	Water Use Activity	Applicable to this development proposal
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	If any structures (tx line towers) are located within any watercourses a GA process can potentially be followed.
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons	Not applicable
S21(k)	Using water for recreational purposes	Not applicable

DWS WILL DETEMINE IF A GA OR WULA APPLICATION WILL BE REQUIRED DURING THE PREAPPLICATION PHASE AND TYPICALLY IF ONE OF THE ABOVE WATER USES REQUIRES A WULA THEN ALL APPLICATIONS WILL BE TREATED AS A WULA AND NOT GA. THE SUBMISSION PROCESS AND DETAIL REQUIREMENTS DOES HOWEVER NOT DIFFER ONLY THE PROCESSING TIMEFRAMES (60 vs 300 DAYS).

8. Impact assessment

The following direct and indirect impacts have been assessed based on the available information:

- Loss of aquatic species of special concern, and
- Wetland loss as natural wetlands were observed
- Loss of riparian systems and water courses
- Impact on aquatic systems through the possible increase in surface water runoff on form and function - Increase in sedimentation and erosion
- Potential impact on localised surface water quality
- Cumulative impacts
- No-Go option

However, if no towers are located within the waterbodies and watercourses shown (Figure 5a-d) it is anticipated that the overall impacts with mitigation would be low to none, based on the assumption that existing tracks, cattle pathways and roads are used as access routes as far as possible and where new access roads are required they must avoid sensitive aquatic areas and all erosion mitigation measures recommended in this report must be effectively implemented. This must be confirmed during a post approval walk down or inspection of the final tower positions and access routes.

Thus, only the following impacts are considered based on the proposed towers shown in Appendix 2:

Project phase	**Construction**	
Impact	**Potential impacts on localised water quality**	
Description of impact	**During construction a number of materials as well as chemicals will be required. Any spills during transport or while works is conducted near any watercourses has the potential to affect the surrounding biota**	
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts
Potential mitigation	All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more 32 m from a watercourse and 50 m from a wetland. Chemicals used for construction must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early; Littering and contamination of water sources during construction must be prevented by effective construction camp management; Emergency plans must be in place in case of spillages onto road surfaces and water courses; No stockpiling should take place within a water course; All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds; Stockpiles must be located away from river channels; The construction camp and necessary ablution facilities meant for construction workers must be beyond the 32 m buffer described previously	

Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Medium term	Impact will last between 5 and 10 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Likely	The impact may occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	Spills do occur, and these should be minimised through avoidance or immediate clean up			
Cumulative impacts	When compared to the surrounding transmission lines (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region			

Project phase	Operation	
Impact	**Impact on aquatic systems through possible increase in surface water runoff - downstream erosion and sedimentation should any new tracks or access roads be constructed.**	
Description of impact	**Clearing of vegetation and an increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows. These higher volume flows, with increased velocity result in downstream erosion and sedimentation**	
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts
Potential mitigation	Substations - A stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. This should then be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas Transmission lines - Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas	

Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Long term	Impact will last between 10 and 15 years	Short term	impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged or is not scarce	Low	The resource is not damaged or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	With effective stormwater management and erosion control all the potential impacts can be minimised			
Cumulative impacts	When compared to the surrounding transmission lines (roads and infrastructure - operational), this impact would be negligible as they have shown that with stormwater management limited impacts have occurred when compared to other land use activities within the region			

9. Cumulative Impacts

Simply stated, there would be no additional impact as the transmission line would either make use of existing access routes, while other impacts such as erosion or sedimentation would be small scale and localised, when considering the overall state of the aquatic environments. Only three planned powerlines were considered as part of the cumulative impact assessment and are listed below for reference:

	Overhead power line	**Length**	**Status**
Melkhout-Kromrivier	132 kV line from Melkhout substation to Kromrivier substation, Eastern Cape – Upgrade existing line to a double circuit line to accommodate Oyster Bay	± 26 km	EA issued, out to tender
Oyster Bay Wind Energy Facility grid connection	132 kV line from Oyster Bay Wind Energy Facility to Melkhout substation	±4.3 km	EA issued; Construction to commence in 2018
Dieprivier-Kareedouw	Construction of 132 kV distribution lines from Dieprivier to Kareedouw, Sarah Baartman District Municipality	±36 km	Amendment authorised in May 2017

The author of this report was involved in the assessment of all three of these projects, which included the delineation of all the waterbodies and their respective buffers, locating the towers and any new access routes away from these. This was also then confirmed during a walk down process of each individual tower for each of these lines. What was evident was that the towers and any stays would have little impact on the aquatic environment, however, creation of tracks and clearing of any vegetation would.

Project phase	**Construction and Operation**			
Impact	**Cumulative Impact**			
Description of impact	**In the assessment of this project, the surrounding transmission lines that would form part of the cumulative impact assessment as listed in this report. Potential impacts include the increase in the number of access tracks and cleared areas that could result in sedimentation and erosion, particularly where steep valleys or mountain sides are encountered**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	Development and implementation of rehabilitation plan post Environmental Authorisation, i.e. Once the final tower positions have been finalised and the walk down post approval has been completed.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Positive	
Duration	Brief	Impact will not last longer than 1 year	Long term	Impact will last between 10 and 15 years
Extent	Limited	Limited to the site and its immediate surroundings	Local	Extending across the site and to nearby settlements
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Minor - positive**	
Comment on significance	A positive contribution to the local area could be made if rehabilitation is initiated. This was effectively shown in the post construction follow-up of the Melkhout-Dieprivier line, where steep access tracks were created, which then resulted in eroded areas. The contract returned to reshape these areas, and ensure revegetation take place (reseeding was required in certain areas).			
Cumulative impacts	N/A			

10.No-Go Option

Should the proposed development not be constructed, it is assumed that the current land use (agriculture) would continue to increase in intensity. As seen on several occasions during the site visits, this could lead to an increase in the number of irrigation pivots, or land being cleared or converted to grazing, or for urbanisation.

Thus, continued clearing as well as other impacts such as water abstraction and changes to water quality (agricultural return flow or urban effluent), would be seen as a High negative impact significance in the region, as the number of wetlands lost, and changes to streams / rivers noted over time has resulted in a deterioration of these systems over time.

11.Environmental Management Plan – Construction and Operational Phase

Objective	Potential Impact	Mitigation Measures	Indicator	Responsibility	Timeframes
Soil erosion control, water quality management at potential road access points	» Erosion and soil loss near **watercourses** » Disturbance to or loss of **watercourses** » Sedimentation of **watercourse areas** » Loss of indigenous vegetation cover, particularly near **watercourse areas** » Increased runoff into rivers potentially associated with accelerated erosion in **watercourses**	» Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) » Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 32 m from a watercourse and 50 m from a wetland, unless agreed otherwise with the ECO. Limit the height of stockpiles as far as possible in order to reduce compaction. » Any excavation, including those for cables, must be supervised by the ECO. Disturbance of vegetation and topsoil must be kept to a practical minimum. » Rehabilitate disturbance areas as soon as construction in an area is completed.	» No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of increased siltation in water courses, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by Resident Engineer & ECO	ECO Contractor	During site establishment, construction and operational phase
Successful waste and pollutant management	» The watercourse areas could be impacted via: 1. Release of contaminated water from contact with spilled chemicals 2. Generation of contaminated wastes from used chemical containers 3. Inefficient use of resources resulting in excessive waste generation 4. Litter or contamination of the site or water through poor waste management practices	» Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling). » Any excavation, including those for cables, must be supervised by the ECO. Disturbance of vegetation and topsoil must be kept to a practical minimum. » Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 32 m from a watercourse and 50 m from a wetland. Limit the height of stockpiles as far as possible in order to reduce compaction. » Storage areas must be located more than 32 m from a watercourse and 50 m from a wetland, unless agreed otherwise with the ECO. » The storage of flammable and combustible liquids such as oils must be in designated areas,	» No chemical spills outside of designated storage areas » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams » Firefighting equipment and training provided before the construction phase commences » No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO	ECO Contractor	During site establishment, construction and operational phase

Objective	Potential Impact	Mitigation Measures	Indicator	Responsibility	Timeframes
		which are appropriately bunded, and stored in compliance with material safety datasheet (MSDS) files, as defined by the safety, health and environment (SHE) Representative / ECO. » Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals must be complied with. » Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils. » Transport of all hazardous substances must be in accordance with the relevant legislation and regulations. » Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. » Waste disposal records must be available for review at any time. Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste. » Construction contractors must provide specific detailed waste management plans to deal with all waste streams. » Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control. » Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc.). Supply waste	» Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of increased siltation in water courses, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by Resident Engineer & ECO		

Objective	Potential Impact	Mitigation Measures	Indicator	Responsibility	Timeframes
		collection bins at construction equipment and construction crew camps. » Under no circumstances may solid waste be burnt or buried on site. » Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area. » Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal. » Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered. » Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised. » All stored fuels to be maintained within a bund and on a sealed surface. Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function. » Construction machinery must be stored in an appropriately sealed area. » An incident/complaints register must be established and maintained on-site. » Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. » Appropriate emergency training (e.g. firefighting) must be given to team prior to the construction period. » Any spills must receive the necessary clean-up action. If required, bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be			

Objective	Potential Impact	Mitigation Measures	Indicator	Responsibility	Timeframes
		made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan). » Oily water from bunds at the substation must be removed from site by licensed contractors. » Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility. » Spilled cement or concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. » In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. » Upon the completion of construction, the area will be cleared of potentially polluting materials. » Rehabilitate disturbance areas as soon as construction in an area is completed.			

12.Conclusion and Recommendations

The proposed alignment corridor would seem to have a limited impact on the aquatic environment assuming that any of the proposed structures, regardless of type, must avoid the watercourses by 32m and wetlands by 50m respectively. Thus, presently no objection to the development taking place is made assuming that existing tracks or roads are used as far as possible and where new access roads are required, they must avoid sensitive aquatic areas and all erosion mitigation measures recommended in this report must be effectively implemented. This is an important consideration with regard the cumulative impact of clearing additional vegetation for roads and tracks within a new servitude that would need to cross any of the delineated waterbodies, and hence the preference for this alignment due to the high number of existing access points, servitudes roads and tracks.

As the proposed activities have the potential to create erosion the following recommendations and assumptions are reiterated:

- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- It is also advised that a suitably qualified and experienced Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 32 m from any demarcated watercourse and 50 m from any wetland, unless agreed otherwise with the ECO.
- All alien plant re-growth must be monitored, and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within areas of disturbance (inclusion of buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMPr preparation. The walkdown is required as the final tower positions (and thus associated access routes) could not be provided at this point, thus it would be important to evaluate in terms of the aquatic environment and evaluate the need for a Water Use License / GA for these areas as well as populate the required DWS Risk Assessment matrix.

13.References

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12. Appendix 1 - Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
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Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07 & EAPSA certified). Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 21 years

SKILLS BASE AND CORE COMPETENCIES

- 21 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 12 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMMU
- 1995: B Sc Hon (Zoology) - NMMU
- 1996: M Sc (Botany - Rivers) - NMMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela Metropolitan University – SAB institute for Coastal Research & Management. Funded by the WRC.
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – present Owner / Ecologist of Scherman Colloty & Associates cc

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Kenmare Mining Pilivilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

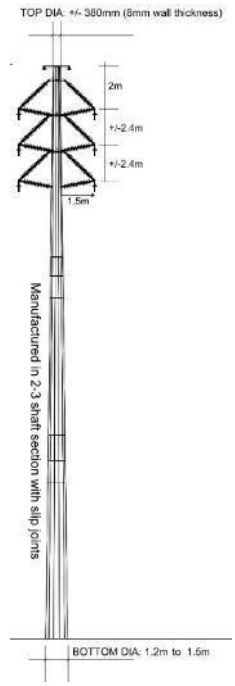
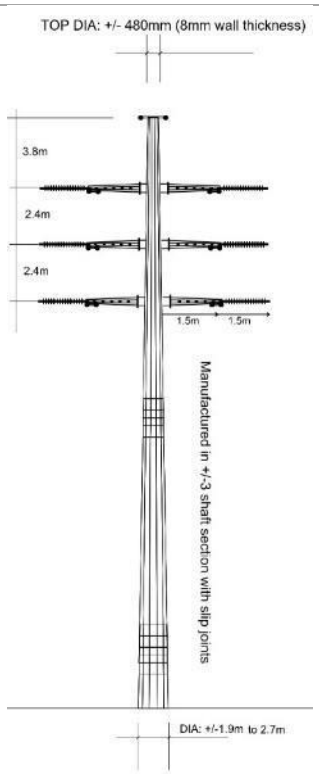
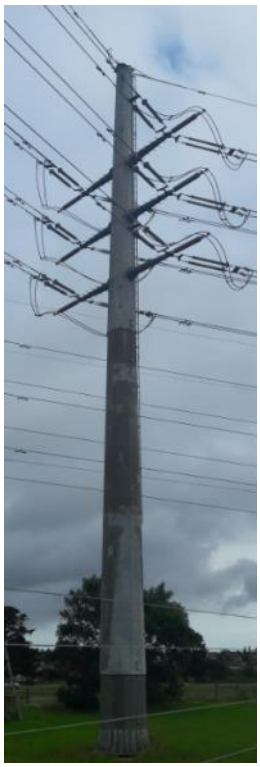
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.

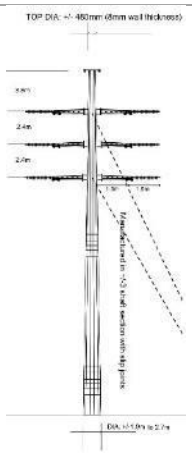
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – current.
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan for the Indwe 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 85 renewable projects in the past four years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farm), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the N2, PE to Cape Town, 2012 on behalf of SRK (2013).

14.Appendix 2: Transmission line tower options assessed

Red Cap Impofu Grid Connection - Pylon options and descriptions

Double Circuit Twin Tern Conductor

	Pylon Type	Description and purpose	Graphic
1.	Monopole intermediate Double Circuit with Twin Tern Conductors	Self-supporting galvanised steel Suspension structure with no stays/anchors. For general use as intermediate structures between turning/angle points. Height: 26-32 m Base diameter: 1.2m to 1.5m	 
2.	Monopole strain (0º-30º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with no stays/anchors. For general use up to 30º turning/angle points Height: 26-32 m Base diameter: 1.9m to 2.7m	 . 

	Pylon Type	Description and purpose	Graphic
3.	Monopole strain (30º-90º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvinised steel Strain Angle structure with additional stays/anchors. For general use between 30º to 90º at turning/angle points. Height: 26-32 m Base diameter: 1.9m to 2.7m 5 to 7 stays/anchors	 
4.	Monopole strain (30º-90º angle) 2 x Single Circuit Twin Tern Conductor	2 x Strain Angle galvinised steel structure with stays/anchors. Two single circuit monopoles installed 10m apart to accommodate a twin Tern Conductor attachment each. For general use between 30º to 90at turning/angle points and where it is acceptable for the landowner. Height: 20m - 24m 5 to 7 stays/anchors	
5.	Triple pole structure. 2 x Single circuit with Twin Tern Conductor	For long spans (>350m to 500m) across valleys and rivers. Strain structure with three single monopoles per circuit. 5-9 stays per triple pole structure depending on angle configuration. Typical 18 to 16m in length.	

	Pylon Type	Description and purpose	Graphic
		In a double circuit configuration it will be a triple pole structure per circuit place at 10m-15m apart	
6.	Strain Lattice Tower (247 type) for Double Circuit Twin Tern Conductor	For very long spans (>500m) across valleys and rivers. Lattice structure with four legs Height: 28m to 32m Base of the tower with 4 legs in general 15m x 15m area.	

Annexure D4

Agriculture

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AGRICULTURAL AND SOILS IMPACT ASSESSMENT FOR PROPOSED IMPOFU GRID CONNECTION EASTERN CAPE

BASIC ASSESSMENT REPORT

Report by
Johann Lanz

Prepared for Aurecon CONSULTANT
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Cape Town
8000
Tel: (021) 526 9400

August 2019

Johann Lanz
Professional profile

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
• B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
• BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
• Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

- **Soil Science Consultant Self employed 2002 - present**

  I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SRK Consulting; Aurecon; Mainstream Renewable Power; SiVEST; Savannah Environmental; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Haw & Inglis; BioTherm Energy; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Wedderwill Estate; Goedgedacht Olives; Zewenwacht Wine Estate, Lourensford Fruit Company; Kaarsten Boerdery; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.
- I have conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.
- I have project managed the development of soil nutrition software for Farmsecure Agri Science.

- **Soil Science Consultant Agricultural Consultors International (Tinie du Preez) 1998 - end 2001**

  Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

- **Contracting Soil Scientist De Beers Namaqualand Mines July 1997 - Jan 1998**

  Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

Specialist Declaration

I, Johann Lanz, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company: Johann Lanz – Soil Scientist

Professional Registration (including number): SACNASP Reg. no. 400268/12

Date: 01 August 2019

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EXECUTIVE SUMMARY

The proposed development is mostly on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to a loss of agricultural production from such land.

The key findings of this study are:

- Soils along the corridor vary widely from deep coastal sands and alluvial deposits to shallow, rocky mountainous soils.
- Rainfall decreases eastwards along the corridor. Dryland cultivation is viable in the extreme west but becomes less viable eastwards.
- Land capability varies from class 3 to class 8 along the corridor.
- The only significant areas of cultivation within the corridor are within the project area for the wind farms in the extreme west and on the Gamtoos river flood plain.
- Most of the rest of the corridor is suitable only for grazing, with small, isolated patches of cultivation.
- Agricultural sensitivity mapping classified all centre pivots as No-Go areas, and the rest of the corridor as low sensitivity.
- No-Go areas need to be entirely avoided by the footprint of the development.
- Electricity grid infrastructure has minimal impact on agriculture after construction because almost all agricultural activities can continue, undisturbed below power lines. Therefore, it is only the ground-based footprints (pylon bases and substations) that have any impact, and these cover an extremely small surface area and therefore have negligible impact on agricultural production.
- The single identified impact of the proposed Impofu grid connection is a loss of agricultural potential on the impacted land. This can result by way of the following different mechanisms:
  - Construction disturbance of agricultural activities;
  - Loss of excavated topsoil;
  - Soil compaction due to heavy vehicle traffic;
  - Occupation of small portions of land by the ground-based footprint; and
  - Erosion resulting from surface disturbance.
- The impact on agriculture is assessed for the construction, operation and decommissioning phases, as negligible.
- Cumulative impact is assessed as negligible.
- Proposed mitigation is:
  - Avoid all No-Go areas.
  - Effective communication with farmers about timing and location of construction activities in order to minimise disturbance to their agricultural activities.
  - Return topsoil to the surface of all backfilled excavations.
  - Ensure run-off control where required.
  - Loosen compacted soils where required.
- The conclusion of this assessment is that, from an agricultural perspective, the

proposed development should be authorised, because it has negligible agricultural impact.

1 INTRODUCTION

To evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a grid connection is required in the form of an approximately 120 km length 132 kV overhead power line between the wind farm project area and Port Elizabeth (PE) (see Figure 1).

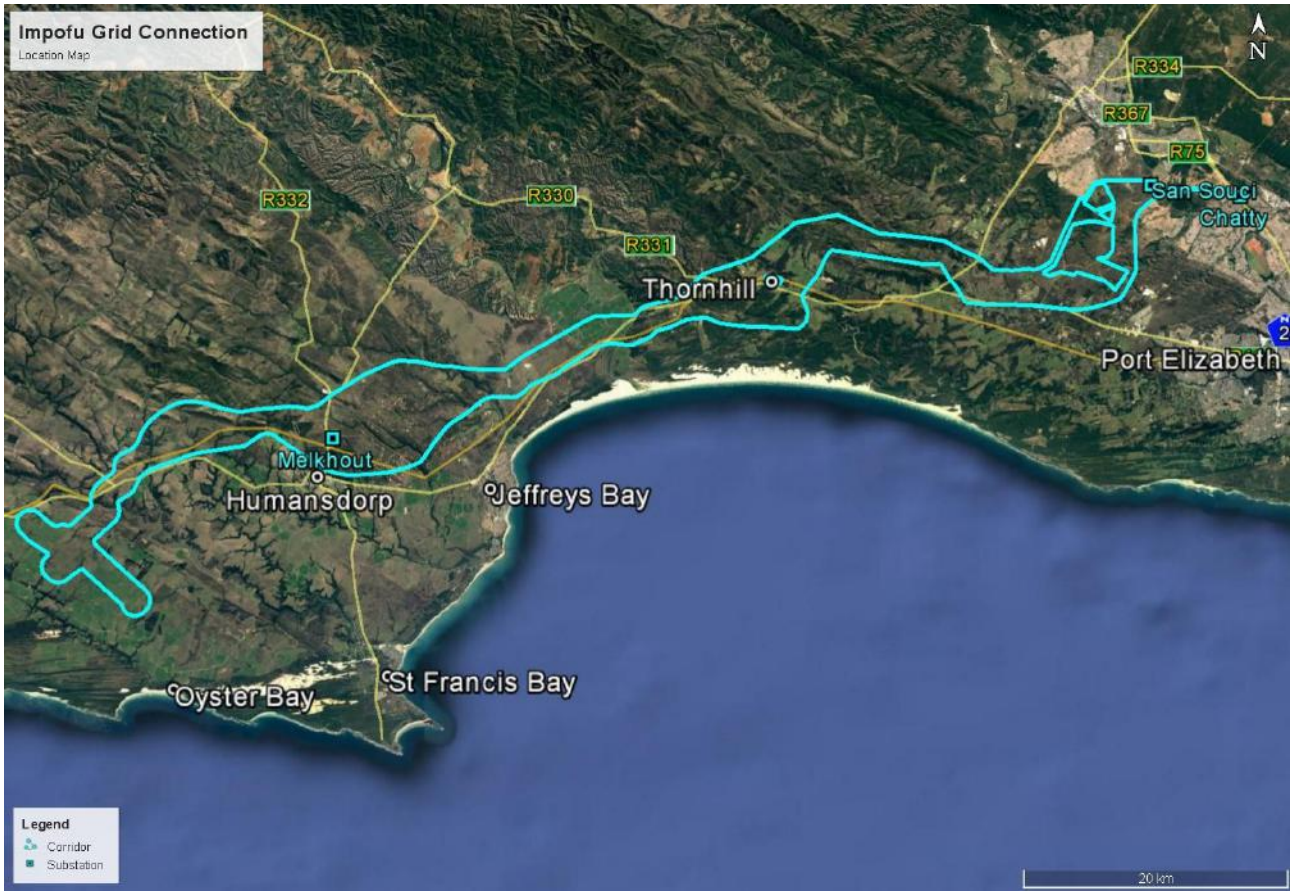

Figure 1. *Location map of the proposed power line corridor, between Oyster Bay and Port Elizabeth.*

Proposed infrastructure for the grid connection will include:

- Three switching stations associated with Impofu North, Impofu West and Impofu East Wind Farms. These are adjacent to each of the wind farm's on-site substations. These switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m^2).
- The three short 132 kV high voltage (HV) lines that link each of the three switching stations to the Impofu collector switching station;
- The single collector switching station with a total footprint of approximately 150 x 150 m (22,500 m^2);
- The entire length of the approximately 120 km and 2 km wide corridor for the 132 kV HV overhead power line, from the Impofu collector switching station to the Chatty substation in PE.

- An approximately 150 x 150 m (22,500 m^2) extension to the existing San Souci Substation on its south western side and;
- A 50 m extension to the existing Melkhout and Chatty substation footprints right around the substations as the exact entry point of the line cannot be determined at this stage.

There are six potential types of pylons that may be used for the 132 kV HV overhead lines. These are not alternative technology types, as all options may be used along the grid corridor route at some stage or another. The type of pylon and distance of the spans depend on the topography and alignment of the line. The type of pylon has no effect on the significance of agricultural impacts.

The objectives of this study are to identify and assess all potential impacts of the proposed development on agricultural resources, including soils, and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts. Johann Lanz was appointed by Aurecon South Africa (Pty) Ltd (Aurecon) as an independent specialist to conduct this Agricultural Impact Assessment.

2 TERMS OF REFERENCE

The terms of reference for the study fulfills the requirements for a soils and agricultural study as described in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011. The study applies an appropriate level of detail for the agricultural suitability and soil variation on site, which, because it is justified (see section 3.1), is less than the standardised level of detail stipulated in the above regulations.

The above requirements may be summarised as:

- Identify and assess all potential impacts (direct, indirect and cumulative) of the proposed development on soils and agricultural potential.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Determine the agricultural potential across the site.
- Determine the agricultural sensitivity to development across the site.
- Provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

The report also fulfils the requirements of Appendix 6 of the 2014 EIA Regulations, as amended (see Table 1).

3 METHODOLOGY OF STUDY

3.1 Methodology for assessing soils and agricultural potential

The aim of this assessment was to provide a general characterisation of soil and agricultural conditions along the proposed corridor. A field soil investigation was not considered necessary, primarily because a power line generally has very minimal impact on agriculture. Almost all agricultural activities can continue unhindered underneath a power line. Detailed soil information is therefore not required in order to make a thorough assessment of the agricultural impacts of this development. The existing land type data set is entirely adequate.

The most significant footprint of disturbance of the proposed development on agriculture is from the four proposed switching stations. The substations adjacent to these switching stations were part of a more detailed, field soil investigation, for the wind farms development.

This assessment is therefore primarily a desktop assessment based on information obtained from existing soil and agricultural potential data for the corridor. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the study area was also used.

The soil data on AGIS, which is presented in this report, originates from the land type survey that was conducted from the 1970s until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of at least many hundreds of years.

Soils are described in this data set according to the previous (but similar) version of the South African soil classification system, the latest version of which is documented in soil Working Group (1991). It is a two tier system of classification. Soil forms are the first level of division. All soil forms are given a South African place name. Soils are divided into forms based on the sequence of diagnostic soil horizons in the soil profile. A particular sequence, defines a particular soil form, for example A horizon – Podzol B horizon – unconsolidated material with signs of wetness is a Witfontein soil form and A horizon – E horizon – Soft Plinthic B horizon is a Longlands soil form.

Table 1: *Compliance with the Appendix 6 of the 2014 EIA Regulations (as Amended)*

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	**Addressed in this Specialist Report**
A specialist report prepared in terms of these Regulations must contain- details of-	
the specialist who prepared the report; and	Title page
the expertise of that specialist to compile a specialist report including a curriculum vitae;	Following Title page

a declaration that the specialist is independent in a form as may be specified by the competent authority;	Following CV
an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1 & 2
an indication of the quality and age of base data used for the specialist report;	Section 3.1
a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 6.5 & 7.2
the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.1
a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6.6
an identification of any areas to be avoided, including buffers;	Section 6.6
a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 6
a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Sections 6, 7 & 9
any mitigation measures for inclusion in the EMPr;	Section 8
any conditions for inclusion in the environmental authorisation;	Section 9
any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
a reasoned opinion- whether the proposed activity, activities or portions thereof should be authorised; regarding the acceptability of the proposed activity or activities and if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	 Section 9 Section 9 Section 8
a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable

3.2 Methodology for determining impact significance

All potential impacts were assessed in terms of the criteria (as per the Aurecon standard assessment methodology) on the following pages.

Numerical rating	Category	Description
Intensity		
1	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
2	Very low	Natural and/ or social functions and/ or processes are slightly altered
3	Low	Natural and/ or social functions and/ or processes are somewhat altered
5	High	Natural and/ or social functions and/ or processes are notably altered
6	Very high	Natural and/ or social functions and/ or processes are majorly altered
7	Extremely high	Natural and/ or social functions and/ or processes are severely altered
Duration		
1	Immediate	Impact will self-remedy immediately
2	Brief	Impact will not last longer than 1 year
3	Short term	Impact will last between 1 and 5 years
4	Medium term	Impact will last between 5 and 10 years
5	Long term	Impact will last between 10 and 15 years
6	On-going	Impact will last between 15 and 20 years
7	Permanent	Impact may be permanent or in excess of 20 years
Extent		
1	Very limited	Limited to specific isolated parts of the site
2	Limited	Limited to the site and its immediate surroundings
3	Local	Extending across the site and to nearby settlements
4	Municipal area	Impacts felt at a municipal level
5	Regional	Impacts felt at a regional / provincial level
6	National	Impacts felt at a national level
7	International	Impacts felt at an international level
Probability		
1	Highly unlikely / None	Expected never to happen

2	Rare / improbable	Conceivable but only in extreme circumstances and/ or might occur for this project although this has rarely been known to result elsewhere
3	Unlikely	Has not happened yet but could happen once in the lifetime of the project therefore there is a possibility that the impact will occur
4	Probable	Has occurred here or elsewhere and could therefore occur
5	Likely	The impact may occur
6	Almost certain / Highly probable	It is most likely that the impact will occur
7	Certain / Definite	There are sound scientific reasons to expect that the impact will definitely occur

Significance is determined as follows:

Consequence = type (- or +) x (intensity + duration + extent).
Significance = consequence x probability

Significance is categorised as follows:

Range		**Significance rating**
-147	-109	Major (-)
-108	-73	Moderate (-)
-72	-36	Minor (-)
-35	-1	Negligible (-)
0	0	Neutral
1	35	Negligible (+)
36	72	Minor (+)
73	108	Moderate (+)
109	147	Major (+)

The assessment of impacts includes the following additional considerations:

Confidence	
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Reversibility	
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact
Irreplaceability	
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere
High	The resource is irreparably damaged and is not represented elsewhere

4 CONSTRAINTS AND LIMITATIONS OF STUDY

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist but is done with due regard and as accurately as possible within these constraints. There are no other specific assumptions, constraints, uncertainties and gaps in knowledge for this study.

5 LEGISLATIVE REQUIREMENTS

Agricultural consent is required for power line servitudes if Eskom is not the applicant. However, if they are the applicant, Eskom is currently exempt from agricultural consent for power line servitudes. The registration of a servitude needs to be done per farm portion.

6 BASELINE ASSESSMENT OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

This section is organised in sub headings based on the requirements of an agricultural study as detailed in Section 2 of this report.

6.1 Climate and water availability

Rainfall reduces in an easterly direction along the corridor. At the western end it is given as 662 mm per annum and at the eastern end, 487 mm per annum (The World Bank Climate Change Knowledge Portal, undated), with rainfall distributed throughout the year. The average monthly distribution of rainfall is shown in Figure 2 and Figure 3.

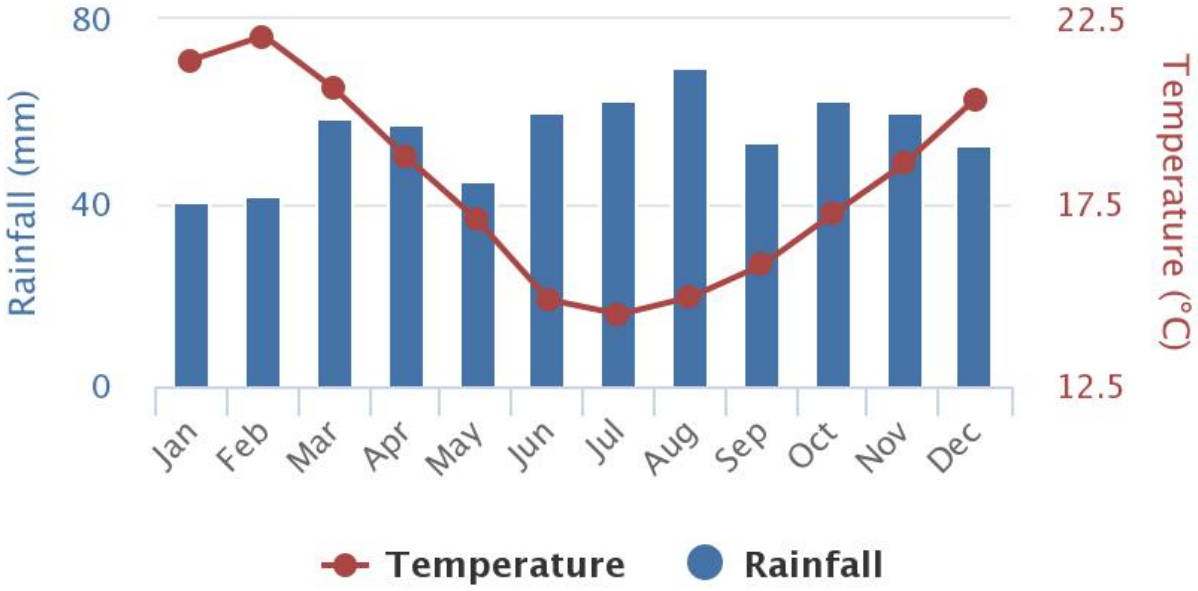

Figure 2. *Average monthly temperature and rainfall for location (-34.07, 24.59) from 1991 to 2015 (The World Bank Climate Change Knowledge Portal, undated). This location is at the western end of the corridor.*

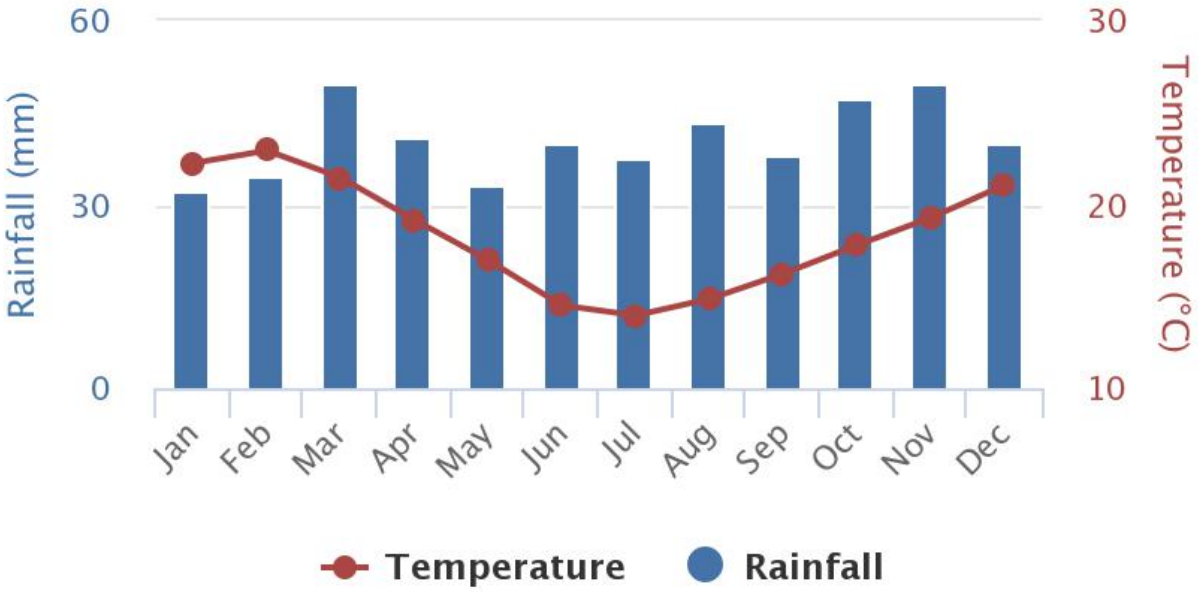

Figure 3. *Average monthly temperature and rainfall for location (-33.84, 25.52) from 1991 to 2015 (The World Bank Climate Change Knowledge Portal, undated). This location is at the eastern end of the corridor.*

There is sufficient rainfall to support viable agricultural production of dryland fodder crops for

dairy cows in the west, but dryland cultivation becomes more marginal eastwards. The Gamtoos River is a major source of irrigation. The Van Stadens River also provides some irrigation.

6.2 Terrain, topography and drainage

The corridor is predominantly on coastal plains at an altitude of around 200 metres, but it extends into the foothills of the first mountain ranges inland of the coast. It also drops altitude across the flood plains of the Gamtoos River. Slopes across the site vary from the predominantly flat coastal plains to steep mountainous terrain and gorges.

The underlying geology is Quartzitic sandstone, feldspathic sandstone and subordinate shale of the Table Mountain Group with some influence of shale and siltstone of the Bokkeveld Group, aeolianite of the Nanaga Formation and aeolian sand (Land type inventories).

The corridor crosses several large rivers as well as numerous wetland and water course features. These have all been addressed by the aquatic specialist study.

6.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed corridor crosses 25 different land types, which are in 11 different land type groups. Information about the soil conditions of the different groups is given in Table 2, and the distribution of the different land type groups along the corridor is shown in Figure 4.

Table 2: *Details of the soils within the different land type groups along the corridor.*

Land type group	Generalised soil description	Dominant soil forms
Ae	Red-yellow apedal, freely drained soils; red, high base status > 300 mm deep (no dunes)	Hutton, Oakleaf, Mispah
Ah	Red-yellow apedal, freely drained soils; red and yellow, high base status, usually < 15% clay	Hutton, Clovelly
Bb	Plinthic catena – dystrophic and/or mesotrophic yellow soils	Constantia, Fernwood, Longlands, Wasbank, Cartref
Ca	Plinthic catena: upland duplex and/or margalitic soils common; undifferentiated	Kroonstad, Longlands, Westleigh, Wasbank, Cartref
Db	Prismacutanic and/or pedocutanic diagnostic horizons dominant; b horizons not red	Kroonstad
Fa	Soils with minimal development, usually shallow, on hard or weathering rock. Glenrosa and/or mispah forms (other soils may occur); lime rare or absent in the entire landscape.	Cartref

Fc	Soils with minimal development, usually shallow, on hard or weathering rock. Glenrosa and/or mispah forms (other soils may occur); lime generally present in the entire landscape.	Cartref
Ha	Grey regic sands; regic sands dominant	Fernwood, Constantia
Hb	Grey regic sands; regic sands and other soils	Vilafontes, Clovelly
Ia	Soils with negligible to weak profile development, usually occurring on deep alluvial deposits	Oakleaf
Ib	Miscellaneous land classes, rocky areas with miscellaneous soils	Cartref, Glenrosa, Mispah

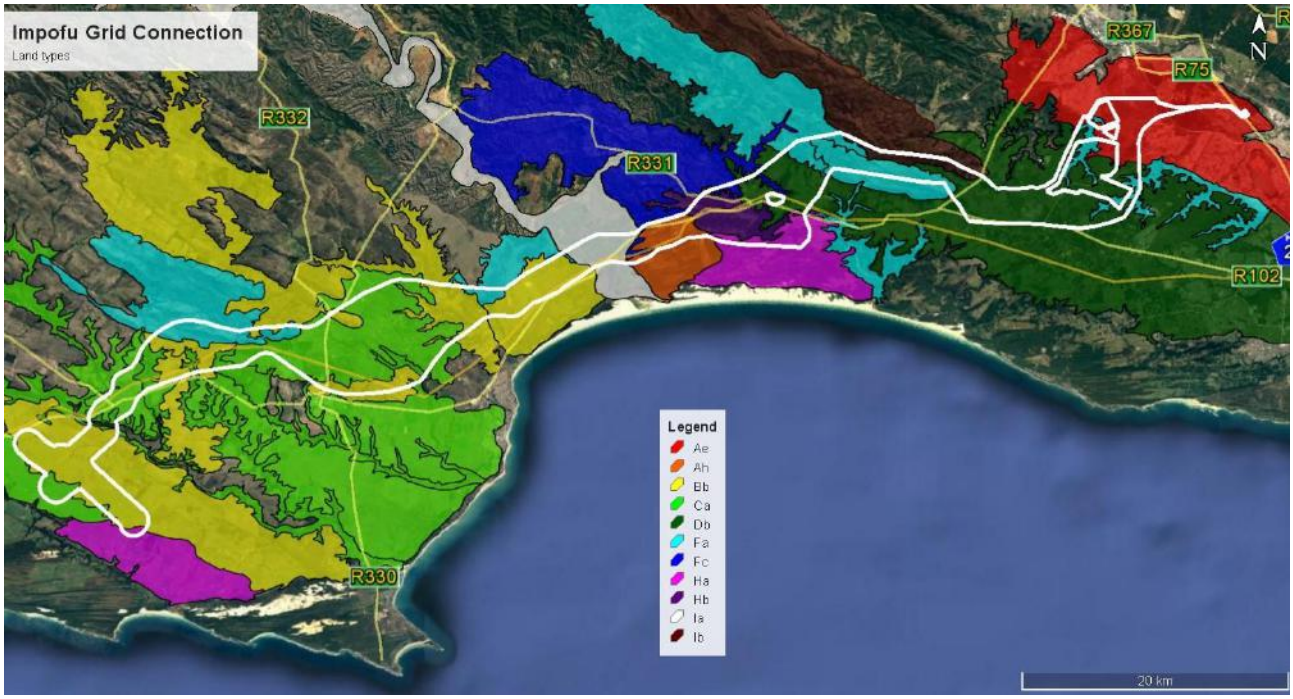

Figure 4. *Satellite map image showing the distribution of different land types along the corridor.*

6.4 Agricultural capability

Land capability is defined as the combination of soil suitability and climate factors. The land capability of the corridor, classified according to the 8 category scale described in Table 3, varies from class 3 to class 8. The distribution of land capability along the corridor is shown in Figure 5.

Table 3: *Description of land capability classes in the South African 8 category land capability system.*

Class	**Description**
1	very high potential arable land
2	high potential arable land

3	moderate potential arable land
4	marginal potential arable land
5	non-arable, moderate potential grazing land
6	non-arable, low to moderate potential grazing land
7	non-arable, low potential grazing land
8	non-utilisable wilderness land

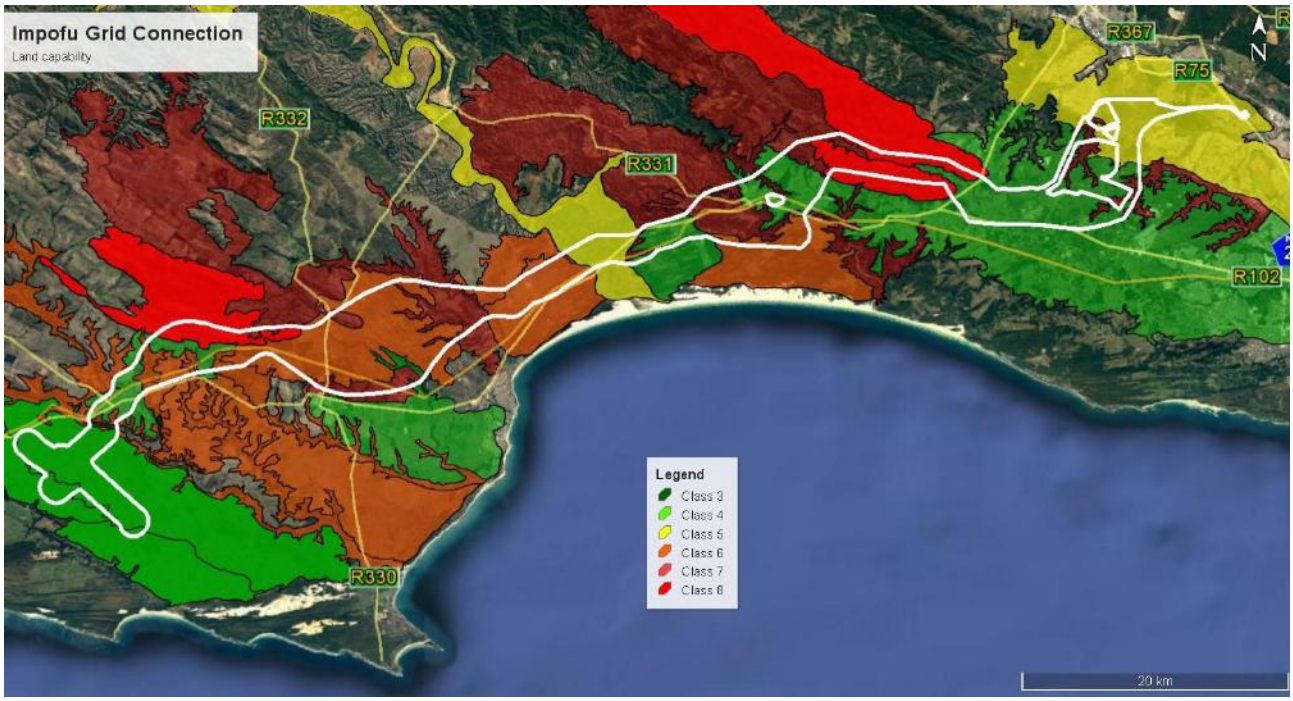

Figure 5. *Satellite map image showing the distribution of different land capabilities along the corridor.*

6.5 Land use and development on and surrounding the site

The extreme western end of the corridor supports intensive, high production dairy farms with cultivated, kikuyu based pasture plus additional fodder crops, both under irrigation, as well as non-irrigated. There is another area of intensive irrigation land on the flood plain of the Gamtoos River. The rest of the corridor is predominantly grazing land with small isolated patches of cultivation.

The grid assessment corridor contains between 500 km and 600 km of existing HV lines, as well as a multitude of medium voltage (MV) power lines.

6.6 Agricultural sensitivity

Electricity grid infrastructure generally has a negligible impact on agriculture (see section 7). The only difference in sensitivity across the corridor is for centre pivot irrigated land, because there are some issues with power lines crossing centre pivots. Power lines can cross centre

pivots, but are then required to be higher than normal to prevent electrical discharge between the irrigation infrastructure and the power lines. Also because of the impact on agriculture, no electricity pylons should be located within centre pivot lands. Centre pivot lands are therefore designated as No-Go areas. All other areas within the corridor have low agricultural sensitivity.

All the No-Go areas should be avoided by the development footprint. These are shown in Figure 6. There are no required buffers around agriculturally sensitive No-Go areas.

Figure 6. *The proposed corridor superimposed on the agricultural No-Go areas.*

7 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The focus of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or future agricultural production. Determining this must go beyond just an assessment of the agricultural capability of the proposed development land. It is important to assess the significance of the impacts, because even if land is of high agricultural capability, the impacts themselves may not compromise production and therefore may still be of low significance.

Electricity grid infrastructure has minimal impact on agriculture after construction because all agricultural activities can continue, undisturbed below power lines. Therefore, it is only the ground-based footprint (pylon bases and switching stations in this case) that have any impact, and these cover an extremely small surface area and therefore have negligible impact on agricultural production.

7.1 Identified impact

The single identified impact of the proposed Impofu grid connection is a loss of agricultural

potential on the impacted land. This can result by way of different mechanisms, of which the following occur only during construction:

- Disturbance of agricultural activities on the land at construction sites, sites of pylon erection and due to the pulling of the cables across the landscape;
- Loss of topsoil from the soil profile due to excavations; and
- Soil compaction due to heavy vehicle traffic across cultivated land.

The following additional mechanisms contribute to loss of agricultural potential during all phases of the development:

- Occupation of very small portions of land by the ground-based footprint (pylon bases and switching stations), and therefore exclusion of agricultural activities on them; and
- Erosion resulting from surface disturbance due to excavations, hardened surfaces and vehicle traffic across lands.

The impact on agriculture is assessed for the construction, operation and decommissioning phases, in table format, below.

The choice of pylon types has no meaningful influence on the significance of agricultural impacts.

Project phase	Construction			
Impact	Loss of agricultural potential			
Description of impact				
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	Avoidance of agriculturally sensitive areas. Effective communication with farmers about timing and location of construction activities. Return topsoil to the surface of all backfilled excavations. Ensure run-off control where surface disturbance could cause erosion. Loosen compacted soils under vehicle tracks on cultivated lands by ripping.			
Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Very low	Natural and/ or social functions and/ or processes are slightly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	Negligible - negative		Negligible - negative	
Comment on significance				
Cumulative impacts	Negligible due to the negligible impact of the individual projects.			

Project phase	Operation			
Impact	Loss of agricultural potential			
Description of impact				
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	Implement erosion control if any erosion occurs			
Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Negligible	Natural and/ or social functions and/ or processes are negligibly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	Negligible - negative		Negligible - negative	
Comment on significance				
Cumulative impacts	Negligible due to the negligible impact of the individual projects.			

