment Practitioner

Name and Surname	Tebogo Mapinga (Project Manager and author of the report)
Highest Qualification	Bsc (Zoology & Physiology)
Professional Registration	Pr.Sci.Nat. (115518)
Company Represented	Zitholele Consulting (Pty) Ltd.
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2060
Facsimile	086 674 6121
E-mail	tebogom@zitholele.co.za
Name and Surname	**Mathys Vosloo (Project Associates and peer reviewer)**
Highest Qualification	Phd Zoology
Professional Registration	Pr.Sci.Nat. (400136/12)
Company Represented	Zitholele Consulting (Pty) Ltd
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2079
Facsimile	086 674 6121
E-mail	mathysv@zitholele.co.za
Name and Surname	**Werner Nel (EAP and author of the EMPr)**
Highest Qualification	Msc. Zoology
Professional Registration	Pr.Sci.Nat.
Company Represented	Zitholele Consulting (Pty) Ltd

Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2079
Facsimile	086 674 6121
E-mail	werner@wnecs.co.za

1.3 Expertise of the Environmental Assessment Practitioner

Mrs Tebogo Mapinga – is a Senior Environmental Scientist, holds a BSc degree with 9 years of experience in the environmental field in both public and private sectors. He holds a BSc Degree (Major in Physiology and Zoology) from the University of Limpopo (Turfloop Campus) and she is in the process of completing her Honours Degree in Environmental Management with the University of South Africa. She has 12 years working experience years of experience in the environmental field in both public and private sectors. Her competencies lie in environmental impact assessments, Basic Assessment, Environmental Screening, Environmental Management Programs, compliance monitoring and obtaining permits for small- and large-scale project. She is a member of the International Association for Impact Assessments (IAIA) and is a registered professional natural scientist (*Pr. Sci. Nat*.) in the field of Environmental Science with the South African Council for Natural Scientific Professionals (SACNASP) since 2017. Tebogo is ideally positioned to manage this environmental authorisation process with integrity and independence, while advising the client toward alternatives that have less potential for environmental impact.

Dr Mathys Vosloo graduated from the Nelson Mandela Metropolitan University with a PhD in Zoology in 2012, after successfully completing a MSc in Zoology and BSc (Hons) in Zoology. Dr Vosloo is a member of the International Association for Impact Assessments (IAIA) and is a registered professional natural scientist (*Pr. Sci. Nat*.) in the field of Ecological Science with the South African Council for Natural Scientific Professionals (SACNASP) since 2012. He has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes.

Dr Vosloo has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National

Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes.

Mathys has a comprehensive understanding of the relevant environmental legislation and works intimately with specialist consultants to ensure that potential impacts are accurately identified, assessed and mitigated. With his experience in similar projects, Dr. Vosloo is ideally positioned to manage this environmental authorisation process with integrity and independence, while advising the client toward alternatives that have less potential for environmental impact.

Werner Nel graduated with a BSc and BSc (Honours) from the University of Port Elizabeth and a Masters in Zoology from the University of Stellenbosch. He began working in the environmental field during his studies and fulltime as Environmental Officer in 2007 within the mining sector and later as Environmental Manager. In 2013 he joined a general environmental consulting firm which focussed on environmental assessments and compliance monitoring.

He has experience in environmental applications, environmental assessments, environmental management, rehabilitation and restoration of degraded landscapes, Environmental Management Systems (EMS), including ISO 14001 and in environmental compliance auditing and site monitoring especially in the arid West Coast environment. He has gained environmental experience within various industries including construction, linear projects, mining, wine industry, manufacturing and retail and provided various environmental services within these.

Werner's specialty and experience within the fields of Mine Rehabilitation, Mine Closure, Environmental Management and Environmental Auditing enables him to add a holistic approach to projects. He has a comprehensive understanding of the relevant environmental legislation and is a member of the International Association for Impact Assessments (IAIA). Werner is ideally positioned to manage this environmental authorisation process with integrity and independence, while advising the client toward alternatives that have less potential for environmental impact.

Please refer to **Appendix A** for the EAPs CV's.

1.4 Statement of Zitholele's Independence and EAP Affirmation

Neither Zitholele, nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of Zitholele.

Zitholele has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

EAP AFFIRMATION:

Section 16 (1) (b) (iv), Appendix 1 Section 3 (1) (r), Appendix 2 Sections 2 (l) and (j) and Appendix 3 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of the NEMA), require an undertaking under oath or affirmation by the EAP in relation to:

- The correctness of the information provided in the report;
- The inclusion of comments and inputs from stakeholders and interested and affected parties;
- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.

Zitholele and the EAPs managing this project hereby affirm that:

- To the best of our knowledge, the information provided in the report is correct, and no attempt has been made to manipulate information to achieve a particular outcome. Some information, especially pertaining to the project description, was provided by the applicant and/or their sub-contractors.
- To the best of our knowledge all comments and inputs from stakeholders and interested and affected parties have been captured in the report and no attempt has been made to manipulate such comment or input to achieve a particular outcome. Written submissions are appended to the report while other comments are recorded within the report. For the sake of brevity, not all comments are recorded verbatim and are mostly captured as issues, and in instances where many stakeholders have similar issues, they are grouped together, with a clear listing of who raised which issue(s).

Information and responses provided by the EAP to interested and affected parties are clearly presented in the report. Where responses are provided by the applicant (not the EAP), these are clearly indicated.

1.5 Specialist Teams

An Ecological Specialist was appointed by Zitholele to undertake the relevant assessments to identify assess impacts and propose appropriate mitigation and management measures for the identified impacts. The following specialist was commissioned:

- Ecological Assessment - Dr. Mathew Ross (Pr Sci Nat) of EnviRoss CC.

Please refer to **Appendix A** for the Specialist CV and Declaration.

1.6 Document roadmap

This Basic Assessment Report for the proposed Project aims to conform to the requirements stipulated in Appendix 1 of the National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment Regulations, 2014 as amended. Table 1-2 presents the document's structure, in terms of the aforementioned regulatory requirements. Based on the contents of this table it is evident that the BAR conforms to the regulatory requirements and provides sufficient information to facilitate the Competent Authority to reach an informed decision with regards to granting or refusal of Environmental Authorisation.

Table 1-2: Document Roadmap

NEMA EIA Regulations, 2014 (as amended) Appendix 1		Corresponding Document Section
Regulatory Requirement	**Description**	
3(a)	Details of - (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vita;	Section 1 & Appendix B
3(b)	Details of the location of the activity, including: (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2
3(c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 2 & Appendix C
3(d)	(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	Section 2
3(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context	Section 4
3(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location	Section 2

NEMA EIA Regulations, 2014 (as amended) Appendix 1			Corresponding Document Section
Regulatory Requirement		**Description**	
3(g)		a motivation for the preferred development footprint within the approved site	Section 2
3(h)		A full description of the process followed to reach the proposed development footprint within the approved site, including	
	(i)	details of the development footprint alternatives considered;	Section 3
	(ii)	details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs	Section 5
	(iii)	a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 5 & Appendix F
	(iv)	the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 6
	(v)	the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 7
	(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Section 7
	(vii)	positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
	(viii)	the possible mitigation measures that could be applied and level of residual risk;	Section 7
	(ix)	if no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 3
	(x)	a concluding statement indicating the preferred alternative development location within the approved site	Section 8

NEMA EIA Regulations, 2014 (as amended) Appendix 1		Corresponding Document Section
Regulatory Requirement	**Description**	
3(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including - (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	Section 7
3(j)	an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section 7
3(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 7
3(l)	an environmental impact statement which contains – (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 8
3(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 7 & 8
3(n)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 8

NEMA EIA Regulations, 2014 (as amended) Appendix 1		Corresponding Document Section
Regulatory Requirement	**Description**	
3(o)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	Section 7
3(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 8
3(q)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	Section 9
3(r)	an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Section 1
3(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
3(t)	any specific information that may be required by the competent authority; and	N/A
3(u)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

2 SCOPE OF PLANNED ACTIVITIES AND MOTIVATION

This chapter provides an overview of the Project and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores the need and desirability of the Project.

2.1 Project Location

Hex Substation is located on Erf 20640 and Erf 16127 which is situated in an industrial area on the outskirts of Worcester close to the Hex River. The site falls within the jurisdiction of the Breede Valley Local Municipality. The footprint required for the proposed development is approximately 1.5ha in extent. Refer to

Figure 2-1.

Table 2-1: Description of the proposed site

	DESCRIPTION
Farm Name	Erf 20640 and Erf 16127
SD Code	Erf 20640 C0850004000206400000 Erf 16127 C0850004000161270000 0
Development Footprint	1.5ha
Co-ordinates	Laydown Area Corner Co-ordinates 33° 38'0.32"S 19° 28'32.84"E 33° 38'1.10"S 19° 28'34.47"E 33° 38'3.91"S 19° 28'29.91"E 33° 38'4.83"S 19° 28'31.59"E Laydown Area Central Co-ordinates 33° 38'2.60"S 19° 28'32.14"E Battery storage area Corner Co-ordinates 33° 38'2.54"S 19° 28'36.89"E 33° 38'5.00"S 19° 28'34.90"E 33° 38'6.07"S 19° 28'36.77"E 33° 38'7.87"S 19° 28'35.31"E 33° 38'9.62"S 19° 28'38.40"E 33° 38'5.39"S 19° 28'41.84"E Battery storage area Central Co-ordinates 33° 38'6.07"S 19° 28'38.57"E
Municipality	Breede Valley Local Municipality
District Municipality	Cape Winelands District Municipality
Ward Number	Ward 8
Land Zoning	Industrial
Access to the site	The project site can be accessed via an existing access road off Louis Langa Street.
Nearest Towns	~1.15km from Zweletemba and ~1.67km from Worcester

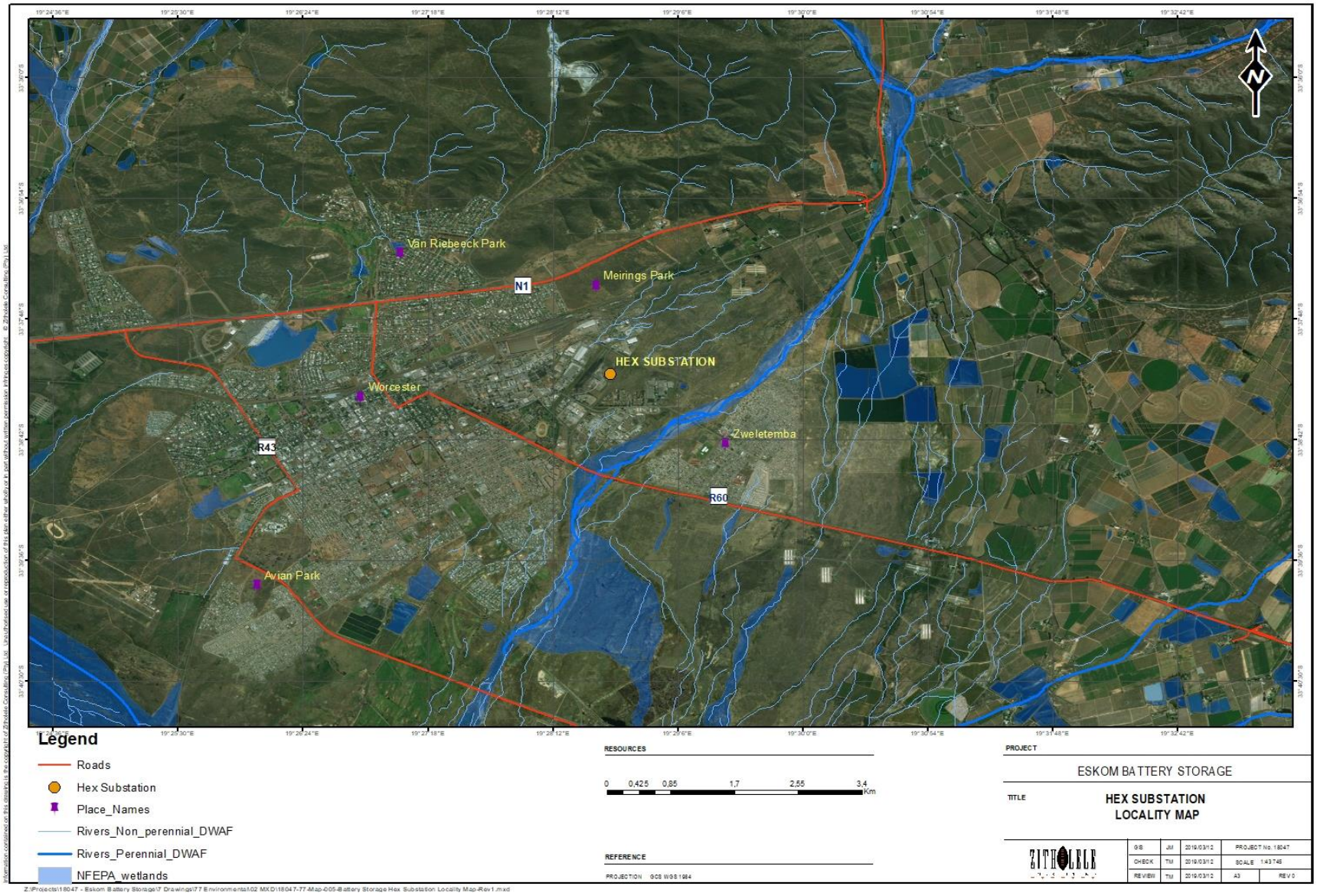

Figure 2-1: Locality of the Hex Substation

2.2 Description of the Planned Activities

Eskom proposes to install grid-scale battery storage at the existing Hex Substation site, mainly as opportunity for capital deferment, which would otherwise require Eskom to embark on normal network strengthening through building new networks and major refurbishments. The proposed development will also include the following infrastructures:

- Network integration equipment (e.g. power cables, control cables, isolators, circuit breakers, transformers, etc.) will be required to connect the new BESS to existing infrastructure at the substations.
- Additional fencing may be required, security equipment, lighting, and/or control room upgrades.
- Where possible, the BESS containers will be placed on the existing substation platform. Where there is insufficient space, the substation platform will be extended (compacted fill, earth protection layer and stone chip) to accommodate the BESS containers.
- Existing access roads to the substations may also need to be lengthened, realigned or upgraded to ensure easy access to the BESS, specifically for low-bed trucks during construction to deliver and install the BESS containers onto the platform.
- A temporary laydown area and site camp will be required during construction.
- Underground cables connecting the BESS to the substation and feeder bay extensions.
- Storm-water management measures to be implemented on site.
- Installation of lightning masts.

Table 2-2: Provides a description of the project components

	DESCRIPTION
Battery Storage Capacity	Approximately 20MWh, while the required storage of a maximum volume of 500m³ of electrolyte
Number of Battery Modules	74
Associated Infrastructure	Transformer- LV/MV Step-up Transformers - The BESS installation steps up the converters output from a possible 1 400V CA to 1kV via the BESS modules intermediate transformers. It must be noted that the preferred connection voltage is 11kV (or 22k or 33kV dependant on substation MV busbar voltage) but if this is not achievable, alternative voltage levels (e.g., 6.6kV) may be offered. The maximum possible transformer rating using the present methodologies of construction is a 5MVA for voltage ranges 400V/11k, 400/22k or 400/33Kv. - Concrete foundation - Cabling between the battery modules - Air conditioners - Internal access Roads
Temporary Infrastructure (required for the Construction Phase)	Laydown Area Construction camps Construction compound and temporary site offices Temporary Access Roads

2.2.1 Detailed description of the Proposed Project

The following main commercially available BESS which this assessment will investigate include:

- Solid State Batteries Technology
  - » Electrochemical capacitors, lithium-ion, nickel-cadmium, Sodium Sulphur): Suitable in many applications that are utilised for in creating a more robust and adaptable energy grid.

Figure 2-2: An example of a lithium-ion container installation

- Flow Battery Technology:
  - » Redox flow batteries: Suitable for energy storage applications with power ratings from 10's of kW to 10's of MW and storage durations of 2 to 10 hours.
  - » Vanadium Redox flow batteries: Suitable for power systems in the range of 100 kW to 10 MW, with storage durations in the 2-8 hour ranges.
  - » Zinc-Bromine flow Batteries: Multiple systems size's up to 1 MW/3 MWh could be connected in parallel for use in much larger applications.

The chemical composition of these types of technologies is considered hazardous, containing toxic materials. All the batteries will be containerized and makes provision for secondary containment to accommodate any spill as a result of normal operation and maintenance.

The proposed Hex BESS is planned to have an installation **storage capacity of 20MW whilst a required storage of a maximum volume of 500m³ of electrolyte**. Provision must also be made at the substation for an additional 22kV feeder bay. The number of containers to be stored within the substation and the development area is dependent on the type of technology that is selected and approved for the site.

The entire existing substation site footprint will be the construction area, (including lay-down areas and storage areas) and all available land space up to the extent of the property boundary

will utilised to accommodate the BESS containers and associated infrastructure. The footprint of each BESS technology alternative excludes the associated infrastructure. All of the BESS alternatives are stackable, which can reduce the required footprint, however this is limited within the substation's yards, where sufficient safety height clearance from high voltage electrical infrastructure is required.

The footprint for the batteries has been **estimated at 63m² per 1MW**. An **additional 45m² per 1MW** will be utilized for cable trenches, foundations, air-conditioning units, inverters and general access for operation and maintenance equipment and vehicles in-between containers. The combined footprint of 90m² does not include site camp, roads and laydown and storage areas.