Project phase	Decommissioning			
Impact	Loss of agricultural potential			
Description of impact				
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	Effective communication with farmers about timing and location of decommissioning activities. Return topsoil to the surface of all backfilled excavations. Ensure run-off control where surface disturbance could cause erosion. Loosen compacted soils under vehicle tracks on cultivated lands by ripping.			
Assessment	Without mitigation		With mitigation	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Negligible	Natural and/ or social functions and/ or processes are negligibly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	Negligible - negative		Negligible - negative	
Comment on significance				
Cumulative impacts	Negligible due to the negligible impact of the individual projects.			

7.2 Cumulative impact

The cumulative assessment considers proposed future overhead power lines that have a valid Environmental Authorisation. These are listed in Table 4. All existing power lines are considered as part of the baseline conditions (and therefore have informed the assessment of impacts in Section 7.1, above).

Table 4: *Overhead power lines considered in the assessment of cumulative impacts.*

Project	Overhead power line	Length	Status
Melkhout-Kromrivier	132 kV line from Melkhout substation to Kromrivier substation, Eastern Cape – Upgrade existing line to a double circuit line to accommodate Oyster Bay	± 26 km	EA issued, out to tender
Oyster Bay Wind Energy Facility grid connection	132 kV line from Oyster Bay Wind Energy Facility to Melkhout substation	±4.3 km	EA issued; Construction to commence in 2018
Dieprivier-Kareedouw	Construction of 132 kV distribution lines from Dieprivier to Kareedouw, Sarah Baartman District Municipality (formerly Cacadu District Municipality)	±36 km	Amendment authorised in May 2017

As discussed above, the agricultural impact of all power lines is negligible if centre pivots are avoided, because all other agricultural activities can continue unhindered beneath power lines. The cumulative impact on agriculture, taking the above three power lines into account, is therefore also negligible. Because of the negligible impacts, the agricultural environment can accommodate much more electricity grid infrastructure before acceptable levels of change are exceeded.

7.3 Comparative assessment of alternatives

The No-Go alternative is the only one assessed because all other alternatives have been screened out during the EIA process.

The No-Go alternative anticipates changes to the agricultural environment that would occur in the absence of the proposed development. No significant changes are anticipated in the No-Go scenario, compared to the negligible, negative impacts anticipated for the development. The No-Go alternative is therefore assessed as negligible.

8 INPUTS INTO THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

The following mitigation measures are proposed for inclusion in the EMPr:

Design phase mitigation:

- Avoid all No-Go areas.

Construction phase mitigation

- Effective communication with farmers about timing and location of construction activities in order to minimise disturbance to their agricultural activities.
- Return topsoil to the surface of all backfilled excavations.
- Ensure run-off control where surface disturbance could cause erosion.
- Loosen compacted soils under vehicle tracks on cultivated lands by ripping.

Monitoring recommendations to ensure effective mitigation are given below. All monitoring should be done by a suitably qualified and experienced Environmental Control Officer.

Soil erosion

Mitigation: Target / Objective	To have no erosion on and downstream of the site.
Monitoring	Include site inspection in environmental performance/audit reporting that inspects all disturbed surface areas and identifies whether, on cessation of disturbance, they pose an erosion risk or not. Preventative run-off control must be implemented at all places

	that are identified as posing an erosion risk. The effectiveness of the run-off control system must be monitored during and upon completion of construction, and on an ongoing basis during the operational phase. The entire length of disturbed area must be monitored before environmental closure and a record made of whether any erosion has occurred or not. Corrective action must be swiftly implemented to the run-off control system in the event of any erosion occurring.

Topsoil

Mitigation: Target / Objective	Ensure effective topsoil covering on all backfilled excavations.
Monitoring	Keep a record with photographic evidence and GPS co-ordinates of all backfilled excavations showing returned topsoil at the soil surface.

Soil compaction

Mitigation: Target / Objective	Ensure that no heavy vehicle track compaction remains across cultivated lands.
Monitoring	Keep a record with GPS co-ordinates of all cultivated land that is crossed by the power lines. Record date of the ripping of heavy vehicle tracks, after power line erection, that cross cultivated land.

9 CONCLUSIONS

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to a loss of agricultural production from such land. This assessment has found that the proposed development has negligible agricultural impact. This is because, after construction, all agricultural activities can continue, undisturbed below power lines. It is only the ground-based footprint (pylon bases and substations) that have any impact, and these cover an extremely small surface area and therefore have negligible impact on agricultural production.

Centre pivot irrigation lands have been designated as No-Go areas of very high sensitivity and must be avoided by the footprint of the development. There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

The conclusion of this assessment is that, from an agricultural perspective, the proposed development should be authorised, because it has negligible agricultural impact.

10 **REFERENCES**

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

The World Bank Climate Change Knowledge Portal available at http://sdwebx.worldbank.org/climateportal/

Annexure D5

Socio-Economic

DRAFT SOCIO-ECONOMIC ASSESSMENT FOR THE BASIC ENVIRONMENTAL ASSESSMENT OF THE:

Proposed Grid Connection for the Impofu Wind Farms

August 2019

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Requirement	Description
Document Title	Draft Socio-Economic Assessment for the Basic Environmental Assessment of the: Proposed Grid Connection for the Impofu Wind Farms
Client Name and Address	*Aurecon South Africa (Pty) Ltd* Aurecon Centre 1 Century City Drive Waterford Precinct Century City Cape Town 7441 PO Box 494 Cape Town 8000 South Africa
Status	Draft v8
Issue Date	21 August 2019
Author (s)	Matthew Keeley (Lead Economist) matthew@urban-econ.com Thomas Parsons (Project Economist) thomas@urban-econ.com Elena Broughton (Moderator) elena@urban-econ.com *Detailed curriculum vitae of the author(s) can be found in Annexure 1*
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Legal Requirements

Table 1 indicates the page references for the relevant requirements of the specialist reports (socio-economic) per EIA Regulations GN R. 982, as amended (4 Dec 2014).

Table 1: EIA Regulations – Specialist Reports

Section	Requirement	Page #
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of-	
(i)	the specialist who prepared the report; and	2
(ii)	the expertise of that specialist to compile a specialist report including a curriculum vitae;	69
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	90
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	10
(cA)	an indication of the quality and age of the base data used for the specialist report;	17
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	38
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	-
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	18; 41
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	40
(g)	an identification of any areas to be avoided, including buffers;	40
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	40
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	16
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	44
(k)	any mitigation measures for inclusion in the EMPr;	44
(l)	any conditions for inclusion in the environmental authorisation;	44
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	44
(n)	a reasoned opinion-	
(i)	whether the proposed activity or portions thereof should be authorised; and	65
(iA)	regarding the acceptability of the proposed activity or activities; and	65
(ii)	if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures	65

	that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	16
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	-
(q)	any other information requested by the competent authority.	

Contents

Executive Summary

Aurecon South Africa (Pty) Ltd, has been appointed by Red Cap Impofu (Pty) Ltd to undertake the Environmental Impact Assessment (EIA) process for the Impofu Wind Farms, and the Basic Assessment (BA) process for the associated Grid Connection Project, in the Eastern Cape, South Africa. These services are to ensure compliance with the relevant environmental legislation, and are to include applications to various Competent Authorities for environmental authorisations, licenses and permits.

Urban-Econ Development Economists was appointed by Red Cap Impofu (Pty) Ltd to undertake a specialist Socio-Economic Impact Assessment as part of the BA process for the Grid Connection Project. The terms of reference for this study includes the identification of potential key social and economic issues, an assessment of their impacts, and proposals on any mitigation measures that may be required to address them. This report contains the findings of this initial assessment. During the Public Participation Process for the initial DBAR, part of the corridor was re-aligned after interaction with I&APs and this revision has incorporated the change into this report. Inputs received during the Public Participation Process for the revised DBAR will be used to update and finalise this report.

The proposed grid connection route begins in the Koukamma Local Municipality[1] and runs through both the Kouga Local Municipality and the Nelson Mandela Bay Metropolitan Municipality (NMBM). The proposed grid connection route is approximately 120 kilometres in length, starting at the proposed Impofu Wind Farms collector switching station and terminating at the Chatty substation in the NMBM.

Given the length of the proposed grid connection, the type of land use on individual properties varies notably. A notable proportion of the properties along the route are engaged in cattle and sheep farming. In addition, the route passes through, or in close proximity to, three farms dedicated to chicken/egg production. As the proposed route crosses the Gamtoos River, it passes through a farm engaged in dairy production. Other types of land use activities along the route include natural game and wildlife (with a very small amount of cattle grazing) and a seedling/plant nursery. The closer the route gets to the NMBM, the more the land use takes on urban characteristics as it transforms to residential small holdings and residential developments. Just prior to the grid connection terminating at the Chatty substation, it passes through the residential area of KwaDwesi in the NMBM.

The Kouga Local Municipality had a total estimated population of 95 270 in 2016, accounting for 21.4% of the Sarah Baartman District's population (Quantec, 2016). In comparison, the NMBM had a total population of 1.1 million people in 2016.

From an economic output perspective, the Kouga Local Municipality contributed approximately 27.1% of the Sarah Baartman District Municipality's GDP in 2016 (Quantec, 2016). The largest sectors within the municipality in terms of GDP contribution in 2016 were finance and business services (26.4%), trade (21.3%), general government (16.6%) and manufacturing (11.2%). While only contributing a small proportion of GDP, the agricultural sector in the municipality is an important employer, employing 8 422 or 22.1% of the working age population. The tourism industry within the municipality is well established and characterised by a range of eco-tourism and adventure activities.

[1] Given the small size of the Koukamma Local Municipality traversed by the proposed grid connection, the length of the section (+/- 8 km) relative to the rest of the grid route +/- 120 km, and the limited number of people that are likely to be affected by this section of the grid, the following report does not consider the policy planning environment, nor the socio-economic context for the municipality.

The NMBM economy was four times the size of the Sarah Baartman District's economy, contributing approximately 38.9% of the province's total GDP in 2016. The largest sectors in terms of GDP contribution during 2016 were finance and business services (23.3%), manufacturing (21.3%), trade (18.9%) and general government (15.4%). Relatively smaller contributions were made by the agricultural (0.5%), utilities (0.8%), and construction (3.2%) sectors.

In 2016, the unemployment rate within the Kouga Local Municipality was estimated at 13.7%, which was below the district figure (19.0%), while 30.1% of the population is considered to be not economically active. The latter is made of scholars/students, pensioners, and those who could not find work.

Unemployment within the NMBM was estimated at 28.7% in 2016, which was just below the Eastern Cape average of 33.1%. A further 34.9% of the working age population was considered to be not economically active. Despite these figures, the NMBM had a labour force participation rate of 65.1% in 2016, well above that of the Eastern Cape (47.0%)

The investigation and assessment of the socio-economic impacts will be informed by Guidelines for Involving Social Specialists in EIA Processes adopted by the Department of Environmental Affairs and Development Planning in the Western Cape (Barbour, 2007). These guidelines have been endorsed at a national level. This approach will include:

- Identification of key interested and affected parties
- Identification and assessment of key socio-economic issues based on feedback from interested and affected parties
- Recommendations regarding mitigation/optimization and management measures to be implemented

The key conclusions of this study are as follows:

- The establishment of the grid connection project is supported at a national and provincial level as evident in policy and planning documents.
- The project will facilitate the connection of the Impofu Wind Farms to the national grid thereby contributing to the Renewable Energy Independent Power Producer Procurement Programme (REI4P). As part of the programme, the following commitments have been made across the seven bid windows:
    - Procure 6 422 MW of electricity from 112 RE Independent Power Producers (IPPs) of which 17 are in the Eastern Cape;
    - Attract investment (equity and debt) to the value of R201.8 billion, of which R48.8 billion (24%) is foreign investment;
    - Create 31 207 job years[2] for South African citizens;
    - Contribute as of 2017, R357.4 million to socio-economic development;
    - Contribute as of 2017, R115.2 million to enterprise development;
    - Reduce carbon emissions by 15.4 MtonCO^2.
- The grid connection project appears to be compatible with the economic development vision of the Sarah Baartman District Municipality, Kouga Local Municipality and the NMBM.
- The potential positive impacts associated with the construction phase of the proposed grid connection project relate to GDP growth, local and preferential procurement (BBBEE, women-owned vendors, etc.), enterprise development and the creation of employment opportunities. The potential negative impacts are linked to the presence of migrant construction workers on

[2] The equivalent of a full-time employment opportunity for one person for one year.

the site and in the area. In addition, because of visual impacts, there may be a resultant impact on surrounding property values. An increase in crime levels is also possible without mitigation measures in place.

- The potential positive impacts associated with the operational phase relate to GDP growth, local and preferential procurement (BBBEE, women-owned vendors etc.), enterprise development, the creation of employment opportunities and the promotion of clean and renewable energy. The potential negative impacts are linked to the influx of migrant labour and the perceived adverse health effects of powerlines.

Based on this study, the information available suggests that, from a socio-economic perspective, that proposed development is acceptable and that the positive socio-economic impacts, will far outweigh the potential negligible negative impacts. The project should thus be authorised. No conditions are recommended for authorisation from a socio-economic perspective.

Chapter 1 Introduction

Aurecon South Africa (Pty) Ltd, (hereafter referred to as Aurecon) has been appointed by Red Cap Energy (Pty) Ltd (hereafter referred to as Red Cap) to undertake the Environmental Impact Assessment (EIA) process for the Impofu Wind Farms, and the Basic Assessment (BA) process for the associated Grid Connection Project, in the Eastern Cape, South Africa. These services are to ensure compliance with the relevant environmental legislation, and are to include applications to various Competent Authorities for environmental authorisations, licenses and permits.

Urban-Econ Development Economists was appointed by Red Cap Impofu (Pty) Ltd to undertake a specialist Socio-Economic Impact Assessment as part of the BA process for the Grid Connection Project. The terms of reference for this study includes the identification of potential key social and economic issues, an assessment of their impacts, and proposals on any mitigation measures that may be required to address them. During the Public Participation Process for the initial DBAR, part of the corridor was re-aligned after interaction with I&APs and this revision has incorporated this change into this report. Inputs received during the Public Participation Process for the revised DBAR will be used to update and finalise this report.

1.1 Terms of Reference

The terms of reference for the basic assessment report require:

- A focussed and relevant description of all baseline characteristics and conditions of the receiving environment (e.g.: site and/or surrounding land uses including urban and agricultural areas as applicable) in relation to the Specialist's field of interest, based on all relevant available data, reports and maps, and information obtained from any field work investigations undertaken to date (to be acquired by the Specialist).
- A detailed evaluation of the predicted impacts of the project on the receiving environment, or of the receiving environment on the project as per the methodology to be prescribed by Aurecon, that uses the criteria of extent, duration and intensity to quantify the significance of the potential impact. The evaluation of impacts should include:
    - An assessment of impacts for all phases of the life-cycle of the project, namely construction, operation, and decommissioning phases, as well as the direct and indirect impacts;
    - An assessment of the probability of each impact occurring, the reversibility of each impact and the level of confidence in each potential impact;
    - An assessment of the significance of each impact before and after mitigation;
    - The identification of any residual risks that will remain after implementation of design and planning mitigation; and
    - An assessment of the No-Go option
- Assess the grid corridor as a whole and not per section.
- Consider and evaluate the cumulative impacts in terms of the current and proposed activities in the area.
- Recommendations to avoid negative impacts. Where this will not be possible then provide feasible and practical mitigation, management and/or monitoring options to reduce negative impacts and enhance positive impacts that can be included in the Environmental Management Programme.
- Identify any additional measures to ensure that the project contributes towards sustainability goals or provides a positive contribution to the environment.

- Where relevant, recommendations and instructions regarding any additional authorisation, permitting or licensing procedures, or any other requirements pertaining to legislation and policies relevant to the Specialist's field of interest.
- An outline of recommended measures to manage residual impacts (i.e. impacts that remain after optimisation of design and planning) for the construction, operational and decommissioning phases with an indication of the following:
    - Who should be responsible for implementation of mitigation;
    - Details of frequency of implementation of each measure; and
    - Envisaged outcome of each action.
- Recommendation of a monitoring plan for the relevant aspects associated with the specialist's field of expertise, if required. In your recommendation, provide an indication of what the monitoring plan should comprise, for example:
    - Aspects to be measured;
    - Responsible person/body;
    - Frequency of monitoring actions;
    - Standards to be met; and
    - Reporting requirements.
- The conditions, in respect of the Specialist's field of interest, for inclusion in the Environmental Authorisation.
- A reasoned opinion as to whether the proposed activity, or portions of the activity should be authorised.

1.2 Project Description, Location and Surrounding Land Use

1.2.1 Grid Connection Route

To evacuate the power generated by the proposed Impofu North, Impofu West and Impofu East Wind Farms, a grid connection is required in the form of an approximately 120 km length 132 kV overhead power line between the wind farm project area and Port Elizabeth (PE).

The transmission line includes three short separate 132 kV high voltage (HV) overhead power lines that emanate from the proposed Impofu North, Impofu West and Impofu East onsite switching stations. The three short separate 132 kV HV lines link each of the three switching stations on the wind farms to a combined central "collector switching station" (Impofu collector switching station). The role of the collector switching station is to consolidate the three power lines from the wind farms into one, such that a single line continues from here onwards. This will also allow Eskom more control over the management of the wind farms' connections into the national grid.

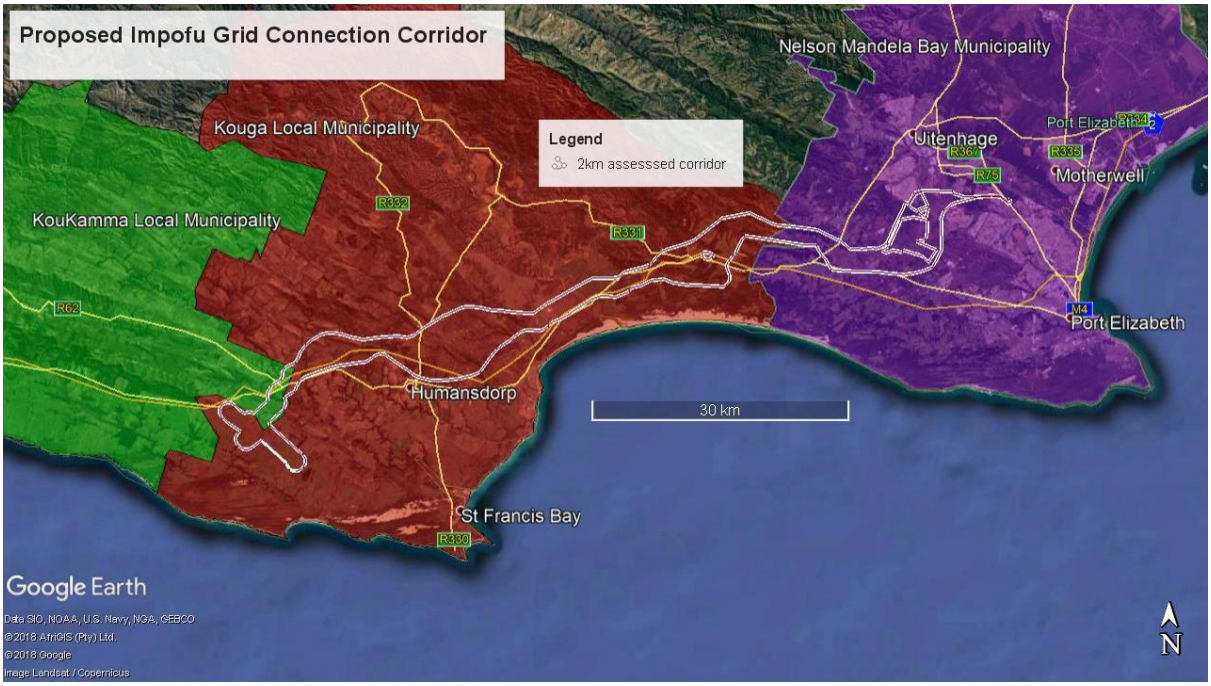
From the Impofu collector switching station, a single 132 kV HV power line will continue towards Port Elizabeth via the Eskom Melkhout Substation. Due to the complex nature of navigating linear infrastructure, this assessment considers that a 31 m servitude will be required for the construction of the powerline, which will occur within an area demarcated by a 2 km corridor. Within this corridor, a single 132 kV HV power line continues to the existing Eskom Melkhout substation, located to the north of the N2 and north of the town of Humansdorp. Thereafter, the line continues through or around the Jeffrey's Bay Wind Farm, across the Mondplaas area and Gamtoos River valley (roughly following the existing Eskom 132 kV lines that come down from Port Elizabeth to Melkhout) towards Thornhill. The corridor then passes through the Thornhill area (but excludes the town itself) and veers north east and then east around the back of the Ladies Slipper mountain area. From there, the power line corridor dips south east toward the St Alban's correctional facility, continuing around the southernmost section of

the Hopewell Conservation Estate, and connects into the Nelson Mandela Bay Metropolitan Municipality (NMBM) Sans Souci substation. From Sans Souci substation the line then continues to the NMBM Chatty substation where the grid connection terminates.

This proposed powerline will improve the evacuation capacity as well as improve the overall stability and reliability of the Eskom and NMBM networks. The ownership of the whole grid connection, including the wind farm switching stations, the HV line to the collector switching stations, the collector switching station and the HV line back to PE all will be transferred to Eskom once construction is complete.

From west to east, the line will start in the Koukamma Local Municipality passing through a small portion of the municipal area before running into the through the Kouga Local Municipality (both falling within the Sarah Baartman District Municipality) and will terminate in NMBM.

Figure 1.1: Proposed Grid Connection Route

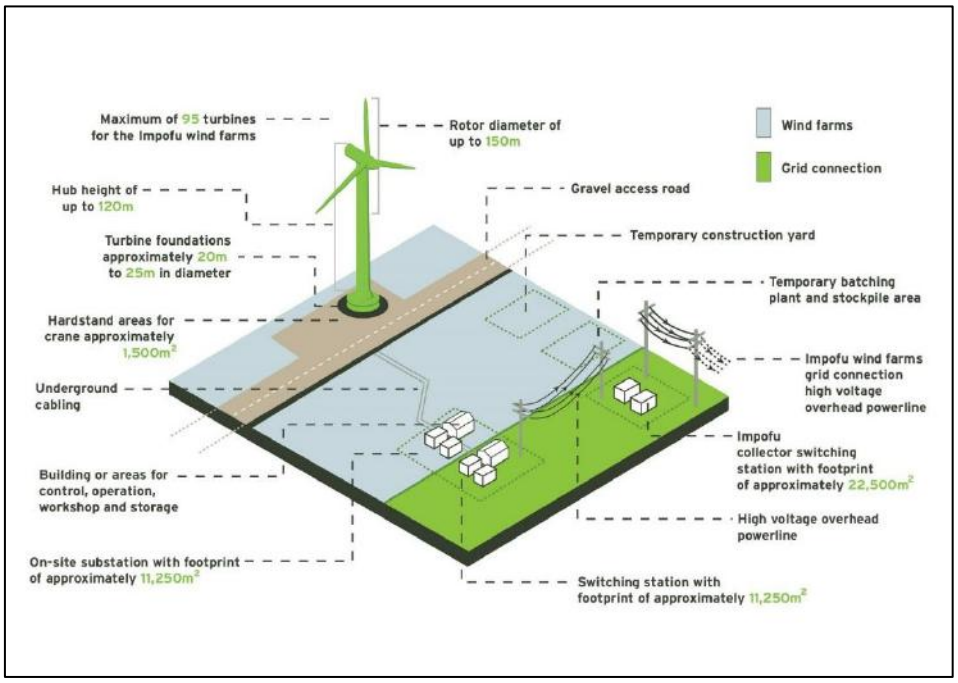


1.2.2 Substations and Switching Stations

Each wind farm application will include an on-site substation with transformer. The transformer will transform / convert the power received from the turbines from either above ground or underground medium voltage (MV) lines (33 kV or lower) to HV (132 kV). The three on-site substations are part of the wind farm applications. Adjacent to each substation will be a switching station. **These associated switching stations are part of the grid connection application**.

The substation areas will include all the standard substation electrical equipment / components, such as transformers and bus bars and will also house control, operational, workshop and storage buildings / areas. Since the three on-site substations will form part of the wind farm, and the switching station component will be owned by Eskom, there will be a physical barrier between the two in the form of a fence. The Eskom switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m^2). The single collector switching station will have a total footprint of approximately 150 x 150 m (22,500 m^2). An illustration of the project components is presented in Figure 1.2 for ease of reference.

Figure 1.2: Typical wind farm layout and associated grid connection (green area)



Source: Aurecon (2018)

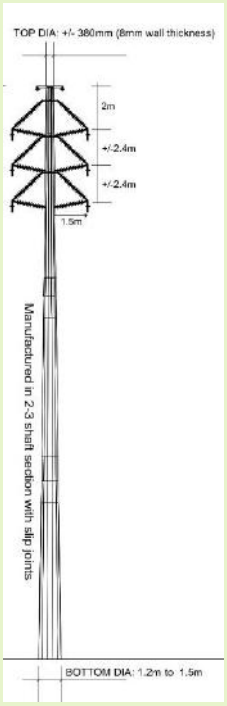
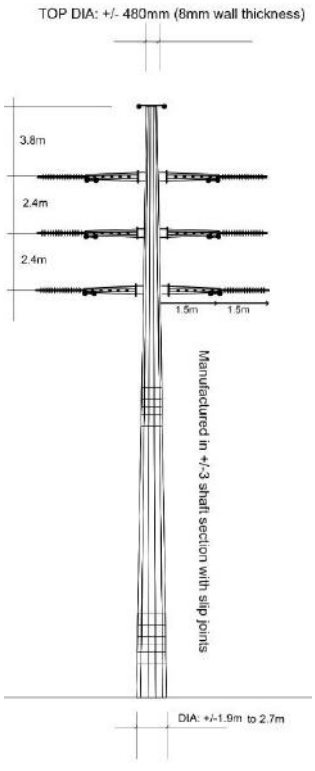
1.2.3 Pylons

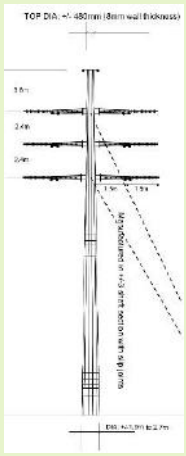
There are six potential types of pylons that may be used for the 132 kV high voltage overhead line. The descriptions are included in Table 1.1 below. The spans (distance between pylons) on the monopole structure (without stays) will be on average 260 m, whilst the spans between the triple poles in the case of valley crossings may be up to 800 m. The type of pylon and distance of the spans depend on the topography and alignment of the line.

At present, no decision has been made on the preferred pylon type to be used along the grid connection route. The socio-economic impact assessment thus considers all six pylon types. The different pylon types are likely to have different cost implications. As such the effect on GDP during construction (see Section 6.2.1), will be higher/lower depending on the pylon selected.

It is unlikely that the lattice structure (pylon type 6) will be used unless specifically requested through consultation with the affected landowner.

Table 1.1: Pylon types and descriptions

	Pylon Type	Description and purpose	Graphic
1.	Monopole intermediate Double Circuit with Twin Tern Conductors	Self-supporting galvanised steel Suspension structure with no stays/anchors. For general use as intermediate structures between turning/angle points. Height: 26-32 m Base diameter: 1.2m to 1.5m	 
2.	Monopole strain (0º-30º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with no stays/anchors. For general use up to 30º turning/angle points Height: 26-32 m Base diameter: 1.9 m to 2.7 m	 . 

	Pylon Type	Description and purpose	Graphic
3.	Monopole strain (30º-90º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with additional stays/anchors. For general use between 30º to 90º at turning/angle points. Height: 26-32 m Base diameter: 1.9 m to 2.7 m 5 to 7 stays/anchors	
4.	Monopole strain (30º-90º angle) 2 x Single Circuit Twin Tern Conductor	2 x Strain Angle galvanised steel structure with stays/anchors. Two single circuit monopoles installed 10 m apart to accommodate a twin Tern Conductor attachment each. For general use between 30º to 90at turning/angle points and where it is acceptable for the landowner. Height: 20 m – 24 m 5 to 7 stays/anchors	
5.	Triple pole structure. 2 x Single circuit with Twin Tern Conductor	For long spans (>350 m to 500 m) across valleys and rivers. Strain structure with three single monopoles per circuit. 5-9 stays per triple pole structure depending on angle configuration. Typical 18 to 16 m in length. In a double circuit configuration, it will be a triple pole structure per circuit place at 10 m-15 m apart	

	Pylon Type	Description and purpose	Graphic
6.	Strain Lattice Tower (247 type) for Double Circuit Twin Tern Conductor	For very long spans (>500 m) across valleys and rivers. Lattice structure with four legs Height: 28 m to 32 m Base of the tower with 4 legs in general 15 m x 15 m area.	

1.3 Assumptions and Limitations

1.3.1 Assumptions

- **Identification of prosed route for the grid connection**
  The identification of the proposed route for the grid connection was informed by Aurecon's Multi-Criteria Decision-Making Model (MCDM), as well as engagement with relevant landowners to obtain servitude rights. The MCDM process requires that specialists and technical experts identify pre-selected alternatives and rate these against relevant biophysical, social and technical criteria. The specialists and technical experts then rate the alternatives based on their judgment on which alternative is preferred, informed by data obtained from fieldwork and existing baseline information.

- **Consultation with affected communities**
  At this stage in the process there has been limited interaction by the socio-economic consultant with communities and other affected parties with the study area. The estimated number of people that will be directly affected by the proposed grid connection route has thus not yet been determined. The authors, however, have worked on other wind energy projects and associated grid connection routes within the Eastern Cape (e.g. 132 kV Powerline in Walmer in the NMBM, Spitskop Wind Energy Facility, Inyanda Roodepoort Wind Farm, Plan-8 Infinite Energy Grahamstown Wind Energy Facility). It is assumed that issues identified on those projects are likely to be similar to those for the proposed Impofu Wind Farms Grid Connection. Detailed consultation will be undertaken during the assessment stage of the BA.

- **Construction and operational costs**
  A detailed costing of the proposed grid connection and associated infrastructure has not yet been undertaken. As such, the potential impacts associated with the construction and operational phases of the grid connection on the local, provincial and national economy cannot be accurately estimated. This phase of the project therefore makes several assumptions about the potential capital and operational costs. These assumptions include:

    - A capital expenditure cost of R2 million per kilometre is utilised as a general guideline figure based on input from the developer. Given the estimated length of the proposed grid connection route (+/- 120 kilometres) – this equates to an estimated capital cost for the proposed rid connection of R240 million.
    - Annual operational expenditure is estimated at R115 000 per kilometre for the first five years as a general guideline based on SRK (2016). This equates to a total annual operational cost for the entire route of over R13.8 million. An additional R10.7 million may be required in order to address routine maintenance and/or component replacements after this five-year period (SRK, 2016).
    - All employment figures for the capital and operational phases of the proposed development are estimated based on sectoral employment multipliers as generated by the 2004 Eastern Cape Social Accounting Matrix (SAM) adjusted to 2017 prices.

- **Consideration of the Koukamma Local Municipality**
  The proposed grid connection route passes through a very small section of the Koukamma Local Municipality's south eastern most area. This area is extremely sparsely populated, suggesting that it is highly unlikely that a significant number of Koukamma residents will be affected by the proposed grid connection.

  Given the small size of the area traversed by the proposed grid connection, the length of the section (+/- 8 km) relative to the rest of the grid route +/- 120 km, and the limited number of people that are likely to be effected by this section of the grid, the following report does not consider the policy planning environment, nor the socio-economic context of the Koukamma Local Municipality.

1.3.2 Limitations

- **Route layout**
  The report is based on a project description taken from a preliminary route layout for the proposed grid connection, which will fall within a demarcated two-kilometre corridor. The specific grid route has not yet been finalised and is likely to undergo minor refinements before it can be regarded as definitive.

- **Statistical Data**
  The most recently available demographic statics published by StatsSA are from the 2016 Community Survey. These statistics however are only available down to a local municipal level. In order to obtain demographic statistics for smaller administrative boundaries (e.g. wards) which more closely align to the boundaries of the proposed wind energy facility site it would be necessary to utilise 2011 Census figures.

  Given that the 2011 data is dated, and the corresponding Kouga and NMB Local Municipalities ward boundaries have changed notably between 2011 and 2016, it is felt that the more recent

statistics from the 2016 Community Survey should be utilised. In utilising these statistics however, it is acknowledged that some of their descriptive power will be reduced given the size of the administrative area being considered.

- **Preliminary findings**
  Interaction with relevant stakeholders and I&APs based on an initial DBAR was undertaken as part of the Public Participation Process. This resulted in the alignment of the corridor being revised and the DBAR being updated accordingly. Input received during the Public Participation Process for the revised DBAR will be used to update and finalise this report.

1.4 Methodology and Approach to Study

The approach to the study is based on the Western Cape Department of Environmental Affairs and Development (DEA&DP) Planning Guidelines for Involving Social Specialists in EIA Processes (Barbour, 2017). The Guidelines are based on accepted international best practice guidelines, including the Guidelines and Principles for Social Impact Assessment[3]. This BA study involved:

- A review of demographic data from the 2016 Community Survey and other available sources
- A review of relevant planning and policy frameworks for the Kouga Local Municipality and the NMBM
- A review of information from similar studies (e.g. 132 kV Powerline in Walmer in the NMB, Spitskop Wind Energy Facility, Inyanda Roodepoort Wind Farm, Plan-8 Infinite Energy Grahamstown Wind Energy Facility)
- A literature review of socio-economic issues associated with grid connections (e.g. Colwell & Foley, 1979; Colwell, 1990; Rigdon, 1991; Delaney & Timmons, 1992; Sims & Dent, 2005; Des Rosiers, 2002; Chalmers & Voorvardt, 2009; EirGrid Plc, 2016)
- A desktop of review of tourist accommodation and attractions within the area based on secondary research (e.g. DEDEAT Tourism Database, Google Maps, Airbnb etc.)

The identification of potential socio-economic issues associated with the proposed grid connection is based on a review of relevant documentation, experience with similar projects, and some familiarity with the study area.

1.5 Report Structure

The report is divided into seven chapters, namely:

- Chapter 1: Introduction
- Chapter 2: Policy and Planning Environment
- Chapter 3: Overview of the Study Area
- Chapter 4: Description of the key socio-economic issues that need to be assessed during the BA phase. This section also includes information that will be required from the developer to facilitate the assessment.
- Chapter 5: Alternatives
- Chapter 6: Assessment of the Significance of Impacts

[3] Source: INTER-ORGANIZATIONAL COMMITTEE ON GUIDELINES AND PRINCIPLES FOR SOCIAL IMPACT ASSESSMENT, 2003. Principles and guidelines for social impact assessment in the USA. **Impact Assessment and Project Appraisal.** 21,3: 231–250.

Chapter 2 Policy and Planning Environment

The policy and planning environment outlines the key legislation and policies, at both a national, provincial and local level, that are applicable to the proposed grid connection as associated wind energy facility development. A review of key planning and policy documents is an integral component of the overall socio-economic impact assessment as it ensures that the proposed development conforms to the relevant spatial principles and guidelines contained in the relevant legislation and planning documents. Failure of the development to comply with these standards means that it would not be supported in its current form.

The following section provides an overview of the most significant policy documents relevant to the proposed grid connection for the Impofu Wind Farms, namely:

- The White Paper on Renewable Energy (2003)
- The National Energy Act (2008)
- The Integrated Electricity Resource Plan (IRP) 2010 – 2030 (2011)
- National Development Plan (NDP) (2011)
- Eastern Cape Sustainable Energy Strategy (2011)
- Eastern Cape Provincial Economic Strategy (PEDS) (2016)
- Sarah Baartman Integrated Development Plan (IDP) (2017)
- Sarah Baartman Spatial Development Framework (SDF) (2013)
- Kouga IDP (2017)
- Kouga SDF (2015)
- NMBM IDP (2017)
- NMBM SDF (2015)
- Renewable Energy Independent Power Producer Procurement Programme (REI4P)

2.1 National White Paper on Renewable Energy (2003)

This White Paper on Renewable Energy supplements the White Paper on Energy Policy (1998), which recognised the significant medium and long-term potential of renewable energy. The 2003 White Paper also sets out Government's vision, policy principles, strategic goals and objectives for promoting an implementing renewable energy in South Africa.

The white paper further develops a framework in which a national renewable energy plan can be established and operate. The purpose of such a plan is to ensure that, in line with the Kyoto Protocol to which the country is a signatory, South Africa reduces its greenhouse gas emissions.

In addition to reducing greenhouse gas emissions, the promoting the use of renewable energy sources, is aimed at ensuring energy security through the diversification of supply as articulated in the National Energy Act (34 of 2008).

The long-term goal of the South African government is to create a renewable energy industry, that utilises energy sources that, in the future, will offer a sustainable, non-subsided alternative to fossil fuels.

The 10-year target set out in the White Paper is:

10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the projected electricity demand for 2013 (41 539 MW).

2.2 National Energy Act (34 of 2008)

The National Energy Act was promulgated in 2008. One of the objectives of the Act was to promote diversity in energy supply and its sources. In this regard the objectives of the Act, as stated in the preamble, makes direct reference to facilitating the "increased generation and consumption of renewable resources".

2.3 Integrated Resource Plan (IRP) 2010 – 2030 (2011)

The 2011 IRP is currently under review and is anticipated to be finalised in 2019. Under the 2011 IRP it is projected that an additional capacity of 56 539 MW will be required to support the country's economic development and ensure adequate reserves over the next 20 years. Under the 2011 assumptions, this required expansion was more than twice the size of the existing capacity of the system.

A significant component of the above-mentioned plan is the expansion of the use of renewable energy sources to reduce carbon emissions involved in generating electricity. Overall, the proposed plan (2011) implies a total generating capacity of 9 200 MW from wind by 2030.

2.4 National Development Plan (NDP) (2011)

The National Development Plan (NDP) was formulated by the National Planning Commission and released in November 2011. The NDP proposes to create 11 million jobs and grow the economy at an average rate of 5.4% per annum by 2030. In respect of renewable energy, the NDP seeks to ensure that half of the new future generation capacity comes from renewable energy sources. It furthermore recognises the importance of the transition to a low carbon economy. As such the NDP suggests the following:

- Supporting carbon budgeting
- Establishing an economy wide price for carbon by 2030 complemented by energy efficiency and demand management interventions
- Setting a target of 5 million solar water heaters by 2030
- Implementing zero emission building standards that promote energy efficacy
- Simplifying regulatory regime to encourage renewable energy, regional hydroelectric initiative and independent power producers (IPPs)

2.5 Eastern Cape Sustainable Energy Strategy (2012)

The Eastern Cape Sustainable Energy Strategy lays out the province's strategic direction in terms of the renewable energy industry. The focus of the strategy is to encourage sustainable, affordable and environmentally friendly energy production by creating an enabling environment for energy production and sustainable technology, skills and industry development. This is to be achieved through several initiatives including:

- An intensive training programme among relevant decision makers with respect to renewable energy project approvals
- The establishment of an implementation task team to provide potential investors with a one-stop-shop for renewable energy information in the province
- Development of a provincial locational perspective of renewable energy
- Lobbying Eskom to expedite and strengthen the transmission capacity of the former Transkei area
- Lobbying the Department of Energy to set out a long-term programme for the procurement of renewable energy generation

Through the pursuit of these initiatives the Eastern Cape Province seeks to become a leading and preferred destination for renewable energy investment in South Africa.

2.6 Eastern Cape Provincial Economic Development Strategy (PEDS) (2017)

The Eastern Cape PEDS seeks to create a clear, long-term vision and strategy for the growth and development of the Eastern Cape by building on the strength and opportunities of the province, while at the same time addressing its weaknesses and threats.

In pursuit of this goal, PEDS identifies six high potential economic sectors that can catalyse growth in the province. These sectors are:

- Agri-industry
- Sustainable energy
- Ocean economy
- Automotive
- Light manufacturing
- Tourism

With respect to sustainable energy, PEDS notes that it is imperative that the province aligns all its energy opportunities so as to:

- Create the optimal institutional environment for the location of sustainable energy projects in the Eastern Cape
- Harness the maximum possible value chain, localisation and industrialisation opportunities from sustainable energy projects
- Ensure adequate and aligned skills development
- Link innovation, entrepreneurial and small business opportunities to sustainable energy projects
- Link black industrialist opportunities to sustainable energy projects

2.7 Sarah Baartman District SDF (2013)

The Sarah Baartman SDF observes that the district's economy is dependent on the natural resources of the area (tourism and production). As such, spatial planning initiatives need to support the implementation of the district's Socio-Economic and Enterprise Development Strategy (SEEDS) by:

- Implementing effective spatial planning land use management

- Ensuring that the SDP identifies areas for renewable energy production
- Recognizing that game reserves and farming are playing a greater role in the economy
- Undertaking urban regeneration projects
- Identifying where infrastructure upgrading is required.
- Providing the spatial framework for the district's Area Based Plan (ABP)

The Sarah Baartman SDF further notes that the introduction of alternative energy generation infrastructure and the associated land use change will provide both economic opportunities but may also have a negative impact on the ecotourism of the district (in the form of potential changes to the visual and cultural landscapes). This is an important consideration as part of the proposed site falls in an area identified by the SDF as the N2 development corridor.

2.8 Sarah Baartman District IDP (2017)

The Sarah Baartman IDP identifies the green economy (including, but not limited to renewable energy and ecosystem services) as a focal point of economic development in the district, noting that such investments are likely to have significant economic spinoffs for the region. To achieve this, the IDP proposes investing in natural capital so as to create a new generation of green and blue economy jobs rooted in renewable energy.

2.9 Sarah Baartman District Municipality's Tourism Master Plan (2009)

The District's Tourism Master Plan, adopted in 2009, aims to provide guidelines and make recommendations on how to develop a functioning tourism system through the application of a defined strategy and specific actions. Accordingly, it takes cognizance of Responsible Tourism Sector Plans of local municipalities in the Sarah Baartman District. The stated mission of the Tourism Master Plan is: "To create an enabling environment which encourages partnerships for the development and promotion of the tourism industry through cooperation and coordination at all levels". In achieving this, the Sarah Baartman District Municipality will need to nurture the tourism industry, ensuring that it grows in line with defined benchmarks, and so provides employment and prosperity for all the local stakeholders while also providing a satisfactory experience for visitors.

2.10 Kouga Local Municipality IDP (2017)

The Kouga IDP notes the growing importance of renewable energy and its associated infrastructure to the municipality's economy, particularly wind farms. The Local Economic Development (LED) department within the municipality actively works with operational wind farms on their social economic development projects as well as preparing the youth for careers in this discipline such as facilitating career expo's and exhibitions, and advocacy for bursaries for learners and university students. The department also assists in facilitating training for Small, Medium and Micro-sized Enterprises (SMMEs) in preparation and anticipation of services needed in wind farm developments.

2.11 Kouga Local Municipality SDF (2015)

The Kouga SDF identifies parts of the proposed grid connection route as falling within an intensive agricultural area and within close proximity to the proposed sustainable rural development node of Oyster Bay. This entails retaining the rural character and low density of Oyster Bay and emphasising coastal conservation.

The parts of the proposed grid connection route however, is designated as a potential location for a wind farm and its associated infrastructure in the SDF. The Kouga SDF sets out several principles that applications for renewable energy and wind farm facilities (including their associated infrastructure such as powerlines) in the municipality should be governed by to ensure that such applications are in line with the municipality's Land Use Planning Ordinance.

2.12 Kouga Local Municipality Heritage Plan (2015)

The main objective of the Kouga Local Municipality's Heritage Plan is to ensure that all future management decisions and actions taken relating to the region's heritage are carried out within a framework governed by the South Africa National Heritage Resources Act of 1999. The Heritage Plan focuses on preparing and developing heritage conservation policies and strategies for the Kouga Local Municipality. In addition, it provides strategies for improving the delivery of heritage services, such as an upgraded inventory and evaluation process, and better management practices both within the Kouga Local Municipality Administration and in the private sector. The database presented in the plan indicates that the two thirds of the heritage assets in the Kouga Local Municipality are located within the settlements of Hankey, Jeffreys Bay, Humansdorp, and Kruisfontein.

2.13 Kouga Local Municipality's Responsible Tourism Plan (2004)

The vision of the Tourism Plan is: "to make to make Kouga a sustainable tourism destination to the benefit of its entire people." The focus of the plan is on targeting the foreign tourist market first, followed by the domestic tourist market. By adopting this approach, the Kouga Local Municipality aims to grow domestic tourist numbers by 4.5% and foreign tourist numbers by 10.0% per annum over a five-year period. These targets are to be achieved by developing the following potential products and offerings: Sun, sea and sand holidays; Surfing holidays; Adventure holidays; Eco-adventurer; General interest tours; Cultural experiences; MICE (meetings, incentives, conferences and events); Agricultural tourism.

2.14 NMBM IDP (2017)

The NMBM IDP is guided by six delivery pillars. Pillar 2 (Opportunity City) speaks to the significant potential that the metro has in terms of developing technology associated with the renewable energy industry. While the IDP notes that the metro only has limited potential for renewable energy generation projects, it is possible to position the metro as a leader in the manufacture of renewable energy technologies, particularly wind in the Eastern Cape. In terms of electrical infrastructure, the NMBM capital budget makes provision between R276 million and R285 million per year, over the next three years to upgrade key electrical and distribution infrastructure.

2.15 NMBM SDF (2015)

The NMBM SDF indicates the proposed grid route currently passes through primarily open land between Despatch, KwaNobuhle and Bethelsdorp. The 2015 SDF notes that the municipality is planning on establishing a link between Stanford Road and Despatch. This proposed road, would subsequently be bisected by the proposed grind line route for the wind farms. The SDF notes that this proposed extension of Stanford Road would be classified as an activity spine. This would entail concentrated urban development along this movement route, likely linked to public transport. This development would either take the form of continuous linear development or a series of nodes along the activity spine.

2.16 NMBM Tourism Master Plan (2007)

The strategic vision set out in NMBM Tourism Master Plan is that, by 2020, the Nelson Mandela Bay should be a leading beach holiday destination also offering a unique nature-based and cultural heritage experience. This should encapsulate the spirit of freedom associated with its branding. Pursuant to this, the Tourism Master Plan sets out a range of strategies that need to be developed by the NMBM. The most relevant of which are: Development and promotion of culture and heritage tourism; Development and promotion of beach tourism; Wildlife and nature reserves.

2.17 Renewable Energy Independent Power Producer Procurement Programme (REI4P)

The Department of Energy's (DoE) Independent Power Producers Procurement Programme was established at the end of 2010 as one of the South African government's urgent interventions to enhance South Africa's power generation capacity.

The DoE, national Treasury and the Development Bank of Southern Africa established the IPP Office for the specific purpose of delivering on the IPP procurement objectives. The primary mandate of this office is to secure electricity from renewable (REI4P) and non-renewable energy sources from the private sector. However, energy policy and supply are not only about technology, but also has a substantial influence on economic growth and socio-economic development. As such the IPPP has been designed to go beyond procurement of energy to also contribute to broader national development objectives such as job creation, social upliftment and the broadening of economic ownership.

At a national level the following commitments have been made for bid windows 1, 2, 3, 3.5 and 4 as of December 2017 (DoE, 2018):

- 6 422 MW of electricity had been procured from 112 RE Independent Power Producers (IPPs) in the seven bid rounds;
- 3 052 MW of electricity generation capacity from 56 IPP projects has been connected to the national grid;
- Investment (equity and debt) to the value of R201.8 billion, of which R48.8 billion (24%) is foreign investment, was attracted;
- Created 31 207 job years[4] for South African citizens;
- Socio-economic development contributions of R357.4 million to date;
- Enterprise development contributions of R115.2 million to date;
- Carbon emission reductions of 15.4 million tons CO^2 has been realised by the programme from inception to date.

From an Eastern Cape perspective, the following commitments have been made across the aforementioned bid windows:

- Add 1 509 MW to the national grid from 17 REI4P projects;
- Incur R33.8 billion in project costs increasing the gross domestic product (GDP) of the province;
- Incur R4 489 million in social economic development expenditure;
- Contribute R7 434 million to community trusts established as part of the programme;

[4] The equivalent of a full-time employment opportunity for one person for one year.

- Create 18 137 job years.

2.18 Conclusion

The review of the policy planning environment suggests that the use of renewable energy sources in South Africa is considered to be an integral means of reducing the carbon footprint of the country, diversifying the national economy and reducing poverty. Any project that facilitates the above-mentioned objectives, such as the grid connection for the Impofu Wind Farms, can therefore be considered strategically important to South Africa.

From a provincial and municipal policy perspective the facilitation of renewable energy projects and interventions that related to the broader green economy are seen as a priority. The Eastern Cape PEDS makes particular reference to the need to develop the sustainable energy industry which includes renewable energies. Likewise, the Sarah Baartman district and Kouga and NMB local municipalities have noted the importance of wind energy in their IDPs and SDFs and are actively seeking to promote such developments.

It is important to note that although the proposed grid connection will not generate renewable energy, the construction of the proposed Impofu Wind Farms will not go ahead if the power generated cannot be distributed to the users.

Chapter 3 Overview of the Study Area

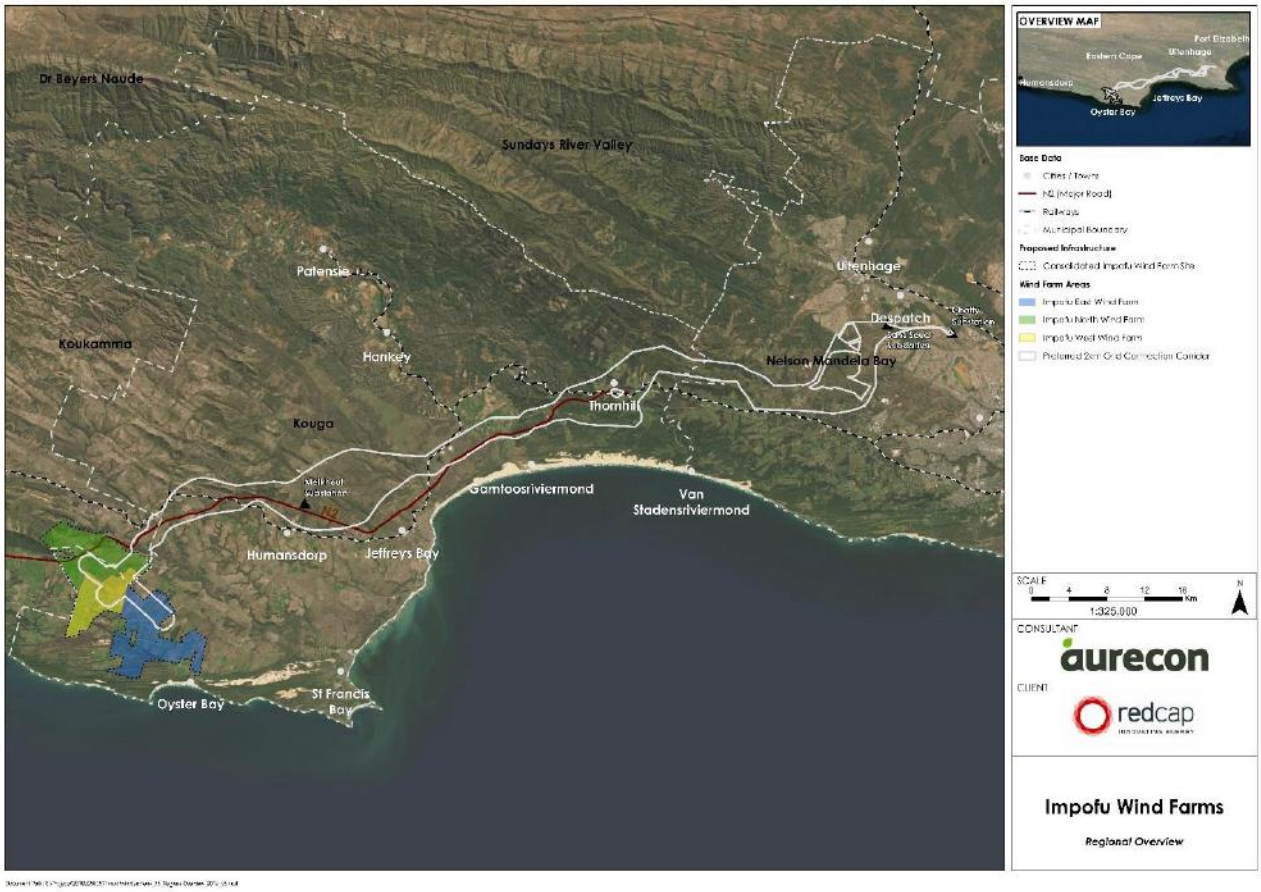
The following section documents various aspects of the study area including: population and household numbers; income levels; and employment. In addition, the section also reviews the economic structure and performance of the study area.

The intention of this review is to provide an overview of the socio-economic context of the area so as to better understand the dynamics of the area and to inform the BA process.

3.1 Administrative Context for Study Area

The Kouga Local Municipality (EC108), in which a large portion of the proposed grid route is located, is situated on the southern seaboard of the Eastern Cape and is one of the seven local municipalities within the Sarah Baartman District Municipality (DC10). The municipality includes a coastal zone between the Van Stadens River in the east and the Tsitsikamma River in the west, stretching inland towards the Baviaanskloof Mountains in the north.

Figure 3.1: Major settlements within the Kouga and NMB Municipalities



The Kouga Local Municipality covers an area of roughly 2 670 km^2. This makes it the second smallest municipality in the district, accounting for only 4.5% of the total surface area of the Sarah Baartman District. The municipality is bordered by the Dr Beyers Naudé and Sundays River Valley Local Municipalities to the north, the Nelson Mandela Bay Metro to the east, and the Koukamma Local Municipality to the west.

The largest towns within the Kouga Local Municipality are Humansdorp and Jeffreys Bay, while smaller settlements include: Hankey, Patensie and St Francis Bay. The administrative centre of the municipality is Jeffreys Bay which lies approximately 75 km southwest of Port Elizabeth in the Nelson Mandela Bay Metropolitan Area The urban areas are typical of the spatial patterns of towns throughout South Africa, namely that they are segregated by economic classes and reside in clusters. The Kouga Local Municipality is divided into 15 administrative wards.

The proposed grid route also passes through a large portion of western part of the NMBM located adjacent to the Kouga Local Municipality. In addition to being adjacent to the Kouga Local Municipality, the NMBM abuts the Sundays River Valley Local Municipality to the north an east. The municipality spans an area of 1 959 km^2, accounting for 1.2% of the total area of the province.

The administrative centre of the NMBM is Port Elizabeth, which is also the metro's largest settlement. This city is considered to the economic centre of the Eastern Cape and is strategically located between Cape Town and Durban along the N2. Other important towns in the metro include: Uitenhage and Despatch. The municipality is divided into 60 administrative wards.

3.2 Socio-Economic Profile of the Study Area

3.2.1 Population, Income and Employment Profile

The Kouga Local Municipality falls within the Sarah Baartman District Municipality and accounts for 21.4% of the population, and 22.9% of the households in the district. This makes the Kouga Local Municipality the most populous municipality within the entire district. The NMBM is one of the two metros in the Eastern Cape, and accounts for 17.3% of the province's population and 18.9% of its households.

Population growth between 2011 and 2016 was 0.9% for the Kouga Local Municipality and -0.1% for the NMBM. The NMBM's population growth rate does not compare favourably with the Eastern Cape's population growth rate, which grew at 0.1% over the same period. These figures suggest the possibility of out-migration from the NMBM as individuals seek higher paying jobs in other parts of the country. This outward migration is likely compounded by the limited number of employment opportunities within the NMBM (see Table 3.2). A growing population would suggest greater economic prosperity, characterised by individuals migrating to the area.

Table 3.1: Overview of the study areas population and household structure in 2016

Indicator	Kouga Local Municipality	NMBM
Area (km^2)	2 670	1 959
Population	95 270	1 130 591
Number of Households	28 173	313 479
Population density (km^2)	35.7	577.1
Average household size	3.4	3.6
Population growth rate (2011-2016)	0.9%	-0.1%
Average monthly household income (2011, in 2016 prices)	R10 598	R12 280

Source: Quantec Standardised Regional (2016)

The disposable average monthly income of households in the Kouga Local Municipality and the NMBM in 2011 was R10 598 and R12 280 respectively. The Kouga Local Municipality's figure was significantly

higher than that of the Sarah Baartman District Municipality (R8 889; adjusted to 2016 prices) during the same period. Both municipality's average household income was also higher than the provincial average for the same period (R7 538; in current 2016 prices).

Despite relatively high average household income, poverty still remains endemic in the Kouga Local Municipality. According to Stats SA (2016) the poverty headcount[5] within the Kouga Local Municipality (5.7%) was higher than the district average (4.5%) but lower than the provincial figure (12.7%). This is evident by the high proportion of households in the Kouga Local Municipality that earn no income (15.3%) – higher than both the district (12.5%) and provincial (15.2%) values.

Although the NMBM's average household income is 62.9% higher than that of the province, it has one of the lowest poverty headcounts in the Eastern Cape at 3.0%. This, despite the fact that 15.7% of households in the metro are classified as having no income in 2011 – higher than the provincial average (15.2%)

Table 3.2: Employment profile of the Kouga Local Municipality and NMBM, 2016

Indicator	Kouga Local Municipality	NMBM
Working age population	62 964	776 392
Labour force	44 043	505 219
Labour force participation rate	69.9%	65.1%
Employed	37 998	360 338
Unemployed	6 045	144 881
Unemployment rate (% of labour force)	13.7%	28.7%

Source: Quantec Standardised Regional (2016)

The review of the employment profile of the Kouga Local Municipality indicates that only 13.7% of the total labour force is classified as unemployed (see Table 3.2). These unemployment rates and labour force participation rates in were also notably better than that of the Sarah Baartman District Municipality (with an unemployment rate of 19.0%; and labour force participation rate of 63.0%). The NMBM in comparison, is characterised by a higher unemployment rate (28.7%) and lower labour force participation rate (65.1%). These figures however, are still below the provincial figures of 33.1% and 47.0% respectively.

The relatively low unemployment rate, high labour force participation relative to the district average, and strong economic growth (see Table 3.3) suggests that the Kouga Local Municipality is likely subjected to inward migration due to the actual and perceived employment opportunities available within the local municipality. The NMBM, despite featuring a low level of poverty, and high labour force participation rate is characterised by low economic growth. This results in weak employment growth amongst firms in the metro, forcing job seekers to leave the metro in an effort to find better paying work.

3.2.2 Economic Profile

The combined GDP of the Kouga Local Municipality and NMBM was R89.1 billion in 2016 (constant 2010 prices), which accounts for just over 41.3% of the Eastern Cape's GDP. Per capita GDP for the

[5] Stats SA utilised the South African Multidimensional Poverty Index (SAMPI) to measure the extent of poverty in the country. The SAMPI is an index that is constructed using eleven indicators across four dimensions, namely: health, education, living standards and economic activity. Poverty headcount figures were then determined based on the proportion of households that are considered to be "multidimensional poor" in terms of the index.

two municipalities was between R55 437 (Kouga) and R74 176 (NMBM) in 2010 prices (Quantec, 2016). These figures were between 68.0% (Kouga) and 124.7% (NMBM) higher than the Eastern Cape figure for GDP per capita (R33 005). These figures suggest that both municipalities perform strongly in terms of economic output.

Table 3.3: GDP-R structure of the Kouga Local Municipality and NMBM between 2011 and 2016 in Constant 2010 prices

Sector	Sectoral Share of GDP				CAGR[6] 2011-2016
	Kouga Local Municipality		NMBM		
	2011	2016	2011	2016	
Primary Sectors	**5.8%**	**5.3%**	**0.6%**	**0.5%**	**0.2%**
Agriculture and hunting	5.7%	5.2%	0.5%	0.4%	0.2%
Mining and quarrying	0.1%	0.1%	0.1%	0.1%	0.4%
Secondary Sectors	**18.9%**	**18.6%**	**25.9%**	**25.3%**	**0.6%**
Manufacturing	**11.4%**	**11.5%**	**22.0%**	**21.3%**	**0.5%**
Electricity, gas and water	1.4%	1.3%	0.9%	0.8%	-1.2%
Construction	6.1%	5.8%	3.1%	3.2%	1.7%
Tertiary Sectors	**75.3%**	**76.1%**	**73.5%**	**74.2%**	**1.3%**
Trade	21.6%	21.3%	18.8%	18.9%	1.3%
Transport and communication	5.4%	5.7%	10.7%	11.1%	1.8%
Finance and business services	26.0%	26.4%	23.1%	23.6%	1.6%
General government	16.1%	16.6%	15.6%	15.4%	1.0%
Community services	6.2%	6.1%	5.3%	5.1%	0.6%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**1.1%**

Source: Quantec Standardised Regional (2016)

Over the last five years, the Compounded Annual Growth Rate (CAGR) of both municipalities was 1.1% which means that it grew slower than the provincial economy (1.3%) (Quantec, 2016). Although the Kouga Local Municipality grew by 2.0% year-on-year between 2011 and 2016, the poor growth prospects and limited investment in the NMBM relative to other parts of the Eastern Cape resulted in a lower overall economic growth rate.

The growth of both the Kouga Local Municipality and the NMBM over the last few years was largely due to the strong performance of the secondary and tertiary sectors, particularly construction. As indicated in Table 3.3, the construction sector has grown by a robust 1.7% year-on-year, making it the second best performing sector over the five-year period. Other sectors that showed strong growth rates in the area over the period include transport and communication (1.8%), finance and business services (1.6%) and trade (1.3%).

Table 3.4: GDP-R per sector for the Kouga Local Municipality and NMBM in constant 2010 prices (in R' millions)

Sector	Kouga Local Municipality		NMBM	
	2011	2016	2011	2016
Primary Sectors	**R276**	**R279**	**R439**	**R444**
Agriculture and hunting	R273	R276	R372	R375

[6] The CAGR figure presented in this column represents the combined growth rates for both the Kouga Local Municipality and NMBM.

Sector	Kouga Local Municipality		NMBM	
	2011	2016	2011	2016
Mining and quarrying	R3	R3	R67	R69
Secondary Sectors	**R904**	**R983**	**R20 617**	**R21 216**
Manufacturing	R544	R608	R17 443	R17 861
Electricity, gas and water	R67	R71	R703	R652
Construction	R294	R304	R2 471	R2 704
Tertiary Sectors	**R3 603**	**R4 019**	**R58 411**	**R62 202**
Trade	R1 035	R1 126	R14 949	R15 882
Transport and communication	R257	R302	R8 520	R9 286
Finance & business services	R1 242	R1 393	R18 371	R19 823
General government	R770	R874	R12 379	R12 912
Community services	R298	R324	R4 192	R4 299
TOTAL GDP	**R4 783**	**R5 282**	**R79 467**	**R83 862**

Source: Quantec Standardised Regional (2016)

The positive growth of the above-mentioned sectors was somewhat offset by the low growth exhibited by the primary sectors specifically the agricultural sector. As a comparably important sector to the Kouga Local Municipality's economy, the 0.2% the year-on-year GDP growth rate of the sector between 2011 and 2016 is concerning. This low growth has resulted in the primary sector share of the total GDP of the two municipality's economies remaining static at 0.8% for both 2011 and 2016.

As evident by both Table 3.4 and Table 3.5 the agricultural sector of the two municipalities economies, despite featuring a negative GDP growth rate (a possible result of the drought), has experienced an increase in employment in absolute terms between 2011 and 2016. Over this five-year period the sector added almost 5 000 jobs, making it an important employment creator across both municipalities. This growth in employment resulted in the agricultural sector exhibiting an average 7.0% year-on-year growth rate between 2011 and 2016.

Agricultural activities are labour intensive, thus a small decline in the size of the sector would generally lead to greater job losses than, for example in manufacturing or utilities, which tend to be more capital intensive. The agricultural sector is also frequently one of the largest employers in rural areas and it is for these two reasons that the sector is generally prioritised in development strategies.

Table 3.5: Employment structure of the Kouga Local Municipality and NMBM between 2011 and 2016

Sector	Share of Total Employment				Absolute Change 2011-2016
	Kouga Local Municipality		NMBM		
	2011	2016	2011	2016	
Primary Sectors	**19.3%**	**22.2%**	**1.8%**	**2.3%**	**0.9%**
Agriculture and hunting	19.3%	22.2%	1.7%	2.2%	0.9%
Mining and quarrying	0.0%	0.0%	0.0%	0.0%	0.0%
Secondary Sectors	**16.1%**	**15.3%**	**23.2%**	**21.8%**	**-1.5%**
Manufacturing	5.9%	5.1%	16.3%	14.2%	-2.1%
Electricity, gas and water	0.3%	0.3%	0.2%	0.2%	0.0%
Construction	10.0%	9.9%	6.7%	7.3%	0.6%

Sector	Share of Total Employment				Absolute Change 2011-2016
	Kouga Local Municipality		NMBM		
	2011	2016	2011	2016	
Tertiary Sectors	**64.6%**	**62.5%**	**75.0%**	**76.0%**	**0.6%**
Trade	27.1%	25.9%	25.2%	25.8%	0.4%
Transport and communication	2.8%	2.9%	5.5%	5.6%	0.1%
Finance and business services	9.4%	8.8%	15.2%	14.8%	-0.6%
General government	10.3%	9.9%	14.6%	14.1%	-0.5%
Community services	14.9%	15.1%	14.3%	15.7%	1.2%
TOTAL EMPLOYMENT	**31 286**	**37 998**	**327 576**	**360 338**	**39 474**

Source: Quantec Standardised Regional (2016)

Aside from the agricultural sector, the construction sector also experienced positive employment growth between 2011 and 2016. It is probable that the over 5 000 jobs created by this sector across both municipalities over the period can be attributed to, in part, the construction of several wind farms in the two municipalities. Concerningly, the manufacturing sector across the two municipalities has shed over 2 000 jobs since 2011, resulting in a negative employment growth rate of 0.8% between 2011 and 2016.

The strong growth in agricultural employment over the 2011 to 2016 period and the job losses in the manufacturing sector, has resulted in a gradual change in employment structure across the two municipalities. This is evident in Table 3.5 which shows that the primary and tertiary share of total employment has risen by 0.9% and 0.6% respectively over the review period.

3.3 Local Social and Economic Resources

The proposed grid connection route runs through areas zoned Agricultural Zone 1 (Kouga Local Municipality) and areas whose zoning is currently undefined (NMBM). These areas are largely undeveloped or are used for agricultural purposes.

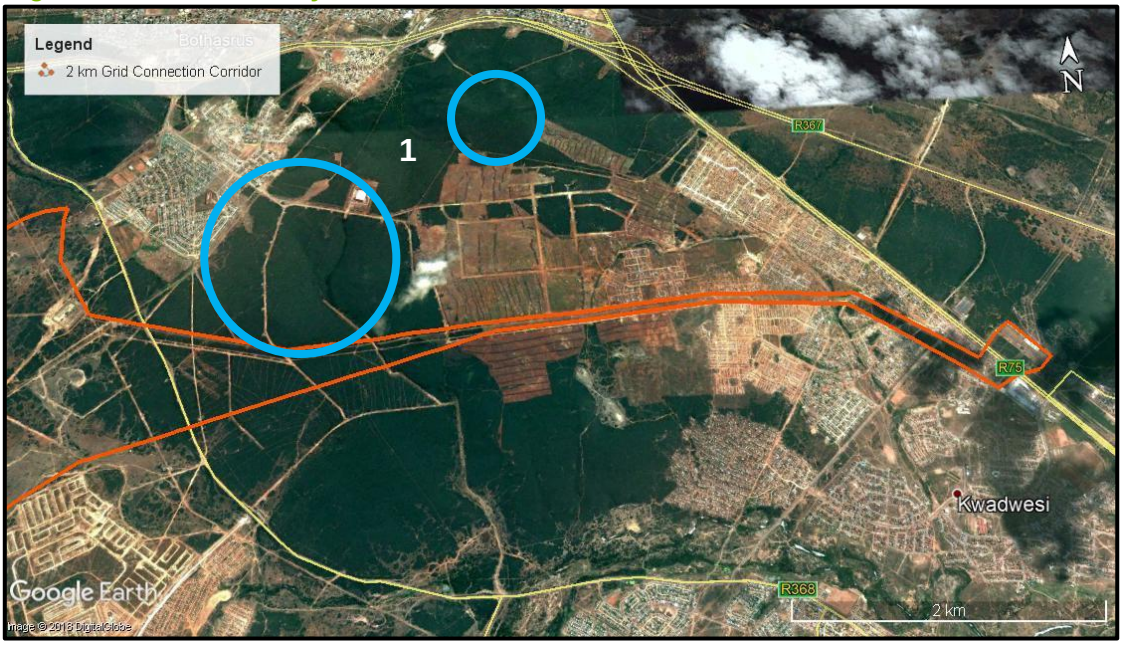
Given the length of the proposed grid connection, the type of land use on individual properties varies notably. A large proportion of the properties along the route are engaged in cattle and sheep farming. In addition, the route passes through, or in close proximity to, three farms dedicated to chicken/egg production. As the proposed route crosses the Gamtoos River, it passes through a farm engaged in dairy production. Other types of land use activities along the route include natural game and wildlife (with a very small amount of cattle grazing) and a seedling/plant nursery.

Figure 3.2: Land use zoning for section of grid connection adjacent to Humansdorp

A portion of the proposed grid connection route passes through the northern most part of Humansdorp. The proposed route crosses areas zoned as medium/high density residential (i.e. 50 units per hectare) as well as across land zoned as industrial. Although these areas are zoned as such they are currently undeveloped (see Figure 3.2).

The route for the proposed grid connection passes through the NMBM Sans Souci substation, before terminating at the NMBM Chatty substation. This substation is located adjacent to the R75 next to the township of KwaDwesi. Figure 3.3 indicates residential growth between 2011 and 2017 around the NMBM Chatty substation.

Figure 3.3: NMBM – Khayamnandi and KwaDwesi: 2011 and 2016



2011

2017

From Figure 3.3 it is evident that the majority of housing development that has occurred in close proximity to the NMBM Chatty substation has been concentrated around Area 1. Area 2 on Figure 3.3 has been designated as a primary urban hub (Chatty Jachtvlakte Hub) in the NMBM SDF.

The hub is situated to the west of Njoli Square around the intersection of the Bloemendal Arterial and Stanford Road. This Hub is at the core of the greenfields component of the Zanemvula Mega Project, developed as an initiative of the National Department of Human Settlements; Provincial Department of Human Settlements and the Municipality. The Housing Development Agency (HDA) is the implementing agent.

Key elements in this hub include:

- The convergence of Stanford Road, Bloemendal Arterials and the MR448 (Old Uitenhage Road). Stanford Road is one of the primary links between the Port Elizabeth CBD and Uitenhage. The Bloemendal Arterial on the other hand is not yet fully developed, but serves as an important North/South linkage between the R75 and Stanford Road. MR 368 still serves as an important secondary link between Port Elizabeth and Uitenhage and has the potential to link the Njoli and Chatty Jachtvlakte Hubs
- The new greenfield residential developments of Joe Slovo West; Bethelsdorp North; Khayamnandi; the Chatty developments and the Jachtvlakte/Kwanobuhle extensions currently in the planning stage, will yield in the order of 54 000 residential opportunities, once fully developed. Approximately 14 000 units have already been completed and are in need of social facilities and amenities.
- There are large tracts of vacant and serviced land in the greenfield development areas that can be utilized for catalytic high-density infill and mixed used development.

3.4 Tourism Sector Profile

This section provides an overview of the tourism characteristics that define the Kouga Local Municipality and the NMBM tourism markets (see Table 3.6). The aim of this profiling exercise is to understand the tourism dynamics within the two areas and to contextualise what impact the proposed grid connection could have on this industry.

Table 3.6: Kouga Local Municipality and NMBM Tourism Profile, 2016

	Kouga Local Municipality	NMBM
Number of trips	**97 600**	**514 100**
Domestic	80 700	446 000
Foreign	16 900	68 100
Purpose of visit	• VFR[7] (53.1%) • Leisure (30.0%) • Other (11.0%) • Business (5.9%)	• VFR (56.7%) • Leisure (23.1%) • Business (10.1%) • Other (10.1%)
Total Estimated Spend (billions)	R0.7	R3.2
Tourism spend per resident capita	R6 050	R2 530
Average length of stay		
Domestic	5.8 days	
Foreign	11.2 days	

Source: Adapted from ECSECC (2017a, 2017b) and SAT (2018)

From Table 3.6 the following tourism characteristics are noted:

- Of the total number of tourists visiting the two municipalities, more than 85.0% were South Africans, the majority of whom were visiting friends and family.
- While a greater number of trips were undertaken to the NMBM in absolute terms, the Kouga Local Municipality attracted a greater proportion of foreign tourists (17.3%), than the NMBM (13.2%).
- Tourists to the Kouga Local Municipality spend on average, notably more (R6 050) than those visiting the NMBM (R2 530).

According to SAT (2018), domestic tourists visiting the Eastern Cape favoured the province's major urban centres, particularly Port Elizabeth (NMBM). International visitors to the province by contrast, are likely to spend only one night in NMBM using the municipality as a stopover between the game reserves and lodges in the Sarah Baartman District Municipality, the Garden Route, Cape Town, Durban or Johannesburg.

After eating out, visiting natural attractions and wildlife were the two most popular activities undertaken by both domestic and foreign tourists that visit the Eastern Cape. Popular destinations for these activities were the Garden Route/Tsitsikamma area. Beach-related activities, another popular activity for both domestic and foreign tourists are concentrated in Jeffreys Bay and Port Elizabeth (SAT, 2018).

A desktop assessment of accommodation facilities identified approximately 358 establishments in the Kouga Local Municipality and a further 445 establishments in NMBM (see Table 3.7). In the Kouga Local Municipality, accommodation establishments are evenly distributed across the municipality's

[7] Visiting Friends and Relatives

major urban settlements – Humansdorp (34.6%), Jeffreys Bay (32.4%) and Cape St Francis (30.4%). Accommodation establishments in the NMBM are concentrated in the suburbs of Summerstrand, Walmer and Mill Park.

A review of the spatial location of these establishments suggests that only between 10 and 20 fall within the proposed grid corridor, mostly around the settlement of Thornhill. These are exclusively self-catering establishments (usually based on a local farm) and charge between R1 000 and R2 500 per night. This is notably higher than the average price for establishments in either the Kouga Local Municipality (R823) of the NMBM (R727).

Table 3.7: Tourism accommodation and attractions in the Kouga Local Municipality and NMBM

Variable	Kouga Local Municipality	NMBM
Accommodation		
Number of Establishments	358	445
Estimated number in grid corridor	Approximately 10 to 20	
Average Price	R823	R727
Dominant Type of Establishments	• Self-Catering • B&B	• B&B • Hotels
Spatial Concentration	• Humansdorp (34.6%) • Jeffreys Bay (32.4%) • Cape St Francis (30.4%)	• Summerstrand (29.0%) • Mill Park (25.8%) • Walmer (13.4%)
Attractions		
Number of Attractions	99	317
Estimated number in grid corridor	Approximately 10 to 20	
Type of Attractions within municipality	• Heritage (57.6%) • Nature & Adventure (32.3%)	• Heritage (34.5%) • Nature & Adventure (25.4%) • Arts & Culture (21.5%)
Spatial Concertation	• Jeffreys Bay • Cape St Francis • Hankey • Humansdorp	• Central • Summerstrand

Source: Adapted from DEDEAT Tourism Database (2013)

Similar to the accommodation establishments, tourist attractions were primarily concentrated in the respective municipality's urban settlements. Most of the tourism attractions within both municipalities' focus are either nature or culture/heritage based.

Over the course of its approximately 120-kilometre route, the grid corridor passes through (or is in close proximity or adjacent to) several tourism assets. These sites are profiled in Table 3.8 below.

Table 3.8: Selection of main tourism attractions within or adjacent to proposed grid corridor

Name	Municipality	Attraction Type	Description
Paragliding site	Kouga	Adventure	Infrequently used and undeveloped site located 8 km north-west of Humansdorp

Railway line	Kouga; NMBM	Heritage	Historic narrow-gauge railway line; Narrow gauge bridge over Van Stadens River (adjacent to corridor)
Zwartenbosch	Kouga	Recreation	Nine-hole golf course
Gamtoos River	Kouga	Nature	Natural water course; Narrow gauge bridge over Gamtoos River (adjacent to corridor)
Single Lane Bridge	Kouga	Heritage	Historic 180-m long bridge built in 1895 to cross Gamtoos River
African Dawn	Kouga	Nature	Bird and wildlife sanctuary, with over 250 species of birds; Includes picnic and braai facilities as well as a restaurant.
3Rivers Trails	Kouga	Adventure	Network of mountain bike trails, offering routes between 4.5 km and 10 km long
Culturama	NMBM	Nature	Self-catering accommodation and campsite able to cater for up to 64 people; Offers obstacle course, hiking trails and recreational facilities. Owned and managed by the Department of Sport, Recreation, Arts and Culture.
Lady Slipper	NMBM	Nature	Mountain range adjacent to corridor; Popular hiking, cycling and trail running destination
Hopewell	NMBM	Nature	Conservation estate partly within the corridor; Includes hiking, cycling and trail running facilities.

Source: Urban-Econ Tourism Audit (2019)

The tourism profile has indicated that the two municipalities receive over 600 000 domestic and foreign visits annually (see Table 3.6). The majority of these visits were to the NMBM. These tourists primarily come visit friends and relatives and undertake nature/adventure-based activities.

The overview of the spatial location of both accommodation facilities and tourism attractions in the Kouga Local Municipality and NMBM, indicated that the overwhelming majority were located adjacent to the coast, with few attractions situated inland, and therefore outside of the grid corridor.

Within the proposed grid corridor there are between 10 and 20 accommodation facilities and tourist attractions. Several of the attractions are either underdeveloped or natural environmental features. Given the undeveloped nature of these attractions and their distance from complementary products, it is highly likely that they receive only a marginal number of tourists annually.

Accordingly, tourist activities within the proposed grid corridor only make a marginal contribution to the Kouga Local Municipality and the NMBM tourism industry's total employment and GDP contributions.

3.5 Local Social and Economic Issues

In addition to social issues such as unemployment (outlined in Section 3.2), the sections of the grid corridor that pass through the Kouga Local Municipality are characterised by poor infrastructure and the absence of needed skills development programmes. Key social and economic priorities in the

affected area of the Kouga Local Municipality are the maintenance, rehabilitation and upgrading of gravel roads; addressing electrical disruptions; eradicating the bucket toilet system; installing bulk infrastructure; and undertaking skills development initiatives. In the section of the grid corridor that passes close to Humansdorp, the top development priority is the construction of appropriate housing on the old Humansdorp Golf Course.

The social and economic issues that characterise the section of the grid corridor that passes through the NMBM, are similar to that of the Kouga Local Municipality. The maintenance and upgrading of gravel roads in the more rural parts of the NMBM section of the grid corridor was noted as being a top priority. Other issues raised by rural NMBM residents in the affected area was the availability and provision of water. In the more urban sections of the NMBM affected area key issues and priorities were: the need for SMME development projects; training and development of local youth; improving overall lighting; the development of housing and the addressing of backyard dwellers; and the acquisition of land for social services such as creches and pre-schools.

Chapter 4 Description of Key Socio-Economic Issues

In line with section (1) (vii) of Appendix 2 in the 2014 EIA regulations, the following section provides a description of the socio-economic issues and potential impacts, including cumulative impacts that have been identified for the proposed grid connection. A more detailed assessment is presented in Chapter 6. These potential socio-economic issues are organised under the following headings:

1. Planning and Design Phase
2. Construction Phase
3. Operational Phase
4. Decommissioning Phase

4.1 Planning and Design Phase

The review of key national, provincial and local energy policy and spatial planning documents indicated that the development of energy from renewable sources is strongly supported at all levels. Consequently, activities that facilitate the connection of renewable energy sources to the national grid are encouraged.

At a national level the National White Paper on Renewable Energy (2003) notes:

- Renewable resources generally operate from an unlimited base, and as such, can increasingly contribute towards a long-term sustainable energy future;
- The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are in fact the least costly energy services in many cases; even more so when social and environmental costs are taken into account.

The National White Paper on Renewable Energy (2003) goes on to set a national target of 10 000 Gwh renewable energy contribution to final energy consumption in 2013. This is echoed in the 2011 IRP which implies a total generating capacity of 9 200 MW from wind by 2030.

At a local level the Sarah Baartman District Municipality identifies the promotion and utilisation of renewable energy as a core initiative that influences its policies, objectives, strategies and projects. As such, the proposed grid connection could play an important role in enabling the district to realise some of its key IDP objectives. The Kouga Local Municipality and NMBM IDPs likewise identifies renewable energy, particularly wind, as a key drive for local economic development in the area.

Therefore, whilst there are no actual impacts arising during planning and design phase of the project, it is evident that any activity that facilitates the connection of renewable energy sources to the national grid aligns with national, provincial and local energy policy and spatial planning objectives.

4.2 Construction Phase

Based on a review of desktop sources and experience with other grid connection and powerline developments, the potential socio-economic issues that will need to be considered during the construction phase are as follows:

- Temporary stimulation of the national and local economy through construction related spending, and additional spending by Small and Micro Enterprises involved in the construction process.
- Temporary increase employment in the national and local economies from those employed during the construction process as well as those employment opportunities created for SMMEs.
- Temporary increase in household earnings from higher construction workers salaries and wages.
- Temporary increase in government revenue through higher personal income tax, VAT, companies' tax, etc.
- Potential negative changes to the sense of place due to increased visual disturbance to the natural setting that currently characterises the area.
- Potential temporary increase in social conflicts associated with the influx of people.
- Potential negative impact on actual and perceived property and land values in the immediately affected area.

The net-effective impact of the construction phase, from a socio-economic perspective, is positive for the local and national economy from construction activities.

4.3 Operational Phase

Based on a review of desktop sources and experience with other wind energy facilities, the potential socio-economic issues that will need to be considered during the operational phase are as follows:

- Sustainable increase in production and GDP nationally and locally through ongoing operational spending (i.e. maintenance).
- Creation of sustainable employment positions nationally and locally. This would almost exclusively be as a result of maintenance activities.
- Improved standards of living for benefiting household through higher incomes generated by those individuals employed in maintenance activities.
- Sustainable increase in national and local government revenue through higher property taxes and wage payments.
- Provision of electricity for future development.
- Potential adverse effects from grid's Electro-Magnetic Field (EMF).

The net-effective impact of the operational phase, from a socio-economic perspective, is positive for the local and national economy from construction activities.

4.4 Decommissioning Phase

It is highly improbable that once established, the proposed grid connection would be decommissioned. In the unlikely event that this does occur, the socio-economic impacts stimulated during the decommissioning phase are expected to be similar to those that took place during the construction phase. They will also be temporary in nature, but most likely will take a much shorter time than the construction phase.

Chapter 5 Alternatives

The National Environmental Management Act (107 of 1998) requires the consideration and assessment of feasible and reasonable alternatives in the EIA process. When assessing the various alternatives of the proposed activity (i.e. establishment of grid connection infrastructure), consideration should be given to the:

- Type of activity to be undertaken;
- Location of the proposed activity
- Design or layout of the activity;
- Technology to be used in the activity; and
- Option of not implementing the activity (no-go alternative).

To date, the proposed grid connection corridor under assessment has been informed by a range of specialist input, screening studies, and technical consideration. Avoidance of highly sensitive no-go areas has been undertaken, and therefore only the No-Go option is assessed in this report; and the site and layouts considered and assessed represent the preferred alternative (refer to Figure 5.1 below).

An environmental and social screening process has been undertaken to ensure all sensitive areas are avoided. Various alternative routes for the proposed grid connection were considered but were not considered feasible from a technical or environmental perspective. Micro-siting of the proposed infrastructure will be required if the project progresses to construction and will result in a preferred layout that minimises the predicted negative impacts.

Chapter 6 Assessment of the Significance of Impacts

6.1 Overview

6.1.1 Impact Methodology

In line with the EIA regulations all impacts identified in Chapter 4 were evaluated in terms of a methodology devised by Aurecon to establish the **intensity of the impact** (size or degree scale), the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); the **extent** (spatial scale), as well as the **probability** (likelihood). Table 6.1 outlines the various categories for each of the aforementioned aspects.

Table 6.1: Categories for various impact aspects

Aspect	Category	Numerical Rating	Description
Intensity	Negligible	1	Natural and/ or social functions and/ or processes are negligibly altered
	Very low	2	Natural and/ or social functions and/ or processes are slightly altered
	Low	3	Natural and/ or social functions and/ or processes are somewhat altered
	Moderate	4	Natural and/ or social functions and/ or processes are moderately altered
	High	5	Natural and/ or social functions and/ or processes are notably altered
	Very High	6	Natural and/ or social functions and/ or processes are majorly altered
	Extremely High	7	Natural and/ or social functions and/ or processes are severely altered
Duration	Immediate	1	Impact will self-remedy immediately
	Brief	2	Impact will not last longer than 1 year
	Short-term	3	Impact will last between 1 and 5 years
	Medium-term	4	Impact will last between 5 and 10 years
	Long-term	5	Impact will last between 10 and 15 years
	On-going	6	Impact will last between 15 and 20 years
	Permanent	7	Impact may be permanent, or in excess of 20 years
Extent	Very Limited	1	Limited to specific isolated parts of the site
	Limited	2	Limited to the site and its immediate surroundings
	Local	3	Extending across the site and to nearby settlements
	Municipal Area	4	Impacts felt at a municipal level
	Regional	5	Impacts felt at a regional / provincial level
	National	6	Impacts felt at a national level
	International	7	Impacts felt at an international level
Probability	Highly Unlikely/ None	1	Expected never to happen

	Rare/ Improbable	2	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
	Unlikely	3	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
	Probable	4	Has occurred here or elsewhere and could therefore occur
	Likely	5	The impact may occur
	Almost Certain/ Highly Probable	6	It is most likely that the impact will occur
	Certain/Definite	7	There are sound scientific reasons to expect that the impact will definitely occur

When assessing these impacts, broader considerations were also considered. These include the **confidence** with which the assessment of the impact was undertaken, the **reversibility** of the impact and the resource **irreplaceability**.

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

Before the significance is determined, it is first necessary to calculate the consequence using the following formula:

Consequence = type x (intensity + duration + extent).

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence as follows:

Significance = consequence x probability

Depending on the numerical result of this formula, the impact would fall into a significance category (see Table 6.2) as negligible, minor, moderate or major, and the type would be either positive or negative

Table 6.2: Application of significance ratings

Significance Rating	Score Range	
Major (-)	-109	-147
Moderate (-)	-73	-108
Minor (-)	-36	-72
Negligible (-)	-1	-35
Neutral	0	
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

6.1.2 Assessment of Cumulative Impacts

The cumulative impacts of the proposed grid connection are an important consideration. The initial grid assessment corridor contains between 500 km and 600 km of existing High Voltage lines, as well as a multitude of MV power lines. In addition, there are a number of existing and proposed grid connections associated with the existing and proposed wind farms in the western section of the corridor. The proposed project will add another approximately 120 km to this network of lines.

The cumulative impacts presented in Section 6.2 will be considered for any linear infrastructure in addition to the assessment taken against the baseline and the proposed grid connection. The cumulative scenario will focus on proposed future overhead power lines that have a valid Environmental Authorisation at the commencement of the study as set out in Table 6.3.

Table 6.3: Overhead power lines considered in the assessment of cumulative impacts

Project	Overhead powerline	Length	Status
Melkhout-Kromrivier	132 kV line from Melkhout substation to Kromrivier substation, Eastern Cape – Upgrade existing line to a double circuit line to accommodate Oyster Bay	+/- 26 km	EA issued, out to tender
Oyster Bay Wind Energy Facility grid connection	132 kV line from Oyster Bay Wind Energy Facility to Melkhout substation	+/- 4.3 km	EA issued; Construction to commence in 2018
Dieprivier-Kareedouw	Construction of 132 kV distribution lines from Dieprivier to Kareedouw, Sarah Baartman District Municipality (formerly Cacadu District Municipality)	+/- 36 km	Amendment authorised in May 2017

Collectively these existing and future projects represent known or anticipated activities that may occur in the project vicinity. The project has the potential to contribute to the cumulative impact thereof. The tabulated projects will not all interact with the preferred overhead power line along its entire route.

6.1.3 Quantifying Economic Impacts

An economic impact is defined as any exogenous change in the local economy that has either a positive or negative effect on current economic activity in that area. This external change can take the form of new investment such as the construction of a powerline, the upgrading of businesses, the expansion of existing production capacity, etc.

It is important to understand that there are two types of investment when a new project is started. Firstly, there is an initial capital injection/expenditure (CAPEX) which takes the form of either the construction of a new structure or the modification of an existing structure. Secondly, there is an annual recurring investment to maintain/operate the capital expenditure investment project. This is referred to as operating expenditure or OPEX.

The economic impacts created by a capital injection (CAPEX) are once-off impacts that will occur for the duration of construction. Thus economic impacts associated with the construction phase are not sustainable economic impacts. Operational economic impacts, unlike capital expenditure economic impacts are sustainable and thus are calculated as an annual impact based on operational expenditure (OPEX) for a given year.

The net economic impact of an exogenous change (from CAPEX and/or OPEX) in the economy will be translated according to various direct and indirect economic effects which are defined as follows:

- **Direct effects**: Are the those changes in local business activity occurring as a direct consequence of the exogenous change to the economy.
- **Indirect effects**: Include business growth for suppliers to the directly affected businesses and potential growth of municipal revenue due to raised taxes and service levies.
- **Induced effects**: Include business growth as the additional workers (created by direct and indirect economic impacts/effects) spend their income on food, clothing, shelter and other local goods and services.

To quantify the anticipated direct, indirect and induced effect of both a CAPEX and OPEX investment, a number of econometric models can be applied. For the purpose of this report the SAM-Leontief model was applied.

A SAM or social accounting matrix is defined as an economy-wide database which contains information about the flow of resources associated with all transactions that take place between economic agents in an economy during a given period. A SAM is an extension of an Input/Output table which shows more detailed information on economic agents and factors of production (i.e. includes households as economic agents). The SAM illustrates in a single square matrix all the interactions between production, income, consumption and capital accumulation in the various sectors of an economy. It is therefore a logical arrangement of statistical information concerning income and expenditure flows in an economy and provides a 'snap shot' of the economy at a given point in time.

The SAM-Leontief model uses social accounting matrices as the underlying database. Coefficients are taken from the SAM and are used to calculate the open (households included) and closed (households excluded) Leontief inverses which are multiplied by the exogenous change to obtain direct, indirect and induced impact on production[8]. The change in production is then multiplied by direct multipliers to obtain specific impacts on GDP, employment and income.

6.2 Impact Evaluation Results

As part of the scoping phase a preliminary impact evaluation was undertaken for both the construction and operational phases of the proposed grid connection. This preliminary impact evaluation is based solely on desktop research and subject to the limitations outlined in Chapter 1. Sections 6.2.1 and 6.2.2 presents a summary of both the construction and operational impacts that are anticipated to arise from the grid connection, before and after mitigation. In the unlikely event that decommissioning occurs, the impacts are expected to be similar to those that took place during the construction phase and therefore the same ratings have been applied.

6.2.1 Construction Phase Impacts

The following sections indicate the positive and negative impacts that are likely to occur during the construction phase of the proposed powerline.

[8] Production/Business Sales refers to the value of all inter- and intra-sectoral business sales generated in the economy as a consequence of the introduction of an exogenous change in the economy. Explained more simply, new business sales equates to additional business turnover as a result of the introduction of an exogenous change in the economy.

6.2.1.1 Positive Impacts during Construction

a) Temporary Stimulation of the national and local economy

As indicated in Table 6.4 it is estimated that the project will increase the country's production by R808.8 million in 2017 prices, which will translate into an additional R213.0 million of Gross Domestic Product per Region (GDP-R). These effects will take place over the course of the construction period.

Table 6.4: Estimated impact on the national and local economies – CAPEX (R' millions, 2017 prices)

Effect	Impact on Production/Business Sales	Impact on GDP-R
Direct	R240.0	R30.9
Indirect	R455.9	R139.3
Induced	R112.9	R42.7
Total	**R808.8**	**R213.0**

The greatest effects on production and GDP-R stimulated during construction activities will be created through the multiplier effects, specifically through a combination of production and consumption induced effects. Production induced effects are those that result from an increase in the demand for goods and services from those businesses that are likely to provide inputs (i.e. cement, steel, etc.) to the construction company(ies) responsible for building the proposed grid connection. Consumption induced effects are those that arise from increased spending on goods and services by those individuals employed during the construction phase of the development.

It is assumed that the majority of the direct spend will be spent within local economies. It should be noted that actual final figures will depend on the choice of suppliers and contracts as well as their procurement strategies.

Project phase	**Construction**			
Impact	**Temporary stimulation of the national and local economy**			
Description of impact	**Temporary stimulation of the national and local economy through construction related spending, and additional spending by SMMEs involved in the construction of the grid connection infrastructure. This will lead to an increase in GDP at a national, provincial and local level.**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• The developer should encourage the contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. • The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	Very high	Natural and/ or social functions and/ or processes are majorly altered

Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - positive**		**Moderate - positive**	
Comment on significance	The implementation of mitigation measures can enhance the project's impact. Benefit is terminated with the end of construction.			
Cumulative impacts	Three other powerline developments are proposed for the area and it is highly likely that if these projects are approved by government the demand for goods and services required for the construction of similar facilities would grow. This could provide sufficient economies of scale and thus open up opportunities for the establishment of new industries in the country and new businesses in the local area, specifically in the sectors that are not well represented in the economy.			

b) Temporary increase employment in the national and local economies

The proposed powerline is anticipated to directly create approximately 55 Full Time Equivalent (FTE[9]) employment positions over the course of the development (see Table 6.5).

Table 6.5: Estimated Full Time Equivalent positions to be created during construction

Effect	Employment (FTE)
Direct	55
Indirect	112
Induced	27
Total	**194**

The construction sector in the Kouga Local Municipality and NMBM collectively employed 30 134 people in 2016 (Quantec, 2016). Given the size of the construction sector within the two municipalities it is anticipated that there will be sufficient local labour to satisfy the demand for 55 construction workers.

Beyond the direct employment opportunities that will be created by the project during the construction phase the development will also have a positive spin-off effect on the employment situation in other sectors of the national and local economies. Through the procurement of local goods (i.e. consumption induced effects) the project will support an additional one FTE employment position.

Based on these figures, the total contribution of the proposed grid connection towards employment creation in South Africa is estimated at further 139 FTE employment positions. Throughout the construction phase it is recommended that the developer encourage the contractor to fill as many local positions as possible using labour with the Kouga Local Municipality and the NMBM.

[9] FTE refers to the total number of hours worked by one employee on a full-time basis.

Project phase	Construction			
Impact	**Temporary increase employment in the national and local economies**			
Description of impact	**Temporary increase employment in the national and local economies from those employed during the construction of the grid connection as well as those employment opportunities created for SMMEs.**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• Recruit local labour as far as feasible • Employ labour-intensive methods in construction where feasible • Sub-contract to local construction companies particularly SMMEs and BBBEE compliant enterprises where possible • Use local suppliers where feasible and arrange with the local SMMEs to provide transport and other services to the construction crews.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	High	Natural and/ or social functions and/ or processes are notably altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - positive**		**Moderate - positive**	
Comment on significance	The implementation of mitigation measures can enhance the project's impact. Benefit is terminated with the end of construction			
Cumulative impacts	None foreseen given the nature of employment.			

c) Temporary increase in household earnings

The proposed powerline will create a total of 194 FTE employment positions during construction generating R54.5 million of revenue for the affected households in the country through direct, indirect and induced effects depending on route selection. Of this figure R17.1 million will be paid out in the form of salaries and wages to those individuals directly employed during the construction phase. The remaining values of R37.3 million in households' earnings will be generated through indirect and induced effects resulting from project expenditure.