The footprint (m²) and volume (m³) of electrolyte (which is comprised of a blend of one or more of the hazardous substances listed in SANS 10234 and Supplementary thereof) per battery technology has been calculated from various industry technology supplier information. The table below provides the footprint and volume for every 1MW with no efficiency factor taken into consideration as well as 1MW installation with a 60% efficiency factor:

Table 2-3: Footprint and volume for every 1MW with no efficiency factor taken into consideration as well as 1MW installation with a 60% efficiency factor

	Battery Technology					
	Footprint (m²)	**Volume (m³)**	**Footprint (m²)**	**Volume (m³)**	**Footprint (m²)**	**Volume (m³)**
1 MW with NO Efficiency Factor	90	16	200	54	152	168
1 MW with 60% Efficiency Factor	150	27.2	333	91	253	280

It is proposed that Hex Substation will accommodate a **20MW BESS installation.**

2.3 Actions to be undertaken during each lifecycle phase

2.3.1 Pre-Construction and Construction Process for proposed development

The pre-construction and construction of the proposed development will be undertaken in the following steps:

- Undertaking and completion of proposed development concept;

- Obtain the relevant permits and siting approval (Undertake the EIA Process, obtain permits from local authorities, landowners, fire department, etc.);
- Pre-Construction site work, such as geotechnical investigations;
- Undertaking of and compliance with pre-construction activities and conditions in terms of the Environmental Authorisation;
- Site preparation (Vegetation clearance);
- Demolishing of the existing building;
- Civil work and civil construction: Casting of new foundations and plinths for the proposed development;
- Construction of the residential and business units and associated infrastructures (roads, open spaces area);
- Construction and/or installation of water supply and storm water management infrastructure; and
- Testing and commissioning.

The construction phase for the proposed project will take approximately 2 year.

2.3.2 Operational and Maintenance Activities

After the installation and commissioning, the responsibility for safe operation and asset management will be transferred to the operation team. It should be noted that in some cases the manufacturer of certain components remains responsible for maintenance of specific components as part of a service agreement. A plan for systematic maintenance and function testing should be kept on location showing in detail how components and systems should be tested and what should be observed during testing. Visual periodical and mandatory services should be kept in place. Maintenance may be performed manually or automated. In case of manual maintenance, a higher level of safety precautions needs to be undertaken.

2.3.3 Decommissioning and Recycling Activities

An electrical energy storage (EES) system that does not meet the performance requirements, where repairs do not solve the problem and where change in the EES system does not lead to a profitable alternative business case, reached its end of lifecycle. Such an ESS system should be de-installed, disassembled, removed from the site, transported, re-used/recycled. If possible, the EES system should be de-energised safely before any other steps can be taken. Before the transportation of the components, it should be made sure that the EES system and its components are safe to transport.

2.4 Project Need and Desirability

The project forms part of the World Bank funding set of criteria for the Major Build program and requires a carbon friendly alternative to be implemented in Eskom as an alternative to the Kiwano CSP project. The project is thus required to connect an equivalent of a 100 MW of Renewable Energy plant, with a capacity of at least 525 GWh per year. Furthermore, according to a high-level analysis of constrained feeders within the distribution business,

current feeder levels do not meet the required voltage and thermal characteristics as required by its license conditions.

Eskom has therefore proposed BESS to provide ancillary support in terms of enhanced frequency control of the network, reactive power support and improved quality of supply performance near existing Distributed Generation Renewable Energy plants. The Battery Storage technology may enable the immediate levels of constraint to be addressed and provide continued access to potential customers to these networks. The battery storage technology will also improve the quality of supply and mitigate voltage related concerns on the networks. The Battery Storage technology may also enable some significant strengthening investments to be deferred, whilst providing a reliable and effective interim solution to the problems faced on the Distribution Networks.

Electricity generation from renewable sources is limited by the intermittency and variability of wind and solar resources, i.e. when wind blows and sun shines. Energy storage allows for the storing of electricity for later use even when the renewable resource is unavailable. The process involves the conversion of electrical energy into another form of energy such as chemical or kinetic energy, store it temporarily and then converted back to electrical energy, therefore, giving the utility considerable flexibility and control.

3 CONSIDERATION OF ALTERNATIVES

In terms of the EIA Regulations, reasonable and feasible alternatives are required to be considered within the EIA process. All identified, feasible alternatives are required to be assessed in terms of social, biophysical, economic and technical factors. A key challenge of the EIA process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project; and
- Fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognise the limitations of project specific EIAs to address fundamentally different alternatives.

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to:

- the property on which, or location where, it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity; and
- the operational aspects of the activity.

These alternatives are discussed below.

3.1 Approach to the assessment of alternatives

This section discusses the alternatives that will be considered as part of the EIA. NEMA requires that alternatives to a proposed activity must be considered (NEMA, Section 24). Alternatives are different means of meeting the general purpose and need of a proposed activity. In the BA process, the consideration of alternatives is always important, should the proposed site not fit into the parameters of the EIA framework. The alternatives can be categorised as follows.

- Location**/**Site alternatives
- Layout Alternatives
- Technology Alternatives
- No-Go alternative

3.1.1 Location Alternatives

The proposed installation of Grid-Scale Battery Storage and the construction of associated infrastructures will take place within the existing Hex Substation which is owned by Eskom. The site is suited for the proposed development. No alternative site was identified or assessed for the proposed Project.

3.1.2 Layout Alternatives

The layout for the proposed development has been optimised based on the availability of land and the existing infrastructure on the site. No layout alternatives have been considered or assessed. Refer to Figure 3-1 below.

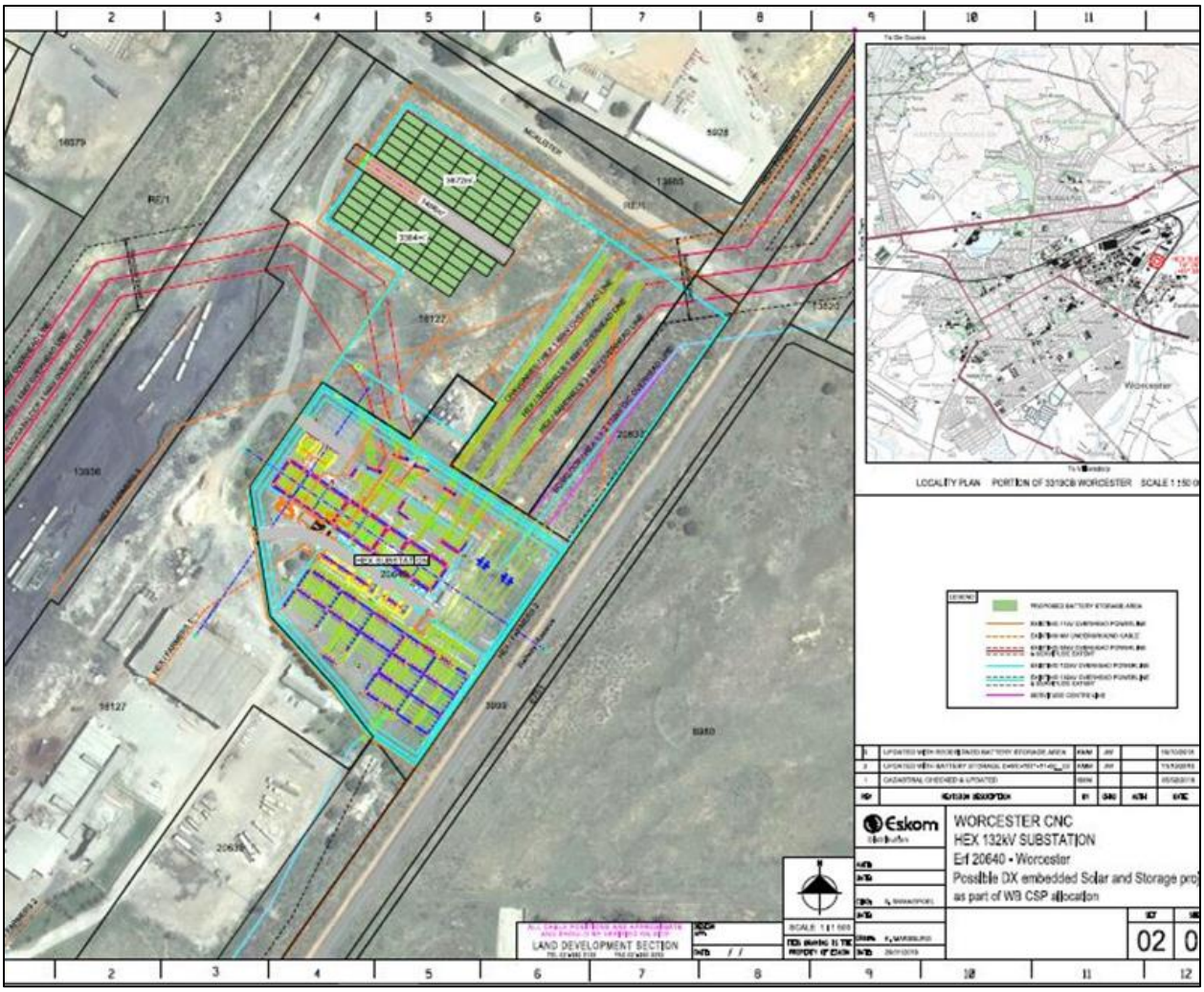

Figure 3-1: Facility Layout (Please refer to Appendix xx of the A3 maps

3.2 Technology Alternatives

The following main commercially available Battery Energy Storage Systems alternatives are discussed in the sections below.

3.2.1 Alternative 1: Solid state batteries (Lithium-ion) (Preferred):

Lithium-ion-based energy storage systems (ESSs) are expected to be the dominant energy storage technology for utility-scale applications with cycle durations up to 4 hours. A lithium-ion (Li-ion) battery is a rechargeable electrochemical battery. Rather than a single electrochemical couple like NiCd, “lithium-ion” refers to a wide array of chemistries in which lithium ions are transferred between the electrodes during the charge and discharge reactions.

A Li-ion cell consists of three main components: cathode and anode electrodes and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when during charge. When the battery is charging, lithium ions flow from the positive metal oxide electrode to the negative graphite electrode. When the battery is discharging, the ions flow in reverse.

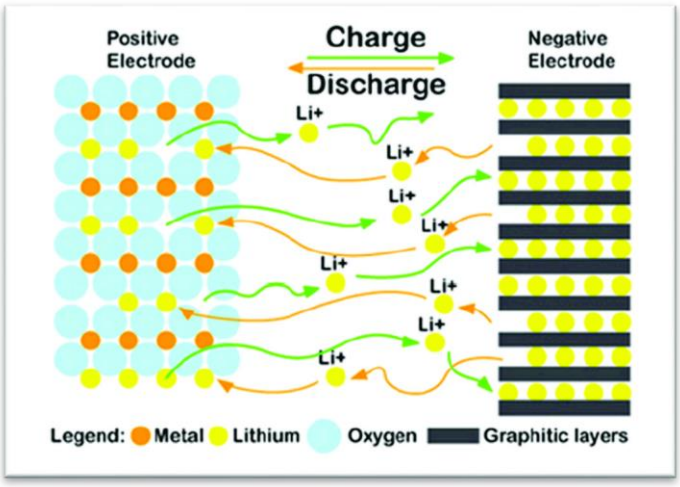

Figure 3-2: Li-ion battery function and components

Li-ion technology has been improved significantly through the evaluation and optimization of various combinations of chemistries, each of which presents slightly different performance characteristics. These chemistries can be confusing. Cathode materials can generally be grouped into two categories, namely iron phosphate and mixed metal (combinations of cobalt and manganese oxide). Anode material is generally graphite/carbon or titanate.

Performance

Li-ion performance depends on the electrode and electrolyte materials (chemistries); however, the following generalizations apply.

Table 3-1: Typical performance for Li-ion battery technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rated Power	generally < 4 hours
Round Trip Efficiency	92% – 96%
Response Time	milliseconds
Self Discharge per day	0.1 – 0.3% per day
Power Density	200 – 500 kWm
Energy Density	1,500 – 10,000kWhm
Depth of Discharge	2,000 – 20,000 cycles
Cycle Life	~80%
System Lifetime	10 – 20 years
Cost , Energy	200 – 3,800 $/kWh
Cost, Power	175 – 4,000 $/kW
Actual cost/performance is highly dependent on chemistry and manufacturer	

One disadvantage of Li-ion batteries is that the expected lifetime is related to the cycling depth of discharge. Although they perform better than lead-acid batteries, which perform better at less than <50% depth of discharge [DoD]), Li-ion batteries' lives are generally limited to <80% DoD to ensure an adequate life.

Applications

Li-ion batteries have been deployed in a wide range of energy-storage applications, ranging from energy-type batteries of a few kilowatt-hours in residential systems with rooftop PV arrays to multimegawatt containerized batteries to provide grid ancillary services. Li-ion batteries can meet all the identified use cases for South Africa.

Construction and Installation

The modularity of the Li-ion cells allows them to be constructed as modules and scaled. Batter packs can then be combined with inverters and controls systems and packaged into BESS at manufacturing facilities. When packaged into standard shipping container sizes, shipping the BESS around the world via truck, rail, or ship is greatly facilitated. Containerized BESS can be sited on pads or simple foundations and electrically connected to switchgear. Containerization significantly reduced the costs for local labor and on-site construction.

Operation and Maintenance

Small ESS for residential and light industrial or office buildings are essentially maintenance free and require little on-site monitoring. This is particularly true for systems that are monitored

remotely, and maintenance staff can be dispatched as needed. The greatest maintenance issue for Li-ion batteries is generally the monitoring and replacement of individual cells/modules later in life as replacement is required.

Decommissioning and Disposal

Modularized and packaged systems offer ease of system removal from site for disposal at end of life. Site contamination is unlikely, and site restoration would include infrastructure removal and revegetation. The materials used in Li-ion batteries are typically considered non-hazardous waste. The metals in the system can be recycled, but they do not represent a high salvage value.

Maturity

Li-ion batteries are a relatively mature commercial technology and are now the dominant electrical storage technology in automotive applications for both electric vehicles and hybrids. Although manufacturers are still experimenting with formulations and fabrication techniques to improve performance, reliability and reduce costs, the overall performance of this technology is reasonably well developed and understood. Most MW and MWh scale utility applications have been operating for less than 5 years of a presumed 10-year lifetime and some of the newer formulations have been operating for significantly less than that. Long-term performance reliability data is therefore still being confirmed. The recent construction of several gigawatt factories in the United States, Japan, and China is indication of confidence in the maturity and
bankability of the Li-ion technology.

Suitability for South Africa

Li-ion technology is a commercial and proven electrochemical battery technology. It exhibits a high energy density and moderate cost that can be scaled for a wide variety of energy storage applications. A variety of chemistries and formulations yield slightly different performance characteristics. Li-ion is and will likely continue to be the dominant energy storage technology for the next 10 to 15 years and will be the yardstick by which other technologies are compared. Li-ion systems are the basis for many current residential and industrial-commercial BESS being installed and will be increasingly used for grid connected utility-scale applications globally and in South Africa as prices fall. Beyond the prospect for local cell manufacture, these systems will require local resources for final system assembly, installation, operation, and maintenance.

3.2.2 Alternative 2: Flow Batteries

Many manufacturers have invested significant capital in the development of commercial flow battery designs. Flow batteries require mechanical systems (pumps, pipes, and tanks) and are inherently more complex than a solid-state battery. The most expensive components within the flow battery are generally the reaction stacks. The greatest advantage of the flow battery is the potential to scale up to longer duration discharge cycles more cost efficiently than solid-state batteries. The most successful and prevalent of these batteries use vanadium and zinc-bromine

chemistries. Several flow battery systems have been sold or have gone bankrupt before they achieved a market competitive commercial offering. Flow battery manufacturers across all chemistries are expected to continue to refine product offerings while reducing the initial costs of their products and demonstrating long-term reliability. Manufacturers that provide reliable

a) **Redox Flow Batteries**: A redox flow battery (RFB) is a rechargeable battery in which the energy is stored in one or more electrolyte species dissolved into liquid electrolytes. The electrolytes are stored externally in tanks and pumped through electrochemical cells that convert chemical energy directly into electrical energy and vice versa, on demand. The power density is defined by the size and design of the electrochemical cell; the energy density or output depends on the size of the electrolyte tanks.

Technology

Flow batteries are reaction stacks separated from one or more of the electrolytes held in external storage tanks. Either one or both active materials are in solution in the electrolyte at all times. Flow batteries have unique characteristics in terms of the power (rate at which energy changes) and energy (volume of energy) they provide. Power (in kW) is a function of the number of cells that are stacked; energy (kWh) is a function of the electrolyte volume, which is circulated by pumps. Flow batteries are generally less affected by overcharge or discharge. This means they can be used without significant degradation of performance. This is even the case when using the majority of energy capacity (deep discharge) uncommon for most battery types and a distinct advantage for this type of battery. On the other hand, tanks, piping, and pumps associated with electrolyte storage and flow add costs and maintenance to the plumbing and pipe work ads to the cost, and the electrolyte may be prone to leaks and must be contained.

Until now, membrane materials have been susceptible to premature degradation and contamination and/or are expensive. Flow batteries are often used for storing and discharging long durations of energy supply (typically between 2 and 10 hours). Leading chemistries at the moment include vanadium redox and zinc bromine redox flow batteries.