Although temporary, this increase in household earnings will have a positive effect on the standard of living within these households. Based on the economic modelling exercise undertaken to determine the effect of construction activities, it is estimated that the average annual salary that will be paid to people employed during construction will be R281 025, with this figure varying significantly based on the respective skill levels and job specifications of the employee.

Project phase	Construction			
Impact	**Temporary increase in household earnings**			
Description of impact	**Temporary increase in household earnings from higher construction workers salaries and wages**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• Recruit local labour as far as feasible to increase the benefits to the local households • Employ labour intensive methods in construction where feasible • Sub-contract to local construction companies where possible • Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	Medium term	Impact will last between 5 and 10 years	Medium term	Impact will last between 5 and 10 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - positive**		**Minor - positive**	
Comment on significance	The implementation of mitigation measures can enhance the project's impact. Benefit is terminated with the end of construction			
Cumulative impacts	Improved standard of living of the affected households. Possible increase of households' savings.			

d) Temporary increase in government revenue

The construction of the proposed grid connection will generate revenue for the government during the construction period through a combination of personal income tax, VAT, companies' tax etc. Additional government revenue will also be earned through corporate income tax. Government earnings will be distributed by national government to cover public spending which includes amongst others the provision and maintenance of transport infrastructure, health and education services as well as other public goods.

Project phase	Construction	
Impact	**Temporary increase in government revenue**	
Description of impact	**Temporary increase in government revenue through higher personal income tax, VAT, companies tax etc.**	
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts
Potential mitigation	• None suggested	

Assessment	Without mitigation		With mitigation	
Nature	Positive		Positive	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - positive**		**Minor - positive**	
Comment on significance	None			
Cumulative impacts	Lower government debt servicing costs. Increased government revenue for social programmes.			

6.2.1.2 Negative Impacts during Construction

a) Changes in the sense of place

A community's 'sense of place' is developed over time as it embraces the surrounding environment, becomes familiar with its physical properties and creates its own history (Lynch, 1981). The sense of place is created through the interaction of a number of different factors such as the areas visual resources, its aesthetics, climate, culture and heritage as well as the lifestyle of individuals that live in and visit the area (Steele, 1981). Most importantly, it is a highly subjective matter and dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs.

For example, a community living in poverty is generally more likely to be accepting of industrial development that promises employment opportunities while a more affluent residential area is more likely to oppose such a development on the grounds that the development is likely to have an adverse impact on property values.

The area proposed for the development as well as its surrounds does not currently have any large-scale industries or high-rise buildings. **Existing powerlines in close proximity to the new development have a very similar visual footprint** to the proposed new powerline. Accordingly, most **properties that have a high degree of visual exposure** to the proposed new grid connection **already have a high degree of visual exposure to the existing powerlines, as the proposed route follows the two existing 132 kV lines for over 70 % of the distance**. Given the characteristics of the area, it can be defined as being largely rural. Any rapid changes that significantly alter the characteristics that define the areas sense of place could potentially have a negative impact.

During the construction of the proposed grid connection there are likely to be some minor noise impacts in the more remote areas (i.e. those locations situated away from the R102 and N2) caused by the movement of vehicles as well as construction activities on site. These impacts are anticipated to occur primarily during the day. The presence of this noise is likely to alter the way the surrounding environment is experienced by households in the area. As construction activities progress and the footprint of the facility grows, the visual impact will also become more apparent and the sense of place experienced by households residing within the visually affected area will be altered further.

It is anticipated that households residing on properties within +/- 500 m radius from the construction of the powerline will experience the most notable disruption in their sense of place during the construction period. These individuals will, over the course of the construction phase of the project, be subjected to either visual or noise disruptions that are currently not present in the area.

The change in sense of place, at the properties located adjacent to, or beyond the site of the proposed powerline, will also be affected to some extent. The visual exposure on all these properties during the construction phase will not be continuous given the proximity of some of the properties from the proposed powerline. Nevertheless, the knowledge of the powerline near the properties and the fact that it could be seen from some parts will still have a negative connotation and will somewhat alter the sense of place experienced by the households residing on these properties.

As stated, the sense of place of local residents is likely to begin to alter once the construction of the proposed powerline begins. Visual impacts will, however, remain for the entire operation of the development. This means that although the effect on the sense of place could be relatively small considering the population to be affected, the duration of the impact increases it significantly.

Project phase	**Construction**			
Impact	**Negative changes to the sense of place**			
Description of impact	**Potential negative changes to the sense of place due to increased visual and noise disturbance to the natural setting that currently characterises the area.**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	• The mitigation measures proposed by the visual specialists should be adhered to • Natural areas that are not affected by the footprint should remain as such. Efforts should also be made to avoid disturbing such sites during construction • Construction activities should be kept to normal working hours according to the Noise Control Regulations in terms of the Environmental Conservation Act (Act 73 of 1989) • Activities that may disrupt neighbours must be preceded by notice being given to the affected neighbours at least 24 hours in advance • Equipment that is fitted with noise reduction facilities must be used as per operating instructions and maintained properly during site operations			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Long term	Impact will last between 10 and 15 years	Long term	Impact will last between 10 and 15 years
Extent	Limited	Limited to the site and its immediate surroundings	Limited	Limited to the site and its immediate surroundings
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered

Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	While reversibility is noted as High, such reversibility can only occur if the site is decommissioned. While the construction period is likely to be less than 5 years, visual impacts that effect the areas sense of place will extend beyond the construction period. As such, the duration has been indicated as long-term.			
Cumulative impacts	Potential change in perception of the area as "out-of-the-way/peaceful/natural" due to the construction of other powerlines in the surrounding area albeit temporarily. Potential altered characteristics of the environment through the introduction of new built elements. Potential change in the perception of tourists of the local environment as "out-of-the-way/peaceful/natural".			

b) Temporary increase in social conflicts associated with the influx of people

Despite the two municipalities being sufficiently diversified to supply the required workforce for the construction of the proposed grid connection, it is highly unlikely that this workforce will be drawn exclusively from the surrounding area. Workers involved in the construction of the proposed grid connection will therefore be traveling to the site on a daily basis.

The influx of construction workers into the area could result in social conflicts between the local population, existing construction workers currently operating in the area and this new workforce. Likewise, the influx of people into the area, could potentially lead to a temporary increase in the level of petty crime, illicit activity, litter and possibly a deterioration of the health of the local community through the spread of communicable diseases (e.g. flu, TB).

Addressing the challenges related to potential social impacts is best done in partnership with all stakeholders in the area, specifically the affected and adjacent property owners, ward councillor and municipality. This would promote transparency, information sharing and help build good relationships between all affected parties.

Project phase	**Construction**	
Impact	**Temporary increase in social conflicts associated with the influx of people**	
Description of impact	**Potential temporary increase in social conflicts associated with the influx of people such as crime, litter etc.**	
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts

Potential mitigation	• Control the movement of workers between the site and areas of residence to minimise loitering around the facility. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence • Employ locals as far as feasible through the creation of a local skills database • Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment • Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area • Ensure that any damages or losses to nearby affected farms that can be linked to the conduct of construction workers are adequately reimbursed • Assign a dedicated person to deal with complaints and concerns of affected parties • Litter collection bins should be provided and appropriately placed within the contractor's site camp and on site, and should be regularly cleared			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	It is possible that social conflicts in the area by construction workers and job seekers could continue to occur after construction if these individuals decide to remain in the area and are unable to find a sustainable income.			
Cumulative impacts	Increased community unrest and protests			

c) Impact on property and land value in the immediately affected area

Over the years, many international studies have been undertaken to determine the impact of high-voltage transmission lines (HVTL) on the value of residential and rural properties. The volume of research into to HVTLs effect on rural property prices (mainly in the United States and Canada) however, is relatively small compared to the large volume of work investigating their possible impacts on urban property prices. These studies however agree that HVTLs effect on properties prices, be they urban or rural, are not easily measurable.

Based on a review of research conducted in the United States, Pitts and Jackson (2007) suggests that HVTL affects residential properties in varied ways based on the interplay of the following five factors namely:

- Proximity to towers and lines
- The view of towers and lines
- The type and size of HVTL structures
- The appearance of easement landscaping; and
- Surrounding topography

Although most research indicates that HVTLs have either no significant impact on urban or rural property values or a slight negative impact (see Kinnard & Dickey, 1995), some studies have shown that properties adjacent to, or with views of an HVTL right-of-way actually sell for a premium over more distant lots. This premium is most likely due to improved visual clearance, increased privacy and larger property sizes (Delaney & Timmons, 1992; Des Rosiers, 2002).

While academic literature provides a broad background of findings on the price effects of HVTL, real estate agents and other property appraisers can provide additional perspective into local property market conditions. Real Property Analytics (2007) assessment of HVTLs in several states in the U.S. indicated that approximately half of the real estate agents and appraisers interviewed said that they had not observed a negative impact on either residential sale prices or days on market due to the presence of the powerlines. According to these real estate agents and appraisers, major factors affecting sale price and marketability of residential properties include:

- Location
- The general economy
- Interest rates
- Inventory (i.e. the number of properties in the area currently on the market)

Many real estate agents and appraisers indicated that price and marketability effects of HVTL depend on the market conditions at the time of sale. One of the key findings of Real Property Analytics' study were that the negative effects from powerlines (and from other negative externalises) are evident in a slow market. When demand is strong, these effects diminish. The price effect of the powerline then depends on property characteristics and market conditions.

Impacts on residential property diminished rapidly with increasing distance from HVTLs. Where an impact was found it was deemed to be mainly from the visual impact of HVTLs with no evidence appearing that would suggest that health concerns were adversely impacting prices. Where negative impacts were found there is evidence to suggest that they generally decrease with time.

In summation, the impacts of powerlines on residential properties are varied and difficult to measure. The impacts from powerlines, as well as other negative externalities, depend on many factors, including market condition, location, and personal preference (EirGrid Plc, 2016). Furthermore, it is highly probable that should a reduction in property prices occur, it would be marginal and only persist for a limited period. It is also likely that, should such a reduction occur, it would be confined to areas where the proposed grid connection route passes through or in close proximity to urban areas. The low number of property transactions and the pre-existence of powerlines in the rural areas, will in all probability make the impact on property values in such areas inconsequential.

Project phase	Construction			
Impact	**Impact on property and land value in the immediately affected area**			
Description of impact	**Potential impact on actual and perceived property and land values in the immediately affected area**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	• Meet with the affected owners and discuss their concerns over property and land values, as well as educate and inform them on the potential environmental impacts that could ensue • Mitigation measures to reduce the impact on the sense of place as considered by the visual impact assessment should also be implemented			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Long term	Impact will last between 10 and 15 years	Long term	Impact will last between 10 and 15 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Low	The affected environment will not be able to recover from the impact - permanently modified
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	The available evidence is inconclusive of the impact of powerlines on property and land values. Several studies have shown no impact, while others have found a small negative impact. In the event that there is an impact on property prices it will arise in the construction phase and persist into the operational phase, as evident by the long-term duration.			
Cumulative impacts	None foreseen.			

d) Impact on local tourism industry in the affected area

The tourism potential of the immediate vicinity within and adjacent to the grid corridor could be negatively impacted, should tourism infrastructure be altered, or tourism-associated products be affected (e.g. bird life, aquatic resources, vegetation and fauna). The impacts on these tourism-associated products have been detailed in the relevant specialist studies.

The proposed power line is also likely to alter the visual character and ambience of the of the immediate areas adjacent to the grid corridor. The impact of this is detailed in the Visual Impact Assessment. Altering the visual character of these areas could adversely reduce the number of ecotourists that could

potentially visit the area. This could subsequently have an impact on the area's current tourism appeal and marketing strategy.

It is however critical to note two salient points. Firstly, the majority of the corridor is considered rural but **largely transformed**, with a number of existing built elements already present (i.e. powerlines, dual carriage way N2, R102, R330, R334, etc.). This has **already likely altered the visual sense of place experienced by tourists that may visit the area**. International academic sources such as Chalmers & Voorvardt (2009), Sims & Dent (2005) and Wolverton & Bottemiller (2013) suggest that there are minimal changes to property use and economic activities as a result of the erecting such power lines.

Secondly, there are **very few tourist attractions within the proposed grid corridor**. The overwhelming majority of tourists that visit either the Kouga Local Municipality or NMBM, are therefore unlikely to be negatively impacted by the presence of the proposed power line as they will simply not visit the area in which it is situated. The negative impact that arises will thus be **confined to a small fraction of ecotourists that visit the area for its visual character**.

It should also be noted that while this impact will arise during the construction phase, it will persist into the operational phase and will only cease on the decommissioning of the power line.

Project phase	**Construction**			
Impact	**Negative impact on the local tourism industry**			
Description of impact	**Potential indirect impact on the local tourism industry through changes in the visual environment**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• Implementation of the mitigation measures outlined in the visual impact assessment relating to sense of place.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Limited	Limited to the site and its immediate surroundings	Limited	Limited to the site and its immediate surroundings
Intensity	Negligible	Natural and/ or social functions and/ or processes are negligibly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the	Medium	The affected environment will only recover from the

		impact with significant intervention		impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance	Visual impacts cannot be eliminated due to the permanent nature of the transmission line thus the local tourism industry could still experience some losses due to lower number of ecotourist visits and resultant expenditure in the area. The research however suggests that this will be confined to a small fraction of ecotourists that visit the area for its visual character. Furthermore, if such impacts do occur, they have likely already arisen as a result of surrounding infrastructure developments (powerlines, roads etc.).			
Cumulative impacts	None foreseen.			

6.2.2 Operational Phase Impacts

The following sections indicate the positive and negative impacts that are likely to occur during the operational phase of the proposed powerline.

6.2.2.1 Positive Impacts during operations

a) Sustainable increase in production and GDP nationally and locally

The total impact on production in the country as a result of the grid connection's operations will equate to R46.5 million in 2017 prices per annum and R82.6 million in the fifth year after completion. Aside from the utilities sector, industries that will experience the greatest stimulus from the project will include electrical machinery and apparatus, insurance, and transport service.

Table 6.6: Estimated annual impact on the national and local economies – OPEX (R' millions, 2017 prices)

Effect	Impact on Production/Business Sales	Impact on GDP-R
Direct	R13.8	R1.8
Indirect	R26.2	R8.0
Induced	R6.5	R2.5
Total	**R46.5**	**R12.2**

Due to the annual spending on labour and procurement of local goods and services required in the maintain the proposed powerline, almost all of these new business sales will be generated on an annual basis in the two municipalities through the multiplier effects. Only a very small proportion of the annual production resulting from the powerlines operations will be accounted for in other parts of the country.

It is estimated that the project will directly generate R1.8 million of value add per annum. Through indirect and induced effects, an additional R10.5 million of GDP-R will be generated per annum, which means that the total impact of the project on the national GDP-R will equate to R12.2 million per annum in 2017 prices.

Project phase	Operation			
Impact	**Sustainable increase in production and GDP nationally and locally**			
Description of impact	**Sustainable increase in production and GDP nationally and locally through ongoing operational spending (i.e. maintenance) by the wind energy facility**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• The operator responsible for the maintenance of the powerline and servitude should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate – positive**		**Moderate - positive**	
Comment on significance	None			
Cumulative impacts	Increased demand for goods and services from multiple grid connection projects coming on line in a short space of time could justify the creation of new businesses that provide such goods and services within the local economies. This would contribute to the local economies' growth and development. Delays in establishing the wind farms, would adversely impact the development of the associated grid connections, and subsequently reduce the opportunities for new business establishment.			

b) Creation of sustainable employment positions nationally and locally

The ongoing maintenance and monitoring of the proposed powerline will directly create an estimated three FTE employment position all of which will be retained for the lifespan of the powerline. Aside from the direct employment opportunities, the powerline will support a further estimated 8 FTE employment positions created through the production and consumption induced effects. Due to the spatial allocation of procurement spending and direct employment created, most of the indirect and induced positions will also be created within the local area.

Project phase	Operation
Impact	**Creation of sustainable employment positions nationally and locally**

Description of impact	**Creation of sustainable employment positions nationally and locally. This would occur through the provision of maintenance and security either by Eskom or through the procurement of such services from local SMMEs.**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• Where possible, local labour should be considered for employment so as to increase the positive impact on the local economy • As far as possible, local SMMEs should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - positive**		**Moderate - positive**	
Comment on significance	None			
Cumulative impacts	Larger number of permanent operational positions created Improved living standards of the directly and indirectly affected households Experience in operating and maintaining a wind energy facility			

c) Improved standards of living for benefiting household

The creation of 11 FTE employment positions throughout the country will generate an estimated R3.1 million of additional personal income (2017 prices), which will be sustained for the entire duration of the powerline's lifespan. Given the average household size in affected local municipalities and nationally, this increase in household earnings will support up to 40 people. The sustainable income generated as a result of the project's operation will positively affect the standard of living of all benefitting households.

Project phase	**Operation**	
Impact	**Improved standards of living for benefiting households**	
Description of impact	**Improved standards of living for benefiting households through higher incomes generated by those individuals either employed to maintain the grid connection, or who derive economic benefit from it**	
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts

Potential mitigation	• Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy • As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - positive**		**Minor - positive**	
Comment on significance	None			
Cumulative impacts	Additional households benefiting from increased income due to working on multiple projects Improved productivity of workers. Improved health and living conditions of the affected households.			

d) Sustainable increase in national and local government revenue

The proposed powerline will, through salaries and wages payments, contribute towards both local and national government revenue. This will occur at a national level with the revenue derived from the payment of salaries and wages to permanent employees involved with the maintenance of the grid connection will contribute to the national fiscus. Although it is impossible to trace exactly how such revenue is allocated, any additional revenue generated means that national governments can increase its spending on public goods and services.

Project phase	**Operation**			
Impact	**Sustainable increase in national and local government revenue**			
Description of impact	**Sustainable increase in national and local government revenue through higher property taxes and wage payments**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• None suggested			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years

Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - positive**		**Moderate - positive**	
Comment on significance	None			
Cumulative impacts	Higher government revenue Increased social expenditure from additional revenue generated from wind farms Possible improved service delivery due to higher government revenue			

e) Provision of electricity for future development

Strengthening of the electricity network within the two municipalities will benefit both residents and business owners, in that the reliability of the current supply will be increased and residences and businesses who do not currently have access to electricity may obtain access. In addition, the proposed 132 kV powerline will help to unlock further development in the both Humansdorp, Jeffreys Bay (Kouga), Thornhill, and KwaDwesi (NMBM) and be of strategic importance in the long-term westward expansion of Port Elizabeth. Construction of the powerlines is not anticipated to limit the expansion potential of the residential or commercial areas.

Project phase	**Operation**			
Impact	**Provision of electricity for future development**			
Description of impact	**Increasing the energy supply will benefit both residents and business owners, in that the reliability of the current supply will be increased and residences and businesses who do not currently have access to electricity may obtain access**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	• None suggested			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Positive		Positive	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	National	Impacts felt at a national level	National	Impacts felt at a national level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain /	It is most likely that the impact will occur	Almost certain /	It is most likely that the impact will occur

	Highly probable		Highly probable	
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - positive**		**Moderate - positive**	
Comment on significance	None			
Cumulative impacts	Increase volume and certainty of the energy supply.			

6.2.2.2 Negative Impacts during operations

a) Negative changes in the sense of place

The effects on the community's sense of place will initially be felt during the construction period and will continue into the operational phase. The assessment of the negative change in the sense of place provided for the construction phase covers the effects during the operational phase due to the long-term duration of the effect.

b) Impact on local tourism industry in the affected area

The effects on the tourism industry will initially be felt during the construction period and will continue into the operational phase. The assessment of the negative effect on the tourism industry provided for in the construction phase covers the effects during the operational phase due to the long-term duration of the effect.

c) Negative impact of Electro-Magnetic Field (EMF)

Since the late 1970s, individuals have raised questions about whether the exposure to extremely low frequency (ELF) electric and magnetic fields (EMF), such as those generated by powerlines, produces adverse health consequences (WHO, 2007).

There is no convincing evidence that exposure to EMF fields below currently accepted international exposure limits causes direct damage to biological molecules, including DNA (WHO 2001). Since the evidence suggests that it is unlikely that EMF fields could initiate cancer, a number of investigations have instead focused on whether EMF exposure can influence cancer promotion or co-promotion. Results from animal studies used in the health risk assessments have been mostly negative (WHO, 2001).

Despite the large number of studies published of the effects of EMF, several endpoints have not been rigorously examined. As the methodology of studies improved, the estimates of risk have become lower, making it unlikely that these studies are failing to identify a high risk. Nevertheless, a sufficient uncertainty remains as to the potential of EMF involvement in the causes of cancer (WHO, 2011). Therefore, even a small risk associated with EMF exposure could have important public health consequences.

Accordingly, the International Commission for Non-Ionizing Radiation Protection (ICNIRP) specified guidelines for EMF exposure in 1998 and subsequently updated these guidelines in 2010. These guidelines recommend the maximum Electric and Magnetic Fields allowable for limiting EMF exposure and subsequently protecting any individuals from any adverse health effects. Eskom has likewise published a study that sets minimum servitude boundaries for powerlines in order to limit adverse EMF exposure (Eskom, 2006).

Project phase	**Operation**			
Impact	**Negative impact of Electro-Magnetic Field (EMF)**			
Description of impact	**Potential adverse health risks associated with being exposed to EMF emitted from proposed grid connection**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**No buildings should be constructed within the powerline servitude During maintenance activities, personnel should ensure that no vagrants stay within the powerline servitude**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Regional	Impacts felt at a regional / provincial level	Regional	Impacts felt at a regional / provincial level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Minor - negative**	
Comment on significance	None			
Cumulative impacts	None foreseen			

6.2.3 Decommissioning Phase Impacts

It is highly unlikely that once the proposed grid connection is established it will be decommissioned. If the proposed grid connection were to be decommissioned, the land will be rehabilitated in order to return it to pre-project conditions. This means that all impacts whether positive or negative, which take

place during the operational phase will cease to exist. At the same time spending on the disassembly of the components and rehabilitation of land will increase the demand for construction services and other industries, thus stimulating economic activity in the local area, albeit over a temporary period.

Socio-economic impacts stimulated during the decommissioning phase are expected to be similar to those that took place during the construction phase. They will also be temporary in nature, but most likely will take a much shorter time than the construction phase.

6.2.4 Net effect and trade-off analysis

The assessment of the proposed powerline, or its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment. Stimulation of production, employment, government revenue, skills development and household income as a result of the investment in the project and its subsequent operations will outweigh possible production, employment and household income losses that could potentially be experienced by local businesses affected by changes in the areas aesthetic and visual resources. Adherence to the proposed mitigation measures however would ensure that the offset of impacts is more balanced and that it also takes into account communities and businesses that will be negatively affected.

The positive effects generated by the project will not entirely offset all the negative impacts. These include impacts on the sense of place and property and business values that could occur during both construction and operation. These impacts though will affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings. This means that when compared with the no-go option, the proposed project is associated with greater socio-economic benefits.

Table 6.5: Summary of the net effect on the socio-economic environment

During Construction		During Operations	
Net effect on production	Positive	Net effect on production	Positive
Net effect on employment	Positive	Net effect on employment	Positive
Net effect on household income	Positive	Net effect on household income	Positive
Net effect of government revenue	Positive	Net effect of government revenue	Positive
Net effect on sense of place	Negative	Net effect on sense of place	Negative
Net effect on property and land values	Negative	Net effect on property and land values	Negative

6.3 Assessment of the No-Go Option

Under the No-Go option the proposed grid connection would not be developed. As such, all the proposed impacts outlined in Section 6.2 would be "neutral" i.e. should the development not occur none of the negative or positive impacts identified during the construction, operational and decommissioning phases would arise.

6.4 Cumulative Impacts

The cumulative impact of the additional developments outlined in Section 6.1.2 during both the construction and operational phases will be similar to those identified in Section 6.2. The positive impacts (e.g. higher GDP, increased employment, greater government revenue etc.) will be greater due to increased investment occurring as a result of these additional developments, while the negative impacts will be lower. The cumulative impacts identified are:

- **Cumulative impact on the national and local economy during the construction and operational phases**
  Cumulative impacts on the national and local economy are the same as the construction and operational phase impacts except that that the size of the impact will greater. That is, since the additional developments will necessitate greater CAPEX and OPEX investment which will in turn increase the effect on production and GDP. Using the SAM (see Section 6.1.3), it is estimated that for every additional R1 million investment in the developments outlined in Section 6.1.2, production will increase by R3.3 million and GDP by approximately R887 000. With mitigation, the impact significance is likely to be **moderate - positive**.

- **Cumulative impact on employment in the national and local economies during the construction and operational phases**
  Cumulative impacts on employment are the same as the construction and operational phase impacts except that that the size of the impact will greater. As in the case of GDP and production, higher CAPEX and OPEX due to the additional developments will increase employment both during construction (temporarily) and operations (permanent). The SAM suggests that for every additional R10 million investment in these developments, employment will increase by approximately 8 FTEs. With mitigation, the impact's significance is likely to be **moderate - positive**.

- **Cumulative impact on household earnings during construction and operational phases**
  Cumulative impacts on household earnings are the same as those that would arise during the construction and operational phases. Again however, the size of the impact will be greater due to increased investment by the other developments. With mitigation, the impact's significance is likely to be **minor - positive**.

- **Cumulative impact of the increase in government revenue during the construction and operational phases**
  Government revenue is anticipated to increase (through higher taxes) during the construction and operational phases of the planned developments outlined in Section 6.1.2. These cumulative impacts will be similar to those of the proposed powerline development, although greater in size. The impact's significance is assessed as being Minor – positive. The implementation of mitigation measures will increase the significance marginally, however it's overall significance will remain **minor – positive**.

- **Cumulative impact on the sense of place**
  The sense of place will be impacted through the presence of various built structures (the proposed power line and its pylons). Because the area is surrounded by several renewable energy facilities and proposed powerlines, the impact significance is assessed as being **minor - negative** without the implementation of mitigation measures. The proposed power line would make a fairly small contribution to the overall visual impact to the landscape given the existence of other powerlines in the area. Because the powerline would likely be seen against a backdrop

of other similar structures, the cumulative impact significance is considered to remain **minor - negative** after mitigation

- **Cumulative impact of an increase in social issues associated with the influx of people**
  Cumulative impacts on social issues the same as those that would arise during the construction phase except that they may occur over a larger area and effect a greater number of people. As noted in the individual impacts however, many of these social issues can be effectively mitigated and accordingly the cumulative impact's significance is assessed as being **negligible – negative.**

- **Cumulative impact on property and land value in the immediately affected area**
  As indicated the in the individual impacts, should a reduction in property prices occur, it would be marginal and only persist for a limited period. Section **6**.2.1.2 also highlighted that the low number of property transactions and the pre-existence of powerlines in the area, will likely make the impact on property prices inconsequential. Accordingly, the cumulative impact's significance was assessed as being **negligible – negative.**

6.5 Summary and Way Forward

Based on the assessment undertaken in this chapter, the following potential positive impacts of the proposed grid connection relate to:

- GDP growth
- Local and preferential procurement (BBBEE, women-owned vendors etc.)
- Enterprise development
- The creation of employment and skills development opportunities
- Provision of electricity for future developments

Potential negative impacts that could arise (but which can largely be mitigated) include:

- The impact on the rural sense of place and scenic integrity of the landscape. In the unlikely event that such negative impacts do occur, the impact is likely to be small given the transformed nature of the landscape and the close proximity to existing overhead powerlines and other developments. These impacts can, in turn, impact the tourism industry in the area.
- It was also noted that many properties that are likely to have a high degree of visual exposure to the proposed new grid connection already have a high degree of visual exposure to the existing powerlines. Thus the likelihood of the proposed powerline altering their sense of place is small.

No fatal flaws were identified as part of the socio-economic assessment.

This preliminary information suggests that, from a socio-economic perspective, that proposed development is acceptable and will have a predominately positive impact on the socio-economic environment and should be authorised.

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Annexure 1: Specialists' Curriculum Vitaes

Elena Broughton

Date of Birth:	11 September 1980
Designation:	Unit Manager: Innovation & Sustainable Development
Profession:	Senior Development Economist
Specialisation:	Sustainable Development Specialist
Years within Firm:	13 Years
Nationality:	Russian
Years of Experience:	13 Years
HDI Status:	White Female

Education:	
University of Pretoria - 2011	MSc (Technology Management)
University of Pretoria - 2007	BScHons (Technology Management)
Parkland College, USA - 2004	Computer Integrated Accounting
Parkland College, USA - 2004	Independent Business
Parkland College, USA - 2003	Intermediate Accounting
Parkland College, USA - 2003	Records Management
Parkland College, USA - 2003	Financial Accounting
Parkland College, USA - 2003	Managerial Accounting
Nizhny Novgorod University, Russia - 2002	BComHons (Economics)

Professional Membership:
SAPOA Urban-Econ Development Economists (Pty) Ltd

Language Proficiency:	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Russian	Excellent	Excellent	Excellent

Work Experience:

2004 - Current	Urban-Econ Development Economists (Pty) Ltd

Key Qualification:

Elena Broughton completed her BComHons in Economics in Russia, at Nizhny Novgorod State University in 2002 specialising in regional economics. At the same time, she completed an additional degree as Translator/Interpreter in Professional Orientated Communication. After completion of her Honours degree in Economics, Elena moved to the USA and stayed there for 1.5 years. During her stay in the USA, she completed a number of Accounting and Business courses at Parkland College, Illinois. In 2007, she obtained her BScHons in Technology Management (Cum Laude) at the University of Pretoria and later received her MSc in Technology Management (2011) from the same university.

Elena Broughton is a senior professional at Urban-Econ and has an extensive knowledge in various fields of economic development, including impact assessments, investment strategy formulation, strategic decision analysis, and monitoring and evaluation. She is experienced in developing input-output and SAM-based models, as well as development and application of other econometric techniques. Elena has a special interest in project evaluation and decision-making framework, with the latter being the focus of her Master's dissertation. Over the past few years, she was able to extend her experience in these fields working on projects for both government and the private sector. Elena is managing the Innovation & Sustainable Development Unit and has successfully completed various energy and innovation projects in this capacity.

Experience Record:	
Project:	The Localisation Potential of Photovoltaics (PV) and a Strategy to support large scale roll-out in South Africa
Year:	June 2012 – March 2013

Location: **Client:** **Project Features:** **Activities Performed:**	**National** **WWF S, South African Photovoltaic Industry Association (SAPVIA), and the Department of Trade and Industry, RSA** ▪ **Describing of the global PV industry and its trends** ▪ **Profiling of the local PV industry** ▪ **Analysing of the local PV value chain considering three market segments, i.e. rooftop, commercial and utilities** ▪ **Analysing of financial dynamics of the market and standardisation requirements** ▪ **Determining the potential for localisation in the country** ▪ **Developing a strategy for the future roll-out** **Policy environment review, market segments analysis, demand analysis, value chain analysis, pricing of components, local content analysis, potential for localisation assessment, strategy formulation** **The goal of the study was to describe the global and local PV industry trends and dynamics, and to develop localisation scenarios for the purposes of providing recommendations with respect to the future roll-out of the industry.**
Project: **Year:** **Location:** **Client:** **Project Features:** **Activities Performed:**	**Feasibility study into establishing CSP component manufacturing facilities in South Africa** **November 2012 – February 2013** **National** **The Industrial Development Corporation, RSA** ▪ **The identification of various CSP technologies and systems that are promoted internationally** ▪ **And various designs and configuration of each technology.** ▪ **An overview of the international and local CSP market, the major materials and components of CSP with a view of establishing a local manufacturing base of CSP systems and components** ▪ **The identification of key technical and technology partner in the development of the manufacturing facility** ▪ **Engagement with the potential technical partner to determine whether the IDC can capacitate the supplier to manufacture components and systems locally** ▪ **Identification of a suitable location for the new facility or expansion of existing local CSP component manufacturing facilities in South Africa** ▪ **The amount of potential jobs that will be created from expansion or creation of a new facility, preliminary financial model and CAPEX budget.** **Global CSP industry analysis, value chain analysis, local industrial capabilities assessment, demand analysis, job creation potential analysis**
Project: **Year:** **Location:** **Client:** **Project Features:** **Activities Performed:**	**Northern Cape Renewable Energy Strategy** **November 2012 – June 2013** **National** **The Northern Cape Department of Economic Development and Tourism, RSA** ▪ **Description of the status and potential of the local renewable energy sector** ▪ **Investigation of the potential to establish clean and green sustainable development projects in the Province in line with the optimal mix identified.** ▪ **Identification of income generation opportunities for the purpose of revitalising rural communities** ▪ **Assessment of the institutional capacity and capability** ▪ **Strategy and implementation plan formulation** **Policy environment analysis, renewable energy industry profiling, desired state of industry analysis, market segmentation and demand analysis, stakeholder analysis and institutional structures review, strategy formulation**
Project: **Year:** **Location:** **Client:** **Project Features:**	**A study of the factors contributing to successful technology commercialization** **March 2015-September 2015** **National** **The dti** • **Current context and framework for technology commercialisation in South Africa** • **Identification of critical factors and resources required for successful commercialisation**

Activities Performed:	• On-line survey • Interviews with numerous stakeholders (universities, businesses, government organisations) • Case study analysis of policies and interventions in other countries • Profiling of the current policy environment, funding mechanisms and stakeholders • Identification of mechanisms and interventions to assist in commercialisation of technologies • Formulation of a guide for commercialisation Project management and quality control, presentation of study findings
Project: Year: Location: Client: Project Features: Position held: Activities Performed:	Assessment of policy to enable the implementation of energy efficiency in the building sector December 2014-April 2015 National SANEDI/Department of Energy • Assessment of existing national and local government policy frameworks (legislations, standards, policy, building codes etc.) with respect to constraints and opportunities created for implementation of energy efficiency in the building sector • Interview various stakeholders • Review of interventions and support mechanisms • Undertake case studies • Provide policy recommendations Project manager Project management and quality control, presentation of study finding
Project: Year: Location: Client: Project Features: Position held: Activities Performed:	A Study of the Economic Impact of load shedding on the City of Johannesburg with or without Kelvin Power Station January 2015 – June 2015 City of Johannesburg City of Johannesburg Metro • Developing a model of electricity usage by various economic sectors based on information supplied by City Power • Profiling economic structure of Coty of Joburg regions • Modelling of the potential economic impact on the City with and without Kelvin Power Station, in the short-term and the impact of outages on the City as a whole over the medium-term; • Interview large electricity users in the City • Interpreting economic effects of load shedding derived from the modelling exercise in the context of the CoJ economy, and specifically its implications on the production, Gross Domestic Product per region (GDP-R), and employment Senior Economist Economic modelling, report quality control, presentation of findings
Project: Year: Location: Client: Project Features: Position held: Activities Performed:	Global Energy Efficiency options: Energy efficient technologies, policy and institutional requirements for adoption in South Africa July 2015 – February 2016 National The dti/the Industrial Development Corporation • Profiling of full range of Energy Efficiency options currently being utilised globally in the building and industrial/mining sectors • Assessment of technologies favoured by countries that have successfully implemented EE measures • Explore policy initiatives and incentives that contribute to both the greening of industries and the establishment of new green industries • Developing a cost and savings potential model to evaluate technologies Project Manager Project management and quality control, presentation of study findings, costing and saving model development
Project:	Feasibility study of high temperature applications for South Africa

Year:	October 2014 – February 2015
Location:	National
Client:	CSIR/the Department of Science and Technology
Project Features:	• Profile HTA technologies • Assess South Africa's readiness and need for HTA • Assess the current and projected future requirements for HTA • Evaluating the prospects (technical and economic) of HTA in South Africa • Determine RDI opportunities for the country • Formulate and action plan and providing recommendations appropriate for the implementation programme
Position held:	Project Manager
Activities Performed:	Project management and quality control, engagement with industry stakeholders

Other Projects:

- Sustainable Energy Consumption and Production (SECP) in agriculture and integrated waste management - research and training: Sustainable Energy Consumption and Production (SECP) is a programme designed and implemented by the Renewable Energy and Energy Efficiency Partnership (REEEP). REEEP partnered with SANEDI to implement the initiative in South Africa, in order to assist the local business communities and entrepreneurs in the agricultural and waste management sectors to implement Sustainable Consumption and Production (SCP) practices within their respective industries. Urban-Econ was appointed to undertake a study into agriculture and integrated waste management with a specific emphasis on SECP practices employed in these two sectors and opportunities that exists for SECP deployment. The study reviewed the value chains within three agricultural sub-sectors, the energy intensity of different agricultural activities and waste generated by these. It identified the opportunities for energy efficient and renewable energy technologies and practices deployment, reviewed 23 case studies, and provided information on financial-and non-financial support that South African farmers could access to assist them in taking up the identified energy efficient and renewable energy technologies and solutions. A training manual was developed and a number of workshops were conducted in three provinces, i.e. Gauteng, Western Cape, and Free State
- Feasibility study on biogas feedstock availability and characterisation: The CSIR main campus is envisaged to become energy autonomous in five to eight years. A number of alternative energy solutions are considered, one of which is a biogas project. The energy Centre at the CSIR appointed Urban Econ to undertake the assessment of the potential organic waste feedstock that could be gathered within 50km radius from the site. They study included analysis of the biomass availability, review of environmental benefits, and recommendations for the most cost-efficient sources of organic waste feedstock that could be explored.
- Go-to-Market Strategy for a PV/Panel Manufacturer: Urban-Econ together with EScience Associates and Tracy Stewart Consulting was appointed by the CEF to undertake a Go-to-Market Strategy for a PV panel manufacturing facility. The project consisted of two major parts. The first component included the analysis of the market and opportunities presented in the market, as well as identification of the needs, affordability levels and requirements by all groups of stakeholders in the industry's value chain. The second part of the study included the formulation of the strategic plan that outlined various target markets to be pursued, value proposition to be offered, market channels to be considered for entering the market and activities to be implemented during the product pre-launch, launch and post-launch phases.
- High-tech bio-sciences incubator feasibility study: The study focused on the assessment of the feasibility of establishing a physical high-tech bio-sciences incubator at the Innovation Hub in Gauteng, South Africa. It involved the investigation into the most feasible location, market viability, service offerings, operational requirements, and seed funding requirements.
- High-tech chemical sector incubator feasibility study: The study focused on the assessment of the feasibility of establishing a high-tech chemical sector incubator in Gauteng, South Africa. It involved

the investigation into the most feasible location, market viability, service offerings, operational requirements, and seed funding requirements.

- Promotion of Decent work in Southern African Ports (phase ii): The study focused on the independent assessment of progress to date of the project across all the outcomes; assessing performance as per the foreseen targets and indicators of achievement at output level, strategies and implementation modalities chosen, partnership arrangements, constraints and opportunities in both Mozambique and South Africa. It provided strategic and operational recommendations as well as highlighted lessons to improve performance and delivery of project results. to port workers.
- A feasibility study and a business plan for downstream beneficiation of fly ash in the Nkangala District Municipality: Large volumes of coal fly ash (CFA) are being produced at power stations in Mpumalanga. CFA is already used as a cement extender by local cement factories; however, CFA has numerous other applicants that are not properly explored. The study therefore aimed at investigating all possible opportunities that could be derived from CFA beneficiation and identification of those that could be realised in Nkangala.
- Matjhabeng Solar Park: Socio Economic needs analysis and plan formulation: The study focused on the community of Matjhabeng, the Free State Province. It involved the identification of the socio-economic needs and priorities for the local communities, creating an inventory of social facilitates and small enterprises, and running a skills registrar. Aside from the secondary data review, 100 households were surveyed, 35 social facilities were profiled, and 30 businesses were audited. a skills development, a social facilitates, and enterprise development investment plans for the project developer were formulated.
- Examining the possibility of attracting corporate social investment (CSI) into water research and development: The study aimed at obtaining feedback from a sample of corporate representing a variety of industries with regard to the possibility and appetite to invest CSI funds in deploying water and sanitation related solutions in communities targeted by them.
- Go-to-Market Strategy for a PV/Panel Manufacturer: Urban-Econ together with EScience Associates and Tracy Stewart Consulting was appointed by the CEF to undertake a Go-to-Market Strategy for a PV panel manufacturing facility. The project consisted of two major parts. The first component included the analysis of the market and opportunities presented in the market, as well as identification of the needs, affordability levels and requirements by all groups of stakeholders in the industry's value chain. The second part of the study included the formulation of the strategic plan that outlined various target markets to be pursued, value proposition to be offered, market channels to be considered for entering the market and activities to be implemented during the product pre-launch, launch and post-launch phases.
- SunCorp Socio-Economic and Enterprise Development Plan Formulation: Urban-Econ was appointed by SunCorp to develop a Socio-Economic Development and Enterprise Development Plan for a Solar PV project in the Free State. The plans were devised in line with the DOE requirements outlined for the bidding phase.
- Savanna Cookware Manufacturing Facility Pre-Feasibility Study: Urban-Econ undertook a pre-feasibility study for a manufacturing facility planned to produce luxurious stainless-steel cookware in South Africa. The pre-feasibility study focused on determining the need and desirability for the proposed manufacturing facility considering the defined primary and secondary markets, the key prerequisites for the viability of the proposed venture and the most optimal location for the proposed manufacturing facility.
- An Opportunity Cost Assessment for the proposed Labonte 5 Mining Project: The purpose of the study was to investigate the opportunity cost of the proposed sand mining project to determine the implications on the local economy dynamics and the impact on the major infrastructure projects implemented in the Lephalale area if the proposed project is not approved.
- Saldanha Bay Separation Plant Economic Impact Assessment: The project involved undertaking an Economic Impact Assessment study for the proposed construction and operation of a Rare Earth Elements (REE) Separation Plant on Portion 6 of the Farm Langeberg 188 in Saldanha, in the Western

Cape Province. The study formed part of the Environmental Impact Assessment process as prescribed in the National Environmental Management Act (NEMA) of 1998 and its subsequent amendments.

- Zandkopsdrift Rare Earth Elements (REE) Project Economic Impact Assessment: The project involved undertaking a Socio-Economic Impact Assessment study for the proposed the Zandkopsdrift Rare Earth Elements (REEs) Project near Garies in the Northern Cape Province of South Africa. The study formed part of the Environmental Impact Assessment process as prescribed in the National Environmental Management Act (NEMA) of 1998 and its subsequent amendments.
- Balmoral EIA: The study involved undertaking a Socio-Economic Impact Assessment as an input into a Basic Impact Assessment Study for the proposed Balmoral X5 Township Development in the Ekurhuleni Metropolitan Municipality (EMM).
- Green Building Market Entry Study: The Embassy of the Kingdom of the Netherlands in Pretoria appointed Urban-Econ to undertake a market entry study for the Green Building Industry of South Africa. The document was compiled for the purpose of guiding the existing or prospective Dutch companies in expanding or involving themselves in the South African Green Building Industry. The report contained information on the policy and regulatory environment that drives the development of this sector in the country and the broad overview of the status of the construction industry with the focus on the green building industry. The document also encompassed information on the state of development and industry maturity of selected green building sub-sectors that are aligned with the expertise of the Dutch companies. Information on doing business in South Africa as far as procurement and tendering practices, business funding and other support offered by South Africa and Netherlands, was also provided.
- Royal Bafokeng Mining Procurement Study: The study identified business opportunities that can be established in the area leading to the localisation of mining inputs. It was based on a comprehensive assessment of the selected mine's contract-based procurement practices.
- Ventersburg Business Development Concept: The study focused on the identification of business development opportunities that could be pursued in the town of Ventersburg based on the traffic derived in the area from the N1 highway and other regional roads. The study involved a comprehensive assessment of the target markets induced by traffic, economic base of the area, current business offerings and derived opportunities. It concluded with a presentation of business development concept scenarios and associated socio-economic benefits.
- Eskom CSP (Solar 1) Macroeconomic Impact Assessment: The study involved the identification of potential localisation opportunities for various components of the project and modelling of the socio-economic impact.
- Proposed Exxaro IPP Coal-Powered Power Station - Lephalale Scoping Inputs: Urban-Econ was appointed to undertake a Socio-Economic Scoping Study and Land-Use Impact Study for the proposed Exxaro Coal-Powered Power Station near the town of Lephalale, Limpopo Province.
- Mafube Nooitgedacht and Wildfontein EIA/EMP Sustainable Development Investigation Study: Urban-Econ was appointed to undertake an investigation into sustainable development options associated with the proposed project. The results of this study aimed at informing the decision makers of socio-economic trade-offs related to each option analysed and the preferred alternative.
- Thaba Metsi Sustainable Development Investigation Study: The objective of the Thaba Metsi Project is to mine coal via opencast and underground mining methods for supply to the Independent Power Producer (IPP) coal-fired power station, to be developed by Exxaro, north of the proposed Thaba Metsi project. Urban-Econ provided a specialist input into the sustainable development Investigation aimed at quantifying and assessing various options associated with the development and post-mining land uses that formed part of an input into the EIA report.
- Eskom Sere Wind (WEF1) Macro-Economic Impact Assessment: The project entailed the strategic assessment of the proposed facility on the macro-economic situation with respect to the impact on the balance of payments, supply of energy, demand for water, and achievement of strategic government objectives. It also entailed the assessment of the proposed project on the regional and local economies.
- Evaluation of Energy-Related Proposals for the Department of Science and Technology: Urban-Econ was appointed to undertake an evaluation of six energy-related proposals submitted to the DST SBS.

The objective of the evaluation is to advise the Department on whether the projects described in the proposals should be funded or not. The assessment takes into account operational and financial feasibility of projects, alignment thereof with government objectives, economic benefits derived from the project, ability of the organisations to implement the projects successfully and a risk assessment. The project also involved the development of a decision framework based on a Multi-Criteria Decision Method to be used to compare proposals and determine suitability for funding and prioritisation.

- Independent Evaluation of the Wireless Mesh Network in Government Broadband: Urban-Econ was appointed to undertake an independent evaluation of the Community Wireless Mesh Networks in the Government Broadband project. Urban-Econ's responsibility was to evaluate the progress of the project and provide recommendations that can be implemented to improve its design and execution.
- Eskom Ariadne-Eros Power Lines Economic & Agricultural Impact Assessment: Urban-Econ was appointed to undertake an Agricultural Potential and Economic Impact Assessment for the proposed Ariadne-Eros Transmission Power Line and expansion and upgrade of the related substations in KwaZulu-Natal.
- Eskom Ingula Pumped Storage Scheme Regional Economic Impact Assessment: The purpose of the study was to present an assessment of socio-economic impact of the Ingula Pumped Storage Scheme on the national and regional economies.
- Gauteng Infrastructure Renewal and Investment Plan (GIRIP): The study involved the formulation of an Infrastructure and Renewal Plan up to 2025 that would transform Gauteng into a competitive Global City-Region. As part of the study a regional model with necessary demographic and economic projects was developed that assisted in identifying future infrastructural needs in the Province.
- De Hoop Dam Economic Impact Monitoring Framework: Urban-Econ was approached to develop and set up an integrated and coherent monitoring and evaluation reporting system which will primarily be based on a regional impact assessment model framework to monitor and evaluate the regional socio-economic impacts due to the development of the De Hoop Dam.
- North West Cluster Performance Analyses: Urban-Econ was appointed by the North West Office of the Premier to undertake the analysis of statistics tables for six clusters (Human Resource Development, Physical Assets, Resource Base, Governance and Protection, Economic and Social), identify areas that require interventions and propose possible solutions to address the key challenges.
- Mopani Investment Strategy: Urban-Econ was appointed by the Mopani District Municipality to formulate an investment strategy for the region with a focus of promoting integrated and sustainable development in the local economy.
- Socio-Economic Impact Assessment - Proposed Route Operator Business in Mpumalanga: The project entailed assisting with the preparation of the response to the Request for Applications in respect of Limited Pay-out Machine Licences in the Mpumalanga Province. The study encompassed a macro-level socio-economic analysis of the proposed route operator business in Mpumalanga with a focus on: (a) benefits to the economy in terms of gross geographical product ("GGP"), employment creation, increased household income, skills development and small, medium, micro enterprise ("SMME") development and (b) potential social impact of gaming in the Province.
- N3 Highway Economic Impact Assessment: Urban-Econ was appointed to determine the Socio-Economic Impact of the proposed re-routing of the N3 highway around Harrismith and the current link with the N5 Route towards Lesotho and Mangaung.
- The Mandela Bay Precinct Economic Impact Assessment: The study entailed conducting an economic-impact assessment of the proposed Mandela Bay Precinct Development in Port Elizabeth. The proposed project was a mixed-use development with the main component being a Regional Shopping Centre that will be surrounded by high density residential property, filling stations, light industrial space, a hospital, and a hotel and office space.
- The City of Windhoek Draft SME Policy: Urban-Econ was appointed by the City of Windhoek (COW) Local Authority to develop a Draft SME Development Policy Directive to guide future SME promotion and development in the City of Windhoek

- Harrismith Logistics Hub Impact Assessment: Urban-Econ Development Economists was appointed to undertake a rapid economic impact assessment study of the proposed Harrismith Freight Logistics Hub ("HLH"). The aim of the study was to determine potential benefits that could be created by the HLH in terms of unlocking the latent development of the area. This technical memorandum presents the results of the study.
- Megamall Economic Impact Assessment: Urban-Econ was requested to undertake an economic impact study for the Megamall project to be developed in the Mogale City Local Municipality. The aim of the study was to determine the potential economic impacts emanating from the proposed development. This study involved assessment of socio-economic impacts the proposed project could have on the local economy which could be used in application for funding from commercial banks and government.
- Coega Ridge Economic and Social Impact Assessments: Urban-Econ was appointed to undertake an economic and social impact assessment of the proposed Coega Ridge development. The aim of the development was to create a unique and sustainable residential enclave encompassing a "live, work, play and shop" environment including components such as affordable housing, shopping centre, office park, industrial park, community and social facilities, bulk service infrastructure, and public open space.
- Amanzi Economic & Social Impact Assessment: Urban-Econ was requested to undertake an economic and social impact study for the proposed Amanzi Estate that included the original homestead of Sir Percy Fitzpatrick, author of Jock of the Bushveld.
- Limpopo Industrial Parks Resuscitation Assessment: Urban-Econ was appointed to assess the feasibility of resuscitation of the selected industrial parks in the Limpopo Province. The study included analysis of the economic potential of the selected areas, development of scenarios and formulation of recommendations. Urban-Econ managed the team of sub-consultants.
- North West PGDS Monitor: The study encompasses a comprehensive analysis and projections of the achievement of the PGDS targets, reviewing the performance of the Working Groups and providing recommendations regarding actions needed to be taken to address the shortfalls.
- Sedibelo Economic Impact Assessment: The study involved conducting an economic-impact assessment of the proposed development utilising, an Input/output model.
- Hanglip Sustainability Model: Urban-Econ was appointed to develop a model that could assist decision makers in identifying the most preferred alternative/s for the Hanglip Development. The model was based on the Multi-Criteria Decision-making process.
- Emalahleni Investment Incentive Package: Urban-Econ was appointed by the Emalahleni Local Municipality to update the Investment Incentive Package for the Emalahleni Local Municipality.
- Eastern Cape Industrial Sector Study: Urban-Econ was appointed by the Eastern Cape Socio-Economic Consultative Council (ECSECC) to undertake an industrial sector study for the Eastern Cape Province. The study provided inputs to the Provincial Industrial Strategy. The focus of the strategy was on provision of support to sectors with the potential for job creation in the Province. In this context, this study aims at identifying the sectors that have the highest potential for uplifting the second economy in the Province and highlighting their growth barriers.
- Socio-Economic Impact Assessment of the Proposed New Eskom Power Stations in the Witbank Area and Northern Free State: The study involved conducting a socio-economic impact assessment of the proposed developments utilising an Input/Output model.
- Sedibeng Investment Incentive Package: The study encompasses a formulation of an incentive package that would enhance development and investment in the area, as well as promote economic growth. A comprehensive socio-economic analysis of the Sedibeng DM and its Local Municipalities, including growth potential was performed.
- North West Sustainable Development Indicators Pilot Project: After completing the North West Sustainable Development Indicators, Urban-Econ was appointed to execute of the pilot project of population the framework. Urban-Econ has been appointed by the North-West Province's Office of the Premier to formulate a Sustainable Development Indicator Framework for the North West Provincial Administration. The purpose of the framework is to assist the provincial government

authority in the monitoring and evaluation of their progress towards achieving sustainable growth and development.

- Polokwane Trade Hub: Urban-Econ assisted by Nyeleti Consulting Engineering, was appointed by Polokwane Municipality to undertake a Polokwane Trade Hub Feasibility study. The feasibility study included investigation of the potential of Polokwane to develop into a regional trade hub, implications associated with its development and the initiatives, including programs and projects that need to be implemented to realise the vision of Polokwane as a regional trade hub.
- Mpumalanga Job Creation Budget: The project involved an assessment of the provincial budget with respect to its impact on job creation and identification of opportunities to enhance sustainable job creation in the Province.
- Joburg BPO Zone: Urban-Econ was appointed to provide an urban-economic rationale and motivation for the selection of a BPO Precinct in the Joburg Inner City.
- Bekkersdal Skills and Entrepreneurship Development Strategy: The Bekkersdal Skills and Entrepreneurship Development Strategy provides the reader with thorough data on the existing pool of enterprises and entrepreneurs, services and products and existing skills in Bekkersdal, which can be utilised by public and private entities. The document includes Skills Audit and Business Audit Databases in Access format.
- Baralink Economic and Market Study: Urban-Econ has been appointed by Urban Dynamics to undertake an economic and market study of four areas, namely, Baralink, JP's Town, Orange Farm, and Kwadzudza and provide the feedback on potential economic activates that can be introduced to the area in regard to promotion of sustainable livelihoods. This study forms a part of a comprehensive analysis of the abovementioned areas, the purpose of which is to compile a strategy for sustainable housing development, according to the new housing policy, in different regions of Johannesburg Metropolitan area.
- Business Improvement District Strategy for Bekkersdal: Due to the low levels of consumer and business confidence in the Bekkersdal CBD, this project required the formulation of a strategy for the establishment and implementation of a BID for the CBD area of Bekkersdal.
- Expansion of Holcim Cement Plant- Economic Impact Assessment: Urban-Econ has been appointed to assess economic impact of the expansion of Holcim Cement plant in Roodepoort.
- Madiba Bay Leisure Park Regional Mall Market Study: Urban-Econ was commissioned by East Cape Showcase (Ltd.) to conduct empirical market research and compile a specialist market study for the proposed regional retail mall within the North Gate precinct of the Madiba Bay Leisure Park project.
- Social and Labour Plan for Brandbach Mine, Cullinan: In order to insure sustainable development of the industry in the future along with the implementation of national visions on skills development, poverty alleviation, BEE and employment creation, the government has introduced a Skills and Labor Plan, preparation of which became a prerequisite for every mine in the country. Urban-Econ has been appointed to develop such plan for the Brandbach Mine in Cullinan.
- NIPS for POPS Economic Impact: Urban-Econ has been appointed as part of a specialist team to undertake the economic impact assessment of Infrastructure related to Persistent Organic Pollutants (POPS) in South Africa. The focus of the assessment is to formulate clear strategic guidelines related to the impacts of POPS and or their removal/eradication for the Development of National Implementation Plans (NIPS) of the Stockholm Convention on POPS.
- Other Socio-Economic and Economic Impact Assessment Studies for Renewable Energy Projects conducted as part of the Environmental Impact Assessment Processes
- Arriesfontein Solar Energy Park: near Danielskuil in the Northern Cape (100 MW CSP-Tower facility and 225 MW PV solar facility)
- Humansrus Solar Energy Facility: near Postmasburg in the Northern Cape (100 MW CSP-Tower facility)
- Rooipunt Solar Energy Park: near Upington in the Northern Cape (100 MW CSP-Tower facility and 215 MW PV solar facility)
- Farm 198 PV Solar Energy Facility: north of Kimberley in the Northern Cape (210 MW PV solar facility)
- Wag'nbiekiespan PV Solar Energy Facility: near Boshof, the Free State Province (75 MW PV solar facility

Countries of Work Experience:

- South Africa
- Russia
- Zambia

References:

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- Elena Broughton
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Matthew Keeley

Date of Birth:	25 February 1985
Designation:	Director/Manager -Eastern Cape
Profession:	Senior Development Economist
Specialisation:	Economic Impact Assessment, Property Market Analysis
Years within Firm:	10 Years
Nationality:	RSA
Years of Experience:	10 Years
HDI Status:	White Male

Education:	
Rhodes University – 2004 to 2006	Bachelor Degree in Geography and Economics
Rhodes University & University West (Sweden) 2007	Post Graduate Honours Degree in Economic Geography

Professional Membership:
SAPOA Urban-Econ Development Economists (Pty) Ltd
Society of South African Geographers - Membership # 05/15

Language Proficiency:	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Afrikaans	Fair	Fair	Fair

Work Experience:

2008 - Current	Urban-Econ Development Economists

Key Qualification:

Matthew Keeley is the Eastern Cape Regional Branch Manager of Urban-Econ Development Economists and oversees all of the company's provincial research projects. Matthew obtained his Bachelor's degree majoring in Geography and Economics from Rhodes University; this was followed by an Honours degree in Economic Geography (Spatial Development), part of which was studied at University West, Sweden. Matthew's fields of professional interest include Economic Property Market Analysis and Socio-Economic Impact Assessments. Matthew's professional experience has involved the project management of a number of high-profile economic planning projects as well undertaking a variety of economic market analysis projects. Areas of Matthew's project experience are listed below:

- Project Management
- Economic Property Market and Trend Analysis
- Strategic Economic Development Potential Analysis
- Geographic Information Systems (GIS)
- Socio-Economic Economic Impact Analysis
- Local Economic Development Planning
- Business Plan Development
- Socio-Economic Research and Statistical Profiling

Experience Record:	
Project:	Coega Infrastructure and Investor Economic Impact Assessment
Year:	2008-2009
Location:	Nelson Mandela Bay, Eastern Cape
Client:	Coega Development Corporation
Project Features:	Urban-Econ Eastern Cape were appointed by the Coega Development Corporation (CDC) to assist in conducting an Economic Impact Assessment for the Coega IDZ. The main objectives for the project included the quantifying of the economic impact of infrastructure and investors within the Coega IDZ to date. It also included a component of developing the capacity of the CDC to assess impacts of potential investors and

Position held:	providing the CDC with guidelines on how to improve positive impacts associated with investments in future.
Activities Performed:	Project Manager / Project Economist Project management; Economic Impact Assessment; Training and capacity building; report writing.
Project:	MBDA Stadium Precinct Development Plan
Year:	2011
Location:	Nelson Mandela Bay, Eastern Cape
Client:	Mandela Bay Development Agency (MBDA)
Project Features:	Urban-Econ project managed a multi-disciplinary team which investigated the viability of establishing additional commercial and leisure property/activities in the immediate surrounds of the new Nelson Mandela Bay Stadium in Port Elizabeth. Investigated the viability of establishing additional commercial and leisure property/activities.
Position held:	Project Manager
Activities Performed:	Project management; client and stakeholder liaison; economic profiling; analysis of multi-disciplinary team inputs; Property Market Research; Opportunity analysis; Project packaging
Project:	Lesotho Renewable Energy Master Plan
Year:	2010 – 2011
Location:	Kingdom of Lesotho
Client:	Lesotho Electricity Company
Project Features:	Urban-Econ was appointed to undertake detailed economic analysis of potential power generation plants identified throughout Lesotho culminating in a comprehensive prioritisation analysis of various projects and their potential contributions to the Kingdom's economy.
Position held:	Project Economist
Activities Performed:	Detailed economic analysis of potential power generation plants; Country Analysis; RE Sector Analysis.
Project:	EPWP Phase 2 Economic and Social Impact Assessment
Year:	2014
Location:	Eastern Cape
Client:	Department of Public Works
Project Features:	Urban-Econ was appointed to undertake an Impact Assessment on the Implementation of the Expanded Public Works Programme Phase 2 (2009-2014) in the Province of the Eastern Cape. The EPWP is a nationwide programme covering all spheres of government and state-owned enterprises.
Position held:	Project Manager
Activities Performed:	Project management; Client liaison; Economic profiling.
Project:	Eastern Cape Tourism Database and Geospatial Profile
Year:	2013
Location:	Eastern Cape
Client:	Department of Economic Affairs
Project Features:	The project involved the collation, consolidation and spatial representation of tourism product information for the Eastern Cape using GIS as an analysis tool. The project was hailed as the first provincial database of its kind in RSA and will be soon integrated as a web-based platform.
Position held:	Project Manager
Activities Performed:	Project management; Client liaison; Database development; Tourism primary research.

Other Projects:

- Industrial Implementation Plan for the Eastern Cape (EC PIDS): Urban-Econ was commissioned as part of a consortium of industrial specialists; to project manage and develop an Industrial Implementation Plan for the Eastern Cape, on behalf of the Eastern Cape Department of Economic Development and Environmental Affairs (DEDAET). The aim of the study was to provide an action-orientated implementation plan to implement the existing Eastern Cape Industrial Strategy; as well as to fill information gaps with regards to key sectors in the Eastern Cape. Thus, a team of sector specialists in agro-processing, petro-chemicals, automotive, green energy, tourism and capital goods was

assembled. Urban-Econ's role was in the overall project management, implementation action framework development and workshop facilitation. The study included the development of a situation analysis for the province, sector potential analysis, opportunity assessment and clustering identification. The outcome of the strategy was an Implementation Framework and Capital Investment Framework.

- ECPTA Reserves as Products: Urban-Econ Development Economists was appointed by the Eastern Cape Parks and Tourism Agency (ECPTA) to investigate ECPTA Reserves as Tourism products. The purpose of the assignment being to provide a business case on profiling the ECPTA nature reserve clusters in terms of their natural endowment and associated product offerings within the dual mandate of managing biodiversity conservation and destination tourism. A full socio-economic benefit analysis was required to support decision making to achieve the most efficient and effective balance and co-existence of the dual mandate as well as compliance with all applicable legislation.
- Sterkspruit Urban Regeneration Plan: Urban-Econ was appointed by the Senqu Local Municipality to undertake an innovative Economic Development Concept for the town of Sterkspruit within the Senqu Local Municipality. The objective was to have a development plan that informs planning, economic and social infrastructure as well as expected economic spin-offs for the area.
- uBuntu Wool Washing Business Plan: Urban-Econ Development Economists in partnership with A.I.M was appointed by the Department of Agriculture, Land Reform and Rural Development in conjunction with the Ubuntu Local Municipality to undertake a comprehensive feasibility study for the proposed development of a Wool Washing Facility in the town of Loxton in the Northern Cape Province.
- Ludeke Dam Feasibility Study: Urban-Econ formed part of a consortium undertaking a feasibility assessment of the potential around the Ludeke Dam for tourism applications. Aspects of the project included an assessment of the market feasibility of establishing tourism accommodation and facilities at the Ludeke Dam. Consideration of supply and demand factors in quantifying the potential viability of a tourism development. Taking into account best practise and lessons learnt from similar developments in SA. Formulation of an optimum development concept to inform the project technical team to take forward towards design. Providing Alfred Nzo District with specific implementation guidelines to take forward the project towards development. Identifying key stakeholders and potential role-players critical to the success of the research and implementation process.
- Ntenetyana Dam Feasibility Study: Urban-Econ formed part of a consortium undertaking a feasibility assessment of the potential around the Ntenetyana Dam for tourism applications. Aspects of the project included an assessment of the market feasibility of establishing tourism accommodation and facilities at the Ntenetyana Dam. Consideration was made of supply and demand factors in quantifying the potential viability of a tourism development. Taking into account best practise and lessons learnt from similar developments in SA. Formulation of an optimum development concept to inform the project technical team to take forward towards design. Providing Alfred Nzo District with specific implementation guidelines to take forward the project towards development. Identifying key stakeholders and potential role-players critical to the success of the research and implementation process.
- Provincial Rural Development Plans: Urban-Econ formed part of the Urban-Dynamics team which was appointed to the panel of service providers to assist the Department of Rural Development and Land Reform to develop Spatial Plans, Rural Development plans and related tools to implement the Spatial Planning and Land Use Management Act, Act no.16 of 2013.
- Coffee Bay Town Promulgation Plan: Urban-Econ was appointed as lead consultants to investigate the legal and institutional processes necessary to set up a new municipal town in the areas of Coffee Bay and Hole in the Wall on the Eastern Cape Wild Coast. This study is seen as a pilot project which will serve as a blue-print for future town establishments in the region going forward. The study was commissioned by ECSECC in partnership with the Department of Economic Development, Environmental Affairs and Tourism (DEDEAT). Throughout the process Urban-Econ, through ECSECC and DEDEAT reported to the National Minister of Rural Development and Land Reform, Mr Gugile Ernest Nkwinti for approval. The final outcome of the process was seen to provide ECSECC and the Provincial Government via DEDEAT with a set of implementable programmes for the promulgation of the new town. Once implemented the project will be the first formalisation of a new town since the onset of democracy in South Africa in 1994.
- NMBM Integrated Public Transport System (IPTS) SMME Strategy: Urban-Econ was appointed by Nelson Mandela Bay Municipality to undertake an SMME Strategy as part of the city's Integrated Public

Transport System. The SMME Strategy seeks to identify areas for the development of small businesses. The study involved the identification of case studies, business opportunity analysis, identifying SMME support services and business packaging.

- DEDEAT Sustainable Energy and Greenhouse Gas Mitigation Initiatives Database: Urban-Econ Development Economists is providing economic and research inputs to a team of service providers updating the provincial Renewable Energy Database on behalf of the Department of Environmental Affairs, Economic Development and Tourism. The project aims to give a consolidated platform for recording and documenting sustainable energy and greenhouse gas mitigation initiatives in the province.
- Mount Fletcher Property Feasibility Study: Urban-Econ Development Economists was appointed by the Elundini Local Municipality to undertake a market research assessment coupled with engineering, town planning, environmental, financial aspects to give guidance in terms of the implementation and roll-out of future property developments in the town of Mount Fletcher.
- Elundini Local Municipality Local Business Enabling Environment: The objective of the study was to examine the Elundini Local Municipality business experience to date and identify models of enabling environment that support business development. Urban-Econ Development Economists was appointed to undertake the study and provide recommendations to improve business investment and retention in the area.
- Regional Economic Profiling for OR Tambo and Joe Gqabi DM: The Eastern Cape Development Corporation (ECDC) commissioned Urban-Econ to undertake a regional economic profiling and socio-economic impact analysis of ECDC Projects. This project comprises two separate studies with different objectives and outcomes. The project is thus approached as two separate studies with their own unique objectives, methodologies and outcomes. The two components were a Regional Economic Profiling Analysis of Specific Sectors in the Eastern Cape, with a particular focus on the O.R. Tambo and Joe Gqabi District Municipalities. An assessment of aquaculture in these districts was undertaken. A Socio-Economic Impact Analysis of Selected ECDC Projects in the O.R. Tambo and Alfred Nzo District Municipalities.
- ECDC Regional Profiles Alfred Nzo and Chris Hani District Municipalities: Urban-Econ Development Economists embarked on a regional economic profiling analysis of the Agriculture and Forestry, Agro-Processing, Aquaculture, Tourism, Automotive, Green Industry, Mining, Information Communication Technology, Business Processing and Outsourcing/ Business Process Services (Services sector) and Petro-Chemical sectors in the Eastern Cape, with a specific look at the identified Districts.
- ECDC PG Bison Investment Impact Assessment: Urban-Econ was appointed by the ECDC to conduct an Economic Impact Analysis of the PG Bison investment in the Ugie/Maclear area. The project modelled the impacts of the infrastructure investments made by the Elundini Local Municipality since 2008 in support of the PG Bison development as well as the Economic Impact of the PG Bison development itself in this same period.
- Eastern Cape Assessment of Potential Limited Payment Machine (LPM) Gross Gambling Revenue (GGR): Urban-Econ was approached to conduct a desktop study to provide a simulation of the potential Gross Gambling Revenue (GGR) for the roll out of Limited Pay-out Machines (LPMs) throughout the Eastern Cape. A model was developed based on secondary data available and assumptions provided through published research into the LPM market.
- iDutywa Precinct Development: Urban-Econ assessed the high-level economic feasibility of various CBD upgrade and precinct development intervention concepts for the town of iDutywa. Urban-Econ then conceptualised business plans for interventions, each considering costing, capital expenditure, income and cash flow projections, as well as financial, economic and social impacts.
- Mthatha Casino Development: Urban-Econ was appointed by African Pioneer (Pty) Ltd who sought to establish a casino in Mthatha. Urban-Econ was required to estimate the Gross Gaming Revenue (GGR) that this casino would generate. As part of this assessment the GGR of the KSD Local Municipality as well as the surrounding areas was estimated. In addition, economic forecasting was conducted to estimate the potential GGR up to 2015
- Alicedale Social Housing Impact Analysis: Urban-Econ was appointed to provide inputs for Public Process Consultants as to the impact of the development of social housing in the town of Alicedale in the Eastern Cape. This involved economic and socio-economic profiling, indicator identification and impact evaluation and reporting

- Impact Assessment of LED Projects within the Amathole District Municipality: Urban-Econ was appointed to undertake a socio-economic impact evaluation for 15 projects in the Amathole District Municipality. This involved the evaluation and rating of projects based on agreed upon economic and socio-economic criteria. Site visits to the project were undertaken to assess the projects and to meet with project co-ordinators. The result of the project is a report to guide the selection, implementation and monitoring of future LED activities in the district
- Tsolo and Qumbu Urban Development Framework: The aim of this project is to provide a comprehensive study of the Tsolo and Qumbu urban nodes in order to develop an Urban Development Framework. The study will include an economic, infrastructural, traffic and transportation, environmental management analyses as well as spatial and land use management. The objective is to provide plans for implementation that will stimulate investment and improve business growth in these towns
- Eastern Cape Government Planning and Capacity Assessment: Urban-Econ was appointed alongside Fort Hare University to undertake a detailed and comprehensive interaction and participation exercise to determine the potential of restructuring the Eastern Cape's provincial planning processes with the idea of creating a centralised planning body. Urban-Econ's role was three fold: 1) a series of engagement sessions were held with high ranking managers and directors within various provincial departments in the Province to gain their input on the existing planning environment in the Province 2) undertake a series of departmental survey's with selected staff members in various departments to assess their opinions with regards to the creation and formation of a new planning body 3) undertake a national and international benchmarking study to better understand centralised provincial planning departments that are operational within other regions/provinces of South Africa and around the world.
- Spitzkop Wind Energy Project Economic Impact Assessment: Urban-Econ was contracted to undertake an economic impact assessment and a community needs analysis for a proposed wind energy project in Makana Local Municipality. This project formed part of the official Environmental Impact Assessment process.
- Caba Cultural Village Feasibility Study: Urban-Econ was appointed by the Mhlontlo Local Municipality to develop a Business Plan for a Cultural Village in Caba. The project involves the development of a feasibility assessment which provides a status quo of the area as well as an analysis of the tourism market. This project is still in its beginning stages, but the objective is to develop a business plan for the implementation of a cultural village that is focussed on job creation, skills development, community empowerment and tourism.
- Chatty Conservation Development Framework: Urban-Econ was commissioned by NMBM to undertake a detailed market research assessment to inform the design of a Conservation Development Framework for the greater Chatty and van der Kemp's Kloof areas in NMBM. The task at hand involved the identification of suitable economic land uses that could be incorporated on the study site and in turn generate suitable income that could be used to achieve the conservation objectives in the area. The market research assessment informed a detailed financial analysis of the carried out for the CDF.
- Eastern Cape Community Residential Units Feasibility Study: Urban-Econ was appointed as part of a project team lead by Bigen Africa by the Eastern Cape Department of Human Settlements to conduct a feasibility study for the development of Community Residential Units (CRU) within eight pilot local municipalities in the Eastern Cape. Urban-Econ's role in the project was to establish the overall demand for CRU housing units within each of the identified municipalities. As part of this process, Urban-Econ was responsible for convening public meetings with identified beneficiaries within each local municipality so as to assist establishing CRU housing demand. Extensive household surveys were also undertaken in each of the pilot municipalities.
- MBDA Economic Impact Assessment: Urban-Econ was appointed by the Mandela Bay Development Agency to conduct Economic Impact Assessments for each of the agency's projects completed to date. The agency wishes to quantify the economic impacts associated with both its infrastructure improvement projects and service orientated projects within its mandate area. As a final deliverable, Urban-Econ EC will provide the MBDA with an Economic Barometer which the agency can use as an information management system for ongoing and future projects. As a result of the project, the agency will be in a position to market itself by publicly quantifying its successes in Nelson Mandela Bay area.
- Eastern Cape Academy of Sports: Urban-Econ was appointed alongside a large team of specialist consultants to develop a provincial sports model for Long Term Athlete development in the Eastern Cape. The outcome of the task involved the design and upgrade of the main provincial academy along

with the various district and regional feeder centres. Urban-Econ's role was that of institutional and operational planning.

- OR Tambo District Municipality Regional Industrial Roadmap: Urban-Econ was part of the Urban-Econ group of companies, which was appointed to conduct the Local Economic Development Capacity Building Programme initiated by the Department of Trade and Industry. The objective is to assist 16 districts across the country to develop credible LED Strategies and capacitate LED Structures. The focus of the project in ORTDM is on providing assistance with an Investors Conference and providing recommendations regarding LED institutional structures in the District.
- Umzimvubu Investment Plan: The project was prepared in response to a request by the Umzimvubu Local Municipality to undertake the development of an Investment Plan to guide implementation of the stimulation, attraction and management of the local economy. It involved analyses of natural resource endowments and a review of the level and quality of available infrastructure and services which form an enabling environment for investment success.
- Strand Street: Environmental Upgrading: A consortium of consultants was appointed by the Mandela Bay Development Agency to propose an environmental upgrading concept for Strand Street in the Nelson Mandela Bay CBD. Urban-Econ EC's role was to conduct research into the status quo of the area and engage with relevant parties to add value to the concept design as well as determine the demand for such an upgrade. The project forms part of the MBDA's inner city regeneration drive.
- Lower Baakens River Valley Re-development: Urban-Econalong with a consortium of consultants was appointed by the Mandela Bay Development Agency to determine the potential for re-development of the Lower Baakens River Valley. Urban-Econ EC's role was to conduct market research to determine the demand for such a re-development and establish what forms of land-use would be best suited to the area. The project forms part of the MBDA's inner city regeneration drive.

Countries of Work Experience:

- South Africa
- Lesotho

References:

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Thomas Searle Parsons

Date of Birth:	04 July 1985
Profession:	Senior Development Economist
Specialisation:	Local Economic Development (LED) Planning, Strategy Development, Impact Assessments
Years within Firm:	9 Years
Nationality:	RSA
Years of Experience:	9 Years
HDI Status:	White Male

Education:	
Nelson Mandela Metropolitan University (NMMU) - 2004	Bachelor of Commerce (Rationum) majoring in Chartered Accounting and Economics
Nelson Mandela Metropolitan University (NMMU) - 2008	Bachelor of Commerce (Honours) majoring in Economics

Professional Membership:
SAPOA Urban-Econ Development Economists (Pty) Ltd

Language Proficiency:	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Afrikaans	Good	Good	Good

Work Experience:

2009 - Current	Urban-Econ Development Economists

Key Qualification:

Thomas Parsons obtained his B.com Rationum majoring in Chartered Accounting and Economics from the Nelson Mandela Metropolitan University. He went on to obtain his Economics Honours degree with subjects in Micro and Macroeconomics, Public Sector Economics, Development Economics and Investment Analysis. His research thesis was on the effectiveness of inflation targeting. Thomas has developed a variety of business skills, including:

- Economic analysis techniques
- Survey design
- Report writing
- Presentation skills
- Workshop Facilitation
- Local Economic Development Training
- E-Views
- Microsoft Office (Advanced)
- ArcGIS Standard (Elementary user)

Thomas' experience at Urban-Econ includes:

- Conducting socio-economic studies
- Developing of LED Strategies and Plans
- Conducting of Economic Impact Assessments
- Developing and facilitating a training and capacity building programme on Local Economic Development Experience in survey design and implementation
- Development of maps using ArcGIS Standard
- Experience in research

Experience Record:	
Project:	Knysna Integrated Strategic Development Plan (ISDF)
Year:	2013/2014
Location:	Knysna

Client:	**Knysna Local Municipality**
Project Features:	**Urban-Econ Development Economists was part of the successful consortium of Chris Mulder and Associates which were awarded the project to develop an Integrated Strategic Development Plan for the Greater Knysna Municipality. This project entailed the development of a long term development strategy for the municipality which integrated environmental, spatial, economic, housing, infrastructure and town planning elements. Urban-Econ Development Economist's role in the project was the development of an Economic Development Strategy for the Knysna Local Municipality – a specific deliverable for the greater ISDF process.**
Position held:	**Project Economist**
Activities Performed:	**Economic Profiling; Local Economic Development Analysis; Economic forecasting and planning; Public Participation; Strategic Planning.**
Project:	**Mandela Bay Development Agency (MBDA) Economic Barometer**
Year:	**2009 – 2011; 2013 – 2015**
Location:	**Nelson Mandela Bay Metro**
Client:	**MBDA**
Project Features:	**Urban-Econ Development Economists was appointed by the Mandela Bay Development Agency (MBDA) to conduct Economic Impact Assessments for each of the agency's strategic upgrades in the CBD and Central areas of Port Elizabeth. The agency wishes to quantify the economic impacts associated with both its infrastructure improvement projects and service orientated projects within its mandate area. As a final deliverable, Urban-Econ Development Economists provided the MBDA with an Economic Barometer, which the agency can use as an information management system for ongoing and future projects. This was developed by means of a survey that will be conducted annually over the three years of the project. As a result of the project, the agency will be in a position market itself by publicly quantifying its successes in Nelson Mandela Bay area.**
Position held:	**Project Manager**
Activities Performed:	**Economic Profiling; primary Research; Perception surveying; Economic Modelling; Index building; Database development.**
Project:	**Provincial Industrial Development Strategy (PIDS) Implementation Plan**
Year:	**2011**
Location:	**Eastern Cape**
Client:	**Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)**
Project Features:	**Urban-Econ Development Economists was commissioned as part of a consortium of industrial specialists; to project manage and develop an Industrial Implementation Plan for the Eastern Cape, on behalf of the Eastern Cape Department of Economic Development and Environmental Affairs. The aim of the study was to provide an action-orientated implementation plan to implement the existing Eastern Cape Industrial Strategy; as well as to fill information gaps with regards to key sectors in the Eastern Cape. Thus a team of sector specialists in agro-processing, petro-chemicals, automotive, green energy, tourism and capital goods was assembled. Urban-Econ's role was in the overall project management, implementation action framework development and workshop facilitation. The study included the development of a situation analysis for the province, sector potential analysis, opportunity assessment and clustering identification. The outcome of the strategy was an Implementation Framework and Capital Investment Framework.**
Position held:	**Project Economist**
Activities Performed:	**Economic Profiling; Sector Study Research; Strategic Planning; Implementation planning; Monitoring and Evaluation**
Project:	**Social and Sustainability Due Diligence of Aspire Projects**
Year:	**2014**
Location:	**Amathole District Municipality**
Client:	**ASPIRE**
Project Features:	**Urban-Econ Development Economists was appointed by ASPIRE to establish how successful five of their supported/funded projects were at meeting the agency's mandate. The assessment of these five projects focused on determining how sustainable the projects were in terms of value for money, employment creation and**

Position held: Activities Performed:	value addition. Consideration was also give to the broader economic impact that these projects had as well as their value chain linkages. Project Economist Economic Profiling; Economic and socio-economic impact assessment; Project profiling.
Project: Year: Location: Client: Project Features: Position held: Activities Performed:	Thina Sinako Gariep Competitiveness Study 2010 Gariep Local Municipality Gariep Local Municipality Urban-Econ Development Economists partnered with the Gariep Municipality and Umnga Framers Training Association to develop a comprehensive competitive advantage assessment of the Gariep Local Municipality. The aim of the project was to stimulate sustainable economic growth and job creation by identifying and exploiting local competitive and comparative advantage in the Gariep Local Municipality. The project involved a training session in LED processes and competitiveness, an analysis of the local economy in which latent and potential competitive and comparative advantages were identified, the identification of priority sectors for competitive interventions (agriculture including agro-processing and tourism), the profiling of these sectors by means of a value chain assessment, and finally the development of detailed action plans for priority projects that once initiated would enhance the competitiveness of the municipality. Project Economist LED; Economic profiling; Competitiveness assessment; Value chain mapping; Tourism Sector Analysis; Agricultural Sector Analysis; Strategic Planning.

Other Projects:

- The Eastern Cape Socio-Economic Review and Outlook, 2015: The Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) in collaboration with the Eastern Cape Provincial Treasury appointed Urban-Econ Development Economists to undertake the compilation of a Provincial Socio-Economic Profile and Outlook for 2015. The annual reports provides timeous, reliable information on the socio-economic outlook of the Eastern Cape providing an overview of the past performance of the economy, within the wider context of the performance of the South African economy.
- ECDC Amathole and Cacadu profiling: Urban-Econ was appointed by the Eastern Cape Development Corporation (ECDC) to undertake economic profiling of the Amathole and Sarah Baartman District Municipalities. The economic profiling entails analysing the potential of economic sectors in both district municipalities, the performance of these sectors in the past year and their importance to the economy of the district municipalities. The economic profiling is vital in seeing in which direction the district municipalities should be heading to ensure economic growth.
- Amathole District Municipality Impact Assessment: Urban-Econ Development Economists was appointed to undertake a socio-economic impact evaluation for 15 projects in the Amathole District Municipality. This involved the evaluation and rating of projects based on agreed upon economic and socio-economic criteria. Site visits to the project were undertaken to assess the projects and to meet with project co-ordinators. The result of the project is a report to guide the selection, implementation and monitoring of future LED activities in the district.
- Amathole District Municipality – Local Municipalities Capacity Building Programme for LED: The Amathole District Municipality (ADM) local municipalities Capacity Building Programme entailed the development of a training manual on LED processes and concepts including economic assessments, strategic planning and partnerships, implementing LED and monitoring and evaluation of LED.
- Regional Economic Profiling for OR Tambo and Joe Gqabi District Municipalities: The Eastern Cape Development Corporation (ECDC) commissioned Urban-Econ Development Economists to undertake a regional economic profiling and socio-economic impact analysis of ECDC Projects. This project comprises two separate studies with different objectives and outcomes. The project is thus approached

as two separate studies with their own unique objectives, methodologies and outcomes. The two components were a Regional Economic Profiling Analysis of Specific Sectors in the Eastern Cape, with a particular focus on the O.R. Tambo and Joe Gqabi District Municipalities. An assessment of aquaculture in these districts was undertaken, a Socio-Economic Impact Analysis of Selected ECDC Projects in the O.R. Tambo and Alfred Nzo District Municipalities.

- Bloukrans Filling Station: Urban-Econ Development Economists was appointed to undertake a specialist economic study to assess the capacity of the market to sustain a new filling station on the N2 near Bloukrans Bridge, Eastern Cape. It is understood that the need for market research is required to inform investment decisions and provide guidelines in terms of the demand for petrol and diesel as well as the auxiliary uses that will support the filling station.
- Butterworth Hospital study: Urban-Econ Development Economists was appointed by Ditlou Consulting Engineers to provide market research to inform a hospital development in Butterworth, Eastern Cape. The research was aimed at providing information to substantiate the demand for a hospital facility.
- Socio-Economic Impact of selected ECDC Projects in the Amathole District: Urban-Econ Development Economists was commissioned by the ECDC to undertake a socio-economic impact assessment of three ECDC supported projects in order to establish how successful these development projects were at meeting the ECDC mandate. Included in this assessment was a broad spectrum analysis of the Eastern Cape priority industrial sectors in order to contextualise the ECDC project interventions.
- Spitskop Wind Energy Facility: Urban-Econ Development Economists was contracted to undertake an economic impact assessment and a community needs analysis for a proposed Wind energy project in Makana and Blue Crane Route Local Municipalities. This project formed part of the official Environmental Impact Assessment process. This report was updated in 2014 to include the economic impact of several transmission line routes.
- Senqu Tourism Plan: Urban-Econ Development Economists undertook the development of a Responsible Tourism Plan for the Senqu Municipality on behalf of the local municipality. The plan was aligned to previous detailed plans of tourism positioning within an alpine region and considered the institutional arrangements for the implementation of Tourism in the Municipality. The objective of the Responsible Tourism Plan was to identify exiting potential and identify appropriate interventions to promote and develop the tourism industry in the Senqu Local Municipality.
- Mthatha Casino Development: Urban-Econ Development Economists was appointed by African Pioneer (Pty) Ltd who sought to establish a casino in Mthatha. Urban-Econ Development Economists was required to estimate the Gross Gaming Revenue (GGR) that this casino would generate. As part of this assessment the GGR of the King SabataDalindyebo Local Municipality as well as the surrounding areas was estimated. In addition, economic forecasting was conducted to estimate the potential GGR up to 2015.
- Zwide Retail Assessment: Urban-Econ Development Economists has been appointed to undertake a desktop Retail Market Research Study to assess the capacity of the Nelson Mandela Bay Metro (NMBM) to sustain a new shopping centre in Zwide, with a Shoprite store as the anchor tenant. The purpose of this study is to determine the extent and nature of the demand for retail space in the area, based on the prevailing demographic and economic conditions of the study area. The aim of this report was to provide an objective assessment of the retail market potential within the study area as well as the impact of growth and the influence it will have on future demand for a retail facility.
- Joe Gqabi LED Strategy: Urban-Econ Development Economists Cape was appointed by the Eastern Cape Provincial Department of Local Government and Traditional Affairs to develop a Local Economic Development Strategy for the Joe Gqabi District. The project outcomes include conducting LED training with LED officials and local stakeholders and developing an updated situation analysis profile. The process of developing the LED strategy concentrates on public participation and an inclusive approach to develop the economic vision of the region. The strategy was also aligned to existing

strategies such as the GDS agreement and the Sustainable Development Strategy that concentrated on the economic development of the region whilst protecting the integrity of the natural resources.

- Gariep LED Plan: The development of the Gariep LED Plan involved the development of a situation analysis report which provided a status quo of the Gariep Local Municipality located in the Joe Gqabi District Municipality. The other output of the project was an implementation framework which proposed specific catalytic projects, that if implemented would promote the achievement of Gariep's economic objectives. The project also entailed two economic indabas where inputs where obtained from a diverse range of stakeholder.
- Feasibility Studies for CRU Projects: Urban-Econ Development Economists was appointed by Bigen Africa to undertake an assessment for the demand for CRU Housing units within selected local municipalities in the Eastern Cape. This entailed desktop research as well as site visits to the affected local municipalities.
- Cacadu Investment Information Portal: The development of the Cacadu Investment Information Portal focused on the packaging of information relating to investment opportunities within the strategic focus areas of the Cacadu District Municipality. These strategic focus areas are agriculture, manufacturing (predominantly linked to agro-processing opportunities), tourism, and SMME development. The packaged investment opportunities will allow the Economic Development Department of the Cacadu District to populate the Trade and Investment Information Portal located on their website.
- Strategic Competitive Advantage Action Plan for the Gariep Local Municipality: The aim of the project is to stimulate sustainable economic growth and job creation by identifying and exploiting local competitive and comparative advantage in the Gariep Local Municipality. The project involved a training session in LED processes and competitiveness. The project also entailed the development of value chains for priority sectors in Gariep including: agriculture (particularly agro-processing), tourism, and government services.
- Flamingo Estate - Residential Market Research: Urban-Econ Development Economists was appointed by the Newco Consortium to conduct residential market research and compile a specialist market study for the Flamingo Estate residential development, a proposed sustainable integrated housing project, near Redhouse in the Nelson Mandela Bay Municipality (NMBM). The project also entailed modelling the potential housing demand in the NMBM.

Countries of Work Experience:

- South Africa

References:

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Annexure 2: Declaration of Independence

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

GRID CONNECTION: IMPOFU WIND FARM – BASIC ASSESSMENT

Specialist:	**Socio-Economic**		
Contact person:	**Mr Matthew Keeley**		
Postal address:	**127 Cape Road; Mount Croix**		
Postal code:	**6001**	Cell:	
Telephone:	**041 585 6640**	Fax:	
E-mail:	**ec@urban-econ.com**		
Professional affiliation(s) (if any)	**-**		

Project Consultant:	**Aurecon South Africa (Pty) Ltd**		
Contact person:	**Ms Mieke Barry**		
Postal address:	**PO Box 494, Cape Town**		
Postal code:	**8000**	Cell:	**-**
Telephone:	**021 526 6025**	Fax:	**-**
E-mail:	**Mieke.barry@aurecongroup.com**		

4.2 The specialist appointed in terms of the Regulations_

I, Matthew Keeler declare that -- General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Urban-Econ Development Economists

Name of company (if applicable):

22/03/2018

Date:

Annexure D6

Archaeology

Phase 1a Archaeological Impact Assessment

Basic Assessment Report in terms of NEMA

Proposed Grid Connection for the Impofu Wind Farms; from Kouga area to Sans Souci and Chatty Substations near Port Elizabeth, Eastern Cape Province.

Conducted in terms of Section 38 of the National Heritage Resource Act (No. 25 of 1999)

prepared for

Aurecon South Africa (Pty) Ltd, PO Box 494, Cape Town, 8000, T: +27 21 526 9400, F: +27 21 526 9500, E: capetown@aurecongroup.com, and **Red Cap Impofu (Pty) Ltd,** C/O Mr Lance Blaine, Unit B2, Mainstream Shopping Centre, Hout Bay, Cape Town, 7806; T: +27 21 790 1392; E: lance@red-cap.co.za

prepared by

Dr. Peter Nilssen, PO Box 176, Great Brak River, 6525
044 620 4936 | 0827835896 |peter@carm.co.za

21 August 2019

Table of Contents

1. Executive Summary

Red Cap Impofu (Pty) Ltd is proposing to develop three adjoining wind farms, namely Impofu North, Impofu East and Impofu West. To evacuate the power generated by the proposed Impofu Wind Farms, a grid connection is required in the form of an approximately 120 km long 132 kV overhead power line between the wind farm project area and Port Elizabeth. The Basic Assessment (BA) process for the Grid Connection is being facilitated by Aurecon South Africa (Pty) Ltd.

Presented here is the archaeological component of the Basic Assessment process, as triggered by Section 38 of the National Heritage Resources Act (Act 25 of 1999; NHRA), that is being undertaken in order to ensure compliance with heritage legislation as well as that of the National Environmental Management Act (Act 107 of 1998; NEMA).

The general study area for the project is under rural, agricultural, forestry and urban development. Large parts of the landscape are transformed by a wide variety of development activities. The development site is situated in the Eastern Cape Province between Clarkson in the west and Port Elizabeth in the east. The development site includes several wind farm and grid connection projects, and therefore, portions of it fall within an existing renewable energy landscape. Because of the excellent local wind regime, the wind farms are situated in one of the best areas for wind farming in South Africa. The development aims to assist in meeting the ever-increasing demand for energy through harvesting this renewable resource.

The scope of the impact assessment for the grid connection corridor includes the following:

- The three switching stations associated with the Impofu North, Impofu West and Impofu East Wind Farms, as well as the single Impofu collector switching station in the wind farm project area;
- The three short 132 kV high voltage (HV) lines that link each of the three switching stations to the Impofu collector switching station; and
- The entire length of the approximately 120 km and 2 km wide corridor for the 132 kV HV overhead power line, from the Impofu collector switching station to the Chatty substation in PE.

The 2 km wide and approximately 120 km long assessment corridor was generated as a result of a variety of specialist inputs during the screening phase, as well as adjustments made according to inputs and concerns provided by this author, Eastern Cape Heritage Consultants as well as preliminary conditions of support from the Gamtkwa Khoisan Council.

The Public Participation Process, in terms of the National Heritage Resources Act, will be advertised and run as part of the Basic Assessment (BA) process. Interested & Affected Parties, including the Gamtkwa Khoisan Council, will be provided the opportunity to give feedback regarding this report and others related to the proposed wind farms development.

The overall purpose of a Phase 1a Archaeological Impact Assessment is to evaluate the sensitivity of archaeological resources in the affected area, to determine the potential impacts on such resources, and to avoid and/or minimize such impacts by means of management and/or mitigation measures. Because the proposed power line is over 100 km long and the area of assessment for the grid corridors is so large, it is not feasible to conduct a detailed archaeological foot survey of the whole corridor. A detailed desktop study and

literature review was thus undertaken and the findings of this were then evaluated as best as possible by drive-throughs that were undertaken in September 2017 and then for the adjustment to the alignment in July 2019. The nature of the heritage resources in the corridor outside any defined no-go areas is one where the resources will mostly consist of localised and spatially confined areas that can easily be avoided by micrositing the final grid alignment and individual pylon placements. Because the impact associated with the grid connection is linear and narrow, it can easily be micro sited during a final pre-construction walkthrough to avoid sensitive heritage resources if and where necessary.

The impacts and recommendations regarding heritage resources known and expected to occur **within the 2 km grid corridor**, service road and grid connection route are summarised as follows:

1) Historic period structure / cottage and dipping kraal (**IE10**) that is not conservation worthy (Table 1, Figure 5 & Plate 7). **Recommendation**: no further studies or mitigation of these finds is required;

2) stone walling at **IG1** (Table 1, Figure 5 & Plate 8), **Recommendation**: A buffer of 30 m from the stone wall should be observed to ensure that the structure is not damaged by construction activities. If the grid connection straddles this structure, then pylon positions should be micro sited prior to the construction phase of development to ensure that the 30 m buffer is complied with;

3) old farm house at **IG5** (Table 1, Figure 5 & Plate 9) and historic period structures (**31b** [Binneman & Reichert 2017]), **Recommendation**: a no-go buffer of 100 m should be observed, but if the overhead power line is closer than 250 m then the affected area should be micro sited to reduce the impact as much as possible, and the overhead power line should not straddle or cross directly over dwellings;

4) fenced graves at **IG6** and NG Kerk cemetery at **IG4** (Table 1, Figures 5 & 6, Plates 10 & 11), graves, grave yards and historic cemetery (**31a**, **28, 78** and **80** [Binneman & Reichert 2017]), **Recommendation**: some graves are already enclosed and protected by fencing, and if not, then they should be fenced in the event that the power line comes within 100 m of graves, but it is recommended that the overhead power line does not straddle graves or grave yards and that pylons be placed no closer than 50 m from graveyard fences;

5) the narrow gauge railway line that was built between Port Elizabeth and Avontuur (1899 – 1903) - with associated bridges and structures – runs through almost the entire length of the larger study area (Figures 4 through 7 and Plates 1 & 2) and **32** (Binneman & Reichert 2017). **Recommendation**: While it is acceptable for the grid connection to straddle or cross over the railway line, it is recommended that, as far as possible, such crossings should not occur at old railway sidings or stations where associated railway buildings are still intact. If the overhead power line runs alongside the historic railway line, it should be placed no closer than 20 m from the line to ensure that the line is not damaged during construction. No structures (buildings, bridges etc) associated with the railway line may be damaged or destroyed without a permit from the heritage authorities, and therefore it is recommended that they are avoided with a buffer of 50 m around such structures. Any grid connection development activities that encroach upon these buffers must be micro sited prior to the construction phase;

6) the broad flood plain and adjacent banks of the Gamtoos River (**IG3**, Figure 6 and Plate 5). This is a visually sensitive area and not a no-go zone, where a multitude of developments already exist. Recommendations are made to avoid or minimize further

negative impacts to the general sense of place of the Gamtoos River flood plain. **Recommendations:** The Impofu grid connection should be kept as close as possible to existing developments and impacts such as roads (R102 & N2), bridges (including the pipeline bridge), overhead power lines, etc., and be restricted to the 2 km corridor (Figure 6). This recommendation is made so that the grid connection does not create a new corridor of impact. The areas north of the R102 bridge and south of the N2 bridge should be avoided;

7) Kabeljous River Rock Shelters with Stone Age materials spanning the last 6000 years (**68**, Binneman 2007). **Recommendations**: Since these are roughly south facing rock shelters, it would be ideal if the grid connection was aligned to the north of this locality. If the overhead power line were to run to the south of the sites, then a buffer of 500 m should be observed. Depending on the circumstances and view sheds, then the buffer zone could be reduced to 300 m if the power line ran to the north and out of sight from the rock shelters. If the grid alignment comes to within 500 m from any side of the rock shelters, then the situation should be re-assessed during the micrositing walkthrough. In any event, the power line should not straddle or cross over the rock shelters regardless of the span length.