Redox flow batteries (RFB) can be divided into two categories. In a true redox flow battery, the active chemical species used to store energy remain dissolved in solution. This allows for the separation of power and energy capacity during battery design as the power is determined by the reaction cell and the energy is determined by the volumes of electrolyte available. Examples of true RFBs include the vanadium-vanadium and iron-chromium systems.

In a hybrid redox flow battery, at least one chemical specie is deposited as a solid in the electrochemical cells during charge. This prevents the complete separation of power and energy characteristics. Examples of hybrid RFBs include the zinc-bromine and zinc-chlorine systems.

Redox flow batteries represent one class of electrochemical energy storage devices. The term “redox” refers to chemical reduction and oxidation reactions employed in the RFB to store energy in liquid electrolyte solutions that flow through a battery of electrochemical cells during charge and discharge.

During discharge, an electron is released via an oxidation reaction from a high chemical potential state on the negative or anode side of the battery. The electron moves through an external circuit to do useful work. Finally, the electron is accepted via a reduction reaction at a lower chemical potential state on the positive or cathode side of the battery. The direction of the current and the chemical reactions are reversed during charging.

The total difference in chemical potential between the chemical states of the active elements on the two sides of the battery determines the electromotive force (emf or voltage) generated in each cell of the battery. The voltage developed by the RFB is specific to the chemical species involved in the reactions and the number of cells that are connected in series. The current generated by the battery is determined by the number of atoms or molecules of the active chemical species that are reacted within the cells as a function of time. The power delivered by the RFB is the product of the total current and total voltage developed in the electrochemical cells. The amount of energy stored in the RFB is determined by the total amount of active chemical species available in the volume of electrolyte solution present in the system.

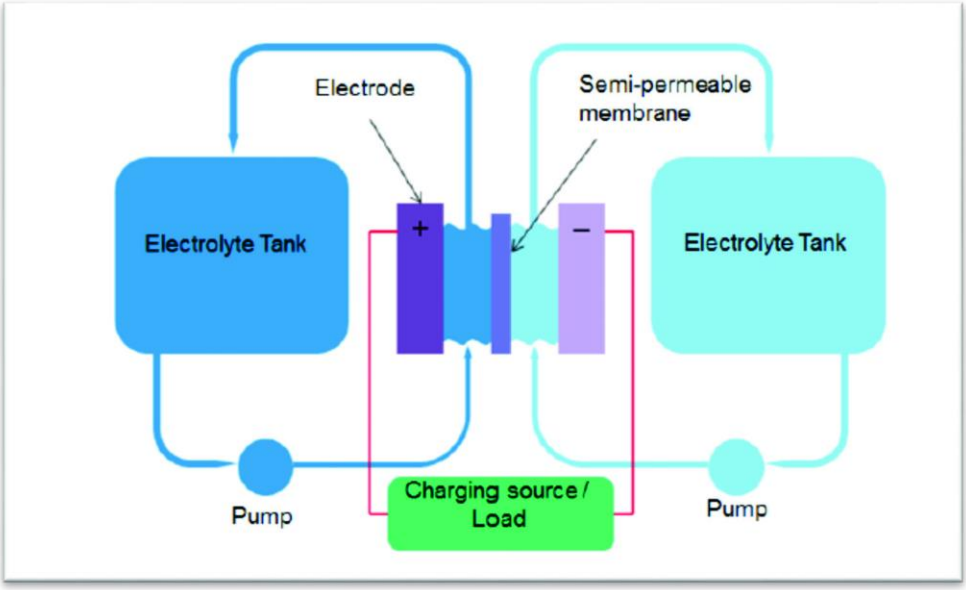

Figure 3-3: Schematic for typical of flow battery

The separation of power and energy also provides design flexibility in the application of RFBs. The power capability (stack size) can be directly tailored to the associated load or generating asset. The storage capability (size of storage tanks) can be independently

tailored to the energy storage need of the specific application. In this way, RFBs can economically provide an optimized storage system for each application. In contrast, the ratio of power to energy is fixed for integrated cells at the time of design and manufacture of the cells. Economies of scale in cell
production limit the practical number of different cell designs that are available. Hence, storage applications with integrated cells will usually have an excess of power or energy capability. An additional advantage of flow batteries is that flow can easily be stopped during a fault condition. As a result, system vulnerability to uncontrolled energy release in the case of RFBs is limited by system architecture to a few percent of the total energy stored. This feature is in contrast with packaged, integrated cell storage architectures (lead-acid, NaS, Li-ion) in which the full energy of the system is connected at all times and available for discharge. One of the primary barriers to the deployment of flow battery systems has been the reluctance of the utilities to allow the interconnection of untried/unproven storage devices on the utility grid. Much of this reluctance is based on the early failures of flow battery systems that were introduced before they were fully ready to perform a successful demonstration. The rush to bring poorly designed and untried flow battery systems to market has contributed heavily to this reluctance. Another barrier to the wide deployment of flow battery systems is the issue of bringing large quantities of potentially dangerous liquid electrolytes to locations that could expose the public to these chemicals in the event of a spill. The public perception of the danger in having bromine chemicals nearby is somewhat widespread. This “not-in-my-backyard” issue has been a major obstacle in the deployment of large flow battery systems.

b) **Vanadium Redox flow batteries**: The vanadium redox flow battery (VRFB) is based on redox reactions of different ionic forms of vanadium. During battery charge, V3+ ions are converted to V2+ ions at the negative electrode through the acceptance of electrons. Meanwhile, at the positive electrode, V4+ ions are converted to V5+ ions through the release of electrons. Both of these reactions absorb the electrical energy put into the system and store it chemically. During discharge, the reactions run in the opposite direction, resulting in the release of the chemical energy as electrical energy.

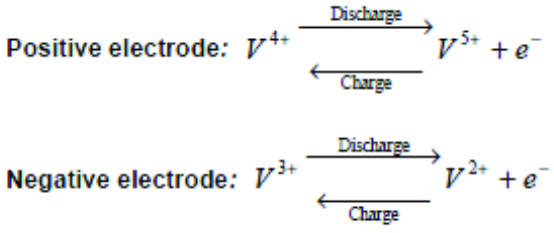

Figure 3-4: VRFB cell electrochemistry

As a true RFB, the active chemical species (vanadium) are fully dissolved at all times in electrolyte solutions and the power and energy ratings of a VRFB are independent of each other and each may be optimized separately for a specific application.

Electrolyte: Both electrolytes in the VRFB are composed of vanadium ions in an aqueous sulfuric acid solution at very low pH. The acidity of the sulfuric acid is comparable to that of the electrolyte found in lead-acid batteries, with a pH of between 0.1 and 0.5. The acidity of the electrolyte serves two purposes in the battery: to increase the ionic conductivity of the electrolyte, and to provide hydrogen ions to the reaction at the positive electrode. In 2011, Pacific Northwest National Laboratory (PNNL) patented a new electrolyte formulation that contains a mixture of hydrochloric and sulfuric acid. PNNL discovered that this increased the batteries' energy storage capacity by 70% and allowed the battery to work in both colder and warmer temperatures, between –5° and +50°C, greatly reducing the need for costly cooling systems.

Electrodes: The electrodes used in VRFB are composed of high-surface area carbon materials. These materials operate across a wide range of voltage potentials with minimal hydrogen and oxygen evolution, are chemically stable with respect to the acidic electrolytes at both the anode and cathode of a cell and are available at reasonable costs. Carbon materials have a very wide range of characteristics depending on the methods of manufacturing and preparation.

Membrane: The two half-cells in each cell are separated by a proton exchange membrane (PEM). The membrane physically separates the two vanadium-based electrolyte solutions, preventing self-discharge while allowing for the flow of ions to complete the circuit. Several membranes can be used in vanadium redox batteries.

Cell Stacks: In practice, vanadium redox batteries are constructed by stacking several cells together in series to form a battery stack. Electrodes are placed on either side of a bipolar plate, which separates each cell from the next cell. The bipolar plate acts as the current conducting mechanism between the negative electrode of one cell and the positive electrode of the next. The positive electrode of the most positive cell in the stack and the negative electrode of the cell at the other end of the stack form the positive and negative ends of the battery, and are connected to the power conditioning system. The cells in the battery are electrically connected in series, but in most designs the electrolyte flows through the cells in parallel. The number of cells used in the complete battery depends on the desired voltage level of the final battery.

Electrolyte Tanks: The vanadium electrolytes are stored in separate large electrolyte tanks outside the cell stack. The tanks must be composed of materials that are resistant

to corrosion in the very low Ph environment. In the past, off-the-shelf plastic or fiberglass tanks, such as those used to store gasoline, have been used to store electrolyte.

Pumps, Piping, And Auxiliary: Pumps, valves, pipes, and other piping components must be corrosion resistant and stable in low pH environments. For this reason, pumps using plastic impellers are used in most installations. Similarly, valves must be rated for low pH environments. For piping, most developers use standard polyvinyl chloride (PVC) piping, which is inexpensive and readily available. Laying out pipe can be a labor intensive process, however. At least one major developer has made an effort to cut down on the amount of piping used, using prefabricated piping wherever possible and minimizing placement of valves.

Table 3-2: Typical Performance for Vanadium REDOX Battery Technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rated Power	4 – 12 hours
Round Trip Efficiency	60% – 85%
Response Time	milliseconds
Self-Discharge per day	Small
Power Density	<2 kWm
Energy Density	16 – 35 kWhm
Cycle Life	>20,000 cycles
Depth of Discharge	100%
System Lifetime	10 – 20 years
Cost, power	500 – 1,500 $/kW
Cost, energy	150 – 1,000 $/kWh

Applications: Due to its relative mechanical complexity and economies of scale, the vanadium redox battery is most suited for utility-scale power systems in the 100-kW to 10-MW size range in applications having low power/energy ratios (long discharge durations). Transmission and distribution applications with these characteristics include load shifting (peak shaving), renewables time shifting, fluctuation suppression, forecast hedging, mitigating transmission curtailment, spinning reserve, power quality (especially long duration), voltage support, and frequency excursion suppression.

Construction and Installation

Newer systems being produced are based on standardized design of modular or containerized construction. Both approaches reduce shipping and installations costs.

Operation and Maintenance: The normal operating temperature of a VRB ranges from about 10° to 40°C. Active cooling subsystems are employed if ambient temperatures exceed 40° to 45ºC. For new installations, monthly visual inspections of piping and tanks are required, with detailed inspection at 6-month intervals. Pumps and HVAC systems require inspection every 6 months. Pump bearings and seals may require replacement at

5-year intervals. Electronic parts such as boards, sensors, relays, and fuses, may require replacement as necessary. Without extended field experience, the system maintenance requirements have not been thoroughly established. However, a typical system has only two moving parts — pumps on the operates at atmospheric pressure and the temperature never exceeds 40°C. Primary maintenance items are annual inspections and replacement of pump bearings and impeller seals at intervals of about every 5 years. As necessary, smaller parts, such as electronic boards, sensors, relays, and fuses are replaced.

Decommissioning and Disposal: The cell stack is generally environmentally benign. The only material in the stack that might be considered toxic is the ion exchange membrane, which is composed of highly acidic (or alkaline) material. During decommissioning, users can dispose of the membranes using the same processes used to handle highly corrosive substances. In fact, membranes are somewhat simpler to handle because they are solid and do not require containment. In considering vanadium electrolyte toxicity, it should be noted that the electrolyte does not require change over the lifetime of the battery because it does not degrade or otherwise require replacement. At the end of life for the battery system, the electrolyte will almost certainly be recycled to recover its valuable vanadium content. For these reasons, electrolyte disposal is not likely to be a significant obstacle to the adoption of VRFBs.

Maturity: The VRFB is the most technically mature of the flow-type battery chemistries. The first operational VRFB was successfully demonstrated in the late 1980s, and early commercial systems were deployed by SEI in the early 2000s. Several manufacturers (Vionx, and UniEnergy Technologies [UET]) are employing advanced designs are at an early stage of field deployment for larger scale systems (500 kW to 1 MW with 6 hours of storage).

Suitability for South Africa: VRFB represents a mature and well understood energy storage technology that is well suited for energy intensive energy storage applications. Advanced vanadium flow battery designs with higher energy capacity and wide operating temperature ranges are expected to further improve cost and performance. The relative ease of vanadium electrolyte production and the availability of vanadium in South Africa further enhances the attractiveness of this specific flow technology.

c) **Zinc-Bromine flow Batteries**: Zinc-bromine is a type of RFB that uses zinc and bromine in solution to store energy as charged ions in tanks of electrolytes. The Zn-Br battery is charged and discharged in a reversible process as the electrolytes are pumped through a reactor vessel.

Technology: The Zn-Br flow batteries are the most developed example of hybrid RFBs. A Zn-Br battery consists of a zinc negative electrode and bromide positive electrode. An

aqueous solution of zinc bromide is circulated through the two compartments of the cell from two separate reservoirs. During charge, zinc metal is plated as a thick film on the anode side of the electrode. Meanwhile, bromide ions are oxidized to bromine on the other side of the electrode. During discharge, the zinc metal (plated on the anode during charge) releases two electrons and dissolves into the aqueous electrolyte. These two electrons return to the cathode and reduce bromine molecules to bromide ions.

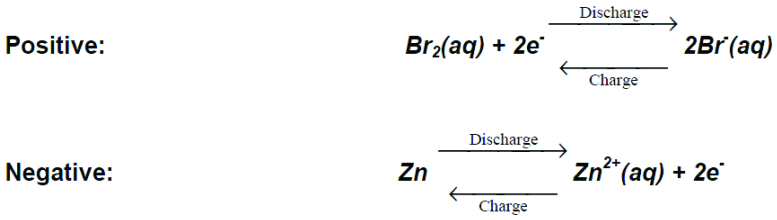

Figure 3-5: Zn-Br cell electrochemistry

Electrodes: The cell electrodes are generally composed of carbon plastic and are designed to be bipolar. Thus, a given electrode serves both as the cathode for one cell and the anode for the next cell in series. Carbon plastic must be used because of the highly corrosive nature of bromine. The positive electrode surface is coated with a high-surface-area carbon to increase surface area.

Electrolyte: The two electrolytes (anolyte and catholyte) will have the same zinc and bromine ion concentrations at any given time during the charge/discharge cycle and differ only in the
concentration of elemental bromine. Because of the limited solubility of elemental bromine, the catholyte will contain organic amine, which reacts with the bromine to form dense, viscous bromine-adduct oil that tends to settle to the bottom of the catholyte tank. Adequate mixing of the catholyte solution is therefore necessary to enable discharge.

Separator: A membrane provides a porous separator between the electrolyte streams in the cells. This membrane can be either selective or non-selective. A selective membrane allows the passage of zinc and bromine ions while preventing the transfer of elemental bromine. Selective membranes, however, can be more costly and less durable so nonselective membranes are generally used. Nonselective micro-porous membranes allow the passage of elemental bromine however, the flow of the catholyte sweeps the bromine (in the form of polybromine) from the positive electrode quickly, freeing up the surface area for further reaction. It also allows the polybromine to be stored in a separate tank to minimize self-discharge.

Packaging: Zn-Br flow batteries are generally constructed as module ranging from 5 kW to 1,000 kW, with variable energy storage duration from 2 to 6 hours, depending on the service requirements and
need.

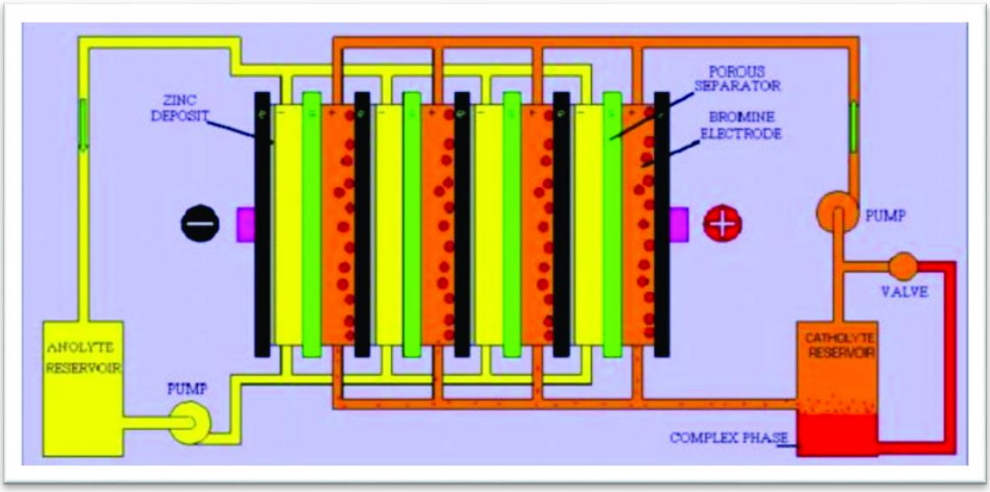

Figure 3-6: Zinc-bromine flow battery cell configuration

Performance: The Zn-Br redox battery offers one of the highest cell voltages and releases two electrons per atom of zinc. These attributes combine to offer the highest energy density among flow batteries. The zinc-bromine cell has a nominal voltage of 1.8 V. Self-discharge arises largely from bromine crossover to the anode side. Testing has shown the effect to be about 1% per hour on a watt-hour basis. Self-discharge can be minimized by stopping electrolyte circulation during stand periods, limiting the degree of crossover to bromine that is in the cell when circulation ceases.