In addition to avoiding these medium to high sensitivity heritage resources, it is recommended that wherever possible, the overhead power line and service road should be constructed as close as possible to existing overhead power line servitudes and existing transport infrastructure rather than creating new corridors of disturbance and impact.

Provided that no direct impact results from the installation of pylons, a power line straddling or running for a short distance across heritage resources such as the historic narrow-gauge railway line is acceptable, the same does not apply to significant historic structures, cemeteries, graves, rock shelters and other archaeological sites of medium to high sensitivity. In addition to the avoidance of physical and direct impact to tangible heritage resources, the impact to the visual or aesthetic value of natural and cultural landscapes will be minimized provided that these recommendations are implemented.

The nature of the heritage resources in the corridor outside any defined no-go areas is one where the resources will most likely consist of isolated sites that can easily be avoided by micrositing of the final alignment. In conjunction with this is the fact that the impact of the grid connection is linear and limited to a narrow area, and the alignment can easily be micro sited if required. Given this, it is evident that the final alignment can be adjusted to satisfactorily avoid any sensitive areas during a final pre-construction walkthrough. It is thus a mitigation requirement that once the final alignment of this line has been defined that as part of the micrositing process a walkthrough is undertaken by a suitably qualified archaeologist to ensure that no unforeseen cultural impacts are missed and that the line is micro sited to avoid such impacts.

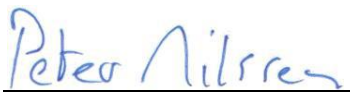
From this assessment and given the mitigation requirements there are no fatal flaws from an archaeological standpoint and there are no objections to the proposed Impofu Grid Connection project proceeding.

2. Name, Expertise and Declaration

I, Peter Nilssen (PhD in archaeology, University of Cape Town 2000), herewith confirm that I am a Professional member - in good standing - of the Association of South African Professional Archaeologists (ASAPA), including the Cultural Resource Management section of the same association since 1989 (ASAPA professional member # 097). I am an accredited Principal Investigator for archaeozoology (specialist analysis), coastal, shell midden and Stone Age archaeology; Field Director for Colonial Period archaeology; and Field Supervisor for Iron Age archaeology and Rock Art. I have worked as a professional archaeologist in Cultural Resource Management since 1989 and have completed more than 200 heritage-related impact assessments and mitigation projects that were approved by provincial and national heritage authorities. My CV accompanies this report.

As the appointed independent specialist (archaeologist) for this project hereby declare that I:

- act as an independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 982) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 982.



Signature of the specialist:

Name of company: Dr Peter Nilssen

Professional Archaeologist and Specialist Heritage Practitioner

Date: **21 August 2019**

NEMA requirements for Specialist Reports		
Appendix 6	**Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended**	**Section**
1 (1)(a)	(i) the specialist who prepared the report; and	Title page & Section 2; as well as the accompanying CV
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Section 2
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 4.3
(cA)	an indication of the quality and age of the base data used for the specialist report;	desktop study up to 2018 and fieldwork data obtained in September 2017 and July 2019; see Section 4.6 and section 5
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4.4 & Sections 6 & 7
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.6 and Section 5
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 4.6
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4.6and Section 5
(g)	an identification of any areas to be avoided, including buffers;	Sections 5, 6 & 7
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 and associated Figures and Plates
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.7
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Section 5
(k)	any mitigation measures for inclusion in the EMPr;	Sections 5, 6 & 7
(l)	any conditions for inclusion in the environmental authorisation;	Section 7
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
(n)	a reasoned opinion-	Section 7
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	consultation with Gamtkwa Khoisan Council will be arranged after their review of this report
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not yet done
(q)	any other information requested by the competent authority.	Not at this time
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

4. Introduction

4.1. Background to Development Proposal

Red Cap Impofu (Pty) Ltd (details on title page; hereafter Red Cap) is proposing to develop the Impofu North wind farm which is one of three proposed adjoining wind farms, namely Impofu North, Impofu East and Impofu West (hereafter referred to collectively as the Impofu Wind Farms). To evacuate the power generated by the proposed Impofu Wind Farms, a grid connection is required in the form of an approximately 120 km long 132 kV overhead power line between the wind farm project area and Port Elizabeth (PE). The location and extent of the Impofu Wind Farms and Grid Connection corridors is shown in Figures 1 and 2.

The Basic Assessment (BA) process for the Grid Connection is being facilitated by Aurecon South Africa (Pty) Ltd (details on title page; hereafter Aurecon). All project background information and proposal specifications presented in this report were supplied by Red Cap and Aurecon. Some sections below are taken verbatim from Aurecon's Terms of Reference document for the grid connection application that was issued to participating specialists.

The archaeological component of the BA process, as triggered by Section 38 of the National Heritage Resources Act (Act 25 of 1999; NHRA), is being undertaken by the present author in order to ensure compliance with heritage legislation as well as that of the National Environmental Management Act (Act 107 of 1998; NEMA). The following clauses of the NHRA are relevant to the requirement for a heritage impact assessment for the proposed Impofu Grid Connection development: Section 38(1) (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length; (c) any development or other activity which will change the character of a site (i) exceeding 5 000 m^2 in extent; or (ii) involving three or more existing Erven or subdivisions thereof. See Appendix A for more information on heritage legislation relevant to this project and to heritage resources discussed in this report.

4.2 Proposed Development Infrastructure

The transmission line includes three short separate 132 kV high voltage (HV) overhead power lines that emanate from the Impofu North, Impofu West and Impofu East substations. Alongside each substation will be a switching station and these will be transferred to Eskom. The three short separate 132 kV HV lines link each of the three switching stations on the wind farms to a combined central "collector switching station" (Impofu collector switching station). The role of the collector switching station is to consolidate the three power lines from the wind farms into one, such that a single line continues from here onwards. This will also allow Eskom more control over the management of the wind farms' connections into the national grid.

From the Impofu collector switching station, a single 132 kV HV power line will continue towards PE via the Eskom Melkhout Substation. Due to the complex nature of navigating linear infrastructure, this assessment considers that a 31 m servitude will be required for the construction of the powerline but may occur within an area demarcated by a 2 km buffer. Within this corridor, a single 132 kV HV power line continues to the existing Eskom Melkhout substation, located to the north of the N2 and north of the town of Humansdorp. An extension of 50m outwards from the existing Melkhout Substation footprint

is included in this assessment. Thereafter, the line continues through or around the Jeffrey's Bay Wind Farm, across the Mondplaas area and Gamtoos River valley (roughly following the existing Eskom 132 kV lines that come down from PE to Melkhout) towards Thornhill. It then passes Thornhill, heads north into the forestry area and then east through the valley behind Lady's Slipper and back down to the R102 where it possibly passes through the St Alban's correctional facility, continuing around the southernmost section of the Hopewell Conservation Estate, and connects into the Nelson Mandela Bay Metropolitan Municipality (NMBM) Sans Souci substation. An extension of 150m on the western side of the existing Sans Souci Substation footprint is considered for this assessment. From Sans Souci substation the line then continues to the NMBM Chatty substation where the grid connection terminates. An extension of 50m outwards from the existing Chatty Substation footprint is included in this assessment.

The reason the power line goes through the Eskom Melkhout substation and the NMBM Sans Souci substation is to improve the evacuation capacity and technical parameters of the grid connection, as well as improving the overall stability and reliability of the Eskom and NMBM networks. The switching stations, short lines, collector switching station and main power line will all be transferred to Eskom once constructed.

From west to east, the line will pass through the Kou-Kamma Local Municipality and the Kouga Local Municipality (both falling within the Sarah Baartman District Municipality) and will terminate in NMBM.

Substations & Switching Stations

Each wind farm application will include an on-site substation with transformer. The transformer will transform / convert the power received from the turbines from either above ground or underground medium voltage (MV) lines (33 kV or lower) to HV (132 kV). The three on-site substations are part of the wind farm applications. Adjacent to each substation will be a switching station. The associated switching stations are part of the grid connection application.

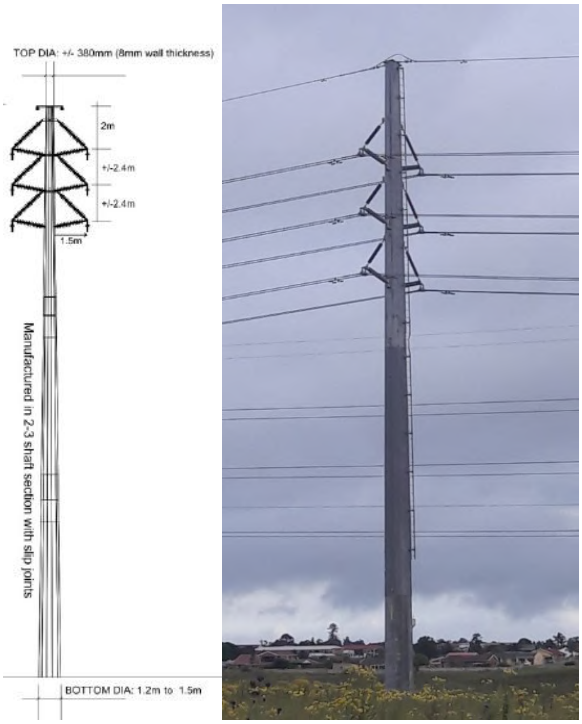
The substation areas will include all the standard substation electrical equipment / components, such as transformers and bus bars and will also house control, operational, workshop and storage buildings / areas. Since the three on-site substations will form part of the wind farm, and the switching component will be owned by Eskom, there will be a physical barrier between the two in the form of a fence. The Eskom switching stations will each have a total footprint of approximately 150 x 75 m (11,250 m^2). The single collector switching station will have a total footprint of approximately 150 x 150 m (22,500 m^2).

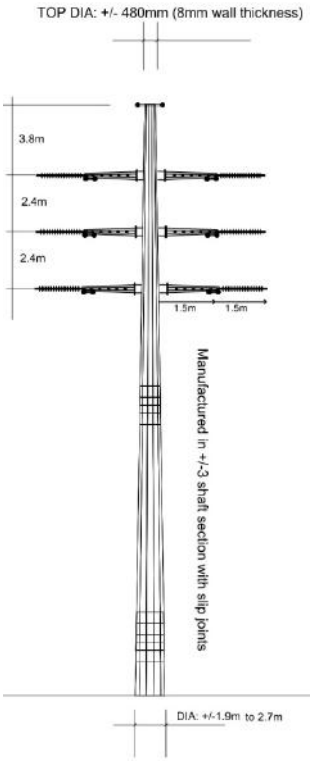
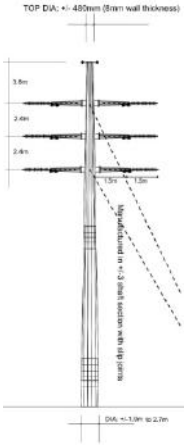
Pylons

There are six potential types of pylons that may be used for the 132 kV HV overhead lines. Descriptions are given in the table below. The spans (distance between pylons) on the monopole structure (without stays) will be on average 260 m, whilst the spans between the triple poles in the case of valley crossings may be up to 500 m and with the lattice structures over 500 m. The type of pylon and distance of the spans depend on the topography and alignment of the line.

These are not alternative 'technology' types as all options may be used along the grid corridor route at some stage or another depending on topography, line alignment and other constraints. However, option 6 (the lattice structure) would only be used if a landowner specifically asked for it or if it is required to get the power line over a significant river crossing or gorge rather than using the triple monopole option. Thus, if the lattice structure is used at all, it will be for very short sections.

Of interest from an archaeological perspective are disturbances to sediments and hence the depths and extents of required excavations for the construction and installation of various pylon types. For the intermediate poles it would be about 1.3 m to 1.7 m deep and about 36 m^2 to 81 m^2 in extent. For the Strain versions it would be about 1.8 m to 3.7 m deep and about 36 m^2 to 81 m^2 in extent. The lattice structures will have bases covering an area of about 225 m^2. The depth and extent of required disturbances to sediments for the installation of stays or anchors in not presently known, as this will depend on the soil and stability conditions. A further potential impact to archaeological resources involves the service road for maintenance of the overhead power line.

	Pylon Type	Description and purpose	Graphic
1.	Monopole intermediate Double Circuit with Twin Tern Conductors	Self-supporting galvanised steel Suspension structure with no stays/anchors. For general use as intermediate structures between turning/angle points. Height: 26-32 m Base diameter: 1.2 m to 1.5 m	

	Pylon Type	Description and purpose	Graphic
2.	Monopole strain (0º-30º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with no stays/anchors. For general use up to 30º turning/angle points Height: 26-32 m Base diameter: 1.9 m to 2.7 m	 
3.	Monopole strain (30º-90º angle) Double Circuit with Twin Tern Conductor	Self-supporting galvanised steel Strain Angle structure with additional stays/anchors. For general use between 30º to 90ºat turning/angle points. Height: 26-32 m Base diameter: 1.9 m to 2.7 m 5 to 7 stays/anchors	 

	Pylon Type	Description and purpose	Graphic
4.	Monopole strain (30º-90º angle) 2 x Single Circuit Twin Tern Conductor	2 x Strain Angle galvanised steel structure with stays/anchors. Two single circuit monopoles installed 10m apart to accommodate a twin Tern Conductor attachment each. For general use between 30º to 90at turning/angle points and where it is acceptable for the landowner. Height: 20 m – 24 m 5 to 7 stays/anchors	
5.	Triple pole structure. 2 x Single circuit with Twin Tern Conductor	For long spans (>350 m to 500 m) across valleys and rivers. Strain structure with three single monopoles per circuit. 5-9 stays per triple pole structure depending on angle configuration. Typical 18 to 16 m in length. In a double circuit configuration it will be a triple pole structure per circuit placed at 10m-15m apart	

	Pylon Type	Description and purpose	Graphic
6.	Strain Lattice Tower (247 type) for Double Circuit Twin Tern Conductor	For very long spans (>500 m) across valleys and rivers. Lattice structure with four legs Height: 28 m to 32 m Base of the tower with 4 legs in general 15 m x 15 m area.	

4.3. Purpose and Scope of the Study

The overall purpose of a Phase 1a Archaeological Impact Assessment (AIA) is to assess the sensitivity of archaeological resources in the affected area, to determine the potential impacts on such resources, and to avoid and/or minimize such impacts by means of management and/or mitigation measures. Note that the AIA presented here considers archaeological materials of prehistoric and historic origin as well as the cultural landscape. A separate palaeontological study was undertaken by Dr John Almond. This study was undertaken according to best practice principles and meets standards required by the heritage authorities in terms of the National Heritage Resources Act, No. 25 of 1999.

The objectives of the Archaeological Impact Assessment are:

- To assess the nature and sensitivity of archaeological resources in the affected parts of the receiving environment;
- To identify the impact of the proposed development on such resources as well as options for mitigation and/or management in order to minimize potential negative impacts and to make recommendations for mitigation / management where necessary; and
- To identify archaeological resources and issues that may require further investigation.

This archaeological study also forms the basis for community consultation in terms of Section 38 (3) (e) of the NHRA. The previous draft Basic Assessment Report (before this current report was undertaken due to the adjustment to the alignment) was made available to all Interested and Affected Parties (I&APs) as part of the Public Participation Process undertaken for the BA process and this new Draft Basic Assessment Report will also be

made available. Thus heritage interest groups such as the Gamtkwa Khoisan Council were provided and will still be provided with the opportunity to give feedback as part of the official community consultation to fulfil NHRA requirements.

A detailed screening assessment was undertaken by the BA project team (including specialists). The archaeological input for the screening assessment was informed by this author and by a scoping study undertaken by Eastern Cape Heritage Consultants (Binneman & Reichert 2017). The screening assessment resulted in a 2 km grid connection corridor being identified for the proposed Impofu grid connection (Figure 2). Within this 2 km corridor, the following infrastructure is proposed:

• The three switching stations associated with Impofu North, Impofu West and Impofu East Wind Farms, as well as the single Impofu collector switching station in the wind farm project area;

• The three short 132 kV HV lines that link each of the three switching stations to the Impofu collector switching station; and

• The entire length of the approximately 120 km and 2 km wide corridor for the 132 kV HV overhead power line, from the Impofu collector switching station to the Chatty substation in PE.

The six possible pylon options listed above are also considered. The existing and operational overhead power lines of the Tsitsikamma Community, Kouga and Gibson Bay Wind Farms as well as the existing 132 kV line from Grassridge Substation back to Melkhout and the two 132 kV lines from Melkhout back to PE are considered as part of the baseline conditions.

The three switching stations associated with each of the three wind farms and the Impofu collector switching station associated with the grid connection were assessed in detail at the time of the Impofu Wind Farms assessment. Archaeological assessments ideally require detailed foot surveys of development impact areas, but it is clearly not viable to cover the entire 100 km+ and 2 km wide grid corridor from the Impofu Wind Farms site to Port Elizabeth.

Certain parts of the landscape that are known to be archaeologically sensitive or that have potential to contain archaeological resources have been identified so that they can be avoided in the 2 km wide grid corridor that is being applied for. The nature of the heritage resources in the corridor outside any defined no-go areas is one where the resources will mostly consist of localised and spatially confined areas that can easily be avoided by micrositing the final grid alignment and individual pylon placements. Because the impact associated with the grid connection is linear and narrow, it can easily be micro sited during a final pre-construction walkthrough to avoid sensitive heritage resources where necessary. It is appropriate, therefore, that the final alignment is developed so as to avoid specific heritage resources and No-Go areas identified in this report - and in line with the requirements of the Environmental Authorisation but that a detailed archaeological walkthrough of this final alignment must be undertaken by a suitably qualified archaeologist as part of the final micrositing of the overhead power line route and associated service road prior to the construction phase.

Since archaeological resources occur on ground surfaces or in sub-surface sediments, only those aspects of the grid development that will impact on surface or sub-surface sediments are considered relevant. The pylon types described above, for example, will have no direct impact on archaeological resources, but will have a visual impact on the aesthetic character and value of the surroundings and cultural landscape.

4.4. Study Area

The location and extents of the assessment corridor for the Impofu grid connection is shown in Figures 1 and 2. The three short 132 kV HV lines, three switching station sites and single collector switching station are situated at the western extent of the grid corridor at the proposed Impofu Wind Farms site (Figure 5).

The 2 km corridor, provided by Aurecon, was determined through desktop studies, screening phase and Multi Criteria Decision Making process undertaken in 2017 & 2018 as well as by the adjustment to the alignment around the van Stadens area in 2019. A few examples of the affected environment along the grid connection corridor are shown in Plates 1 through 5.

For descriptive and comparative purposes of this AIA, the larger study area is divided into three sections that in this text are named West Grid, Central Grid and East Grid (Figure 2). The West Grid section comprises the coastal plain and the south-eastern slopes, foothills and hills of the more mountainous terrain to the north (Figure 5). Ancient aeolian sediments on the coastal plain are deeply incised in places by rivers and their associated tributaries revealing the underlying hard rock geological formations described in greater detail by Dr Almond in the palaeontological study. Numerous drainage lines and water sources occur in this area as do man-made dams. Apart from the town of Humansdorp, the bulk of the area is under rural and agricultural development. Large parts of the landscape, particularly along the coastal plain and areas adjacent to water sources are transformed by farming activities. Further human-related impacts of the more recent past include roads, bridges, railway lines, quarries, dams, variety of farming activities, variety of structures and infrastructure, fencing, overhead power lines, transmission/receiver masts, wind turbines and so on.

The West Grid portion of the grid corridor is more than 5 km from the present day shoreline and thus lies inland of the archaeologically sensitive coastal zone and also outside the pre-colonial cultural landscape (Binneman 2010a and Binneman & Reichert 2017). Archaeological resources that may occur in this area include historic period infrastructure, structures, cemeteries, graves and cultural materials, Stone Age artefacts in open air and disturbed contexts of mostly Early Stone Age and Middle Stone Age origin, Stone Age artefacts in sub-surface sediments, and unmarked burials. If present along river valleys, rock shelters may include archaeological remains of Stone Age and pastoralist origin as well as rock art.

The Central Grid section also includes the coastal plain and the south-eastern slopes, foothills and hills of the more mountainous terrain to the north, but in addition includes a coastal strip about 25 km in length (Figures 2 & 6). Along the 25 km strip, the 2 km grid corridor gets as close as 3 km from the present day shoreline. Although the 2 km corridor falls within the archaeologically sensitive 5 km coastal zone, it straddles previously disturbed areas and lies outside the archaeological no-go zone indicated by the polygon IG2 in Figure 6. Based on the literature review and the known presence of numerous archaeological sites along the shoreline, the latter no-go zone was defined during the screening phase of the project. The no-go zone indicated by IG2 in Figure 6 is specifically relevant to previously undisturbed areas.

As in the West Grid section, soft sediments along the Central Grid stretch are eroded and cut by the Kabeljous, Gamtoos and Van Stadens rivers and their associated tributaries. Drainage lines, water sources and dams are common. Overall, this section appears topographically more varied than the West and East Grid sections and a major natural

feature is the broad floodplain of the Gamtoos River roughly in the middle of the Central Grid section and labelled IG3 in Figure 6. Apart from a portion of the coastal town of Jeffreys Bay and the smaller villages of Loerieheuwel and Thornhill, the bulk of this area is under rural and agricultural (including forestry) development. As in the west, large parts of the natural landscape are transformed by agricultural and forestry activities. Other human-related impacts of the more recent past include roads, bridges, railway lines, quarries, dams, a variety of farming activities, a variety of structures and infrastructure, fencing, transmission/receiver masts, overhead power lines, wind turbines and so on.

Apart from the high density of shell middens, pastoralist and other heritage resources in the archaeologically sensitive coastal zone referred to above, the archaeological record in this section of the grid corridor is known and expected to include Stone Age and pastoralist materials and possible rock art in rock shelters, Stone Age and pastoralist artefacts in open and often disturbed contexts, artefacts in sub-surface sediments, unmarked prehistoric graves, historic period infrastructure, structures, cemeteries, graves and cultural materials associated with the historic period.

The East Grid section consists of a combination of coastal plain, undulating low lying hills with slopes and foothills of the more mountainous interior in the north-west (Figure 7). The Elands and Swartkops are the main rivers in this section though numerous drainage lines and water sources are present. Apart from the more mountainous portions in the north-west, this part of the grid assessment corridor is notably more transformed by human related activities, specifically those associated with modern urban developments. The main urban centres include Uitenhage, Despatch and Port Elizabeth. Outside of the urban centres, the most common land use is rural and agricultural (numerous small holdings and numerous chicken farms), and with the exclusion of wind farms, recent human-related impacts are the same as those described above for the other grid sections.

The East Grid portion of the grid connection corridor is more than 5km form the shoreline and thus lies outside the archaeologically sensitive coastal zone. Very few heritage related studies have been done in this area and while some historic period remains as well as Stone Age artefacts have been recorded, no significant archaeological resources are known or expected to occur within the 2 km grid corridor. The most likely heritage resources present in this area are historic period infrastructure, structures, cemeteries, graves and cultural materials associated with the historic period, and to a lesser extent, Stone Age and pastoralist artefacts in open and disturbed contexts. If rock shelters are present, they may contain Stone Age or pastoralist remains as well as rock art.

The operational wind farms and associated grid connections of Tsitsikamma Community, Gibson Bay, Kouga and Jeffery's Bay are located nearby, and the construction of the Oyster Bay Wind Farm immediately to the east of the Impofu Wind Farms site will commence soon (Figure 3). The Ubuntu and Banna Ba Pifhu Wind Farms have received Environmental Authorisation (EA). The EAs for the Deep River and Happy Valley wind farms (Figure 3) have lapsed. The proposed Impofu Wind Farms and grid connection are therefore considered to be an addition to an existing and growing renewable energy landscape.

4.5 Legal Requirements

The following legal requirements - relevant to heritage - apply to the proposed grid connection development:

- The National Environmental Management Act, No. 107 of 1998 (NEMA as amended): An Environmental Authorisation is required for Listed Activities in Regulations pursuant to NEMA, and specialist assessments are required to

inform the Scoping and EIA phases associated with the Application for Environmental Authorisation for the project;

- The National Heritage Resources Act, No. 25 of 1999 (NHRA): A full Heritage Impact Assessment is not required by the Eastern Cape Provincial Heritage Resources Authority for the proposed project. Only archaeological and palaeontological studies are required (ECPHRA e-mail of 22 & 23 August 2017).

The archaeological component of the BA process is being undertaken to comply with the following clauses of Section 38(1) of the NHRA which trigger the requirement for a heritage impact assessment: (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (c) any development or other activity which will change the character of a site (i) exceeding 5 000 m^2 in extent; or (ii) involving three or more existing Erven or subdivisions thereof. Because of these triggers, ECPHRA was approached by this author, and ECPHRA confirmed in terms of Section 38(2) (a) that a heritage study was required, and ECPHRA requested in terms of Section 38(3) that archaeological and palaeontological impact assessments be undertaken and that these studies be done by separate specialists, one for the archaeological component, and one for the palaeontological component. See further details required for the heritage study in terms of the NHRA No 25 of 1999 in Section 38(3) in Appendix A.

4.6. Approach to the Study - Methodology

This assessment was conducted according to best practice principles and in accordance with guidelines and minimum standards required by heritage authorities in respect of the NHRA (HWC 2007, 2016a, 2016b, SAHRA 2007, 2010, 2012, 2017, 2018), and as set out in Section 13, GN.R982 of NEMA (General requirements for EAPs and Specialists).

4.6.1. Desktop & Literature Review (see Section 5.1)

This author has considerable work experience in the West Grid section of the Impofu grid connection corridor and is familiar with the main types of heritage resources and issues (Nilssen 2003, 2010, 2013, 2014, 2015 & 2016, Nilssen & Van Ryneveld 2012, and Nilssen & Smith 2015). A desktop study and literature review was undertaken, which relied in part on this author's experience in the area and also focused on the SAHRIS database up to 2018, which is by no means exhaustive. Previous heritage and archaeological studies in the immediate surroundings have already provided detailed descriptions of the history, heritage and archaeological record of the area (see section on Archaeological Background below). While giving a broad overview of the archaeological record presented in the above-named reports as well as those listed in the reference section below, the focus is on presenting key heritage resources and concerns already identified in earlier studies and how they relate to the assessment being conducted here.

The desktop study also involved a detailed inspection of aerial imagery available through Google Earth as well as high resolution aerial photography for the Impofu Wind Farms site supplied by Red Cap. The main aim of examining aerial imagery was to determine which development activities encroached upon previously undisturbed and hence potentially sensitive areas, and to locate man-made structures or ruins.

In addition to this, a desktop study for the Impofu Wind Farms and associated Grid Connection was commissioned by Red Cap and completed by Eastern Cape Heritage

Consultants (Binneman & Reichert 2017) and was invaluable for the generation of the 2 km grid corridor and for the completion of this assessment. The Binneman and Reichert desktop study reports on the most important work and documented archaeological sites in the area up to the year 2017, including archaeological assessments for a wide variety of development activities as well as the existing Tsitsikamma Community, Gibson Bay, Kouga and Jeffery's Bay Wind Farms and their associated grid connections, as well as the proposed Oyster Bay, Ubuntu and Banna Ba Pifhu Wind Farms (Figure 4). Binneman and Reichert also provided Google Earth mapping for 100 archaeological occurrences and sites in the affected area. As alluded to above, the SAHRIS database is not an exhaustive or up to date record of heritage studies, but given Dr Binneman's and Mr Reichert's vast experience and in-depth knowledge of the heritage record of the area, we are very unlikely to have missed any of the important heritage resources recorded in the broader study area (Binneman & Reichert 2017).

4.6.2. Screening and Basic Assessment Phases (see Section 5.2)

The initial Impofu grid corridor was examined using Google Earth imagery to identify parts of the study area that looked relatively undisturbed by more recent human activities and with potential to contain archaeological resources. Accepting that the grid corridor is too large to undergo a detailed archaeological foot survey, these potentially sensitive areas and the general surroundings of the grid corridor were inspected during drive throughs of the grid corridor between the Impofu Wind Farms site and the Chatty substation near Port Elizabeth in September 2017 and again in July 2019 for the adjustment that was made to the grid corridor in the van Stadens area. The focus of this exercise was to establish if any fatal flaws or no-go areas are present, which parts of the grid corridor were likely to contain significant heritage resources and which areas were less sensitive archaeologically and hence more suitable for receiving the grid connection development. It is assumed that a detailed archaeological walkthrough of the grid corridor, including the extended footprints around the existing Melkhout, Sans Souci and Chatty substation footprints, must be conducted to microsite the grid route, pylon positions and service road prior to the construction phase. The 2 km grid corridor shown in Figure 2 was generated as a result of a project team screening workshop held in Cape St Francis in September 2017. This screening workshop included inputs from all project specialists including the desktop study done by Eastern Cape Heritage Consultants as well as the provisional inputs received from the Gamtkwa Khoisan Council (Binneman & Reichert 2017).

4.6.3. Consultation (see Section 5.3)

Mr Kobus Reichert, a representative of the Gamtkwa Khoisan Council (GKC) – a registered I&AP – was consulted informally and advised this author that the GKC will provide feedback after they have reviewed this archaeological report. If considered necessary by the Gamtkwa Khoisan Council, further consultation may be conducted.

The GKC was consulted by Eastern Cape Heritage Consultants on 13 July 2017 regarding their desktop study for the Impofu Wind Farms and Grid Connection projects (Binneman & Reichert 2017). This consultation was an informal preliminary engagement and does not replace the required Public Participation Process of the EIA process or community consultation in terms of section 38(3)(e) of the NHRA (Binneman & Reichert 2017).

4.7. Assumptions, Limitations and Gaps in Knowledge

This assessment assumes that all background information and layout plans provided by Red Cap and Aurecon are correct and current. This assessment is specifically for the 2 km grid assessment corridor as shown in Figure 2.

It is assumed that the location data for heritage resources provided by Binneman and Reichert (2017) and used in the production of Figures 4, 5 and 6 are accurate, and that if the final alignment comes close to them, these localities will be inspected during the archaeological walkthrough micrositing phase prior to construction. Note that, only archaeological and heritage resources of medium to high significance and sensitivity are included in the maps shown in Figures 4, 5 and 6. The med-high heritage labelled markers and polygons are taken from the Binneman and Reichert (2017) report and from this author's work in the area. Nevertheless, all heritage resources identified through this study are presented here and all heritage resources identified by Binneman and Reichert are presented in their 2017 report.

The most significant limitation of this study is that, due to the very large study area, a detailed archaeological foot survey cannot be conducted. However, the final impact of the grid connection is linear and limited to a narrow area, and the final alignment can be easily adjusted to avoid any sensitive areas. The nature of the heritage resources in the corridor outside any defined no-go areas is one where the resources will mostly consist of localised and spatially confined areas that can easily be avoided by micrositing the final grid alignment and individual pylon placements. This limitation, therefore, can be overcome by requiring that a detailed archaeological walkthrough of this final alignment be undertaken by a suitably qualified archaeologist as part of the final micrositing of the overhead power line route, including the extended footprints around the existing Melkhout, Sans Souci and Chatty substation footprints, pylon positions and associated service road prior to the construction phase.

5. Results

5.1. Archaeological Background

Most of the references cited and literature consulted during the desktop study are heritage-related impact assessments for a variety of developments that are relevant to the Impofu grid connection study and are listed in the reference section below. Studies specifically conducted for wind farm and associated grid connection projects in the affected area that are referred to here include Anderson 2010, Binneman 2010a, 2010b, 2011a, 2011b, 2011c, 2011d, 2011e, 2012a, 2012b, Binneman and Reichert 2015, Kaplan 2016, Nilssen 2014, 2015, 2016, 2018, Van Ryneveld 2010a, 2013, Wahl and van Schalkwyk 2013.

Heritage studies for the Thyspunt nuclear grid connection corridors – broadly similar to the corridors investigated here – were also conducted, but no heritage resources were mapped or documented through actual archaeological foot surveys (Van Schalkwyk, J. 2010, Van Schalkwyk, L.O. 2009a, 2009b). Because of the inadequacies of the latter studies and after considerable debate between the Gamtkwa Khoisan Council and SiVEST Pty Ltd, a further study was commissioned by SiVEST and undertaken by Ms Mary Patrick (Binneman & Reichert 2017). Although the Patrick report listed 37 sites as obtained from the Albany Museum database, no coordinates for the sites were given and most of them fall outside of the grid corridor (Binneman & Reichert 2017 and Patrick 2012). Binneman & Reichert noted that one or two sites may be situated near or within the southern boundary of the grid connection corridor (Binneman & Reichert 2017). Nevertheless, the Van Schalkwyk reports recommended that detailed archaeological investigations were required once the power line routes were determined and prior to the construction phase of development.

Archaeological resources mapped by Eastern Cape Heritage Consultants and that lie within or near the proposed Impofu grid connection corridor are discussed in Section 5.2 below (Binneman & Reichert 2017).

Pre-Colonial / Stone Age Period

Several heritage related studies have been conducted along the nearby coastline, which is rich in archaeological resources of Early, Middle and Later Stone Age origin as well as that of the Pastoralist period. A strip along the coast of up to 5 km wide is particularly rich and is considered to be one of the richest archaeological and pre-colonial cultural landscapes in South Africa (ACO 2010, Binneman 2010a, Nilssen 2003, SAHRA 2010). The archaeology of the adjacent interior is not well known due to a lack of research.

Early Stone Age (ESA) materials including Acheulian hand axes, cleavers and chopping tools that date from between about 1.5 million and 300 000 years ago is the earliest evidence for human ancestors occupying this area (e.g., Anderson 2010, 2011, Binneman 2010b, 2011b, 2011c, 2011d, 2012b, 2013b, 2013c, Binneman and Reichert 2015, Booth 2017, Deacon and Geleijnse 1988, Kaplan 2016, Nilssen 2014, 2016, 2018, Van Ryneveld 2010a, Webley 2006). Such artefacts are usually found among ancient river gravels and on old palaeosols exposed within dune fields like those at Geelhoutboom and Brandewynkop (Deacon & Geleijnse 1988 and Binneman's personal observations). While ESA artefacts are common among the dunes immediately east of Thysbaai, they are rare in the dunes a bit further north between Oyster Bay and St Francis Bay and always identified in disturbed or derived contexts where they are usually mixed with artefacts of more recent Stone Age times. Although ESA artefacts were identified in the immediate surroundings, they are relatively rare, and usually found in secondary, derived and mixed contexts, and are therefore considered to be of low significance (also see Van Ryneveld 2010a). More recently, however, during an archaeological assessment near Jeffery's Bay, some *in situ* ESA stone artefacts were identified in a similar context to that described below (Kaplan 2016).

During his palaeontological field investigations for the Impofu Wind Farms project, Dr Almond identified *in situ* ESA artefacts in ancient aeolian deposits at two quarries with exposed geological stratigraphy (Almond 2017). The stone artefacts are bedded in Plio-Pleistocene aged Nanaga aeolianites (Almond 2017). If present in high densities, such *in situ* ESA materials are potentially of greater scientific value than the exposed, displaced and temporally mixed ESA & MSA accumulations at sites like Geelhoutboom (Binneman & Reichert 2017 and Deacon &Geleijnse 1988). The above-mentioned quarries and a newly discovered site with *in situ* MSA and possible ESA artefacts are described in the archaeological investigations for the Impofu Wind Farms (Nilssen 2018a, 2018b).

The Middle Stone Age (MSA) starts at about 300 000 years ago and gives way to the Later Stone Age some 30 000 years ago. MSA stone tools are scattered widely across the landscape, mostly in disturbed ad secondary context and devoid of any other cultural remains or fossil bone (ACO 2010, Anderson 2010, 2011, Binneman 2008, 2010a, 2010b, 2011b, 2011c, 2011d, 2011e, 2012a, 2012b, 2013a, 2013b, 2013c, Binneman and Reichert 2015, Booth 2017, Deacon and Geleijnse 1988, Nilssen 2003, 2013, 2015, 2018, Van Ryneveld 2007, 2010a, 2010b, 2013, Webley 2003). MSA stone artefacts are characterised by flake and blade industries where evidence for core preparation - also known as the Levallois technique - is seen on prepared or faceted striking platforms of points, flakes and blades. Convergent flakes or points are also one of the markers of the MSA period. The Klasies River Cave complex - a National Heritage Site some 8 km west of the SW boundary of the Impofu Wind Farms study area - is the most significant MSA site in the area that contains evidence for human occupation spanning the last 120 000 years. Research at the

site has made a significant contribution to our understanding of the origins of modern humans, and therefore, Klasies River Cave is among 5 other South African archaeological sites that are in the process of being nominated for World Heritage Site status with UNESCO.

Stone artefacts of MSA origin occur among the dunes and exposed gravels in the area, with the dunes at Brandewynkop containing numerous MSA stone tools (personal observation). Unfortunately, no other cultural materials or faunal remains are associated with these artefacts at Brandewynkop, but bone and fossil bone is associated with MSA materials in the dunes between Oyster Bay and St Francis Bay (also see Nilssen 2010). SAHRA has declared a delineated area containing Brandewynkop an exclusion area where no wind turbine development is permitted. "At the eastern end of the (St Francis Bay) dune field are most remarkable Middle Stone Age 'factory' sites which consisted of large circular piles of flakes and cores. Most of the flake piles represent unique 'moments in time' where large numbers of flakes were produced from a single core" (Binneman 2010a pg 3). Apart from Brandewynkop, the most significant ESA / MSA site recorded in the vicinity of the study area is site 2.3 at the Kouga Wind Farm (formerly the Central Cluster), which will be conserved in perpetuity (Van Ryneveld 2010a).

The Later Stone Age (LSA) in this area starts about 30 000 years ago and is characterised by substantial technological improvements over the MSA industries. Advancements on previous technologies and new technologies as well as cultural developments include the widespread occurrence of rock art (cave paintings and rock engravings), decorative objects (ostrich egg shell beads, marine shell pendants and beads, ochre), human burials with grave goods including painted stones, an expanded stone tool kit, microlithic stone tool industries (often associated with composite tools such as bow and arrow technology), bone tools, tortoise carapace bowls, ostrich egg shell containers, fire making sticks and so on. Many of the LSA sites in the area are shell middens, and although these usually occur within a few hundred metres of the shoreline, they are also found up to 5 km inland (ACO 2010, Anderson 2010, Binneman 1996, 2008, 2011e, Deacon and Geleijnse 1988, Nilssen 2003, 2010, Nilssen and van Ryneveld 2012, Van Ryneveld 2013, Webley 2003).

Binneman has identified, described and dated the following types of LSA archaeological sites and their contents that occur in the dune systems along the 5 km coastal strip: large stone features associated with cooking (one dated to some 300 years ago); shell middens with pottery only and with pottery and domesticated fauna that represent Khoi pastoralists or herders (dated to about 1800 and 1600 years ago respectively); shell middens, without pottery, associated with a quartzite stone industry that Binneman has named the Kabeljous industry, which represent hunter-collector-fishers who lived along the coastal foreland (dated to between about 4700 and 1800 years ago); shell middens, without pottery, associated with a silcrete or quartz microlithic Wilton Industry that represent hunter gatherers or San who lived mainly in the interior and only visited the coast periodically (dated to between about 5180 and 1900 years ago) (Binneman 2010apg 4-5). Apart from the Kabeljous River Rock Shelter (Binneman 2007), no other significant LSA sites have been recorded by previous studies in the 2 km grid assessment corridor.

Pastoralist / Herder Period

The last 2000 years saw a significant shift in the socio-economic setting with the immigration and settlement of KhoiKhoi peoples in the area from about 1800 years ago. As described above in the Later Stone Age section, the most common archaeological traces of the pastoralist / herder lifestyle in the area include large stone features associated with

cooking, shell middens with pottery only and shell middens with pottery and domesticated animals (ACO 2010, Binneman 2010a, 1996, 2008, 2011e, Nilssen 2003, 2010).

The KhoiKhoi were the first food producing peoples in South Africa who brought domestic stock, pottery / ceramic containers and bowls and associated cultural items into the region. A lifestyle still closely connected with nature would have allowed for likely easy and mutually beneficial relations between KhoiKhoi and hunter-gatherer (San) peoples. Descendants of these first farming peoples, and offspring from converging KhoiKhoi and San families, such as members of the Gamtkwa Khoisan Council, still live in the region today.

Colonial / Historic Period

The most recent inhabitants of the area are mostly of European origin and started settling here from around the mid to late 1700s during the Colonial Period. These latest arrivals have had the most dramatic effect on the environment, particularly in more recent years with large scale cattle / dairy farming where large tracts of indigenous vegetation were cleared for ploughing and planting of crops and pastures for cattle feed and grazing. Heritage resources related to this period - older than 60 years or of historic significance - include roads, railway lines and bridges, dwellings and associated structures and material culture as well as cemeteries, marked and unmarked human burials (e.g., Anderson 2010, 2011, Bennie 2008, Binneman 2012c, 2013b, Binneman and Reichert 2015, Booth 2015, 2017, Nilssen 2003, 2018, Van Ryneveld 2007, 2013, 2010a, 2010b, Wahl and van Schalkwyk 2013).

Cultural Landscape

Human occupation and use of the landscape and its features result in a visually more or less evident modification of that landscape. Human use of the environment, however, may have no visually detectible altering effect at all, but nevertheless, this imprinting of human behaviour on the environment, and the relationship between people and the landscape is what is implied by the term “cultural landscape” (see UNESCO 2008 for definitions, significance and preservation of cultural landscapes).

Although this area has been occupied by hominins and humans for at least 1.5 million years, the nomadic hunter-gatherer and, to a lesser extent, early pastoralist lifestyles of pre-historic inhabitants leaves little to no physical evidence of their presence in the landscape and has a negligible modifying effect on it. This is in stark contrast to the significant alteration to the environment made over the past few hundred years by colonial agricultural and urban settlements of the area.

Cultural landscapes are defined and informed by several elements including, but not limited to; natural landscape features, palaeontology, archaeology / anthropology, oral histories, public memory, the built environment and social and written histories. The value of cultural landscapes is determined through professional interpretation and opinion, community and public values as well as environmental and heritage legislation.

The cultural landscape of the affected environment includes three broad layers, with the most recent, colonial settlement and development over the past few hundred years having the most visually evident modifying effect on the landscape. Impacts related to this cultural layer include roads and associated bridges, single vehicle tracks, railway lines and associated bridges and structures, agricultural clearings for grazing and cultivation, variety of farming activities, forestry, variety of farmsteads, structures and infrastructure, quarries, dams, fencing, overhead power lines, transmission/receiver masts, wind turbines and so on.

The second layer underlying the historic period and dating to the last 2000 years is the pastoralist or herder period, which in turn is underlain by the third layer comprised of the three Stone Age periods spanning the period from a few hundred years ago to the early periods of stone tool making archaic humans at least 1.5 million years ago. The physical traces associated with herder and hunter-gatherer or Stone Age occupation of the area are described above.

Although the prehistoric cultural landscape is the least evident and often invisible, temporally, it makes up for the overwhelming bulk of human occupation of the region. Given that most of the archaic human (ESA) and human (MSA to recent) occupation of this area involves the Stone Age era, it can be argued that the most significant cultural layer in this area involves the pre-colonial cultural landscape and its sense of place.

SAHRA has already recognized the significance of the Thyspunt cultural landscape and will not approve any developments that will have a negative impact on it (SAHRA 2010). The Thyspunt cultural landscape, however, is only a fraction of a much larger and equally significant pre-colonial cultural landscape that involves an up to 5km wide coastal strip that extends at least from St Francis Bay in the east to Klasies River in the west (Binneman 2011b & 2011c and ACO 2010). Binneman provides a detailed description of the archaeological riches in this area, which justifies the Gamtkwa Khoisan Council's and scientific significance attributed to the pre-colonial cultural landscape in this area (Binneman 2011b & 2011c). Moreover, large stretches of South Africa's coastline are rich and varied cultural landscapes that house the highest quantity and quality of archaeological Stone Age sites in the world. With ever increasing coastal developments and resulting degradation of the coastal strip, it follows that as much as possible of this cultural landscape should be protected for future generations and scientists.

The renewable energy landscape made up of the existing Kouga, Gibson Bay, Tsitsikamma Community and Jeffery's Bay Wind Farms and their associated transmission lines is the most recent layer of the cultural landscape. These and additional approved wind farms in the surroundings of the study area already encroach on and have a mostly aesthetic impact on the pre-colonial cultural landscape. The avoidance of the archaeologically sensitive areas identified in the screening phase and detailed below will help to reduce the visual and physical impact of the Impofu grid connection on the overall cultural landscape.

5.2. Screening and Basic Assessment Surveys and Desktop Study

Because the area of assessment for the grid connection corridor is so large, it is not feasible to conduct a detailed archaeological foot survey. Nevertheless, a site visit and drive-through of the grid corridors was conducted in September 2017 and again in July 2019 for the adjustment to the grid in the van Stadens area. The approach to the site visit was based on the literature review, desktop study, including the desktop study undertaken by Eastern Cape Heritage Consultants, inspection of Google Earth imagery, knowledge of previously identified heritage sites and sensitive areas, and spatial information of existing electrical and transport infrastructure and other constraints provided by Aurecon. As mentioned earlier, the focus of this exercise was to establish if any fatal flaws or no-go areas are present, which parts of the grid connection corridor were likely to contain significant heritage resources and which areas were less sensitive archaeologically and hence more suitable for receiving the proposed grid connection development.

Based on the site visits and desktop study, it is expected that the nature of heritage resources in the corridor outside any defined no-go areas is one where the resources will mostly consist of localised and spatially confined areas that can be avoided by micrositing

the grid alignment and individual pylon placements. Because the impact associated with the grid connection is linear and narrow, it can easily be micro sited during a final pre-construction walkthrough to avoid sensitive heritage resources if and where necessary.

Several localities and areas in the larger study area were identified as being more sensitive to development than others and these are avoided by the 2 km grid corridor (Figure 2). The generation of the 2 km grid assessment corridor shown in Figure 2 was based on various specialist inputs during the desktop and screening phases including the Multi Criteria Decision Making process undertaken in September 2017. In addition, at this stage of the assessment and planning process, heritage resources that should be avoided include those reported to be of medium to high sensitivity by Binneman and Reichert (2017). Sites and other areas to be avoided are discussed in more detail below.

Heritage resources and areas of medium to high archaeological sensitivity that were identified during this assessment process along with those reported by Eastern Cape Heritage Consultants (Binneman& Reichert 2017), and that fall within and near the 2 km grid corridor are shown in Figures 4, 5 and 6. The med-high heritage labelled markers and polygons in the fore-mentioned figures are taken from the Binneman and Reichert (2017) report and from this author's work in the area. Nevertheless, all heritage resources identified through this study are presented here, and all heritage resources identified by Binneman and Reichert are presented in their 2017 report. These resources are all protected by the NHRA, and with the exception of a relatively modern structure at **IE10**, the heritage resources in Figures 4, 5 and 6 are considered to be of medium to high sensitivity. The best way to deal with these is to ensure that they are avoided by the proposed overhead power line and associated service road and that they are conserved for I&APs, future generations and scientists. To this end, specifics are given below.

The below deals first with the heritage resources identified by this author and thereafter those considered by Eastern Cape Heritage Consultants to be of medium to high sensitivity (Binneman & Reichert 2017; Table 1).

Stone Age quarrying of quartzite outcrops, as seen at **IN35**, is a common indicator of people inhabiting this area prior to the colonial period and represents the extraction of raw materials for the manufacture of stone tools, and therefore, it is recommended that this locality be conserved. Several distinct flake scars are visible on the exposed quartzite outcrop, but dense vegetation in the immediate surroundings precludes further examination of ground surfaces for flaking debris that could result from quarrying activities (Figure 5, Plate 6). It is noted that this find lies outside the 2 km corridor.