Table 3-3: Typical Performance for Zinc-Bromine Battery Technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rates Power	4 – 12 hours
Round Trip Efficiency	65% - 80%
Response Time	Milliseconds
Self-Discharge per day	Small
Power Density	<25 kWm^3
Energy Density	30 – 65 $kWhm^3$
Cycle Life	10,000 – 15,000 cycles
Depth of Discharge	100%
System Lifetime	10 – 20 years
Cost, power	600 – 2,500$/kW
Cost, energy	150 – 1,000$/kWh

Application: Zn-Br flow batteries exhibit the dual advantages of low cost and high energy density and are best suited for applications requiring high energy density (such as load shifting), as opposed to high power density.

Construction and Installation: Integrated Zn/Br ESSs have been tested on transportable trailers (up to 1 MW/3 MWh) for
utility-scale applications. Multiple systems of this size could be connected in parallel for use in much larger applications. Smaller Zn-Br systems are also being supplied at the 5-kW/20-kWh community energy storage (CES) scale and are now being tested by utilities, primarily in Australia.

Operation and Maintenance: Zn-Br flow battery operations are typically fully automated. Maintenance is similar to any piece of mechanical/process equipment. Most systems require scheduled conditioning for morphology control and dendrite removal (stripping) about once a week. Annual preventive maintenance, testing, and reconditioning of electrolytes may be required approximately every 5 years.

Decommissioning and Disposal
Bromine is a toxic material and should be recovered in the event of a spill or if the unit is decommissioned. Zinc-bromine is corrosive and should be handled appropriately. Zinc is considered a transition-metal contaminant in some locales and thus should be properly recovered when the unit is decommissioned.

Maturity
Although initially patented in 1885, the zinc-bromine flow battery was not developed as a hybrid flow battery system until the early 1970s. Since 2009, small projects comprising 5-kW/2-hour systems have been deployed in rural Australia as an alternative to installing new power lines. Larger scale Zn-Br flow batteries are generally in an early stage of field deployment and demonstration trails, although several companies (e.g., Redflow, Primus Power and EnSync) are introducing commercial products.

Suitability for South Africa
Zn-Br flow batteries offer an economical, low-vulnerability means for grid scale electrical energy storage. These batteries also offer greater flexibility to independently tailor power rating and energy rating for a given application than other electrochemical means for storing electrical energy. Zn-Br flow batteries are suitable for energy storage applications with power ratings from kilowatts up to multiple megawatts and are most efficient for storage durations of 4 to 12 hours. This technology shows strong potential for energy storage application in South Africa.

3.3 No-go Alternatives

This alternative considers the option of 'do nothing' and maintaining the status quo. Should the proposed development not proceed, the site will remain unchanged. Eskom will no longer be able to provide ancillary support in terms of enhanced frequency control of the network, reactive power support and improved quality of supply performance near existing Distributed Generation Renewable Energy plants. Therefore, the no-go alternative is not considered to be feasible.

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4 LEGISLATIVE REQUIREMENTS

This chapter provides an overview of the legal context of the proposed project, including the applicable legislation, guidelines and information that will inform the BA process. This chapter also details the PPP to be undertaken during the BA process in accordance with the NEMA EIA Regulations (R982).

4.1 Requirement for an EIA

In terms of Sections 24 and 24D of NEMA, as read with Government Notices R983, as amended, a Basic Assessment Process is required for the proposed development. The table below contains the listed activities in terms of the EIA Regulations of December 2014, as amended which apply to the proposed development, and for which an Application for Authorisation has been applied. The table also includes a description of those project activities which relate to the applicable listed activities.

Table 4-1: Listed activities triggered by the proposed project

Activity	Description
GN R. 983 Listing Notice 1 Activity 14: (i) The development and related operations of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	The proposed development entails the storage and handling of dangerous good where the storage contained will have a combined capacity of 80 cubic metres or more and not exceeding 500 cubic metres.
GN R. 983 Listing Notice 1 Activity 56 (ii): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (ii) Where no reserve exists, where the existing road is wider than 8 metres	The proposed development may require that the some of the exiting access roads to be widened or lengthened.
GN R. 985 Listing Notice 3 Activity 12 (i)(ii): The clearance of an area of 300 square metres or more of vegetation- (i) Western Cape (ii) Within critical biodiversity areas identified in bioregional plans	The proposed development will result in the clearance of 300m2 and the project site is located within a Critical Biodiversity Area.

4.2 Regulatory and Legal Context

4.2.1 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this BAR:

- National Environmental Management Act (NEMA) 107 of 1998
- EIA Regulations, published under Chapter 5 of NEMA (GNR R982 in Government Gazette No 40772 of December 2014, as amended)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
    i. Public Participation in the EIA Process
    ii. Integrated Environmental Management Information Series (published by DEA)

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in the table below.

Table 4-2: Relevant legislative permitting requirements applicable to the proposed development

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R982, R983, R984 and R985 of December 2014, a Scoping and EIA Process is required to be undertaken for the proposed project.	DEA – competent authority.	The BAR report is to be submitted to the DEA.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DEA	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	DEA – lead authority.	There is no requirement for a noise permit in terms of the legislation. Noise impacts may result from specific activities carried out during the construction phase of the project and could present an intrusion impact to the local community.

National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse – Section 21i.	Department of Water and Sanitation (DWS)	Should water be extracted from groundwater/ a borehole on site for use within the facility, a water use license will be required in terms of Section 21(a) and 21 (b) of the National Water Act.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 32 makes provision for measures in respect of dust control. Section 34 makes provision for: i. the Minister to prescribe essential national noise standards – (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.	DEA – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission license issued in terms of Section 22 may contain conditions in respect of noise. This will, however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: • the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; • any development or other activity which will change the character of a site exceeding 5 000 m2 in extent.	DEA where heritage assessment is a component of the EIA » SAHRA – National heritage sites (grade 1	A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

	The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m²; or the re-zoning of a site exceeding 10 000 m² in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.	sites) as well as all historic graves and human remains.	
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	• Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) • A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. • Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened or Protected Species Regulations). • Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011).	DEA&DP DAFF_ Application for tree removal permit	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. An ecological study has been undertaken as part of the Basic Assessment Process. As such the potential occurrence of critically endangered, endangered vulnerable, and protected species and the potential for them to be affected has been considered. This report is contained in Appendix F-1.

	• DEA published Regulations on Alien and Invasive Species (AIS) in terms of the National Environmental Management: Biodiversity Act, on Friday 1st August2014. A total of 559 alien species are now listed as invasive, in four different categories. A further 560 species are listed as prohibited, and may not be introduced into the country		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	• Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: • Category 1 plants: are prohibited and must be controlled. • Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. • These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	DAFF	• While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. • The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. However, none of these activities are expected to be undertaken on site.
National Forests Act (Act No. 84 of 1998)	» Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. » Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.	DEA&DP	A permit or license will be required for any destruction of protected tree species and/or indigenous tree species within a natural forest.

National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	DAFF	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer proactively manage risks associated with veld fires and provide cooperation to the local Fire Protection Agency
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitizing or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
National Environmental Management:	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list.	DEA	N/A

Waste Act, 2008 (Act No. 59 of 2008)	» Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited_SANRAL (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded.

5 PUBLIC PARTICIPATION PROCESS

The Basic Assessment process refers to that process (in line with the EIA Regulations) which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project/ activity. The BA process culminates in the submission of a Final BAR (including an Environmental Management Programme (EMPr)) to the competent authority for decision-making. The BA process is illustrated below:

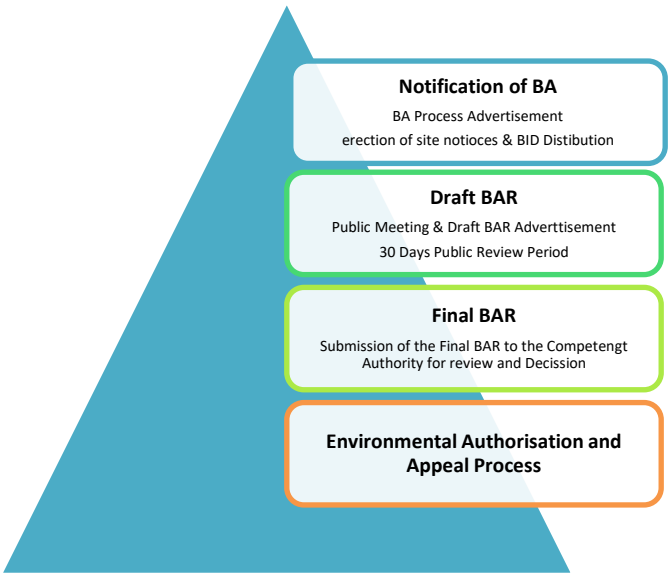

Figure 5-1 : Basic Assessment flowchart

5.1 Basic Assessment Process

This Basic Assessment Report for public review has been prepared by Zitholele in order to assess the potential significance of environmental impacts associated with proposed Project near Worcester in the Western Cape Province. This process is being undertaken in support of an application for environmental authorisation to the National DEA. The 30-day period for review is from 27 September 2019 - 28 October 2019. The report is available for public review at the following locations:

- Worcester Public Library; and
- Zweletemba Municipal Library.

The Draft BAR is aimed to provide interested and affected parties (I&APs) with the opportunity to receive information regarding the proposed project, participate in the process, and raise issues of

concern. The Draft BAR aims at detailing the nature and extent of the proposed development, identifying potential issues associated with the proposed project, and defining the extent of studies required within the BA Process. This is achieved through an evaluation of the proposed project, involving the project proponent, appointment of specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and I&APs.

5.1.1 Tasks completed during the Basic Assessment Process

The EIA Phase for the proposed development has been undertaken in accordance with the EIA Regulations published in GN 40772 in December 2014, in terms of NEMA, as amended. Key tasks undertaken within the EIA phase included:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels);
- Undertaking a public participation process throughout the EIA process in accordance with Chapter 6 of EIA regulations 2014 as amended in order to identify any additional issues and concerns associated with the proposed project. Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the BA Process;
- Undertaking of independent specialist studies in accordance with Appendix 6 of EIA regulations 2014 as amended;
- Preparation of a Draft BAR in accordance with Appendix 1 of EIA regulations 2014 as amended; and
- Preparation of a Final BAR in accordance with Appendix 1 of EIA regulations 2014 as amended.

These tasks are discussed in detail below.

5.1.2 Authority Consultation

The DEA is the competent authority for this application. A record of all authority consultation undertaken is included within this BAR. Consultation with the competent authorities (i.e. DEA) has continued throughout the BA Process. On-going consultation included the following:

- Pre-Application Meeting which was held with the DEA on the 09 May 2018.
- Notification and Consultation with Organs of State (refer to **Error! Reference source not found.**) that may have jurisdiction over the project, including:
    i. Provincial departments
    ii. Local Municipality
- The draft BAR will be submitted to the DEA for review in May 2019 for comments.

A record of the authority consultation in the BA process is included within Appendix 4.

1.1.1 Public Involvement and Consultation

The aim of the public participation process is primarily to ensure that:

- Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
- Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
- Comments received from stakeholders and I&APs will be recorded and incorporated into the Final BAR.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the BA Process will be provided as follows:

- Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
- Written, faxed or e-mail correspondence.
- The Draft BAR will be released for a 30-day public review period. The comments received from I&APs will be captured within a Comments and Response Report which will be included within the final EIA Report, for submission to the authorities for decision-making.

The following key public participation tasks will be or have been undertaken in terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended:

- Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
    i. the site where the activity to which the application relates is or is to be undertaken; and
    ii. any alternative site mentioned in the application;
- Giving written notice to:
    i. the owner or person in control of that land if the applicant is not the owner or person in control of the land;
    ii. the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    iii. owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    iv. the municipal councilor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
    v. the municipality which has jurisdiction in the area;
    vi. any organ of state having jurisdiction in respect of any aspect of the activity; and
    vii. any other party as required by the competent authority.
- Placing an advertisement in:
    i. one local newspaper; and

- I&APs registry was open and maintained throughout the BA process.
- The Draft BAR will be made available for Public Review.
- Comments received will be collated and addressed accordingly.

In compliance with the requirements of Chapter 6 of the EIA Regulations, 2014, the following summarises the key public participation activities conducted to date:

- *Placement of Site Notices and distribution of Background Information Documents*
  - Site notices were placed on-site on and at the Local Libraries; and
  - Background information documents were also distributed. proof of this is included in (Appendix E-1).
- *Identification of I&APs and establishment of a database.*

Identification of I&APs was undertaken by Zitholele through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations **(refer to Table 5-1 below).**

Table 5-1: Key stakeholder groups during the EIA process

National Government Departments
Department of Agriculture, Forestry and Fisheries (DAFF)
Department of Water and Sanitation (DWS)
South African Heritage Resources Agency
South African National Roads Agency Limited (SANRAL)
Provincial Government Departments
Department of Environmental Affairs and Development Planning (DEA& DP)
Local Government Departments
Breede Valley Local Municipality
Cape Winelands District Municipality
Landowners
Neighbouring landowners and tenants

All relevant stakeholder and I&AP information has been recorded within a database of affected parties, please refer to (Appendix E-4). While I&APs were encouraged to register their interest in the project from the onset of the process undertaken by Zitholele, the identification and registration of I&APs has been on-going for the duration of the BA Process.

5.1.3 Identification and Recording of Issues and Concerns

Issues and comments raised by I&AP's over the duration of the BA process will be incorporated into the Comments and Response Report. The Comments and Response Report will include responses from members of the EIA project team and/or the project proponent.

5.1.4 Assessment of Issues Identified through the BA Process

Issues which required investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in (refer to **Table 5-2)** below.

Table 5-2: Specialist consultant appointed to evaluate the potential impacts associated with the proposed project

Study	**Contact Person**	**Company**
Ecological Study	Dr Mathew Ross (Pr Sci Nat) and Dr Tahla Ross	Enviross CC

5.1.5 Assumptions and Limitations

The following assumptions and limitations were applicable to the studies undertaken within this BA Process:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.

- It is assumed that the development site identified by the developer represents a suitable site for the establishment of the proposed project.

- Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.

- This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

6 BASELINE ENVIRONMENTAL DESCRIPTION

This section of the report provides a description of the environment that may be affected by the proposed Project. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed Project is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area and aims to provide the context within which this BA is being conducted. A comprehensive description of each aspect of the affected environment is included within the specialist report contained within the Appendices F-1

6.1 Regional Setting

Hex Substation is located on Erf 20640 and Erf 16127 which is situated in an industrial area on the outskirts of Worcester close to the Hex River. The site falls within the jurisdiction of the Breede Valley Local Municipality. The footprint required for the proposed development is approximately 1.5ha in extent.

6.2 Topography

The terrain of the Hex Substation can be characterised as partly grassed terrain with existing concrete surfaced areas. The proposed battery storage footprint area has grassed terrain with a gentle sloping ground.

6.3 Hydrology

Worcester falls within the Breede Water Management Area. The average annual rainfall in the Worcester area is 400 mm. The Breede River and Brandvleidam is located south of the Hex Substation.Regional.

6.4 Ecological processes

The proposed development site has an association with Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) according to the Western Cape Conservation Plan (C-Plan, 2017). These associations are presented in Figure 6-1 .

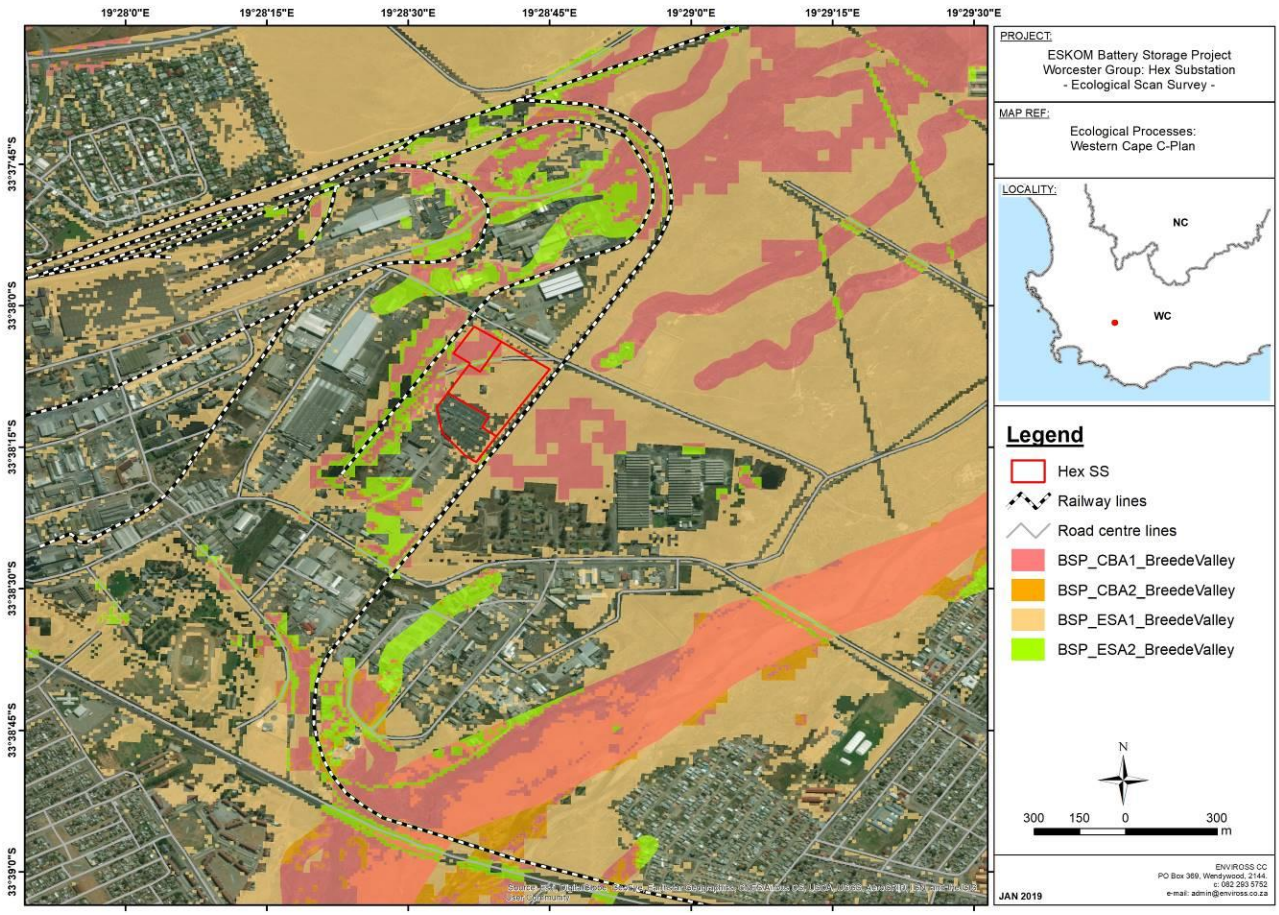

Figure 6-1: The association that the proposed development site has with areas designated as ecologically significant according to the Western Cape C-Plan (2017).