Recommendation: If development activities are within 200 m from the coordinates given in Table 1, then the locality must be micro sited and a buffer of 50 m from the site boundaries should be observed around **IN35**. In the event that the grid alignment straddles this buffer zone, then the pylon placements must be micro sited prior to the construction phase of development to ensure that they are placed outside the buffer zone.

Remnants of the historic or colonial period include (Table 1):

1. Historic period structure / cottage and dipping kraal (**IE10**), that is not conservation worthy (Figure 5, Plate 7). **Recommendation**: no further studies or mitigation of these finds is required;

2. stone walling at **IG1** (Figure 5, Plate 8), **Recommendation**: A buffer of 30 m from the stone wall should be observed to ensure that the structure is not damaged by

construction activities. If the grid connection straddles this structure, then pylon positions should be micro sited prior to the construction phase of development to ensure that the 30 m buffer is complied with;

3. old farm house at **IG5** (Figure 5, Plate 9), **Recommendation**: a no-go buffer of 100 m should be observed, but if the overhead power line is closer than 250 m then the affected area should be micro sited to reduce the impact as much as possible, and the overhead power line should not straddle or cross directly over dwellings;

4. fenced graves at **IG6** and NK Kerk cemetery at **IG4** (Figures 5 & 6, Plates 10 & 11), **Recommendation**: the graves are already enclosed and protected by fencing, but it is recommended that the overhead power line does not straddle the graves or cemetery and that pylons be placed more than 50 m from the graveyard fence; and

5. the narrow gauge railway line that was built between Port Elizabeth and Avontuur (1899 – 1903) - with associated bridges and structures – runs through almost the entire length of the larger study area (Figures 4 through 7 and Plates 1 & 2), **Recommendation**: While it is acceptable for the grid connection to straddle or cross over the railway line, it is recommended that, as far as possible, such crossings should not occur at old railway sidings or stations where associated railway buildings are still intact. If the overhead power line runs alongside the historic railway line, it should be kept more than 20 m from the line to ensure that the line is not damaged during construction. No structures (buildings, bridges etc) associated with the railway line may be damaged or destroyed without a permit from the heritage authorities, and therefore it is recommended that they are avoided with a buffer of 50 m around such structures. Any construction activities associated with the grid connection that encroach upon these buffers must be micro sited prior to the construction phase.

A few areas were identified as being more sensitive to development than others (Figure 3 and Plates 1 through 3). This includes sensitivity to direct impact on tangible heritage resources as well as visual impact on cultural landscapes and sense of place. The sensitive areas are not necessarily no-go zones and include:

1. the stretch along the northern, relatively undeveloped and archaeologically unknown portions of the original grid corridor where more hilly and mountainous landscapes are less disturbed – this area is also known to contain rock art sites (Binneman & Reichert 2017). This northern portion of the original grid corridor has been avoided and lies outside the 2 km grid corridor as shown in Figure 2;

2. the broad flood plain and adjacent banks of the Gamtoos River (**IG3**, Figure 6 and Plate 5). This is a visually sensitive area and not a no-go zone, where a multitude of developments already exist. Recommendations are made to avoid or minimize further negative impacts to the general sense of place of the Gamtoos River flood plain. **Recommendations**: The Impofu grid connection should be kept as close as possible to existing developments and impacts such as roads (R102 & N2), bridges (including the pipeline bridge), overhead power lines, etc., and be restricted to the 2 km corridor (Figure 6). This recommendation is made so that the grid connection does not create a new corridor of impact. The areas north of the R102 bridge and south of the N2 bridge should be avoided; and

3. the archaeologically sensitive coastal zone indicated by a shaded polygon in Figure 6 (**IG2**). This area is likened to the pre-colonial cultural landscape along the shoreline south of the Impofu Wind Farms (ACO 2010, Binneman 2010a, Nilssen 2003, SAHRA 2010).

Recommendations: This should be considered as a no-go area and is avoided by the 2 km corridor layout.

It is recommended that, wherever possible, the overhead power line should be constructed as close as possible to existing electrical and transport servitudes rather than creating new corridors of disturbance and impact (for example, see existing overhead power line pylons in Plate 5).

At the initiation stage of the Impofu Wind Farms and Grid Connection projects, Eastern Cape Heritage Consultants were commissioned by Red Cap to undertake a desktop study (Binneman& Reichert 2017). Their comprehensive study included a review of reports of heritage-related work in the surrounding area from 2006 up to 2017. Dr Binneman, however, has also been involved in archaeological research in this area since the 1980's and headed the archaeology unit at the Albany Museum until recently. The Binneman and Reichert desktop study also includes the findings and assessments of the existing neighbouring wind farms and their transmission lines as well as those with Environmental Authorisation and that are currently being applied for. They produced a Google Earth map with 100 archaeological sites and observations, which has been very valuable in the completion of the assessment presented here.

Their desktop study focused on the original Impofu grid corridor as shown in Figure 2 and also assumed that the grid connection would terminate at the Grassridge substation to the north-east of Port Elizabeth. Several areas that they assessed and discussed have subsequently been excluded from the 2 km grid corridor and are not included here. For a full discussion of the original grid corridor and relevant heritage resources see pages 18 through 20 of their report (Binneman & Reichert 2017).

Listed below are heritage resources that were rated to be of medium to high sensitivity and that fall within or near the 2 km grid corridor (for the list of 100 sites and observations see Table 1 in Binneman & Reichert 2017). Sites of low significance or sensitivity are excluded from this study and from the maps presented below. This is because even though they are protected by the NHRA, sites of low significance do not warrant further mitigation or investigation if they were adequately recorded when initially discovered. For assessment purposes, only sites or observations of medium to high sensitivity and that fall within the 2 km grid corridor were considered. Heritage resources listed below are protected by the NHRA, and as such, it is recommended that they should be avoided by the proposed grid connection development. The location of heritage resources listed in Table 1 are indicated in Figures 4, 5 and 6, and note that no medium to high significance heritage resources have been recorded in the East Grid section of the 2 km corridor as shown in Figure 7.

Heritage resources are numbered according to Table 1 in Binneman & Reichert (2017, pg 11-15) and include:

1) A large rock shelter of unknown heritage value, but that is expected to house Stone Age and/or Pastoralist materials as well as rock art (**LRS**). **Recommendations**: This site is a no-go zone and falls outside the 2 km corridor, but in the event that the grid route is aligned to within 500 m of this locality, then the locality must be micro sited prior to the construction phase to determine a suitable buffer;

2) one of the largest recorded Early Stone Age sites in the region with thousands of stone tools scattered on disturbed surfaces (**13,** Binneman 2010b). **Recommendations**: This site is a no-go zone and falls outside the 2 km corridor, but in the

event that the grid route is aligned to within 500 m of this locality, then the extent of a protective buffer should be determined during the micrositing walkthrough prior to the construction phase;

3) historic graveyards and graves (**28**, **31a**, **43**, **73, 78** and **80**). **Recommendations**: All graves and grave yards must be avoided with a buffer of 50 m from their fencing and in the event that they are not fenced, then they should be fenced and the same buffer observed. Overhead power lines should not straddle or cross directly over grave yards, while straddling or crossing directly over isolated graves may be acceptable. In the event that the grid route comes within 100 m of a known grave or grave yard, then an assessment of appropriate site-specific buffering or treatment should be determined during the micrositing walkthrough prior to the construction phase;

4) historic farm houses and farmstead structures (**31b** and **42**), **Recommendations**: a no-go buffer of 100 m should be observed, but if the overhead power line is closer than 250 m then the affected area should be micro sited to reduce the impact as much as possible, and the overhead power line should not straddle or cross directly over dwellings;

5) historic narrow-gauge railway line at various localities including (**32** and **44**). **Recommendations**: While it is acceptable for the grid connection to straddle or cross over the railway line, it is recommended that as far as possible, such crossings should not occur at old railway sidings or stations where associated railway buildings are still intact. If the overhead power line runs alongside the historic railway line, it should be kept no closer than 20 m from the line to ensure that the line is not damaged during construction. No structures (buildings, bridges etc) associated with the railway line may be damaged or destroyed without a permit from the heritage authorities, and therefore it is recommended that they are avoided with a buffer of 50 m around such structures. Any grid connection development activities that encroach upon these buffers must be micro sited prior to the construction phase

6) , Early Stone Age stone artefacts (**39**, **40** and **41**). **Recommendations**: These finds fall outside the 2 km corridor but are considered as no-go areas, pending further investigation if needed. In the event that the grid route comes to within 500 m of these localities, then their extents and appropriate buffers, or site-specific mitigation or management measures should be determined during the micrositing walkthrough prior to the construction phase of development; and

7) Kabeljous River Rock Shelters with Stone Age materials spanning the last 6000 years (**68**, Binneman 2007). **Recommendations**: Since these are roughly south facing rock shelters, it would be ideal if the grid connection was aligned to the north of this locality. If the overhead power line were to run to the south of the sites, then a buffer of 500 m should be observed. Depending on the circumstances and view sheds, then the buffer zone could be reduced to 300 m if the power line ran to the north and out of sight from the rock shelters. If the grid alignment comes to within 500 m from any side of the rock shelters, then the situation should be re-assessed during the micrositing walkthrough. In any event, the power line should not straddle or cross directly over the rock shelters regardless of the span length.

In addition to the above-mentioned heritage resources requiring protection from development, Binneman and Reichert (2017) also recommend that a new power line route should follow existing disturbances and power line servitudes as far and as closely as possible.

Provided that no direct impact results from the installation of pylons, a power line straddling or running for a short distance across heritage resources such as the historic narrow gauge railway line may be acceptable, the same does not apply to significant historic structures, cemeteries, rock shelters and other significant archaeological sites In addition to the avoidance of physical and direct impact to tangible heritage resources, the impact to the visual or aesthetic value of natural and cultural landscapes should be kept to a minimum.

Table 1. Description, location, rating and recommendations for identified archaeological occurrences (see Figures 5 and 6).

Point Name	Age & Material	Location - WGS 84 Lat/Lon dec.degrees	Rating	Mitigation or Management
IN35	Stone Age quarrying (Nilssen 2018)	S34.06440° E24.61429°	Low	avoid - 50 m buffer
IE10	Historic structure - modern (Nilssen 2018)	S34.11512° E24.61196°	Low	none
IG1	Historic stone walling (Nilssen 2018)	S33.98194° E24.63909°	Low/Med	avoid - 30 m buffer
IG2	archaeological no-go zone (Nilssen 2018)	S33.95932° E25.04439°	High	avoid - no-go zone
IG3	Gamtoos flood plain - visual/aesthetic value (Nilssen 2018)	S33.91578° E24.98777°	Medium	develop along existing disturbances
IG4	Historic NG Kerk formal and fenced Cemetery (Nilssen 2019)	S33.89193° E25.28765°	High	avoid - 50 m buffer
IG5	Historic structure (Nilssen 2018)	S33.98096° E24.64566°	Low/Med	avoid - 100 m buffer
IG6	Historic graves - fenced (Nilssen 2018)	S33.98135° E24.64805°	High	avoid - 50 m buffer
LRS	Large rock shelter - unknown (Binneman 2010b)	S34.02886° E24.58239°	unknown	avoid - microsite if line within 500 m
13	ESA - large site (B & R 2017)	S34.03216° E24.57522°	Low/Med	avoid - microsite if line within 500 m
28	Historic graveyard (B & R 2017)	S34.00057° E24.72122°	High	avoid - 50 m buffer
31a	Historic graves (B & R 2017)	S33.99065° E24.66098°	High	avoid - 50 m buffer
31b	Historic farm house (R & B 2017)	S33.99073° E24.66156°	Medium	avoid - 100 m buffer
32	Historic narrow gauge railway line (B & R 2017)	S33.99220° E24.66527°	Med/High	avoid direct impact to line and assocaited structures - see text for details
39	ESA tools (B & R 2017)	S34.01755° E24.60162°	Low/Med	avoid - microsite if line within 500 m
40	ESA tools (B & R 2017)	S34.01737° E24.60058°	Low/Med	avoid - microsite if line within 500 m
41	ESA tools (B & R 2017)	S34.01704° E24.59929°	Low/Med	avoid - microsite if line within 500 m
42	Historic farm house (B & R 2017)	S34.01610° E24.59762°	Low/Med	avoid - 100 m buffer
43	Historic grave (B & R 2017)	S34.01683° E24.59770°	High	avoid - 50 m buffer
44	Historic narrow gauge railway bridge (R & B 2017)	S34.01943° E24.59848°	Medium	avoid direct impact to line and assocaited structures - see text for details
68	Stone Age Rock Shelters (B & R 2017)	S33.97047° E24.91075°	High	avoid - 500 m buffer - see details in text
73	Burial disturbed by earthworks (B & R 2017)	S33.91874° E25.06105°	High	none - this burial already damaged / destroyed
78	Historic Cemetery (B & R 2017)	S33.89146° E25.13736°	High	avoid - 50 m buffer
80	Graves (B & R 2017)	S33.89115° E25.17973°	High	avoid - 50 m buffer

5.3. Consultation

This report was used for the public participation process undertaken for the BA process. In terms of Section 38(3) (e) of the NHRA, and as mentioned above, this report was submitted to the Gamtkwa Khoisan Council for their review. After they have reviewed this report, the Gamtkwa Khoisan Council will provide feedback, and further consultation may be arranged if deemed necessary.

Eastern Cape Heritage Consultants informally consulted the Gamtkwa Khoisan Council with respect to their desktop study (Binneman & Reichert 2017). At this stage the

Gamtkwa Khoisan Council have no objections to the Wind Farms proposal but see their comments and conditions of support below.

Regarding this preliminary consultation, the GKC responded on 21 July 2017 with comments in a letter to Eastern Cape Heritage Consultants, which states the following;

"In terms of our Indigenous Knowledge about the general area identified for the proposed Wind Farms we regard the entire area as of cultural significance to our community and all our comments that formed part of previous Wind Farm applications or socio-cultural consultations related to other projects remains valid and applicable to this project. This is also applicable to the grid servitude from the proposed Wind Farm up to the Van Stadens River that marks the western boundary of our ancestral land.

There are no additional archaeological sites or features that we wish to add to the current list that appears in the desktop study but we reserve the right to provide further comments in this regard after we have studied the Heritage Impact Assessment for the proposed project.

We also considered the fact that several Wind Farms have been approved in the area in the past, and as a result of the impact of these Wind Farms on the cultural landscape as well as the impact of previous and current agricultural activities, we have no objections at this stage if this project proceeds on condition that previous undisturbed areas within archaeological sensitive areas will be avoided for the purpose of this development. If it cannot be avoided this must be addressed in the HIA and we reserve the right to reconsider our provisional support for the project should we disagree with any of the recommendations in this regard" (Gamtobakwa Khoisan Council 2017).

With reference to the last paragraph of the above letter, and in consideration of the recommendations in the desktop study undertaken by Eastern Cape Heritage Consultants, Red Cap removed all wind turbines from the archaeologically sensitive areas in the SE and SW sectors of the Impofu Wind Farms site. Furthermore, the archaeologically sensitive coastal zone east of Jeffrey's Bay has also been excluded from the 2 km grid connection corridor as an archaeological no-go zone (Figures 4 & 6).

6. Sources of Risk, Impact Identification and Assessment

Vegetation clearing and earthmoving activities associated with the construction phase of development have potential to impact archaeological resources and ultimately the cultural landscape, and therefore, only the construction phase is considered as a potential risk. The exception to this, however, is the visual impact to the Gamtoos flood plain, which will occur during the operational phase. Consequently, and given these exceptions, only known and predicted impacts associated with the construction phase of the Impofu Grid Connection that fall within the 2 km grid corridor are assessed.

Since the no-go option will involve continued and unknown impacts of natural processes and agricultural activities on archaeological resources, and because the proposed development impacts can be controlled and monitored, then the wind farms and grid connection developments may actually be preferred over the no-go option. At this stage, however, there is no preference of one over the other.

Existing and future wind farms with associated grid connections in the area could have a significant negative cumulative impact on archaeological resources. The impact on

the archaeology of the area could be avoided or minimised where the finds are documented, mitigated or conserved according to their significance and to ensure that, where appropriate, representative samples of the archaeological record are conserved for interested and affected parties, future generations and scientists. Through the implementation of management and mitigation measures such as those recommended below in Section 7, the cumulative impact of these developments on the archaeological record is greatly reduced. The positive cumulative impact on heritage resources is that the impact assessments required for these developments have greatly improved our record and understanding of archaeological material in the area and have provided an opportunity to conserve them for present and future generations. This is not possible if uncontrolled piecemeal developments as well as natural processes were to take place. A further cumulative impact of overhead power lines is on the aesthetic and visual value of the natural and cultural landscape. Although the bulk of the proposed Impofu Grid Connection will be situated in an existing and growing renewable energy landscape with numerous wind turbines and evacuation lines in the immediate surroundings, the elimination of developments from sensitive and no-go areas as recommended below will help to reduce this negative impact.

If this project is approved and a final alignment is defined then it is a requirement of this report that a detailed archaeological walkthrough of this final alignment be undertaken by a suitably qualified archaeologist as part of the final micrositing of the overhead power line route including the extended footprints around the existing Melkhout, Sans Souci and Chatty Substation footprints, pylon positions and associated service road prior to the construction phase. At this stage, if all heritage resources are suitably avoided by the overhead power line, pylons and associated service road, then negative impacts to heritage resources will be limited to visual impacts, which are further assessed by the visual specialist.

Note that a negative impact rating without mitigation can become a positive impact rating with mitigation as the mitigation can have a positive influence on archaeological resources. For example, the mitigation measure of archaeological monitoring during the construction phase may result in the recording of previously undocumented heritage remains, which is a positive impact on the archaeological record and our understanding of it. If mitigation results in an archaeological resource being conserved or if something new is learned about a resource as a result of mitigation, then the impact can go from negative (without mitigation) to positive (with mitigation).

Table 2. Impact table for historic period structure / cottage and dipping kraal (IE10) – not conservation worthy.

Project phase	**Construction**			
Impact	**Historic period structure / cottage and dipping kraal (IE10) - not conservation worthy**			
Description of impact	**unlikely to be impacted but falls within 2 km grid corridor**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	**none, no further studies or mitigation required**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Very limited	Limited to specific isolated parts of the site		#N/A
Intensity	Negligible	Natural and/ or social functions and/ or processes are negligibly altered		#N/A
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur		#N/A
Confidence	Medium	Determination is based on common sense and general knowledge		#N/A
Reversibility	High	The affected environmental will be able to recover from the impact		#N/A
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce		#N/A
Significance	**Negligible - negative**		**#N/A**	
Comment on significance	agree with calculated significance - with mitigation impact is negligible to neutral			
Cumulative impacts	low - see text for further details on cumulative impacts			

Table 3. Impact table for Historic period stone walling (IG1)

Project phase	Construction			
Impact	Historic period stone walling (IG1)			
Description of impact	damage or destruction as a result of grid connection construction			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	A buffer of 30 m from the stone wall should be observed to ensure that the structure is not damaged by construction activities. If the grid connection straddles this structure, then pylon positions should be micro sited prior to the construction phase of development to ensure that the 30 m buffer is complied with			
Assessment	Without mitigation		With mitigation	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Limited	Limited to the site and its immediate surroundings		#N/A
Intensity	Very low	Natural and/ or social functions and/ or processes are slightly altered		#N/A
Probability	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere		#N/A
Confidence	Medium	Determination is based on common sense and general knowledge		#N/A
Reversibility	High	The affected environmental will be able to recover from the impact		#N/A
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce		#N/A
Significance	Negligible - negative		#N/A	
Comment on significance	agree with calculated significance - with mitigation the impact is negligible or neutral and the resource is conserved			
Cumulative impacts	low negative without mitigation and neutral with mitigation - see text for further details on cumulative impacts			

Table 4. Impact table for Historic period structures (IG5, 31b)

Project phase	**Construction**			
Impact	**Historic period structures (IG5, 31b)**			
Description of impact	**damage or destruction as a result of grid connection construction**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**a no-go buffer of 100 m should be observed, but if the overhead power line is closer than 250 m then the affected area should be micro sited to reduce the impact as much as possible, and the overhead power line should not straddle or cross directly over dwellings**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Local	Extending across the site and to nearby settlements		#N/A
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered		#N/A
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur		#N/A
Confidence	Medium	Determination is based on common sense and general knowledge		#N/A
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified		#N/A
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere		#N/A
Significance	**Minor - negative**		**#N/A**	
Comment on significance	agree with calculated significance - with mitigation there is no impact (N/A) and resource is conserved			
Cumulative impacts	low negative without mitigation and neutral with mitigation - see text for further details on cumulative impacts			

Table 5. Impact table for Graves, Grave Yards and Cemeteries (IG6, IG4, 31a, 28, 78 & 80)

Project phase	**Construction**			
Impact	**Graves & grave yards (IG6, IG4, 31a, 28, 78 & 80)**			
Description of impact	**damage or destruction as a result of grid connection construction**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**some graves are already enclosed and protected by fencing, and if not, then they should be fenced in the event that the power line comes within 100 m of graves, but it is recommended that the overhead power line does not straddle graves or grave yards and that pylons be placed at least 50 m from graveyard fences**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Limited	Limited to the site and its immediate surroundings		#N/A
Intensity	High	Natural and/ or social functions and/ or processes are notably altered		#N/A
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur		#N/A
Confidence	Medium	Determination is based on common sense and general knowledge		#N/A
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention		#N/A
Resource irreplaceability	High	The resource is irreparably damaged and is not represented elsewhere		#N/A
Significance	**Minor - negative**		**#N/A**	
Comment on significance	without mitigation the impacts are actually high negative due to legal protection of burials - with mitigation there is no impact (N/A) and resource is conserved			
Cumulative impacts	negative without mitigation and neutral with mitigation - see text for further details on cumulative impacts			

Table 6. Impact table for Historic narrow-gauge railway line and associated structures (32)

Project phase	**Construction**			
Impact	**Historic narrow gauge railway line and associated structures (32)**			
Description of impact	**damage or destruction as a result of grid connection construction**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**While it is acceptable for the grid connection to straddle or cross over the railway line, it is recommended that, as far as possible, such crossings should not occur at old railway sidings or stations where associated railway buildings are still intact. If the overhead power line runs alongside the historic railway line, it should be kept at least 20 m from the line to ensure that the line is not damaged during construction. No structures (buildings, bridges etc) associated with the railway line may be damaged or destroyed without a permit from the heritage authorities, and therefore it is recommended that they are avoided with a buffer of 50 m around such structures. Any grid connection development activities that encroach upon these buffers must be micro sited prior to the construction phase**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Local	Extending across the site and to nearby settlements		#N/A
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered		#N/A
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur		#N/A
Confidence	Medium	Determination is based on common sense and general knowledge		#N/A
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified		#N/A
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere		#N/A
Significance	**Minor - negative**		**#N/A**	
Comment on significance	agree with calculated significance - with mitigation there is no impact (N/A) and resource is conserved			
Cumulative impacts	negative without mitigation and neutral with mitigation - see text for further details on cumulative impacts			

Table 7. Impact table for Gamtoos River flood plain (IG3)

Project phase	**Operation**			
Impact	**Gamtoos River flood plain (IG3)**			
Description of impact	**visual impact of overhead power line on aesthetic value of the landscape**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**The Impofu grid connection should be kept as close as possible to existing developments and impacts such as roads (R102 & N2), bridges (including the pipeline bridge), overhead power lines, etc., and be restricted to the 2 km corridor (Figure 6). This recommendation is made so that the grid connection does not create a new corridor of impact. The areas north of the R102 bridge and south of the N2 bridge should be avoided**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Local	Extending across the site and to nearby settlements	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	agree with calculated significance			
Cumulative impacts	moderate negative without mitigation and minor negative with mitigation - see text for further details on cumulative impacts			

Table 8. Impact table for Kabeljous River Rock Shelters (68, Binneman & Reichert 2017)

Project phase	**Construction**			
Impact	**Kabeljous River Rock Shelters (68, Binneman & Reichert 2017)**			
Description of impact	**damage or destruction as a result of grid connection construction**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**Since these are roughly south facing rock shelters, it would be ideal if the grid connection was aligned to the north of this locality. If the overhead power line were to run to the south of the sites, then a buffer of 500 m should be observed. Depending on the circumstances and view sheds, then the buffer zone could be reduced to 300 m if the power line ran to the north and out of sight from the rock shelters. If the grid alignment comes to within 500 m from any side of the rock shelters, then the situation should be re-assessed during the micrositing walkthrough. In any event, the power line should not straddle or cross over the rock shelters regardless of the span length.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Neutral	
Duration	Permanent	Impact may be permanent, or in excess of 20 years		#N/A
Extent	Regional	Impacts felt at a regional / provincial level		#N/A
Intensity	High	Natural and/ or social functions and/ or processes are notably altered		#N/A
Probability	Likely	The impact may occur		#N/A
Confidence	High	Substantive supportive data exists to verify the assessment		#N/A
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified		#N/A
Resource irreplaceability	High	The resource is irreparably damaged and is not represented elsewhere		#N/A
Significance	**Moderate - negative**		**#N/A**	
Comment on significance	if the site is impacted by construction then the impact would be high negative - with mitigation there is no impact (N/A) and resource is conserved			
Cumulative impacts	high negative without mitigation and no impact with mitigation and neutral due to conservation - see text for further details on cumulative impacts			

7. Conclusions and Recommendations

The impacts and recommendations regarding heritage resources known and expected to occur **within the 2 km grid corridor**, service road and grid connection route are summarised as follows:

1) Historic period structure / cottage and dipping kraal (**IE10**) that is not conservation worthy (Table 1, Figure 5 & Plate 7). **Recommendation**: no further studies or mitigation of these finds is required;

2) stone walling at **IG1** (Table 1, Figure 5 & Plate 8), **Recommendation**: A buffer of 30 m from the stone wall should be observed to ensure that the structure is not damaged by construction activities. If the grid connection straddles this structure, then pylon positions should be micro sited prior to the construction phase of development to ensure that the 30 m buffer is complied with;

3) old farm house at **IG5** (Table 1, Figure 5 & Plate 9) and historic period structures (**31b** [Binneman & Reichert 2017]), **Recommendation**: a no-go buffer of 100 m should be observed, but if the overhead power line is closer than 250 m then the affected area should be micro sited to reduce the impact as much as possible, and the overhead power line should not straddle or cross directly over dwellings;

4) fenced graves at **IG6** and NG Kerk cemetery at **IG4** (Table 1, Figures 5 & 6, Plates 10 & 11), graves, grave yards and historic cemetery (**31a**, **28, 78** and **80** [Binneman & Reichert 2017]), **Recommendation**: some graves are already enclosed and protected by fencing, and if not, then they should be fenced in the event that the power line comes within 100 m of graves, but it is recommended that the overhead power line does not straddle graves or grave yards and that pylons be placed no closer than 50 m from graveyard fences;

5) the narrow gauge railway line that was built between Port Elizabeth and Avontuur (1899 – 1903) - with associated bridges and structures – runs through almost the entire length of the larger study area (Figures 4 through 7 and Plates 1 & 2) and **32** (Binneman & Reichert 2017). **Recommendation**: While it is acceptable for the grid connection to straddle or cross over the railway line, it is recommended that, as far as possible, such crossings should not occur at old railway sidings or stations where associated railway buildings are still intact. If the overhead power line runs alongside the historic railway line, it should be placed no closer than 20 m from the line to ensure that the line is not damaged during construction. No structures (buildings, bridges etc) associated with the railway line may be damaged or destroyed without a permit from the heritage authorities, and therefore it is recommended that they are avoided with a buffer of 50 m around such structures. Any grid connection development activities that encroach upon these buffers must be micro sited prior to the construction phase;

6) the broad flood plain and adjacent banks of the Gamtoos River (**IG3**, Figure 6 and Plate 5). This is a visually sensitive area and not a no-go zone, where a multitude of developments already exist. Recommendations are made to avoid or minimize further negative impacts to the general sense of place of the Gamtoos River flood plain. **Recommendations:** The Impofu grid connection should be kept as close as possible to existing developments and impacts such as roads (R102 & N2), bridges (including the pipeline bridge), overhead power lines, etc., and be restricted to the 2 km corridor (Figure 6). This recommendation is made so that the grid connection does not create a new corridor of impact. The areas north of the R102 bridge and south of the N2 bridge should be avoided;

7) Kabeljous River Rock Shelters with Stone Age materials spanning the last 6000 years (**68**, Binneman 2007). **Recommendations**: Since these are roughly south facing rock shelters, it would be ideal if the grid connection was aligned to the north of this locality. If the overhead power line were to run to the south of the sites, then a buffer of 500 m should be observed. Depending on the circumstances and view sheds, then the buffer zone could be reduced to 300 m if the power line ran to the north and out of sight from the rock shelters. If the grid alignment comes to within 500 m from any side of the rock shelters, then the situation should be re-assessed during the micrositing walkthrough. In any event, the power line should not straddle or cross over the rock shelters regardless of the span length.

In addition to avoiding these medium to high sensitivity heritage resources, it is recommended that wherever possible, the overhead power line and service road should be constructed as close as possible to existing overhead power line servitudes and existing transport infrastructure rather than creating new corridors of disturbance and impact.

Provided that no direct impact results from the installation of pylons, a power line straddling or running for a short distance across heritage resources such as the historic narrow gauge railway line is acceptable, the same does not apply to significant historic structures, cemeteries, graves, rock shelters and other archaeological sites of medium to high sensitivity. In addition to the avoidance of physical and direct impact to tangible heritage resources, the impact to the visual or aesthetic value of natural and cultural landscapes will be minimized provided that these recommendations are implemented.

The nature of the heritage resources in the corridor outside any defined no-go areas is one where the resources will most likely consist of isolated sites that can easily be avoided by micrositing of the final alignment. In conjunction with this is the fact that the impact of the grid connection is linear and limited to a narrow area, and the alignment can easily be micro sited if required. Given this, it is evident that the final alignment can be adjusted to satisfactorily avoid any sensitive areas during a final pre-construction walkthrough. It is thus a mitigation requirement that once the final alignment of this line has been defined that as part of the micrositing process a walkthrough is undertaken by a suitably qualified archaeologist to ensure that no unforeseen cultural impacts are missed and that the line is micro sited to avoid such impacts.

From this assessment and given the mitigation requirements there are no fatal flaws from an archaeological standpoint and there are no objections to the proposed Impofu Grid Connection project proceeding.

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9. **Figures and Plates** (on following pages)

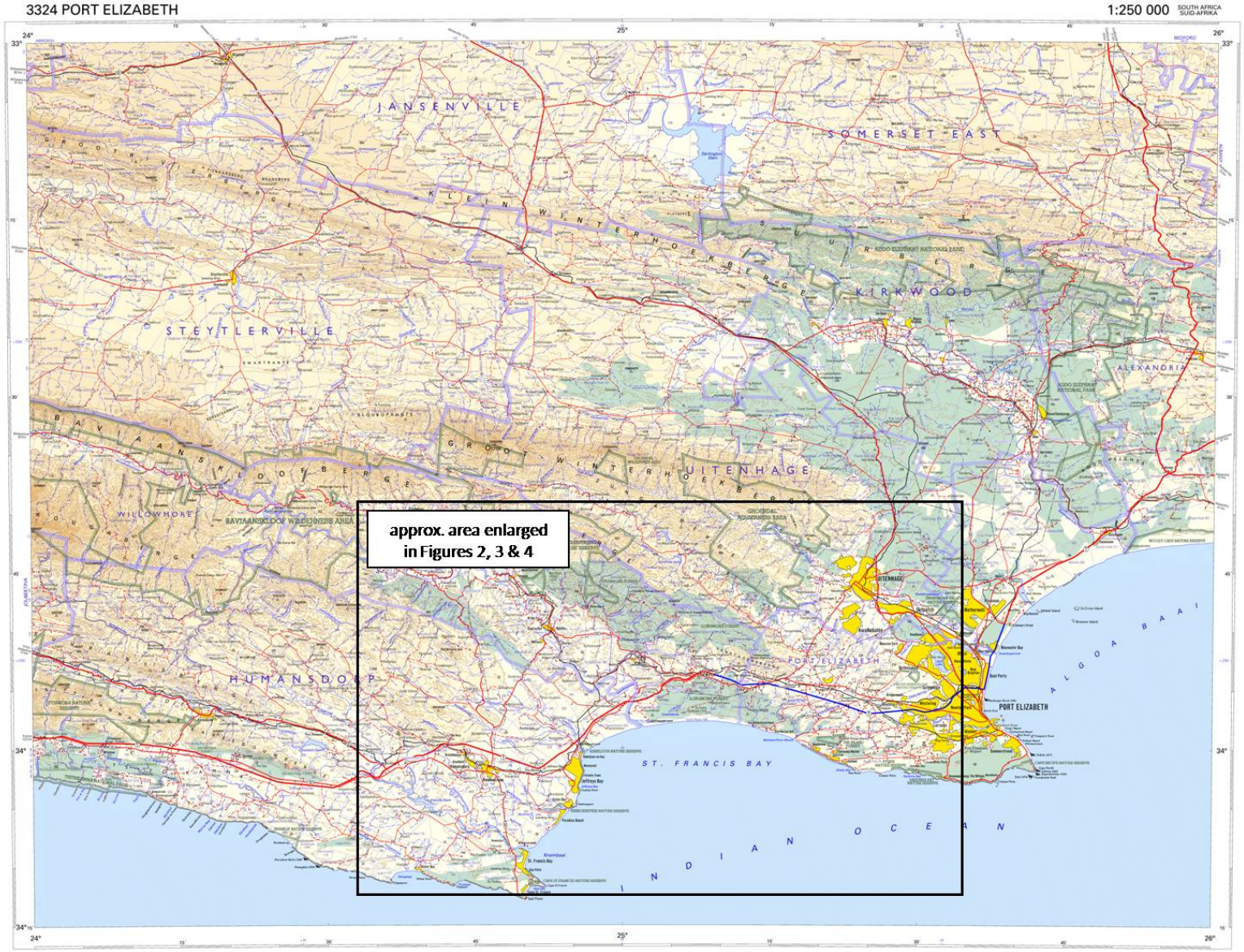

Figure 1. General location of the larger study area for the Impofu WEFs Grid Connection, west of Port Elizabeth, Eastern Cape Province. Map – 3324 Port Elizabeth 1:250 000 - courtesy of The Chief Directorate, Surveys & Mapping, Mowbray.

Figure 2. Approximate area enlarged from Figure 1 showing the Impofu Wind Farms boundary (white polygon at lower left of image), the original grid corridor (large white polygon) and the 2 km (large purple polygon) grid corridor stretching from west to east. Courtesy of Red Cap, Aurecon and Google Earth 2018.

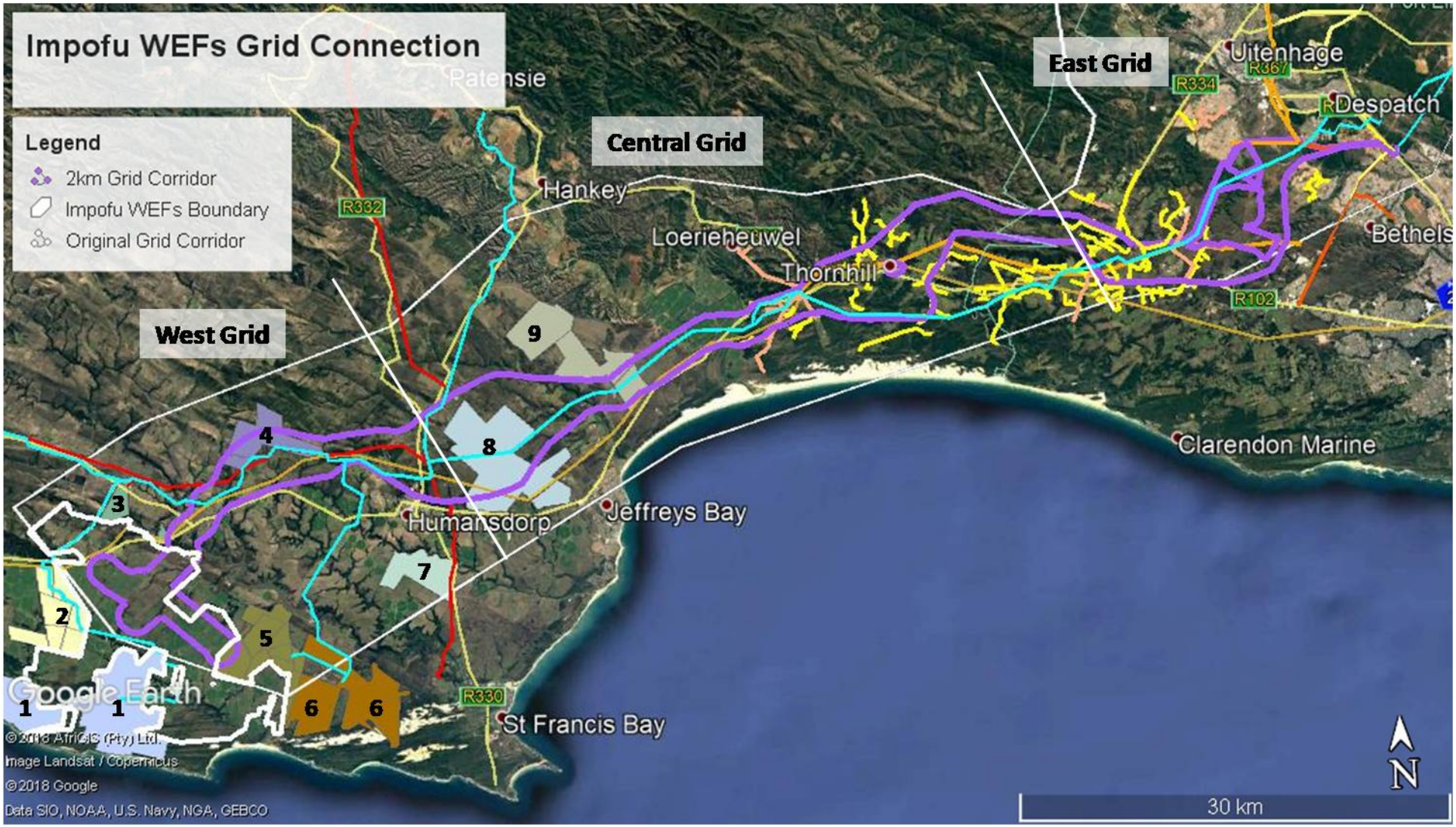

Figure 3. Shaded and numbered polygons represent existing, approved, lapsed and in application Wind Farms while coloured lines represent existing electrical infrastructure in the immediate vicinity and within the grid assessment corridor (purple polygon). 1 = Gibson Bay, 2 = Tsitsikamma Community, 3 = Deep River (lapsed), 4 = Happy Valley (lapsed), 5 = Oyster Bay, 6 = Kouga, 7 = Banna Ba Pifhu, 8 = Jeffery's Bay and 9 = Ubuntu. Courtesy of Red Cap, Aurecon and Google Earth 2018.

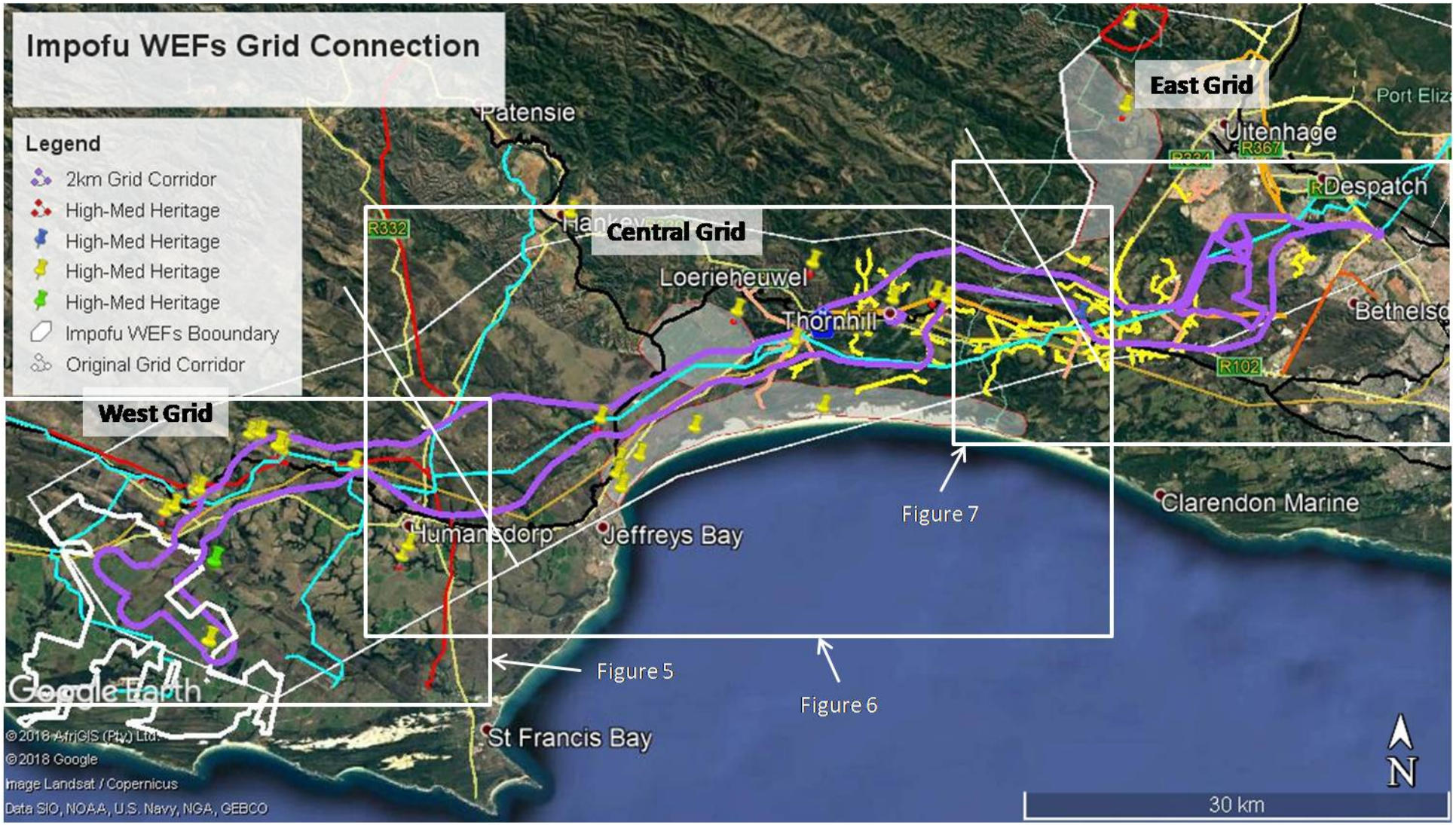

Figure 4. Yellow, green and blue markers with associated red polygons represent heritage resources of medium to high sensitivity that must be avoided (Nilssen field work and Binneman & Reichert 2017). Some of the heritage sensitive areas are represented by shaded polygons. Black lines represent railway lines including the historic narrow gauge railway line running through sections of the grid assessment corridors. The shaded polygon along the coast in the middle of the image represents an archaeologically sensitive no-go zone whose boundaries are rough. Courtesy of Google Earth, Red Cap and Aurecon.

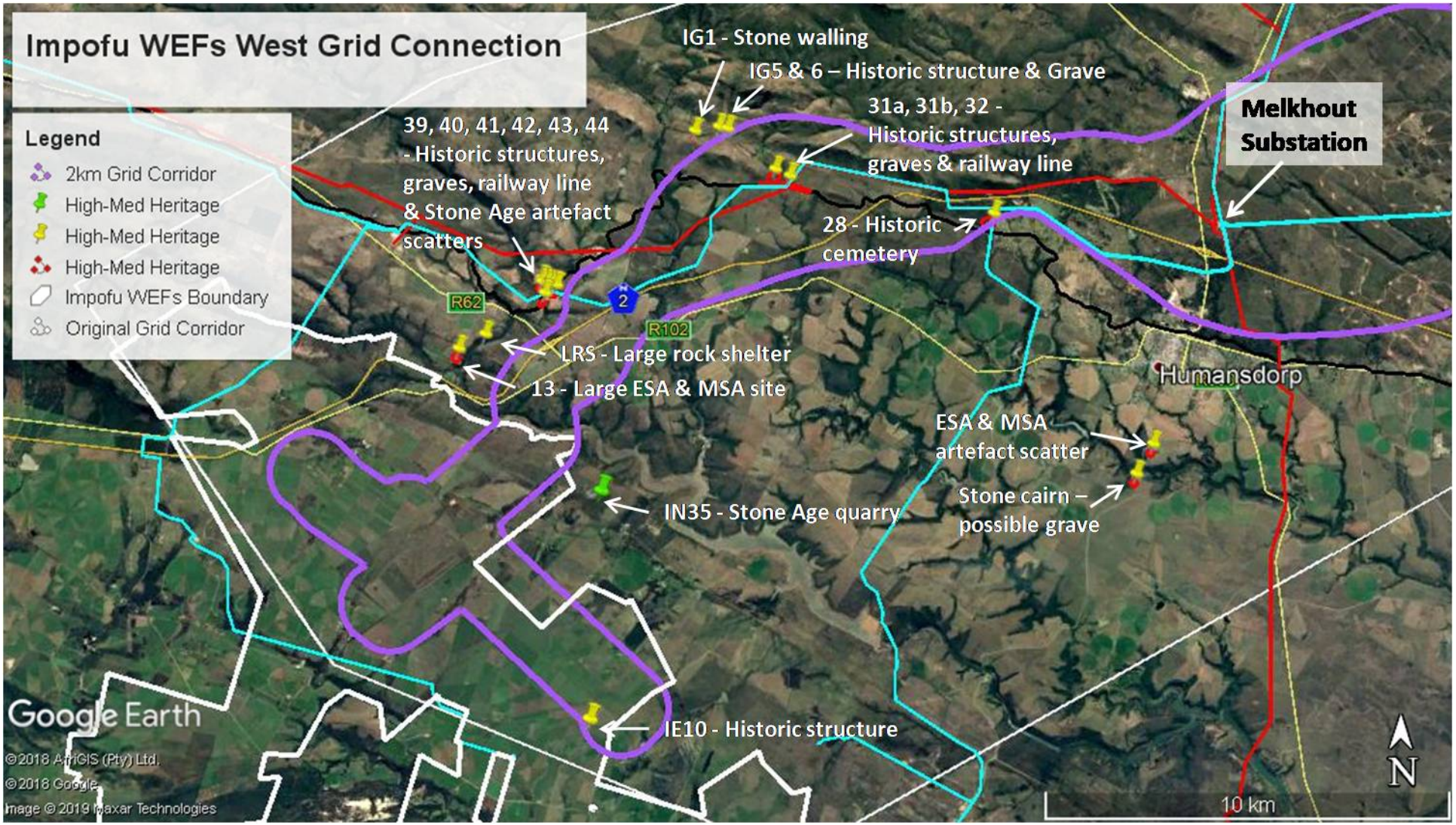

Figure 5. Area enlarged from Figure 4 showing the known heritage resources of medium to high sensitivity (labelled markers) that should be avoided by the overhead power line and associated infrastructure. Archaeological resources include historic structures, stone walling, graves, cemeteries, narrow gauge railway line (black lines), bridge, and Stone Age sites and artefact scatters of mainly ESA & MSA origin (Nilssen field work, Binneman & Reichert 2017, Binneman 2010b). Courtesy of Red Cap, Aurecon and Google Earth 2018.