From Figure 6-1: The association that the proposed development site has with areas designated as ecologically significant according to the Western Cape C-Plan (2017).Figure 6-1 it can be seen that the proposed development site falls within an area designated as a CBA1 and also includes an area designated as ESA1. Areas that have retained natural vegetation that are embedded within a floral unit of conservational significance are generally categorised as CBA1, as they have the potential to support representation of the vegetation units as well as provide potential habitat for Rd Listed floral species. The areas designated as ESA1 represent natural areas that have suffered a degree of transformation but are considered to provide valuable buffer zones to CBA areas or are those areas that perform specific ecological functions (regardless of ecological condition), such as linear habitat units such as riparian and wetland zones. The site has been subject to a significant amount of transformation and therefore limited natural habitat has remained. Indigenous flora does occur at the site, but vegetation structures don't represent primary vegetation features.

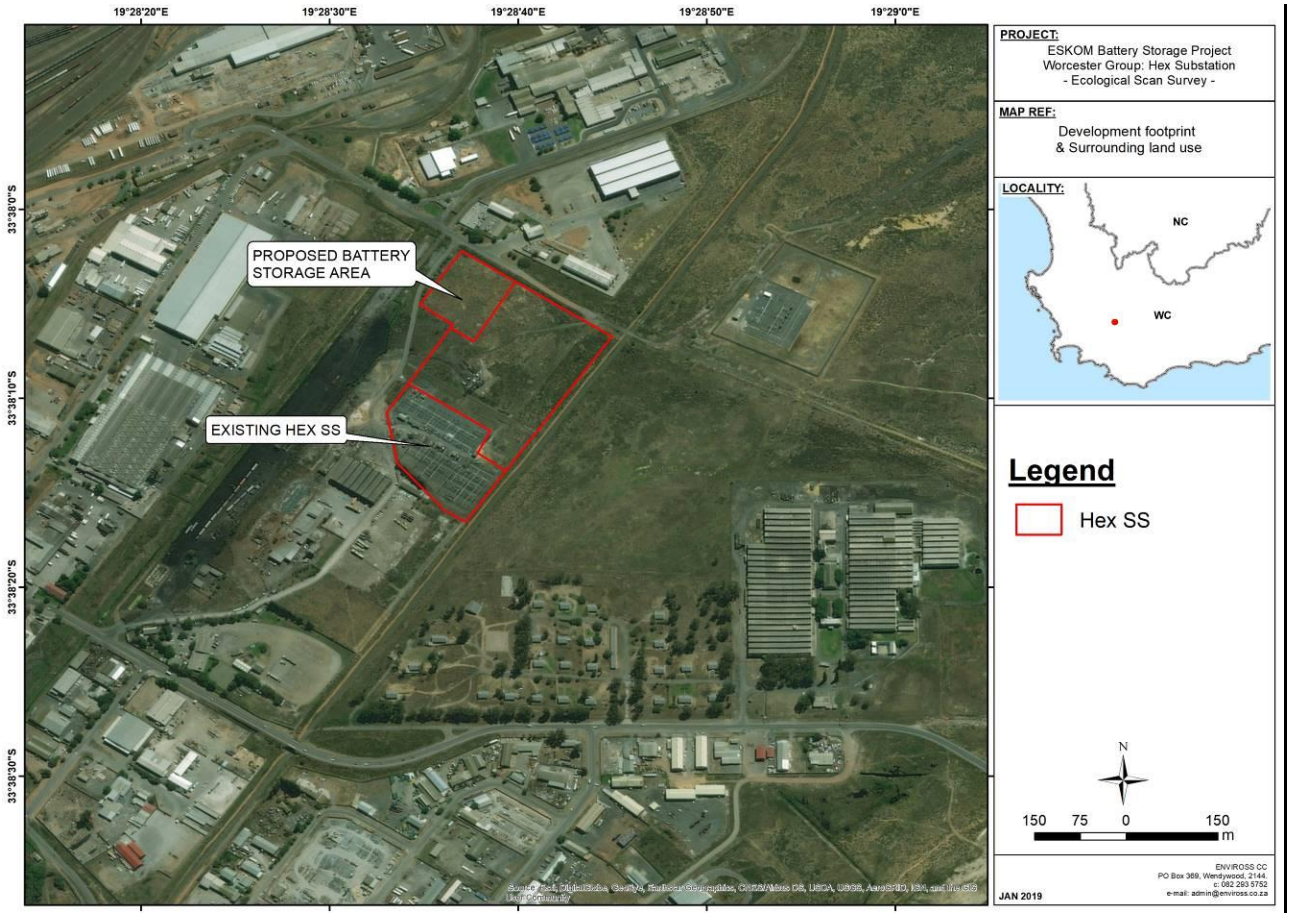

Figure 6-2: The proposed development footprint and surrounding land use.

Being embedded within the industrial and commercial sector, and lying adjacent to the existing substation, has resulted in the site suffering from ecological isolation (refer to **Figure 6-2**). Pressures emanating from the surrounding land use, and historical and ongoing degradation factors associated with the site have resulted in an ecologically transformed area, which is regarded as having limited ecological value. Landscaping, dumping of refuse and rubble as well as persistent impacts from historical infrastructure development have all had deleterious impacts on the overall ecological integrity of the site as shown in **Figure 6-3**. No wetland and/or other surface water ecosystems are associated with the site. The proposed development site is also topographically flat and therefore the development of the site will lead to a low risk of erosion and therefore a low risk of impacting any nearby wetland or aquatic features.

Figure 6-3: Various views of the proposed development footprint area.

6.4.1 Vegetation unit

The proposed development area falls within the Fynbos Biome, with the major vegetation unit being Breede Alluvium Renosterveld. This vegetation type is considered to be conservationally *Endangered* due to a high level of transformation and limited formal conservation of the unit. Although some floral species that typify the vegetation unit are present at the site, structure of the floral community indicates transformation of the unit, which is mostly through pressures and drivers emanating from the local land use.

6.4.2 Floral species

Indigenous floral species do occur at the site, but in a floral community structure that was not representative of the diagnostic characteristics of the vegetation unit. Exotic vegetation was also noted to occur at the site. Dominant species noted during the field survey included *Aspalathus spinosa, Athanasia trifurcata* and *Stoebe plumosa*. Pioneering grass species, being indicative of recent historical and ongoing disturbances, were noted, with *Cynodon dactylon* being most dominant. *Pentaschistis airoides* also occurred at the site. The development of the site would not pose a threat to floral conservation within the area.

6.4.3 Faunal features

No mammalian species were noted within the site. A variety of bird species were noted but were limited to those that opportunistically were utilising the site for foraging purposes. Species were limited to generalist and adaptable species. No herpetofaunal species were noted during the survey. Invertebrate species noted included only generalist species that are found in a variety of habitat types and are considered to be common throughout their geographical distribution range.

The development of the site would not pose a threat to faunal conservation within the area. This is reiterated by the site being ecologically isolated.

6.5 Socio-Economics

According to the on the Breede Valley Municipal Integrated Development Plan (IDP) 2017 – 2022. The Breede Valley Municipality covers an area of approximately 3 833 km² stretching from the Du Toitskloof Mountains in the southwest to the Kwadousberg in the southeast and includes the towns of Rawsonville, Worcester, De Doorns and Touws River, as well as the rural areas adjacent to and between these towns and the Matroosberg rural area. The town of Worcester lies on the N1 and has a major railway link, which presents the town with a locational advantage that provides access to inland markets.

The region has a counted population of 176 578 (inclusive of the informal settlements) comprising 47 569 households, based on the Community Survey 2016 Stats SA data, of which approximately 14,7% (7 000) are classified as indigent. The key economic sectors for the municipality are agriculture, tourism and manufacturing.

The Breede Valley has a vibrant economy, based on strong agricultural, manufacturing and tourism sectors. The region is world-renowned for its wine farms that produce export quality wines and create sustainable livelihoods for many citizens in the Breede Valley. Parts of the Breede Valley are integrated into wine routes frequented by overseas tourists, which form the basis of a robust tourism economy. The region has a mixed farming character, with vegetable farming, poultry farming and livestock production dominating the agricultural landscape. The region has a strong business sector, comprising large corporates in the financial, insurance and business services sector in Worcester and smaller enterprises operating in manufacturing, agriculture, retail and the tourism sectors. Situated on the N1 and with a major railway intersection, the Breede Valley Municipality has a unique locational advantage, which is highly desirable for the businesses operating in these sectors. The national toll road on the N1 to Cape Town acts as a major incentive for businesses to relocate to Worcester

6.5.1 Socio-Econimic Profiling

The table below provides a snapshot or an overview of the socio-economic profile of communities living in the Breede Valley Municipality, according to the Community Survey 2016 StatsSA data:

Table 6-1: Overview of the socio-economic profile of the Breede Valley Municipality (data sourced from the 2016 StatsSA survey)

Socio-Economic Profile in Breede Valley Local Municipality	
Total Population	176 578
Youth (5-34)	60 545 (34.3%)
Total population intercensal growth rate (2011 – 2016)	0.013
Matric Aged 20+	42 484
Number of Households	47 569
Poverty headcount	2.4%
Intensity of poverty	44,3%
Formal Dwellings	36 964
Informal Dwellings	9 679

6.5.2 Skills Level

Education levels in any given market area will influence economic and human development. It is clear that low education levels lead to a low skills base in an area while high education levels have the opposite effect, producing a skilled or highly skilled population. There is also no doubt that household and personal income levels are either positively or adversely affected by education levels. Also, a population that is skilled does not necessarily aspire to employment but to entrepreneurship, which will add businesses to the area, increase economic activity and consequently increase the number of jobs available.

In Breede Valley Municipality, there were 49 234 formally employed individuals and 20 379 individuals were informally employed in 2015. The majority of Breede Valley's formally employed individuals (44,5 per cent) are semi-skilled, compared to 34,8 percent low skilled and 20,7 per cent skilled. Skilled and semi-skilled formal employees have been growing positively between 2004 and 2015, while the low-skilled employees have been decreasing. This tendency is encouraging, as skills are increasingly becoming the currency in a modern and knowledge-based economy.

Table 6-2: Skills Levels in Breede Valley (Source: Mero 2016)

Formal employment by skill	Skill level contribution (%) 2015	Average growth (%) 2004 -- 2015	Number of Jobs 2015
Skilled	20.7	2.1	10 214
Semi Skilled	44.5	1.3	21 894
Low Skilled	34.8	-3.1	17 126
Total Breede Valley	**100**	**-0.42**	**49 234**

6.5.3 Household income

Household income is an indicator of current poverty levels amongst citizens in a municipality, which has a direct influence on indigent household policies, poverty relief and tariff policies. It also provides information about the living standards prevalent in a particular community, for example whether it is predominantly poor, middle-income or a rich community.

The majority of households in Breede Valley (53,8 per cent) fall under the low-income brackets. This could indicate that an increasing number of households find it difficult to survive and will ultimately become dependent on social assistance in the form of social grants in the absence of targeted sustainable employment creation programmes. This observation will also have a significant impact on the Breede Valley Municipality's indigent policies, ultimately impacting on the rates and tariffs structure.

Table 6-3: Average Household Income, 2016 (Source: Quantec/ Urban Econ calculations, 2016)

Income Level	Breede Valley Municipality	Low/Middle/High Income
No income	12.0	
R1 – R6 327 R6 328 – R12 653	1.7 3.1	Low Income
R12 654 - R25 306	15.2	
R25 307 - R50 613	2.8	

R50 614 - R101 225	18.6	Middle Income
R101 226 - R202 450	12.7	
R202 451 - R404 901	8.5	
R404 902 - R809 802	4.7	
R809 203 - R1 619 604	1.0	High Income
R1 619 605 - R3 239 208	0.3	
R3 239 207 or more	0.3	

It is clear that the income inequality intensified in Breede Valley between 2014 and 2015 with an increase in the Gini coefficient from 0,570 in 2014 to 0,581 in 2015. This inequality in income indicates that economic growth is not benefiting everyone in the municipality and that efforts should be redoubled to build a more inclusive local economy.

6.6 Heritage

Hex Substation is located on Erf 20640 and Erf 16127 which is situated in an industrial area on the outskirts of Worcester close to the Hex River. It is noted that the Worcester area exhibits a number of heritage, cultural and architectural features in the form of monuments and historical buildings which should be protected to maintain the character of Worcester. However, the proposed development site is less than 5ha in extent, it is highly disturbed due to the current activities on the site and the development will be undertaken within the Hex Substation footprint, therefore no further Heritage studies were undertaken on this site.

7 ENVIRONMENTAL IMPACT ASSESSMENT

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the proposed Project.

The proposed Project site is approximately 1.5ha. The planning phase of this project will evaluate the following phases:

- Pre-Construction / Construction – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, transportation of material to site; and undertaking site rehabilitation including implementation of a stormwater management plan.
- Operation – will include operation of the BESS.
- Decommissioning – depending on the economic viability of the Batteries, the length of the operation phase may be extended beyond a 20-year period. At the end of the battery life, decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

7.1 Impact Assessment Rating Methodology

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below.

7.1.1 Nature of the impact

Each impact should be described in terms of the features and qualities of the impact. A detailed description of the impact will allow for contextualisation of the assessment.

7.1.2 Extent of the impact

Extent intends to assess the footprint of the impact. The larger the footprint, the higher the impact rating will be. The table below provides the descriptors and criteria for assessment.

Table 7-1: Criteria for the assessment of the extent of the impact.

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1

Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

7.1.3 Duration of the impact

The duration of the impact is the period of time that the impact will manifest on the receiving environment. Importantly, the concept of reversibility is reflected in the duration rating. The longer the impact endures, the less likely it is to be reversible. See **Table 7-2** for the criteria for rating duration of impacts.

Table 7-2: Criteria for the rating of the duration of an impact

Duration Descriptor	Definition	Rating
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5

7.1.4 Potential intensity of the impact

The concept of the potential intensity of an impact is the acknowledgement at the outset of the project of the potential significance of the impact on the receiving environment. For example, SO_2 emissions have the potential to result in significant adverse human health effects, and this potential intensity must be accommodated within the significance rating. The importance of the potential intensity must be emphasised within the rating methodology to indicate that, for an adverse impact to human health, even a limited extent and duration will still yield a significant impact.

Within potential intensity, the concept of irreplaceable loss is taken into account. Irreplaceable loss may relate to losses of entire faunal or floral species at an extent greater than regional, or the permanent loss of significant environmental resources. Potential intensity provides a measure

for comparing significance across different specialist assessments. This is possible by aligning specialist ratings with the potential intensity rating provided here. This allows for better integration of specialist studies into the environmental impact assessment. See **Table 7-3** and **Table 7-4** below.

Table 7-3: Criteria for impact rating of potential intensity of a negative impact

Potential Intensity Descriptor	Definition of negative impact	Rating
High	Significant impact to human health linked to mortality/loss of a species/endemic habitat.	16
Moderate-High	Significant impact to faunal or floral populations/loss of livelihoods/individual economic loss.	8
Moderate	Reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4
Moderate-Low	Nuisance impact	2
Low	Negative change with no associated consequences.	1

Table 7-4: Criteria for the impact rating of potential intensity of a positive impact

Potential Intensity Descriptor	Definition of positive impact	Rating
Moderate-High	Net improvement in human welfare	8
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-Low	Economic development	2
Low	Positive change with no other consequences.	1

It must be noted that there is no HIGH rating for positive impacts under potential intensity, as it must be understood that no positive spinoff of an activity can possibly raise a similar significance rating to a negative impact that affects human health or causes the irreplaceable loss of a species.

7.1.5 Likelihood of the impact

This is the likelihood of the impact potential intensity manifesting. This is not the likelihood of the activity occurring. If an impact is unlikely to manifest, then the likelihood rating will reduce the overall significance. **Table 7-5** provides the rating methodology for likelihood.

The rating for likelihood is provided in fractions in order to provide an indication of percentage probability, although it is noted that mathematical connotation cannot be implied to numbers utilised for ratings.

Table 7-5: Criteria for the rating of the likelihood of the impact occurring

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1

Likelihood Descriptor	Definition	Rating
Unlikely	The possibility of the impact occurring is low with a less than 10% chance of occurring. The impact has not occurred before.	0.2
Probable	The impact has a 10% to 40% chance of occurring. Only likely to happen once in every 3 years or more.	0.5
Highly Probable	It is most likely that the impact will occur and there is a 41% to 75% chance of occurrence.	0.75
Definite	More than a 75% chance of occurrence. The impact will occur regularly.	1

7.1.6 Cumulative Impacts

Cumulative impact is reflected in the in the potential intensity of the rating system. In order to assess any impact on the environment, cumulative impacts must be considered in order to determine an accurate significance. Impacts cannot be assessed in isolation. An integrated approach requires that cumulative impacts be included in the assessment of individual impacts.

The nature of the impact should be described in such a way as to detail the potential cumulative impact of the activity.

7.1.7 Significance Assessment

The significance assessment assigns numbers to rate impacts in order to provide a more quantitative description of impacts for purposes of decision making. Significance is an expression of the risk of damage to the environment, should the proposed activity be authorised.

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, which takes cognisance of extent, duration, potential intensity and likelihood.

Impact Significance = (extent + duration + potential intensity) x likelihood

Table 7-6 provides the resulting significance rating of the impact as defined by the equation as above.

Table 7-6: Significance rating formulas.

Score	Rating	Implications for Decision-making
< 3	Low	Project can be authorised with low risk of environmental degradation
3 - 9	Moderate	Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.

Score	Rating	Implications for Decision-making
10 - 20	High	Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.
21 - 26	Fatally Flawed	Project cannot be authorised

An example of how this rating scale is applied is shown below in **Table 7-7**.

Table 7-7: Example of Rating Scale

Activity	Nature of Impact	Impact type	Extent	Duration	Potential Intensity	Likelihood	Rating	Mitigation	Interpretation
SO2 emissions	Direct Impact:	Existing	3	4	16	1	23 - FLAW	With mitigation the residual air quality impact will be reduced due to a lower probability of SO2 emission from the proposed project.	Ambient air quality is high impact for the area.
	SO2 emissions on air quality within an area of high priority air pollution.	Cumulative	2	4	16	0,2	4 - MOD		Air quality will remain high impact with the proposed project coming on-line.
		Residual	5	4	16	0,5	13 - HIGH		With mitigation the residual air quality impact will be reduced due to a lower probability of SO2 emission from the proposed project.

7.1.8 Notation of Impacts

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

- Extent- *in italics*
- Duration – in <u>underline</u>
- Potential intensity – IN CAPITALS
- Likelihood - in **bold**

Please note that the impact rating system may change slightly to accommodate ease of use. However, the basic principle of the rating system will remain the same.

Measures to avoid, reduce or manage impacts consistent with best practice will be proposed and the effectiveness of such measures assessed in terms of their ability to avoid, remove an impact entirely, render it insignificant or reduce its magnitude. In assessing the significance of the impact, natural and existing mitigation will be considered. Natural and existing mitigation measures are defined as natural conditions, conditions inherent in the project design and existing management measures that alleviate (control, moderate or curb) impacts. In addition, the significance of impacts will be assessed considering any mitigation measures that are proposed.

An Environmental Management Programme (EMPr) has been prepared and is attached as an appendix to this report. This programme specifies the methods and procedures for managing the environmental aspects of the proposed development. Monitoring requirements are also be detailed within the plan, particularly for those environmental aspects that give rise to potentially significant impacts.

7.2 Alternatives Assessed

The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects are considered. The details pertaining to each alternative considered, as well as the technical preference are provided below:

- Impact Assessment of **Technology Alternative 1- Solid State Batteries (Lithium-ion) (Preferred Alternative)**: A lithium-ion (Li-ion) battery is a rechargeable electrochemical battery. Rather than a single electrochemical couple like nickel-cadmium, “lithium-ion” refers to a wide array of chemistries in which lithium ions are transferred between the electrodes during the charge and discharge reactions.
  A Li-ion cell is comprised of three main components; cathode and anodes electrodes, and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when charging. When the battery is charging, lithium

ions flow from the positive metal oxide electrode to the negative graphite electrode. When the battery is discharging the reverse flow of ions takes place.
Li-ion battery cells contain two reactive materials capable of electron transfer chemical reactions. The reaction is facilitated through electric contact or direct contact, through wire. Ion exchange must take place to maintain overall charge neutrality as electrons are transferred.

- Impact Assessment of **Technology Alternative 2 – Redox Flow Batteries**: Three flow battery systems are considered: vanadium flow batteries, zinc-bromine flow batteries and iron-chromium flow batteries. Flow batteries consist of external tanks filled with electrolyte, which flows through an electrochemical cell or reaction stack. Environmental impacts for batteries are dependent on a number of influencing factors. Location of battery technologies will need to be considered due to the coastal regions increasing susceptibility to corrosiveness. Redox Flow Batteries (RFB) are a class of electrochemical energy storage technology. It entails a chemical reduction and oxidation reaction that stores energy in liquid electrolyte solutions, which flows through a battery of electrochemical cells during charge and discharge.

*The size and scale of this type of energy storage system is likely to determine the extent to which environmental impacts are significant. Larger quantities of land use may be required for electrolyte storage tanks. These electrolytes are not specifically toxic; however, care must be taken at the design and operational phases as other chemicals used may be toxic (e.g. Bromine). There are no significant waste products associated with the operation due to the storage system having the capability to perform discharge cycles indefinitely.

7.3 Impact Assessment of Technology Alternative 1 and Alternative 2- Solid State Batteries (Lithium-ion) (Preferred Alternative) and Redox Flow Batteries

7.3.1 Ecological Impacts

a) Specialist Findings

The proposed development site lies adjacent to the existing Hex Substation and therefore requires an expansion of the actual substation footprint area. This will require the removal of all vegetation within the footprint, landscaping and importing of aggregate to line the ground to abate fire hazards. The impact footprint will therefore be completely transformed, with little to no mitigation measures being appropriate to reduce the ecological impact within the infrastructure footprint. It is, however, a relatively small footprint area. The proposed site is an open area that is currently disused, but which has been subject to historical and ongoing ecological impacts that all have led to transformation of the natural habitat features, including soils, vegetation and

general habitat. Historical infrastructure development has directly impacted the site and is regarded as one of the most prominent drivers of ecological change. These include a railway line and formal roads that border the site. The site is embedded within an urbanised setting, with the land use being predominantly industrial and commercial sectors. These factors have led to the relative ecological isolation of the site. Landscaping and dumping of surplus building materials, rubble and urban refuse are pressures that are further regarded as drivers of ecological transformation. Although some indigenous flora does occur at the site, it is regarded as having limited ecological value.

b) Pre-Construction & Construction Phase

The pre-construction and construction phases of the proposed development activities will include the site preparation for the storage area, which will include the complete stripping of vegetation, landscaping, compaction of soils and preparation of the ground with a fire retardant inert substance (most likely to be concrete, stone paving or crushed stone (such as crushed dolerite). This will have the inevitable impacts of loss of habitat and loss of vegetation, which will influence the biodiversity within the area. The significance of this impact will vary according to the present ecological state of the site, the conservation status of the vegetation type and whether the vegetation present at the site can be considered to be representative of primary vegetation structure, the scale of the site to be cleared, the use of heavy earthmoving equipment that may require to impact an area larger than the ultimate development footprint (site offices, equipment and materials storage yards, access roads) and whether the site has an association with other sensitive ecological features such as surface water ecosystems. The significance is also determined by what impacting features can be mitigated for and how successful those mitigation measures are expected to be in the long term. By keeping the footprint of the impacts reduced to a minimum by only allowing heavy machinery to operate on designated access roadways and by avoiding the indiscriminate destruction of habitat within areas adjacent to the actual construction areas, the ecological impacts can be greatly reduced. This is especially pertinent for activities that are to take place adjacent to the wetland areas and associated conservation buffer zones (if applicable).

<u>Red Data Listed biodiversity impacts</u>

No RDL species were noted to occur at the site during the field survey and, due to the close proximity to existing infrastructure that results in the site suffering relative ecological isolation, no RDL faunal or floral species are thought to occur within the impact footprint area. This impact is therefore regarded as being insignificant.

<u>Floral community structures</u>

The disturbance of soils and vegetation enhances the growth of opportunistic pioneering species. These species can be indigenous but are most often exotic in origin that grow rapidly, colonising an area through aggressive encroachment and will out-compete the indigenous counterparts in most cases. The proposed development footprint has already been subject to historical disturbances and therefore the floral community structures have already been altered.

Faunal community structures

The construction phase of a development of this nature requires the use of heavy machinery, earthmoving equipment and large teams of construction crews who are very often accommodated in construction camps (although this is unlikely for this particular development). This means that disturbance features typically increase. This could lead to displacement of sensitive species, especially ground-dwelling and ground-nesting species. Direct impacts to habitat will also lead to destruction of suitable nesting and foraging areas. This is thought to be of minor significance to the project though as the proposed development footprint area is located directly adjacent to existing industrial infrastructure. The proposed development activities are therefore seen to be of minor ecological significance.

Soil features

Soil erosion emanating from disturbed areas and soil stockpiles could smother surrounding habitat and silts could reach aquatic and wetland systems (if applicable). This will displace faunal biota from those areas that are transformed through this impact. This feature can be easily mitigated. It is, however, regarded as being highly unlikely that soils and silts would be transported to any surface water ecosystems due to the distance of the proposed development area from the nearest wetland units and the site is considered to be topographically flat. It is, however, prudent to manage soil erosion throughout all phases of the proposed development activities as a general means of maintaining ecological health.

c) Management/Operations Phase

The operations phase of the proposed development refers to the everyday activities and those impacts that are thought to perpetuate. The proposed activities will store chemicals associated with battery storage that are deleterious to the environment without proper storage and handling. Impacts will be the result of accidental spillages, inadequate storage facilities (such as not being bunded) and poor handling by badly-informed operators and technicians. Again, these impacts can be mitigated for to abate negative ecological impacts, but the likelihood of an impact occurring will be largely up to the operators and technicians and their attitudes toward safe practice.

Chemical spillages

The management of dangerous chemicals that are utilised and stored on site is regarded as the most pertinent mitigation point to minimise the risk of environmental contamination. Chemicals must be stored in a designated and approved storage area where access is limited to qualified and approved personnel only. This storage area must be bunded with a volume capable of containing spillages from accidental spillages, or leaking containers, or any other foreseeable accidental spillage scenarios. Maintenance of batteries and chemical handling must be done by appropriately trained personnel only. Any accidental spillages must be immediately cleaned, contaminated soils removed and disposed of at a registered disposal site that is capable of processing such chemicals. The severity of the impact associated with spillages will depend on the scale, the runoff potential, the response time between the spill event and the clean-up operations and the success rate of the clean-up operations. Emergency procedures to deal with spillages must be written up in the EMPr and all applicable personnel must be familiar with the procedures.

d) Other perpetuating impacts

Management of soil erosion as well as exotic vegetation will also be important to the management/operations phase and should be monitored for routinely. Any emerging concerns must be dealt with immediately. Stormwater runoff must also be monitored for as this is often a source of emerging erosion.

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e) Impact Assessment Tables

Table 7-8: Ecological Pre-construction and Construction Phase Impacts Assessment

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
Clearing of vegetation to accommodate infrastructure and services	Direct Impact:	Existing	1	4	1	1	6.0 - MOD	Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; Rehabilitation of the areas that are impacted by the development outside of the ultimate infrastructure footprint will aid in abating the ecological impacts.	The construction footprint area has already suffered significant ecological transformation. Limited significant impacts are thought to occur.
	Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; This will have limited significance to the due to the site having already been historically subject to impacting features.	Cumulative	3	4	2	1	9.0 - MOD		Cumulative loss of the vegetation unit to accommodate infrastructure development is relatively high.
		Residual	1	4	1	1	6.0 - MOD		Insignificant residual impacts will remain as the site already suffers ecological transformation and degradation, but the site will establish infrastructure within an area that had natural features before.
Loss of RDL floral species during site clearing.	Direct Impact:	Existing	1	4	1	0.1	0.6 - LOW	The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	Loss of RDL floral species at the local scale from the proposed development activities is considered insignificant following historical transforming land use.
	Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral	Cumulative	2	4	2	0.5	3.0 - MOD		Cumulative loss of RDL flora is relatively high. Cumulative losses are the very reason why species become threatened.

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
	species may be included when vegetation is stripped, suffering loss of individuals; This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.	Residual	1	4	1	0.1	0.6 - LOW		Residual impacts to RDL flora are minimal due to the site being located adjacent to existing industrial infrastructure.
Loss and/or displacement of sensitive faunal species.	Direct Impact:	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	Thought to be insignificant due to the largescale transformation of the habitat throughout the survey area.
	Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to disturbances. Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.	Cumulative	2	4	2	0.5	0.8 - LOW		Displacement of sensitive faunal species due to habitat destruction eventually leads to loss of those species.
		Residual	1	4	1	0.1	0.6 - LOW		Insignificant residual impacts will remain as the site already suffers ecological transformation and degradation, but the site will establish infrastructure within an area that had natural features before.
Destruction of nesting and/or roosting habitat for faunal species.	Direct Impact:	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services);	Thought to be insignificant due to the largescale transformation of the habitat at the site.
	Site clearing will remove all vegetation to accommodate	Cumulative	2	4	2	0.5	4.0 - MOD		Destruction of nesting habitat displaces the affected species

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
	the infrastructure development; The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.							Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	eventually leads to loss of those species.
		Residual	1	4	1	0.1	0.6 - LOW		Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Destruction of ground-dwelling and/or sedentary fauna.	Direct Impact:	Existing	1	4	1	0.1	0.6 - LOW	Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; Avoid indiscriminate destruction of habitat.	Thought to be insignificant due to the transformation of the habitat at the site.
	Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.	Cumulative	2	4	2	0.5	4.0 - MOD		Loss of habitat is the leading cause of species decline in general.
		Residual	1	4	1	0.1	0.6 - LOW		Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Destruction of sensitive habitat.	Direct Impact:	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as	Thought to be insignificant due to the largescale transformation of the habitat at the site.

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
		Cumulative	3	4	2	0.5	4.5 - MOD	possible (including support areas and services);	Cumulative loss of sensitive habitat is relatively high within the region.
	Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.	Residual	1	4	1	0.1	0.6 - LOW	Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Disturbance features that alter the vegetation structures	Indirect Impact:	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	Exotic vegetation could invade the area following disturbance impacts. This will require active management. True for the maintained perimeter areas that will be continually maintained to avert fire risk. Continued maintenance means that this impact is easily mitigated.
	Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will	Cumulative	3	4	2	0.5	4.5 - MOD		Cumulative loss of primary vegetation features is relatively high within the region and therefore should be avoided.
		Residual	1	4	2	0.1	0.7 - LOW		Insignificant residual impacts will remain as it is an impact that is readily mitigated for.

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
	also be maintained to avert fire risks.								
Habitat fragmentation resulting from infrastructure development.	Direct Impact:	Existing	1	3	1	0.1	0.5 - LOW	The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the proposed development is therefore insignificant.	Habitat fragmentation is thought to be an insignificant impact due to the close proximity to existing features that already disrupts the connectivity of the habitat units.
	The proposed development site is embedded within an industrial area and therefore already suffers relatively ecological isolation. An open area occurs to the southeast, but access is hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.	Cumulative	3	4	2	0.5	4.5 - MOD		Habitat fragmentation is relatively high within the region and is a leading cause of habitat destruction.
		Residual	1	2	1	0.1	0.4 - LOW		Insignificant residual impacts will remain.
Soil erosion	Direct Impact:	Existing	1	1	1	0.1	0.3 - LOW	Topsoil stockpiles should be protected from erosion.	Soil erosion should not be a significant impacting feature due to the relatively flat topography of the site.
	Soil erosion will take affect any unprotected soils that have suffered disturbances,	Cumulative	2	2	2	0.5	3.0 - MOD		Soil erosion is of national concern and is one of the leading causes of ecological degradation.

PRE-CONSTRUCTION AND CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likely-hood**	**Rating**	**Mitigation***	**Interpretation**
	including unprotected stockpiles of stored topsoil. Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; The site is relatively flat, so there will be limited risk of erosion. Stockpiled soils will, however, be at risk of dispersal.	Residual	1	1	1	0.1	0.3 - LOW		Insignificant residual impacts will remain if managed appropriately.

Table 7-9: Ecological Operation Phase Impacts Assessment

OPERATIONS PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
Storing and utilisation of dangerous chemicals.	Direct & Indirect Impact:	Existing	1	2	4	0.2	1.4 - LOW	Storage of chemicals to be limited to appropriate and secure facilities on site and access limited to authorised personnel only; Storage in secure containers to ensure/limit the potential for the occurrence of leakages; Storage area to be bunded with an appropriate volume capacity	The storage facilities as well as the management and utilisation thereof will be strictly controlled and therefore significant accidental spillages, although possible, are thought to be improbable.
	Spillages of dangerous chemicals from inadequate and unprotected storage facilities and/or spillages during routine operations will	Cumulative	3	3	2	0.75	6.0 - MOD		Cumulative habitat degradation through soil and water contamination from pollutants, especially heavy metals elements, is a leading cause of

	contaminate soils and lead to chemicals (heavy metals) becoming bio-available to enter into the food chain; Chemical leachates could contaminate groundwater and/or be transported to surface water ecosystems via surface water runoff.							to protect from environmental contamination should accidental leakages occur; Transferal of chemicals to batteries should be done according to best practice guidelines to limit spillage; Should spillage occur, the ECO must be informed immediately, and a clean-up operation immediately commenced. Contaminated soils must be cleared and removed for disposal at a registered waste site capable of disposal of the chemicals.	ecological degradation in industrial areas.
		Residual	1	1	1	0.2	0.6 - LOW		Insignificant residual impacts will remain if adequate clean-up operations are immediately implemented should spillages occur.
Vegetation transformation for areas that are routinely maintained.	<u>Indirect Impact:</u>	Existing	1	3	1	0.1	0.5 - LOW	The peripheral area of the substation will be routinely maintained to avert the fire risks and therefore any emergent exotic vegetation can be simultaneously managed.	This will have a limited impact to the site.
	Routine disturbances of vegetation will result in transformation of the structures, with an expected increase in abundance of pioneering species; The relatively small spatial scale tends to render this impact insignificant.	Cumulative	2	3	2	0.5	3.5 - MOD		Cumulative vegetation transformation through invasion of exotic vegetation is a nationwide concern,
		Residual	1	2	1	0.1	0.4 - LOW		Little to no residual impacts should remain if managed appropriately.

7.3.2 Heritage and Archaeological Impacts

The Heritage and Archaeological Impacts associated with the Technology Alternative 1 and Alternative 2- Solid State Batteries (Lithium-ion) (Preferred Alternative) and Redox Flow Batteries are the same.

A Phase 1 Archaeological Heritage was not conducted for the proposed Project as the Footprint is less than 5 ha and the Batteries will be located within the boundaries of the existing Hex Substation which is located within an industrial area which is highly disturbed, nevertheless potential impacts associated with the proposed Project were assessed by the EAP.

a) Construction Phase

It is anticipated that the construction phase activities could potentially result in disturbance of surfaces and/or sub-surfaces, destruction, damage, alter, or remove of position archaeological and paleontological material or objects from its original location.

Refer to **Table 7-10** below for the Impact Assessment Tables.

7.3.3 Social -Economics Impacts

The Socio-Economic Impacts associated with the Technology Alternative 1 and Alternative 2- Solid State Batteries (Lithium-ion) (Preferred Alternative) and Redox Flow Batteries are the same.

a) Construction Phase

Impacts associated with the construction phase of a project are usually of a short duration (approximately 24 months), temporary in nature, but could have long-term effects on the surrounding social environment if not managed appropriately. The proposed Project is likely to create employment opportunities, depending on the final design during the construction phase. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the town of Worcester and Zweletemba and surrounding areas.

The Construction Phase could potentially result in the following Impacts:

- Increased employment opportunities and economic growth;
- Creation of temporary skilled and unskilled job opportunities directly on the project;
- Temporary increase in traffic disruption and movement patterns during construction''
- Nuisance impacts interms of temporary increase in noise and dust, or wear and tear on access roads to the site;
- Termination of temporary employment; and

- Safety and Security- An increase in crime is often associated with construction activities.

b) Operation Phase

During the operation phase, full-time operational and maintenance crews would be required for the BESS Project. Minimal job opportunities will be created during the lifespan of the BESS Project. Establishing and operating the Batteries will result in improved skills amongst the staff. On-the-job training is a key element of the staff development; many of the required skills during the operational phase will be taught to staff through day-to-day operations.

The Operation Phase could potentially result in the following Impact:

- Direct employment and skills development.

Refer to **Table 7-11** and **Table 7-12** below for the Impact Assessment Tables.

Table 7-10: Heritage and Archaeological Impacts Assessment- Construction Phase

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.	Direct Impact:	Existing	1	5	4	0.1	1 - LOW	No mitigation measures are required as no sites were identified. It is recommended that a chance find procedure should be implemented for the project.	Archaeological sites and heritage features are non-renewable and impact on any archaeological and heritage context or material will be permanent and destructive.
	The disturbance, damage, destruction or sealing, or remove of archaeological and paleontological material or objects from its original position.	Cumulative	2	4	16	0,2	1 - LOW		The project site is not considered to contribute to the heritage landscape of the region No cumulative palaeontological impacts are anticipated due to the very low palaeontological sensitivity

									ascribed to the study area.
		Residual	5	4	16	0,5	1- LOW		No sites have been recorded and no residual impacts are expected.

Table 7-11: Social Impact Assessment Construction Phase

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Increased employment opportunities during the construction Phase	Direct Impact:	Existing	2	2	4	0.5	4 – MEDIUM	Leverage this through procurement policies that favour local suppliers and businesses.	Infrastructure development drives economic growth and has a huge multiplier effect. Infrastructure development not only generates employment directly through construction and operations but also creates an industrial base around the development for
	Increased employment opportunities and economic growth.	Cumulative	2	4	16	0,2	1 - LOW		
		Residual	5	4	16	0,5	1- LOW		

									goods and services to supply the construction workers and activities. These industries would get more entrepreneurs and employ more labour. These workers would purchase more goods from the markets, creating a virtuous cycle.

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Creation of temporary skilled and unskilled job	Direct Impact:	Existing	2	2	4	0.5	4 – MEDIUM	• It is recommended that if practical, a local employment policy is adopted to maximise the opportunities made	Creating temporary skilled and unskilled job
	Creation of temporary	Cumulative	2	4	16	0,2	1 - LOW		

opportunities directly on the project during the construction Phase	skilled and unskilled job opportunities directly on the project	Residual	5	4	16	0,5	1- LOW	• available to the local labour force (Sourced from nearest towns or within the Breede Valley Local Municipality). • The recruitment selection process should seek to promote gender equality and should aim to optimise the employment of women wherever possible. • Efforts need to be employed to enhance indirect local employment/entrepreneurship opportunities by supporting local entrepreneurs as far as possible, where appropriate.	opportunities. .

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Temporary increase in traffic disruptions and	Direct Impact:	Existing	2	2	4	0.5	4 – MEDIUM	• Standard working hours to be implemented during the	If mitigation measures are not implemented the propose
	Temporary increase in traffic	Cumulative	2	4	16	0,2	1 - LOW		

movement patterns during the construction phase	disruptions and movement patterns.	Residual	5	4	16	0,5	1- LOW	construction phase, and/or as any deviation that is approved. • Construction vehicles must be roadworthy, and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues. • All construction vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs and control measures along the main access roads to warn road users of the construction	development will generate dust and noise and will continue to impact the surrounding businesses and the nearby communities.

								activities taking place for the duration of the construction phase. Warning signs must be visible at all times. • Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules. • All roads used by the project Developer and its contractors must be maintained in good working order during the construction phase. • It is recommended that a Community Liaison Officer be appointed to implement as the proposed	

								grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process	

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Termination of temporary employment towards the	Direct Impact:	Existing	2	2	4	0.75	6 – MEDIUM	N/A	Loss of temporary employment.
		Cumulative	2	4	16	0,2	1 - LOW		

end of the construction Phase	Termination of temporary employment	Residual	5	4	16	0,5	1- LOW		

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Safety and Security- An increase in crime is often associated with construction activities.	<u>Direct Impact:</u>	Existing	2	2	4	0.5	4 – MEDIUM	• Waste streams must be identified and documented. • Waste management plan must be implemented. • Accredited waste facilities to be contracted for accepting / recycling the waste. • Working hours should be kept between daylight hours during the construction phase, and/or as any deviation that is approved by the	This increase the risk of a fire outbreak which will have an impact on the substation and the personal working within the premises.
	An increase in crime is often associated with construction activities.	Cumulative	2	4	16	0,2	1 - LOW		
		Residual	5	4	16	0,5	1- LOW		

								relevant authorities. • The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction periods. • Access in and out of the construction camp should be strictly controlled • No open fires are permitted outside of designated areas. • Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff. • A comprehensive employee induction programme would cover land access protocols, fire	

								management and road safety. • The contractor should have personnel trained in first aid on site to deal with smaller incidents that require medical attention • It is recommended that a Community Liaison Officer should be appointed to implement a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process It is recommended that a Stakeholder Engagement	

								Plan be compiled and implemented for the construction phase of the project.	

Table 7-12: Social Impact Assessment- Operation Phase

Construction Phase									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likelihood**	**Rating**	**Mitigation**	**Interpretation**
Direct employment and skills development during the Operation Phase	Direct Impact:	Existing	1	5	4	0.1	1 - LOW	• It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. • The recruitment selection process	The positive benefits will be enhanced if local employment policies are adopted and local service providers are utilised by the developers to maximise the project opportunities available to

								should seek to promote gender equality and the employment of women wherever possible. • It is recommended that vocational training programs are considered for employees to promote the development of skills, where possible.	the local community.
	The disturbance, damage, destruction or sealing, or remove of archaeological and paleontological material or objects from its original position.	Cumulative	2	4	16	0,2	1 - LOW		The positive benefits will be enhanced if local employment policies are adopted and local service providers are utilised by the developers to maximise the project opportunities available to the local community.
		Residual	5	4	16	0,5	1- LOW		Improved pool of skills and experience in the local area.

7.3.4 Impacts related to the Storage and handling of Dangerous Goods

"Dangerous goods" is defined under the Listing Notices of the EIA Regulations (2014) that deal with the storage, or storage and handling, of dangerous goods. "Dangerous goods" are defined as:

"Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated “List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)” published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards".

The above definition makes specific reference to SANS 10234. South Africa has implemented the Globally Harmonized System of Classification and Labelling of Chemicals by issuing this national standard. The dangerous goods likely to be stored or handled on site would mainly include grease and fuels.

a) Description of the Impacts associated with the Storage and Handling of Dangerous Goods- Technology Alternative 1 Solid State Batteries (Lithium-ion) (Preferred Alternative)

Preconstruction- <u>Material Manufacturing</u>

Lithium occurs as a compounded form within the environment, such as lithium carbonate (although some lithium oxide sources also exist) thereby requiring chemical processing to be developed into lithium.

Lithium carbonate is generally situated within salt flats, which are typically water scarce areas. The mining of such resources requires large amounts of water.

Heavy metals (such as cobalt) are used within the lithium ion battery as part of the reactions required to store energy. Therefore, lithium ion batteries require the extraction of an additional battery specific element for its manufacture.

<u>Chemical Production</u>

The majority of batteries require chemicals as an integral part of the energy storage process. The production of such chemicals will have substantial negative effects.

Construction Phase:

Hazardous substances in the form of chemicals are an integral part of the workings of batteries however, most Li-ion batteries are factory sealed devices and no additional hazardous or toxic chemicals are required to be stored on-site during construction.

Operation Phase:

Hazardous substances in the form of chemicals (e.g. solvents) are an integral part of the workings of batteries. Furthermore, the battery includes the use of heavy metals. The use of hazardous substances also increases the risk of combustion etc. during operation.

b) Description of the Impacts associated with the Storage and Handling of Dangerous Goods- Technology Alternative 2 -Redox Flow Batteries are the same.

Preconstruction- <u>Material Manufacturing</u>

Extracting vanadium for example is done through mining or recovery from petroleum residues. Vadanium occurs in the minerals vanadinite, partonite and carnotite.

<u>Chemical Production</u>

Flow Batteries require chemicals as an integral part of energy storage process. The production of such chemicals could have substantial nedetive effect on the environment.

Construction Phase:

Hazardous substances in the form of chemicals are an integral part of the workings of flow batteries. Many large scale systems do not ship with electrolytes loaded and therefore, these chemicals will need to be stored on site during construction.

Operation Phase:

Hazardous substances in the form of chemicals (e.g. solvents) are an integral part of the workings of batteries

Table 7-13: Impact Assessment Tables for the Construction and Operation Phase

CONSTRUCTION AND OPERATION PHASE									
Activity	**Nature of Impact**	**Impact type**	***Extent***	**Duration**	**POTENTIAL INTENSITY**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
Soil and water contamination due to the handling and storage of dangerous goods during the construction and operation phases.	Direct & Indirect Impact:	Existing	1	2	4	0.2	1.4 - LOW	• Any spillages of dangerous substances must be contained as soon as possible, and remedial and clean-up actions initiated immediately. • Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken throughout the life cycle of the project. • Appropriate spill kits must be available on site. • Maintenance vehicles must have access to spill kits. • An emergency spill response plan must be developed for implementation during the construction and the operational phase. Personnel should be suitably trained to attend to any spills that may occur. • A fire management plan must be developed for implementation during the construction and the operational phase. Personnel must be suitably trained to	The management and will be strictly controlled and will need to be identified to in order to limit the potential impacts.
	• The recycling of lithium is an extremely complicated processes the material is toxic, highly reactive and flammable. • Due to the high costs of recycling lithium and the associated risks, there is a global absence of lithium recycling. • The disposal of hazardous substances will need to be at a hazardous waste disposal facility. There are only a few of these facilities in the country; therefore, there will be an increase in the overall carbon footprint of the technology. • Decreasing the available "airspace" within the hazardous landfill site. • The transportation of the hazardous waste to either a recycling facility or a hazardous waste disposal facility will have associated risks, namely with	Cumulative	3	3	2	0.75	6.0 - MOD		Cumulative habitat degradation through soil and water contamination from pollutants, especially heavy metals elements, is a leading cause of ecological degradation in industrial areas.
		Residual	1	1	1	0.2	0.6 - LOW		Insignificant residual impacts will remain if adequate clean-up operations are immediately implemented should spillages occur.

	regards to contamination emanating from spillages. • Contaminated run-off emanating from the disposal of hazardous substances to land will be detrimental to the surrounding ecosystem. • Sterilization of land for the disposal of the hazardous substances.	Residual	1	2	1	0.1	0.4 - LOW	manage any fires which may occur on site. • Flammable substances must be stored in enclosed containers away from heat, sparks, open flames, or oxidizing materials. • Develop a monitoring and leak detection procedure for monitoring of the chemical spillages.	Little to no residual impacts should remain if managed appropriately.

7.4 Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the BESS Project. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of the BESS Project, However, applicant will not be able to meet the the World Bank funding set of criteria for the Major Build program and carbon friendly alternative to be implemented in Eskom as an alternative to the Kiwano CSP project.

The project is thus required to connect an equivalent of a 100 MW of Renewable Energy plant, with a capacity of at least 525 GWh per year. Furthermore, according to a high-level analysis of constrained feeders within the distribution business, current feeder levels do not meet the required voltage and thermal characteristics as required by its license conditions.

From a social perspective, Social: The impacts of pursuing the Do Nothing Alternative are both positive and negative as follows:

- The benefits would be that there is no disruption from, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
- There would be an opportunity loss in terms of job creation, skills development and associated economic business opportunities for the local economy. The impact would be negative.

However, the socio-economic benefits for local communities would be forfeited.

8 ENVIRONMENTAL IMPACT STATEMENT

8.1 Comparative Assessment of Alternatives

Technology Alternative 1 (Preferred)

As with all battery technologies, the extraction of specific elements and the production of chemicals that form an important basis of the energy storage process have significant environmental impacts. However, lithium ion batteries require both lithium and an additional heavy metal (typically cobalt or manganese) for the reactions needed to store energy.

The installation of the lithium ion batteries will result in the following Positive impacts:

- Reduced reliance on fossil fuels as energy is being stored.
- No release of emissions or effluent as a result of the energy storage process.
- Minimal impacts associated with noise generation.
- No additional natural resources required for operation.
- Lithium ion batteries require low maintenance.
- No intensive loss of visual quality (technology not extremely large and cumbersome).

The impacts of most concern with the operation of lithium ion batteries are associated to the use of hazard substances in the form of lithium and heavy metals. However, being a closed system the risks associates to hazardous substances are mainly related to the storage during construction, leakages and the disposal of the hazardous waste at the end of life. Although the occurrence of these impacts may not be highly probable, the severities of such impacts are a cause for concern.

The largest concern associated with li-ion batteries is the possibility of thermal run-away and resulting fire. Most new systems employ sophisticated and integrated battery management systems to limit the battery operation to within safe parameters and prevent thermal runaway.

Technology Alternative 2

Much research has been conducted comparing Vanadium Redox Flow Batteries to Lead Acid Batteries. The overall consensus it that Vanadium Flow Redox Batteries are preferred according to most assessment aspects, including environmental impacts. Since it is a low maintenance technology and no heavy metals are used in this technology, there are fewer environmental impacts. The largest environmental concerns are, however, associated to the extraction of the chemicals and construction of the holding tanks. Mostly due to the types of material used and the large portions of land required. A positive aspect is that no waste is generated during operation due to the system having the capability to perform cycles indefinitely. Vanadium is reusable; therefore, disposal

presents little environmental impacts. The electrolyte used, in this case sulphuric acid, may present the most concern when a plant is decommissioned.

The installation of the Vanadium Redox Flow Batteries will result in the following Positive impacts:

- Vanadium has a high economic value and can be recycled. .
- Largest sources of vanadium are found in South Africa.
- Vanadium is taken up by most flora and fauna and is very soluble.
- This battery type does not require the use of heavy metals.
- Fewer emissions than lead acid batteries, reducing global warming potential.
- Reduced reliance on fossil fuels as energy is being stored.
- No additional natural resources required for operation.
- No release of effluent as a result of the energy storage process.
- Minimal impacts associated with noise generation.
- Redox flow batteries have a longer lifespan than conventional batteries and generally require little maintenance as it is a self-discharging system.

The technology Assessed in this Report both present Negatibe and Posive aspects, and none of them are fatally flawed form an Environmental Perspective, however Technology Alternative 1 is Preferred at this stage mainly based on the level of information that currently available on the type of technology

8.2 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of BESS in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. This, however, is beyond the scope of this study. The current study assesses the cumulative impacts associated with the BESS Project together with similar facilities within the region on the basis of current and best available information, with precautionary assumptions considered.

Considering the findings of the specialist assessment undertaken for the project, the cumulative impacts for the proposed BESS Project will be acceptable, without any unacceptable loss or risks and the majority are rated as being of **moderate-low** significance.

8.3 Key Findings of Environmental Impact Assessment

A specialist ecological assessments has been conducted for the proposed Project and a summary of the findings have been included below:

Ecology Assessment

During the field survey conducted, no Red Data Listed species were observed on site. The current ecological state of the proposed development footprint has already been subject to historical disturbances and therefor the floral community structures have already been altered. The proposed development impacts are seen be of minor significance due to the proximity of the site to existing industrial infrastructure. Although soil management is recommended the site is regarded as topographically flat, and stormwater run-off is not thought to be a significant concern. As long as the proposed mitigation measures are implemented on site during construction, the overall impacts associated with the proposed development can be managed to be of low significance.

Overall, the impact of the proposed activity is expected to be LOW as the study site is already heavily impacted by the current and surrounding activities and land use. The activities will further be mitigated to acceptable levels. A summary of the anticipated environmental impacts associated with each of the project lifecycle phases of the proposed project that were identified during the BA Process is presented in Table 8-1 below.

Table 8-1: Summary of Pre-Construction, Construction and Operation Phase Impacts

Proposal

Potential impacts:	**Significance rating of impacts (positive or negative):**	**Proposed mitigation:**	**Significance rating of impacts after mitigation:**	**Risk of the impact** and **mitigation not being implemented**
PRE-CONSTRUCTION				
Appointment of construction contractor	**4 – Moderate Positive**	• Ensure that unskilled labour required for the construction and installation of equipment are predominately South Africans from the surrounding communities.	**4 – Moderate Positive**	• No improvement on the unemployment conditions in the area and livelihood of the surrounding communities.
Poor communication about the project creates high expectations about the potential of job opportunities.	**3 – Low (-)**	• Caution with communication so as not to create the expectation of massive job creation	**2- Low (-)**	• Poor communication could lead to disappointment amongst community members, Labour and social unrest. While the project will create employment opportunities – the scale of the project means that not everyone will get employed
Damage to equipment or containers transportation n	**3 – Low (-)**	• Making use of accredited hazardous goods transportation companies. • Equipment properly packaged in line with regulations to facilitate safe handling, transportation and placement. • Inspection of packaging for damage. • Risk assessment to be conducted. • Route planning and obtaining all relevant permits from the local authorities. • Adhere to OEM handling and transportation instructions. • Agreement / contract with HazMat company for first response, site cleanup and rehabilitation. • All MSDS available for the BESS.	**2 – Low (-)**	• This could lead to road accident caused by driver or 3rd party, cargo not being properly secured. • Spillage of electrolytes/ dangerous substances. • Contamination of the soil, ground water and flora.

Clearing of vegetation to accommodate infrastructure and services	**6 - Mod**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; • Rehabilitation of the areas that are impacted by the development outside of the ultimate infrastructure footprint will aid in abating the ecological impacts.	**6 - Mod**	• Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; • This will have limited significance to the due to the site having already been historically subject to impacting features.
Loss of RDL floral species during site clearing.	**0.6 - Low**	• The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral species may be included when vegetation is stripped, suffering loss of individuals; • This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.
Loss and/or displacement of sensitive faunal species.	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas	**0.6 - Low**	• Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to disturbances. • Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.

Destruction of nesting and/or roosting habitat for faunal species.	**4.0 - Moderate**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development; • The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.
Destruction of ground-dwelling and/or sedentary fauna.	**0.6 - Low**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; Avoid indiscriminate destruction of habitat.	**0.6 - Low**	• Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; • Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.
Destruction of sensitive habitat	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.

Disturbance features that alter the vegetation structures	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.7 - Low**	• Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; • The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will also be maintained to avert fire risks.
Habitat fragmentation resulting from infrastructure development.	**0.5 - Low**	• The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the proposed development is therefore insignificant.	**0.4 - Low**	• The proposed development site is embedded within an industrial area and therefore already suffers relatively ecological isolation. An open area occurs to the southeast, but access is hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.
Soil erosion.	**0.3 - Low**	• Topsoil stockpiles should be protected from erosion. Compile and implement the Stormwater Management Plan and the Erosion Management Plan.	**0.3 - Low**	• Soil erosion will take affect any unprotected soils that have suffered disturbances, including unprotected stockpiles of stored topsoil. • Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; • The site is relatively flat, so there will be limited risk of erosion. Stockpiled

				soils will, however, be at risk of dispersal.
CONSTRUCTION PHASE				
➢ **ECOLOGY**				
Damage to equipment or containers during storage and installation	**6-Mod**	• Inspection of packaging for damage. • Risk assessment to be conducted. • Effective scheduling to limit onsite storage of equipment - site to be ready to readily accept BESS. • Proper supervision is required. • Adhere to OEM handling, transportation and storage instructions. • Agreement / contract with HazMat company for first response, site cleanup and rehabilitation. • All MSDS available for the BESS.	**0.6- Mod**	• This could lead to road accident caused by driver or 3rd party, cargo not being properly secured. • Spillage of electrolytes/ dangerous substances. • Contamination of the soil, ground water and flora.
Clearing of vegetation to accommodate infrastructure and services	**6 - Mod**	• Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; • Rehabilitation of the areas that are impacted by the development outside	**6 - Mod**	• Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; • This will have limited significance to the due to the site having already been historically subject to impacting features.

		of the ultimate infrastructure footprint will aid in abating the ecological impacts.		
Loss of RDL floral species during site clearing.	**0.6 - Low**	• The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral species may be included when vegetation is stripped, suffering loss of individuals; • This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.
Loss and/or displacement of sensitive faunal species.	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas	**0.6 - Low**	• Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to disturbances. • Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.
Destruction of nesting and/or roosting habitat for faunal species.	**4.0 - Moderate**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Site clearing will remove all vegetation to accommodate the infrastructure development; • The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.

Destruction of ground-dwelling and/or sedentary fauna.	**0.6 - Low**	• Limit the footprint to only areas necessary for the construction process; • Utilise single access roads only; and • Avoid indiscriminate destruction of habitat.	**0.6 - Low**	• Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; • Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.
Destruction of sensitive habitat	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.6 - Low**	• Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.
Disturbance of features that alter the vegetation structures	**0.6 - Low**	• Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); • Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	**0.7 - Low**	• Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; • The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will also be maintained to avert fire risks.

Habitat fragmentation resulting from infrastructure development.	**0.5 - Low**	• The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the proposed development is therefore insignificant.	**0.4 - Low**	• The proposed development site is embedded within an industrial area and therefore already suffers relatively ecological isolation. An open area occurs to the southeast, but access is hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.
Soil erosion.	**0.3 - Low**	• Topsoil stockpiles should be protected from erosion.	**0.3 - Low**	• Soil erosion will take affect any unprotected soils that have suffered disturbances, including unprotected stockpiles of stored topsoil. • Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; • The site is relatively flat, so there will be limited risk of erosion. Stockpiled soils will, however, be at risk of dispersal.
Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemicals	**4 - Moderate**	• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks.	**0.3 - Low**	• Pollution of water resources and land. • Loss of natural habitats for the biodiversity occurring in the area.

		• Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. • Implement suitable erosion control measures.		
Potential Impact Vegetation and habitat disturbance due to the accidental introduction of alien species	**4 - Moderate**	• The Contractor implements suitable methods during the construction phase to limit the introduction and spread of alien invasive plant species. • Promote awareness of all personnel. • The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation. • Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes.	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Vegetation and habitat disturbance due to pollution and littering during construction phase	**4 - Moderate**	• The Contractor should employ personnel on site responsible for preventing and controlling of litter. • Promote good housekeeping with daily clean-ups on site. • During construction, refresher training can be conducted to construction workers with regards to	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.

		littering, ad hoc veld fires, and dumping. • No fires are allowed on site.		
Loss of habitat of the Marikana thornveld and CBA region	**4 - Moderate**	• Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation. • Where possible, natural vegetation must not be cleared and encouraged to grow. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation. • Disturbance of vegetation must be limited only to areas of construction. • Prevent contamination of natural grasslands by any pollution. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Damage to plant life outside of the proposed development site	**4 - Moderate**	• Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by Environmental Control Officer (ECO). • Areas which could be deemed as no go should be clearly marked.	**0.3 - Low**	• Loss of natural habitats for the biodiversity occurring in the area.
Disturbance to animals	**4 - Moderate**	• Animals residing within the designated area shall not be unnecessarily disturbed. • During construction, refresher training can be conducted to construction workers with regards to littering and poaching.	**0.3 - Low**	• Displacement of animals.

		• The Contractor and his/her employees shall not bring any domestic animals onto site. • Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.		
Animal passage out of construction site	**4 - Moderate**	• Allow for safe animal passage through and specifically out of the construction site.	**0.3 - Low**	• Loss of animals within the proposed area.
The proposed construction activities may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area	**4 - Moderate**	• Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives.	**0.3 - Low**	• The encroachment of exotic vegetation following soil disturbance.
Increased employment opportunities and economic growth	**4- Moderate**	• Leverage this through procurement policies that favour local suppliers and businesses.	**2- Low**	• Infrastructure development drives economic growth and has a huge multiplier effect. Infrastructure development not only generates employment directly through construction and operations but also creates an industrial base around the development for goods and services to supply the construction workers and activities. These industries would get more entrepreneurs and employ more labour. These workers would purchase more goods from the markets, creating a virtuous cycle.
Creation of temporary skilled and unskilled job	**4- Moderate**	• It is recommended that if practical, a local employment policy is adopted to	**2- Low**	• Creating temporary skilled and unskilled job opportunities.

opportunities directly on the project		maximise the opportunities made available to the local labour force (Sourced from nearest towns or within the Breede Valley Local Municipality). • The recruitment selection process should seek to promote gender equality and should aim to optimise the employment of women wherever possible. • Efforts need to be employed to enhance indirect local employment/entrepreneurship opportunities by supporting local entrepreneurs as far as possible, where appropriate.		
Temporary increase in traffic disruptions and movement patterns during the construction phase	**6- Moderate**	• Standard working hours to be implemented during the construction phase, and/or as any deviation that is approved. • Construction vehicles must be roadworthy, and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues. • All construction vehicles should be inspected regularly to ensure their road worthiness. • Provision of adequate and strategically placed traffic warning signs and control measures along the main access roads to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be visible at all times. • Implement penalties for reckless driving for the drivers of heavy	**3- Low**	• If mitigation measures are not implemented, the traffic disruptions will continue to impact the surrounding businesses and the nearby communities.

		vehicles as a way to enforce compliance to traffic rules. • All roads used by the project Developer and its contractors must be maintained in good working order during the construction phase. • It is recommended that a Community Liaison Officer be appointed to implement as the proposed grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process		
Nuisance impacts in terms of temporary increase in noise and dust, or the wear and tear on access roads to the site	**5- Moderate**	• Dust suppression measures must be implemented for heavy vehicles on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues. • It is recommended that a Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	**4- Low**	• If mitigation measures are not implemented the propose development will generate dust and noise and will continue to impact the surrounding businesses and the nearby communities.
Termination of temporary employment	**6 Moderate**	• N/A	**6-Moderate**	• Loss of temporary employment.

Safety and security	**4-Moderate**	• Waste streams must be identified and documented. • Waste management plan must be implemented. • Accredited waste facilities to be contracted for accepting / recycling the waste. • Working hours should be kept between daylight hours during the construction phase, and/or as any deviation that is approved by the relevant authorities. • The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction periods. • Access in and out of the construction camp should be strictly controlled • No open fires are permitted outside of designated areas. • Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff. • A comprehensive employee induction programme would cover land access protocols, fire management and road safety. • The contractor should have personnel trained in first aid on site to deal with smaller incidents that require medical attention • It is recommended that a Community Liaison Officer should be appointed to implement a grievance mechanism. A method of communication should be	**2- Low**	• This increase the risk of a fire outbreak which will have an impact on the substation and the personal working within the premises.

		implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process • It is recommended that a Stakeholder Engagement Plan be compiled and implemented for the construction phase of the project.		
Disturbance, damage, destruction or sealing-in of fossil remains preserved at or beneath the ground surface within the development area, most notably by bedrock excavations during the construction phase.	**1-Low**	• Monitoring of all substantial bedrock excavations for fossil remains by ECO, with reporting of substantial new palaeontological finds to SAHRA for possible specialist mitigation.	**1-Low**	• Will result in the permanent loss of any heritage features.
During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.	**1-Low**	• No mitigation measures are required as no sites were identified. It is recommended that a chance find procedure should be implemented for the project.	**1-Low**	• Will result in the permanent loss of archaeological and paleontological material or objects
Soil and water contamination due to the handling and storage of dangerous goods during the construction and operation phases.	**6-Moderate**	• Any spillages of dangerous substances must be contained as soon as possible, and remedial and clean-up actions initiated immediately. • Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken throughout the life cycle of the project. • Appropriate spill kits must be available on site.	**1-Low**	• May result in a fire or explosion and the contamination of soil and ground water.

		• Maintenance vehicles must have access to spill kits. • An emergency spill response plan must be developed for implementation during the construction and the operational phase. Personnel should be suitably trained to attend to any spills that may occur. • A fire management plan must be developed for implementation during the construction and the operational phase. Personnel must be suitably trained to manage any fires which may occur on site. • Flammable substances must be stored in enclosed containers away from heat, sparks, open flames, or oxidizing materials. • Develop a monitoring and leak detection procedure for monitoring of the chemical spillages. •		
OPERATION PHASE				
Vegetation transformation for areas that are routinely maintained.		• The peripheral area of the substation will be routinely maintained to avert the fire risks and therefore any emergent exotic vegetation can be simultaneously managed		• Routine disturbances of vegetation will result in transformation of the structures, with an expected increase in abundance of pioneering species; • The relatively small spatial scale tends to render this impact insignificant.
➢ **Storage and handling of Hazardous Substances**				
Storing and handling of dangerous chemicals	**4 - Moderate**	• Storage of chemicals to be limited to appropriate and secure facilities on site and access limited to authorised personnel only;	**3 - Low**	• Spillages of dangerous chemicals from inadequate and unprotected storage facilities and/or spillages during routine operations will contaminate soils and lead to

		• Storage in secure containers to ensure/limit the potential for the occurrence of leakages; • Storage area to be bunded with an appropriate volume capacity to protect from environmental contamination should accidental leakages occur; • Transferal of chemicals to batteries should be done according to best practice guidelines to limit spillage. • A fire management plan must be developed for implementation during the construction and the operational phase. Personnel must be suitably trained to manage any fires which may occur on site. • Should spillage occur, the ECO must be informed immediately, and a clean-up operation immediately commenced. Contaminated soils must be cleared and removed for disposal at a registered waste site capable of disposal of the chemicals.		chemicals (heavy metals) becoming bio-available to enter into the food chain; • Chemical leachates could contaminate groundwater and/or be transported to surface water ecosystems via surface water runoff.

8.4 Overall Recommendation

The findings of the specialist study undertaken in support this EIA to assess both the benefits and potential negative impacts anticipated from the Project conclude that the significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. As such the authorisation of the project for development will meet the objectives of sustainable development and is supported by the EAP.

The confidence in the Basic Assessment undertaken is acceptable. Taking into consideration the above and based on the nature and extent of the Project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the Basic Assessment, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the proposed BESS Project can be managed and mitigated to an acceptable level. The information provided as part of the BA process, and specifically within this BA report, is sufficient to enable the DEA to make an informed and defendable decision. The layout plan as presented in this report has been informed by the findings of the specialist study and available information (refer to Appendix B for the Layout Map). The facility in its current position results in an acceptable level of loss and is considered to be the preferred layout and environmentally acceptable.

The following conditions would be required to be included within an authorisation issued for the Project:

Construction

- The footprint of the impact should be kept to a minimum and unnecessary disturbance to habitats should be controlled.
- Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- All mitigation measures detailed within the Environmental Management Programme (EMPr) as contained within Appendix M of this report are to be implemented.

Operations

- On-going monitoring programme should be established to detect and manage alien species within the site for the duration of the operation phase.
- The operation phase EMPr must be implemented and used to ensure compliance with environmental specifications and management measures.

The EAP recommends the following general conditions to be included:

- Environmental authorisation (EA) will be subject to the implementation of mitigation measures and conditions stipulated within the EMPr and this Basic Assessment Report.
- Construction must commence within a period of 2 years
- EA will be valid for the life of the BESS, subject to revisions and amendments through legislated procedures as the need arise.
- Eskom must continue to investigate mechanisms for waste reduction or minimisation, especially relating to the re-use of Batteries. This has the potential to unlock further economic benefits for local communities living near Hex Substation stations.

As such, Zitholele Consulting as the EAP recommend that this project is awarded an EA from the DEA.

9 REFERENCES

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