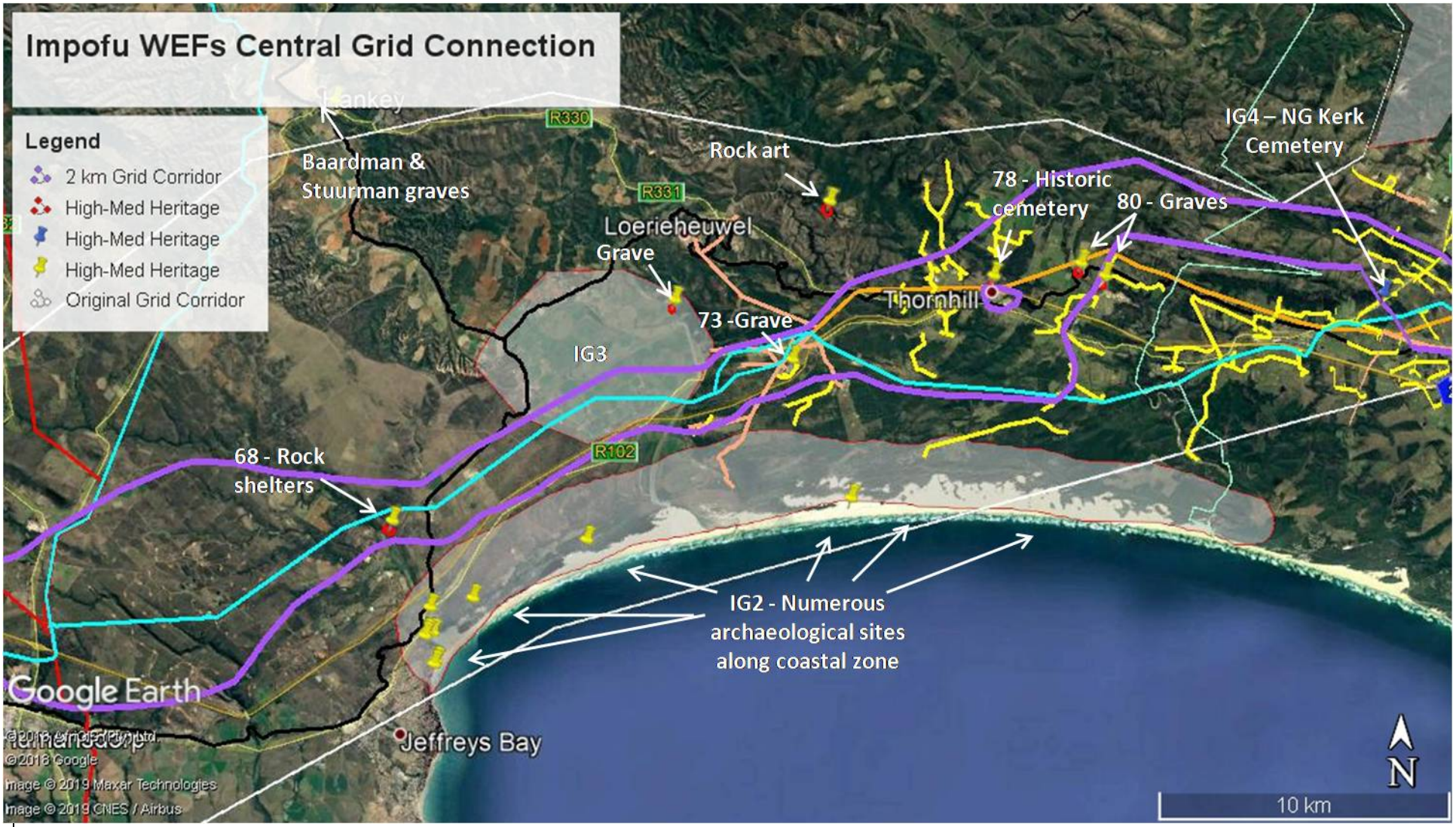

Figure 6. Area enlarged from Figure 4 showing the known heritage resources of medium to high sensitivity (labelled markers) that should be avoided by the overhead power line and associated infrastructure. Archaeological resources include historic structures, graves, cemeteries, railway line (black lines) and Stone Age sites, rock shelters, shell middens, artefact scatters and rock art (Nilssen field work and Binneman & Reichert 2017). Courtesy of Red Cap, Aurecon and Google Earth 2018.

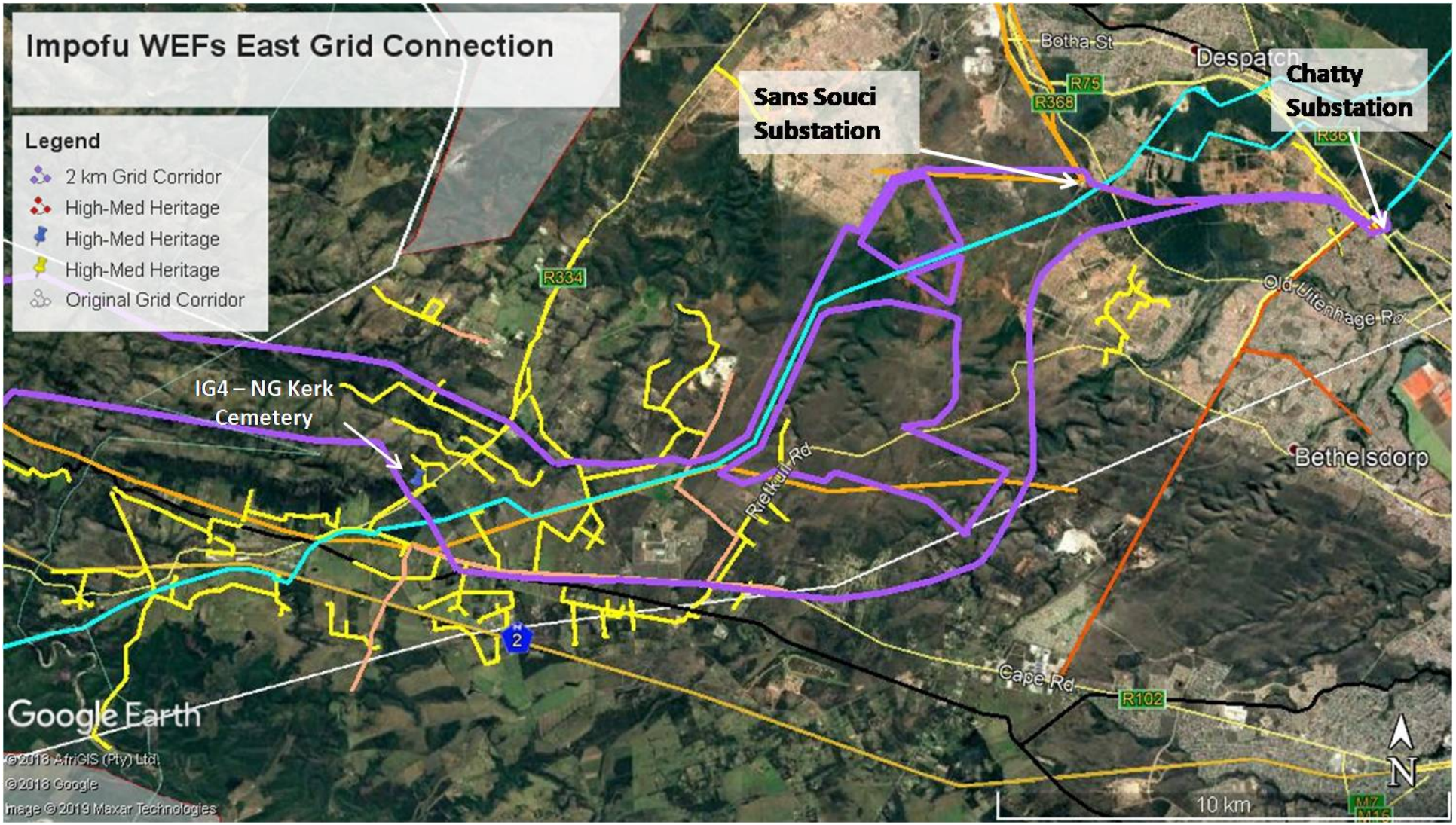

Figure 7. Area enlarged from Figure 4 showing existing electrical infrastructure including overhead power lines (coloured lines), the Sans Souci and Chatty Substations, railway line (black lines) and existing human-related disturbances / developments associated with agricultural, rural and urban settlements. This is the most transformed stretch of the 2 km grid connection corridor and the only known heritage resource of high significance is the NG Kerk Cemetery (IG4) that must be avoided (Nilssen field work and Binneman & Reichert 2017). Courtesy of Red Cap, Aurecon and Google Earth 2018.

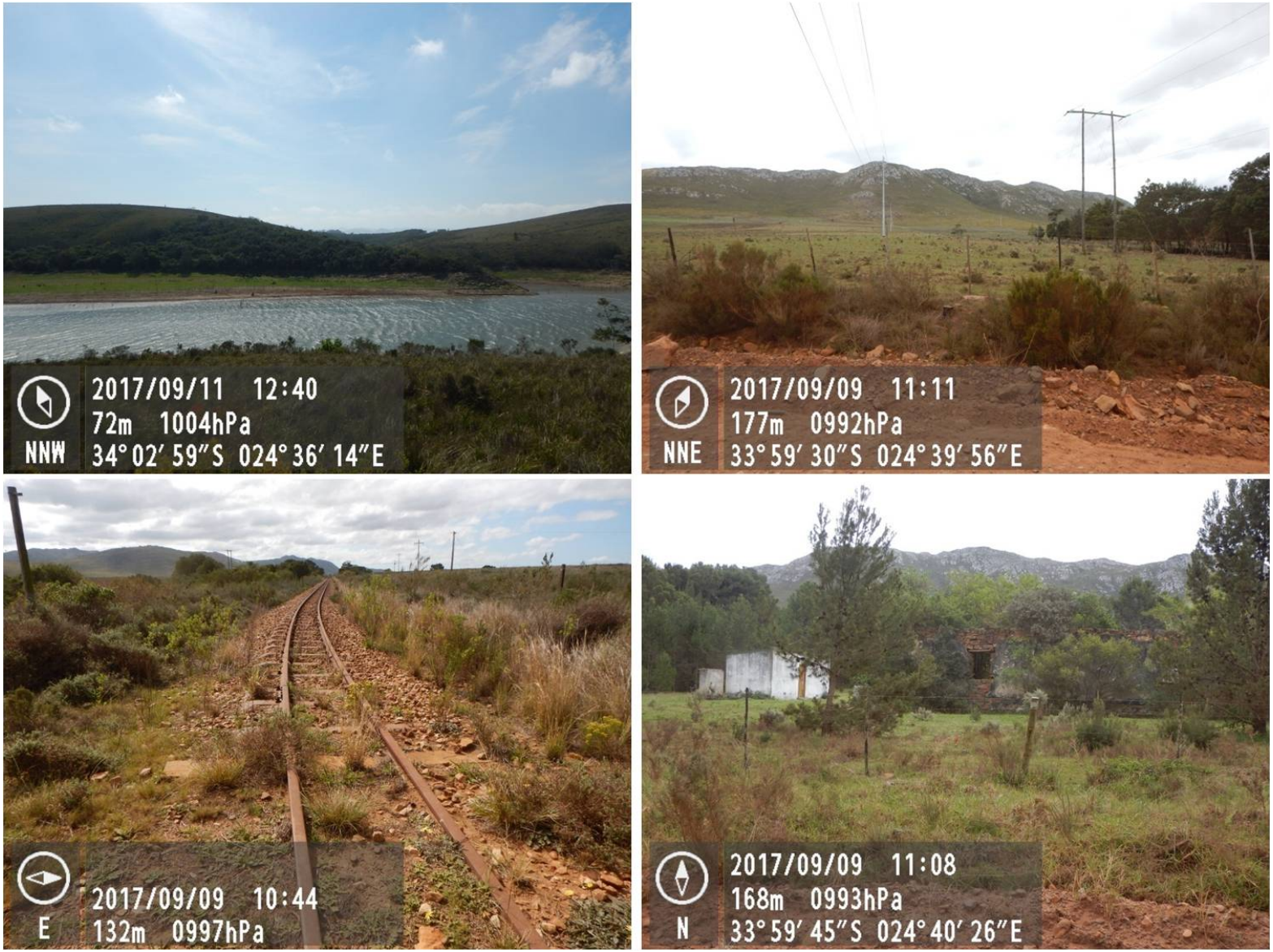

Plate 1. Examples of the receiving environment showing topography, vegetation cover and existing developments. Impofu dam (top L),power lines (top R), narrow gauge railway line (bottom L) and historic ruins and structures (bottom R).

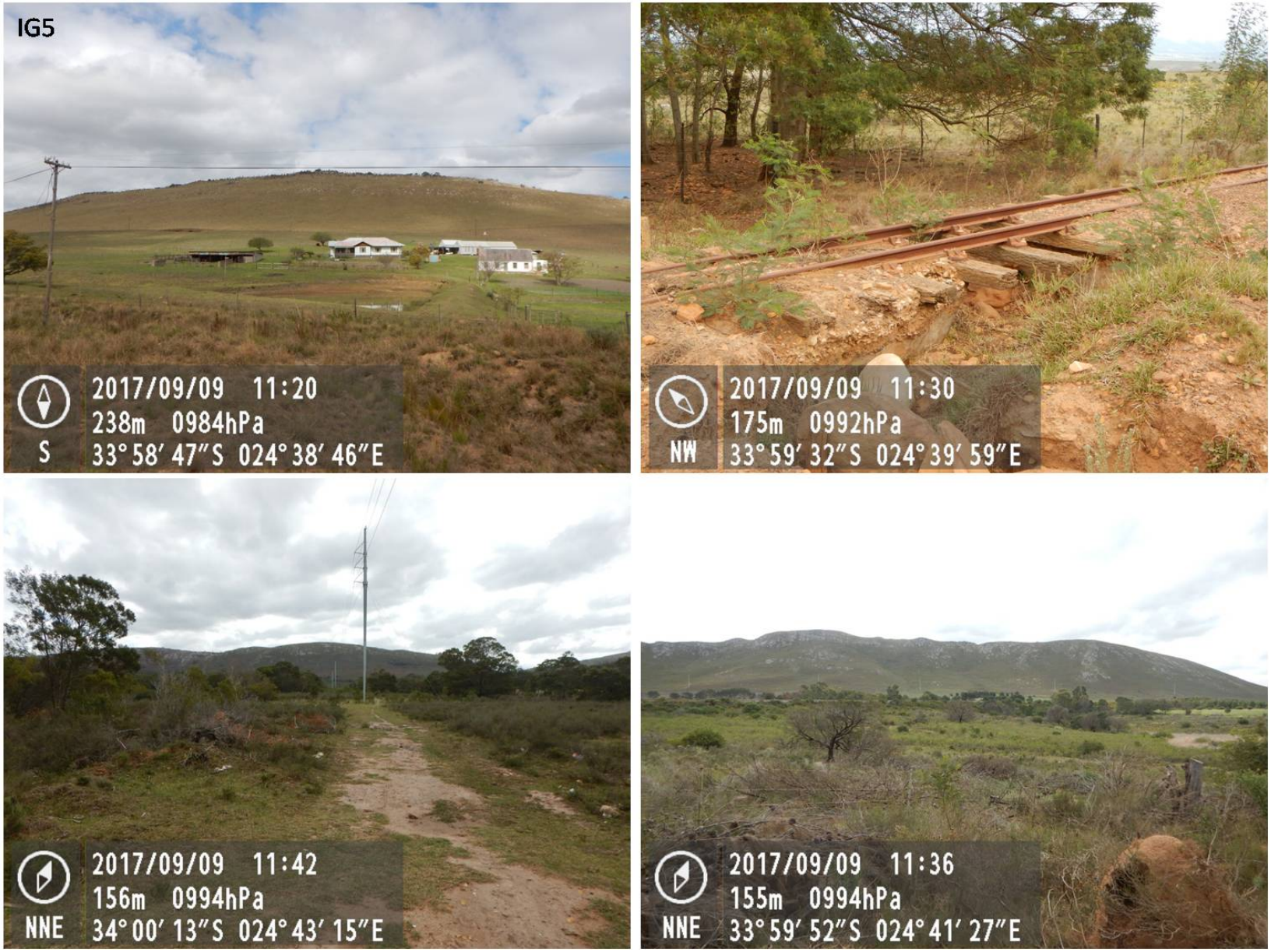

Plate 2. Examples of the affected environment showing topography, vegetation cover, historic structures, power lines and agricultural lands.

Plate 3. Examples of the affected environment showing historic structures, Melkhout substation (topR), topography, vegetation cover and view towards PE and Despatch (bottom R).

Plate 4. Examples of the environment showing the Chatty substation (top L), pollution near PE, and the stretch of corridor running through the MTO state forestry (bottom).

Plate 5. Examples of the environment showing the Gamtoos flood plain (top) with existing pylons (white ellipses), view toward Jeffreys Bay from R102 (bottom L) and view toward St Francis from the NE.

Plate 6. Stone Age quarrying of quartzite outcrop. Fingers pointing to impact points and flake scars. GPS unit is 10cm long.

Plate 7. Non conservation worthy historic period structure with mixture of clay and cast cement bricks, not directly impacted by proposed development.

Plate 8.Historic period stone walling (**IG1**).

Plate 9. Historic period structure (**IG5**).

Plate 10.Historic period graves (**IG6**).

IG4

Plate 11. Historic period NG Kerk cemetery (**IG4**).

Appendix A

Legislation regarding the general protection of heritage resources taken from the National Heritage Resources Act (Act 25 of 1999)

Provisional protection

29. (1) SAHRA, or a provincial heritage resources authority, may, subject to subsection (4), by notice in the Gazette or the Provincial Gazette, as the case may be—

(a) provisionally protect for a maximum period of two years any—

(i) protected area;

(ii) heritage resource, the conservation of which it considers to be threatened and which threat it believes can be alleviated by negotiation and consultation; or

(iii) heritage resource, the protection of which SAHRA or the provincial heritage resources authority wishes to investigate in terms of this Act; and

(b) withdraw any notice published under paragraph (a).

(2) A local authority may, subject to subsection (4), by notice in the Provincial Gazette—

(a) provisionally protect for a maximum period of three months any place which it considers to be conservation-worthy, the conservation of which the local authority considers to be threatened and which threat it believes can be alleviated by negotiation and consultation; and

(b) withdraw any notice published under paragraph (a): Provided that it notifies the provincial heritage resources authority within seven days of such provisional protection.

(3) A provincial heritage resources authority may, by notice in the Provincial Gazette, revoke a provisional protection by a local authority under subsection (2) or provisionally protect a place concerned in accordance with subsection (1).

(4) A heritage resources authority or a local authority may not provisionally protect any heritage resource unless it has notified the owner of the resource in writing of the proposed provisional protection.

(5) A heritage resource shall be deemed to be provisionally protected for 30 days from the date of service of a notice under subsection (4) or until the notice is withdrawn or the resource is provisionally protected by notice in the Gazette or the Provincial Gazette, whichever is the shorter period.

(6) A heritage authority or a local authority may at any time withdraw a notice which it has issued under subsection (4).

(7) SAHRA shall inform the relevant provincial heritage authority and local authority within 30 days of the publication or withdrawal of a notice under subsection (1).

(8) A provincial heritage resources authority shall inform the relevant local authority within 30 days of the publication or withdrawal of a notice under subsection (1).

(9) A local authority shall inform the provincial heritage authority of the withdrawal of a notice under subsection (2)(b).

(10) No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provisionally protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provisional protection.

Legislation relevant to Heritage Areas taken from the National Heritage Resources Act (Act 25 of 1999)

Heritage areas

31. (1) A planning authority must at the time of revision of a town or regional planning scheme, or the compilation or revision of a spatial plan, or at the initiative of the provincial heritage resources authority where in the opinion of the provincial heritage resources authority the need exists, investigate the need for the designation of heritage areas to protect any place of environmental or cultural interest.

(2) Where the provincial heritage resources authority is of the opinion that the need exists to protect a place of environmental or cultural interest as a heritage area, it may request a planning authority to investigate its designation in accordance with proposals submitted by the provincial heritage resources authority with its request. The planning authority must inform the provincial heritage resources authority within 60 days of receipt of such a request whether it is willing or able to comply with the request.

(3) Where the planning authority informs the provincial heritage resources authority that it is willing and able, the provincial heritage resources authority must assist the planning authority to investigate the designation of the place as a heritage area.

(4) Where the planning authority does not so inform the provincial heritage resources authority, or informs the provincial heritage resources authority that it is not so willing and able, the provincial heritage resources authority may investigate the designation of the place as a heritage area and, with the approval of the MEC, designate such place to be a heritage area by notice in the Provincial Gazette.

(5) A local authority may, by notice in the Provincial Gazette, designate any area or land to be a heritage area on the grounds of its environmental or cultural interest or the presence of heritage resources, provided that prior to such designation it shall consult—

(a) the provincial heritage resources authority; and

(b) owners of property in the area and any affected community, regarding inter alia the provisions to be established under subsection (7) for the protection of the area.

(6) The MEC may, after consultation with the MEC responsible for local government, publish regulations setting out the process of consultation referred to in subsection (5).

(7) A local authority must provide for the protection of a heritage area through the provisions of its planning scheme or by-laws under this Act, provided that any such protective provisions shall be jointly approved by the provincial heritage resources authority, the provincial planning authority and the local authority, and provided further that—

(a) the special consent of the local authority shall be required for any alteration or development affecting a heritage area;

(b) in assessing an application under paragraph (a) the local authority must consider the significance of the area and how this could be affected by the proposed alteration or development; and

(c) in the event of any alteration or development being undertaken in a heritage area without the consent of the local authority, it shall have the power to require the owner to stop such work instantly and restore the site to its previous condition within a specified period. If the owner fails to comply with the requirements of the local authority, the local authority shall have the right to carry out such restoration work itself and recover the cost thereof from the owner.

(8) A local authority may erect signage indicating its status at or near a heritage area.

(9) Particular places within a heritage area may, in addition to the general provisions governing the area, be afforded further protection in terms of this Act or other heritage legislation.

Legislation relevant to archaeology and palaeontology taken from the National Heritage Resources Act (Act 25 of 1999)

Archaeology, palaeontology and meteorites

35. (1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and

(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

(6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or a meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

(7) (a) Within a period of two years from the commencement of this Act, any person in possession of any archaeological or palaeontological material or object or any meteorite which was acquired other than in terms of a permit issued in terms of this Act, equivalent provincial legislation or the National Monuments Act, 1969 (Act No. 28 of 1969), must lodge with the responsible heritage resources authority lists of such objects and other information prescribed by that authority. Any such object which is not listed within the prescribed period shall be deemed to have been recovered after the date on which this Act came into effect.

(b) Paragraph (a) does not apply to any public museum or university.

(c) The responsible authority may at its discretion, by notice in the Gazette or the Provincial Gazette, as the case may be, exempt any institution from the requirements of paragraph (a) subject to such conditions as may be specified in the notice, and may by similar notice withdraw or amend such exemption.

(8) An object or collection listed under subsection (7)—

(a) remains in the ownership of the possessor for the duration of his or her lifetime, and SAHRA must be notified who the successor is; and

(b) must be regularly monitored in accordance with regulations by the responsible heritage authority.

Legislation relevant to burial grounds and graves taken from the National Heritage Resources Act (Act 25 of 1999)

Burial grounds and graves

36. (1) Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit.

(2) SAHRA must identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with the grave referred to in subsection (1), and must maintain such memorials.

(3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)(b) unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—

(a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and

(b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in co-operation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and

(b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.

(7) (a) SAHRA must, over a period of five years from the commencement of this Act, submit to the Minister for his or her approval lists of graves and burial grounds of persons connected with the liberation struggle and who died in exile or as a result of the action of State security forces or agents provocateur and which, after a process of public consultation, it believes should be included among those protected under this section.

(b) The Minister must publish such lists as he or she approves in the Gazette.

(8) Subject to section 56(2), SAHRA has the power, with respect to the graves of victims of conflict outside the Republic, to perform any function of a provincial heritage resources authority in terms of this section.

(9) SAHRA must assist other State Departments in identifying graves in a foreign country of victims of conflict connected with the liberation struggle and, following negotiations with the next of kin, or relevant authorities, it may re-inter the remains of that person in a prominent place in the capital of the Republic.

Legislation relevant to the proposed activity under consideration taken from the National Heritage Resources Act (Act 25 of 1999)

Heritage resources management

38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50 m in length;

(c) any development or other activity which will change the character of a site—

(i) exceeding 5 000 m2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

(2) The responsible heritage resources authority must, within 14 days of receipt of a notification in terms of subsection (1)—

(a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report. Such report must be compiled at the cost of the person proposing the development, by a person or persons approved by the responsible heritage resources authority with relevant qualifications and experience and professional standing in heritage resources management; or

(b) notify the person concerned that this section does not apply.

(3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;

(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(c) an assessment of the impact of the development on such heritage resources;

(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) plans for mitigation of any adverse effects during and after the completion of the proposed development.

(4) The report must be considered timeously by the responsible heritage resources authority which must, after consultation with the person proposing the development, decide—

(a) whether or not the development may proceed;

(b) any limitations or conditions to be applied to the development;

(c) what general protections in terms of this Act apply, and what formal protections may be applied, to such heritage resources;

(d) whether compensatory action is required in respect of any heritage resources damaged or destroyed as a result of the development; and

(e) whether the appointment of specialists is required as a condition of approval of the proposal.

Annexure D7

Palaeontology

PALAEONTOLOGICAL HERITAGE: COMBINED DESKTOP & FIELD-BASED BASIC ASSESSMENT

Grid connection for the proposed Impofu North, Impofu West & Impofu East Wind Farms near Humansdorp, Eastern Cape

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EXECUTIVE SUMMARY

The present report provides a palaeontological heritage Basic Assessment of the proposed Impofu grid connection. This includes (a) the approximately 120 km-long, 2 km-wide 132 kV grid connection corridor between the proposed Impofu North, Impofu West and Impofu East Wind Farms and the national grid in the Nelson Mandela Bay Municipality (NMBM) near Port Elizabeth, Eastern Cape. Potential impacts of the proposed new Impofu collector switching station, wind farm switching stations and short 132 kV transmission lines linking them to the collector switching station as well as of substation extension areas are also considered. The report is based on a combined desktop and field-based study of the preferred grid connection corridor, incorporating a 2 km wide zone, with a special focus on areas underlain by potentially fossiliferous bedrocks.

The grid connection study area is underlain by several formations of potentially fossiliferous sediments of the Gamtoos Group, Cape Supergroup, Uitenhage Group and Algoa Group (Sections 6 & 7, Table 1). However, on the southern coastal platform most of the fossils originally preserved in these bedrocks appear to have been destroyed by tectonic deformation and deep chemical weathering. The overlying Late Caenozoic superficial sediments such as alluvium, soils and ferricretes, are likewise of low palaeontological sensitivity. Relict patches of Plio-Pleistocene aeolianites (wind-blown sands) of the Nanaga Formation (Algoa Group) present in the subsurface on the interior coastal platform contain Early Stone Age artefacts but any associated fossils such as mammalian remains, or terrestrial gastropods have probably been destroyed by weathering here. It is concluded that the great majority of the study area is in effect of LOW palaeontological sensitivity.

During the present study only two small areas of high palaeontological sensitivity have been identified within the grid connection study area: (1) steep cliff exposures of the Early Cretaceous Kirkwood Formation along the eastern banks of the Gamtoos River that are rich in fossil plant material, and (2) low fossiliferous scarp exposures of the Late Jurassic Bethelsdorp Member (lower Kirkwood Formation) along a pan margin some 1.8 km west of Sans Souci Substation (See polygons annotated on Figs. 35 & 36 herein). It is recommended that any excavations within the first area are carefully monitored for fossils by the Environmental Control Officer (ECO) (See Appendix 1: Chance Fossil Finds Procedure) while the latter should be treated as a No-Go area for development.

Due to the rarity of well-preserved, unique fossils of potential scientific importance within the grid connection corridor, potential impacts on palaeontological heritage during the construction phase are assessed as of *negligible (negative) significance* (both before and after mitigation). Significant impacts during the operational and decommissioning phases are not anticipated. The No-Go alternative (*i.e.* no grid connection) will have a neutral impact on palaeontological heritage.

Cumulative impacts posed by the grid connection and associated electrical infrastructure developments are inferred to be *minor*. This also applies to cumulative impacts from other approved or proposed transmission line developments in the region. Confidence levels for this assessment are *high* due to comparatively good field data available for the study region.

Pending the potential discovery of significant new fossil remains during the construction phase of the proposed Impofu grid connection, no further specialist palaeontological studies or mitigation are recommended for this project in the construction phase. There are no fatal flaws to the proposed electrical infrastructure project as far as fossil heritage is concerned. Providing that the Chance Fossil Finds Procedure outlined below and tabulated in Appendix 1 is followed through, there are no objections on palaeontological heritage grounds to authorisation of the Impofu grid connection and associated electrical infrastructure (including the Impofu collector switching station, three wind farm switching stations and short 132 kV transmission lines connecting these *plus* any substation extension areas).

The suitably qualified and experienced ECO responsible for the electrical infrastructure development construction phase should be made aware of the potential occurrence of scientifically-important fossil remains within the development footprint. During the construction phase all major clearance operations (*e.g.* for new access roads, pylon placements) and deeper (> 1 m) excavations should be monitored for fossil remains on an on-going basis by the ECO. Should substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the Eastern Cape Provincial Heritage Resources Agency, ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za) as soon as possible. This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense. These recommendations are summarized in the tabulated Chance Fossil Finds Procedure appended to this report (Appendix 1).

The palaeontologist concerned with any mitigation work will need a valid fossil collection permit from ECPHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies developed by SAHRA (2013).

These monitoring and mitigation recommendations are to be incorporated into the Environmental Management Programme (EMPr) for the proposed Impofu grid connection. The operational and decommissioning phases of this development are unlikely to have further significant impacts on palaeontological heritage and no additional recommendations are made in this regard (The Chance Fossil Finds Procedure still applies).

1. INTRODUCTION

The company Red Cap Energy (Pty) Ltd is proposing to develop up to three adjoining wind farms with a total of up to 95 wind turbines on a consolidated site of approximately 15 500 hectares (ha) situated to the west of Humansdorp within the Sarah Baartman District Municipality (Kouga and Kou-Kamma Local Municipalities), Eastern Cape (Fig. 1). The present report provides a paleontological heritage Basic Assessment of (a) the approximately 120 km-long, 2 km -wide 132 kV grid connection corridor between the proposed Impofu North, Impofu West and Impofu East Wind Farms and the national grid in the Nelson Mandela Bay Municipality (NMBM) near Port Elizabeth, Eastern Cape,

(b) the new Impofu collector switching station, as well as of (c) the switching stations and 132 kV overhead transmission lines linking them to the collector switching station associated with the three wind farm projects and (d) extension areas of 150 m x 150 m for the San Souci Substation and 50 m extensions for the Melkhout and Chatty Substations. It is based on a combined desktop and field-based study of the preferred 132 kV grid corridor, incorporating a 2 km inclusion zone (Figs. 1 & 2), with a special focus on areas underlain by potentially fossiliferous bedrocks. The Impofu North, Impofu West and Impofu East Wind Farms are being assessed separately.

Aurecon South Africa (Pty) Ltd (Aurecon) has been commissioned by the proponent to carry out three Environmental Impact Assessment (EIA) processes for the proposed Impofu Wind Farms as well as one Basic Assessment (BA) process for the associated switching stations and transmission lines (Aurecon contact details: Mr Charles Norman, Aurecon South Africa (Pty) Ltd. Address: Aurecon Centre, 1 Century City Drive, Waterford Precinct, Century City, South Africa. Tel: +27 44 8055433. Fax: +27 21 5269500. E-mail: Charles.Norman@aurecongroup.com).

2. PROJECT OUTLINE & BRIEF

The grid connection corridor study area for the proposed 132 kV grid connection linking the proposed Impofu West, Impofu East and Impofu North Wind Farms to the national grid (orange polygon in Figs. 1 & 2) stretches for approximately 120 km in a WSW-ESE direction and is approximately 2 km wide on average over its length. It extends from the proposed new Impofu collector switching station in the SW, located some 18 km WSW of Humansdorp, *via* the existing Eskom Melkhout Substation and thence eastwards to the existing Sans Souci Substation or Chatty Substation located in the Nelson Mandela Bay Metropolitan Municipality (NMBM). A range of route options for the 132 kV grid connection is under consideration within the study corridor. Most of the currently preferred route would follow existing powerline servitudes and it is anticipated that existing access roads will be employed. A range of electrical pylon designs are under consideration (more than one of which may be employed) entailing footing excavation depths up to 3.7 m and excavation widths up to 9 m, depending on substrate conditions. Associated stays require foundations of up to 2 m x 2 m (depending on the suitability of the soils). The spacing of the pylons will depend on the alignment and topography and may vary from 260 to 800 m.

This study also includes an assessment of the Eskom switching stations (11,250 m^2) that will be associated with the new substations for each of the three Impofu Wind Farms as well as of the 132 kV transmission lines (± 5 km) between these switching stations and the new Impofu collector switching station (22,500 m^2) (See Figs. 1 & 3a). Possible extension areas of 150 m for the San Souci Substation and 50 m extensions for the Melkhout and Chatty Substations have also been assessed here. A palaeontological and geological heritage study of the consolidated Impofu Wind Farms project area including the footprints of these proposed electrical infrastructure developments has been carried out by Almond (2017).

2.1. Terms of Reference

The Terms of Reference for the desktop and field-based palaeontological heritage assessment of the Impofu Wind Farm projects have been defined by Aurecon South Africa (Pty) Ltd to comprise (1) three separate Scoping Impact Assessments, one for each wind farm, including the on-site

substations, internal roads, underground and overhead cables and upgrading of public roads, as well as (2) one Basic Environmental Assessment for the associated 132 kV grid connection between the project area and Port Elizabeth, the Impofu collector switching station as well as the internal overhead132 kV transmission lines and switching stations within the wind farms project area.

Figure 1. Google Earth© satellite image of the western sector of the Impofu Wind Farm 132 kV grid connection corridor study area (orange polygon) extending from the proposed new Impofu collector switching station (red square) and the Gamtoos River, Eastern Cape. The three switching stations (black squares) connecting to the central collector switching station as well as the combined Impofu North, Impofu East and

Impofu West WEF project areas (white polygon) are also shown. See Fig. 35 for detail of palaeontologically-sensitive area F1 (red).

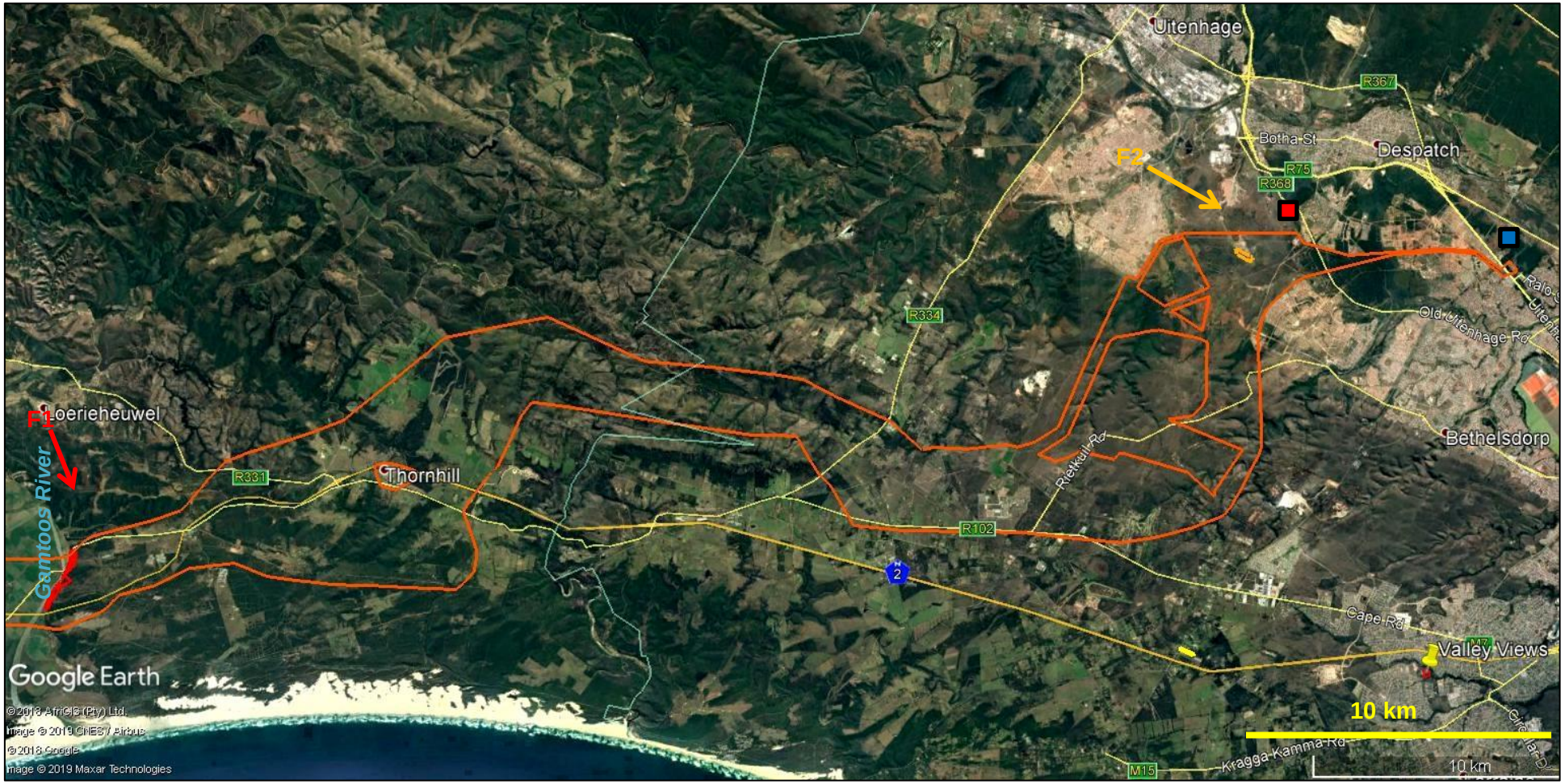


Figure 2. Google Earth© satellite image of the eastern sector of the Impofu grid connection corridor (orange polygon) extending from the Gamtoos River to the San Souci Substation (red square) and Chatty Substation (blue square) near Port Elizabeth, Eastern Cape. The revised corridor shown here shows route alternatives west of Chatty Substation, including along the existing powerline through Hopewell Estate. See Figs. 35 and 36 for details of palaeontologically-sensitive areas F1 (red) and F2 (orange).

3. STUDY APPROACH

This combined desktop and field-based PIA report provides an assessment of the observed or inferred palaeontological heritage within the Impofu grid connection corridor, with recommendations for specialist palaeontological mitigation where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, including previous palaeontological impact assessments in the area (*e.g.* Almond 2010a, 2011a, 2011b, 2011c, 2011d, 2012a, 2013a, 2013b, 2013c, 2013d, 2016a, 2017 and De Klerk 2010a, 2010b, 2011), (2) published geological maps and accompanying sheet explanations, (3) a four-day field study of the consolidated Impofu Wind Farms study area (23-26 September 2017) and the resulting palaeontological heritage screening report (Almond 2017), (4) a two-day field study (20-21 March 2018) of potentially-sensitive areas within the grid connection study area, focusing on areas of natural or artificial bedrock exposure, as well as (5) the author's extensive field experience with the formations concerned and their palaeontological heritage (Almond *et al.* 2008).

4. ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerised database of fossil collections in major RSA institutions which can be consulted for impact studies.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist, as in the case of the present study.

In the case of the Impofu Wind Farms and the associated grid connection study area, bedrock exposure is highly constrained by extensive superficial deposits, especially in areas of low relief, as well as by grassy vegetation. The study area is very extensive and for the most part fairly flat, with some gentle hillslopes and few access roads (Figs. 4 to 6). However, sufficient bedrock exposures were examined during the course of the field studies to assess the palaeontological heritage sensitivity of the main rock units represented within the study area (See Appendix 2). Comparatively few academic palaeontological studies have been carried out hitherto in the region, so any new data from impact studies here are of scientific interest. Palaeontological and geological data from the recent field study is usefully supplemented by those from several other field-based fossil heritage impact studies carried out in the Kouga (Humansdorp - Jeffrey's Bay - Cape St Francis) region by the author and other palaeontologists in recent years (See reference list); the paucity of previous field-based palaeontological impact assessments within the central and eastern sectors of the grid connection corridor, as documented on the SAHRIS website, is noted, however. Confidence levels for this impact assessment are rated as high, despite the unavoidable constraints of limited exposure, time and access.

5. LEGISLATIVE CONTEXT

The present combined desktop and field-based palaeontological heritage report falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the EMPr for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and

(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013).

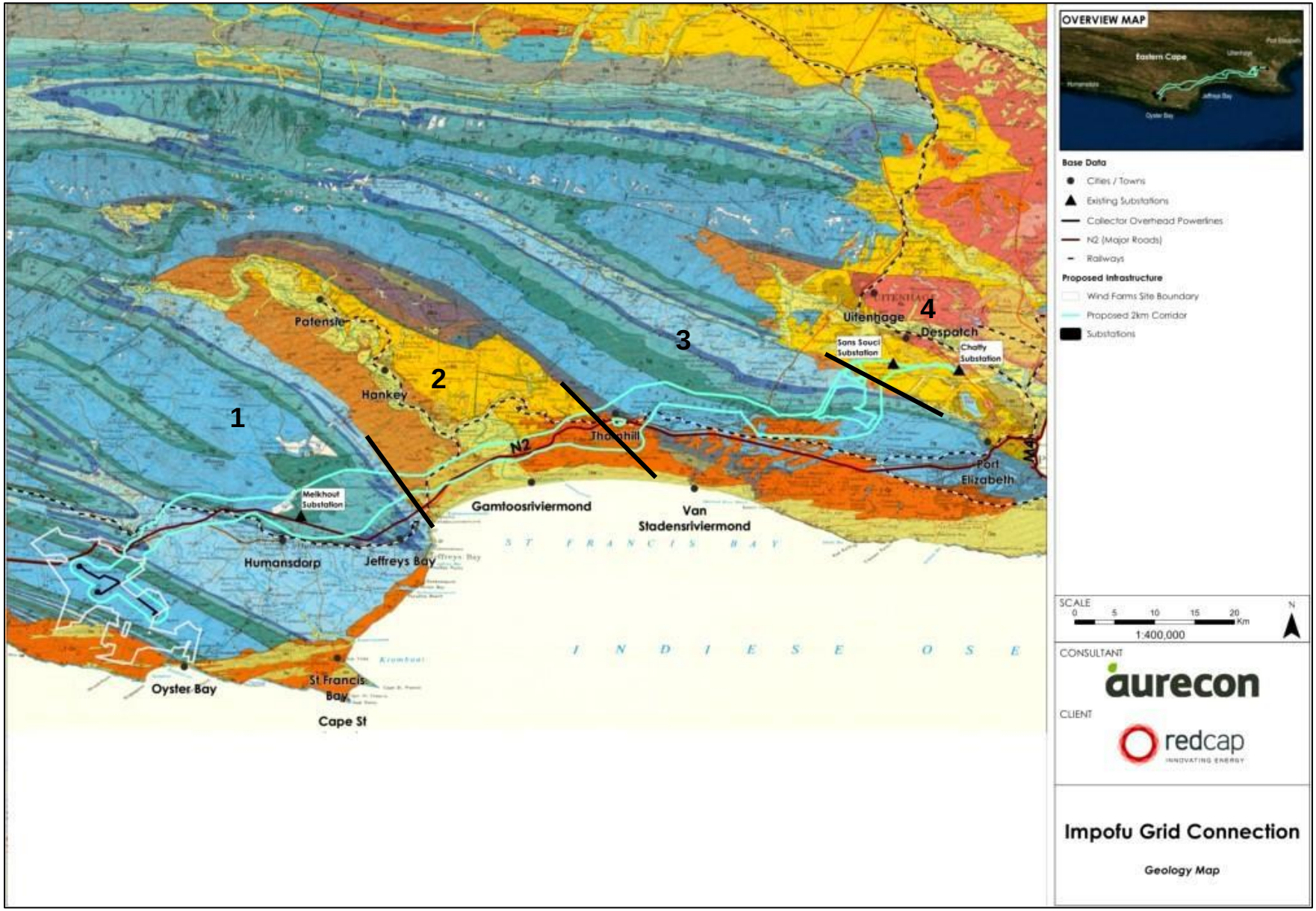
6. GEOLOGICAL CONTEXT

The proposed Impofu grid connection corridor traverses several geomorphic provinces on the southern coastal platform and Cape Fold Belt of southern Africa, as defined by Partridge *et al.* (2010), *viz*: the Southern Coastal Platform, Southern Coastal Lowlands as well as the Central and Eastern Cape Fold Mountains. This large region shows a considerable degree of topographic variety, due in large part to the varied underlying geology. This includes gently rolling hills and seawards-sloping plateaux along the wave-cut coastal platform inland from St. Francis Bay and Algoa Bay, rugged upland ridges of the NW-SE trending Cape Fold Mountains, as well as highly-dissected terrain along the margins of the Gamtoos River Valley. In addition to the ancient, deeply-incised Gamtoos River the study area is traversed by several smaller and younger drainage systems such as the Kromrivier, Swartrivier, Kabeljousrivier and Swartkopsrivier.

The geology of the grid connection corridor is shown on 1: 250 000 geology sheet 3324 Port Elizabeth (Toerien & Hill 1989) (Figs. 3, 3a, 3b), supplemented by sheet explanations for several larger-scale geological maps (*e.g.* Haughton 1928, Haughton *et al.* 1937, Engelbrecht *et al.* 1962, Le Roux 2000). It should be emphasised that mapping of the various geological formations outside the rugged uplands in this area is often *schematic* because of the generally poor levels of bedrock exposure; *i.e.* the outcrop areas shown in Fig. 3 may not be very accurate. Exposures in lowland areas where bedrocks are covered by superficial sediments (alluvium, colluvium, soils *etc*) are largely limited to river and stream banks, erosion gullies, borrow pits and quarries, road and railway cuttings and farm dams.

The geology and palaeontology of the sedimentary rocks represented here have already been outlined in several previous desktop and field-based studies by the author and others (notably Almond. 2010a, 2011f, 2012c, 2014), including field-based palaeontological assessments for 132 kV powerline corridors between Kareedouw and Patensie (Almond 2013a-c). A separate palaeontological and geological report for the consolidated Impofu Wind Farms project (Almond 2017) is relevant to the western sector of the proposed grid connection corridor as well as to the associated new Impofu collector switching station, switching stations and transmission lines connecting these. The main sedimentary rock units represented within the present grid connection study area are tabulated in Table 1 together with an outline of their potential fossil heritage and a provisional assessment of their palaeosensitivity (*N.B.* These sensitivity ratings have been updated from those shown on the SAHRIS palaeosensitivity maps based on recent field experience in the broader study region).

Figure 3 (following page). Extract from 1: 250 000 geology sheet 324 Port Elizabeth (Council for Geoscience, Pretoria) showing the outline of the Impofu grid connection corridor (elongate pale blue polygon) between the proposed Impofu West, East and North Wind Farms near Humansdorp (white polygon) and the existing Sans Souci or Chatty Substations in Nelson Mandela Bay Metropolitan Municipality, Eastern Cape (Image provided by Aurecon. See following figures for enlargements). The 2 km grid corridor (pale blue polygon) is subdivided into four numbered sectors on the basis of the bedrock geology. The numerous sedimentary rock units represented here are enumerated in Table 1. The palaeontologically-sensitive Kirkwood Formation outcrop area is coloured dark yellow.


1
2
3
4
Patensie
Hankey
Uitenhage
Despatch
Sans Souci Substation
Chatty Substation
Melkhout Substation
N2
Gamtoosriviermond
Van Stadensriviermond
Port Elizabeth
Humansdorp
Jeffreys Bay
Oyster Bay
St Francis Bay
Cape St
ST FRANCIS BAY
INDIESE OSE
OVERVIEW MAP
Eastern Cape
Base Data
Cities / Towns
Existing Substations
Collector Overhead Powerlines
N2 (Major Roads)
Railways
Proposed Infrastructure
Wind Farms Site Boundary
Proposed 2km Corridor
Substations
SCALE
0 5 10 15 20 Km
1:400,000
N
CONSULTANT
aurecon
CLIENT
redcap
INNOVATING ENERGY
Impofu Grid Connection
Geology Map

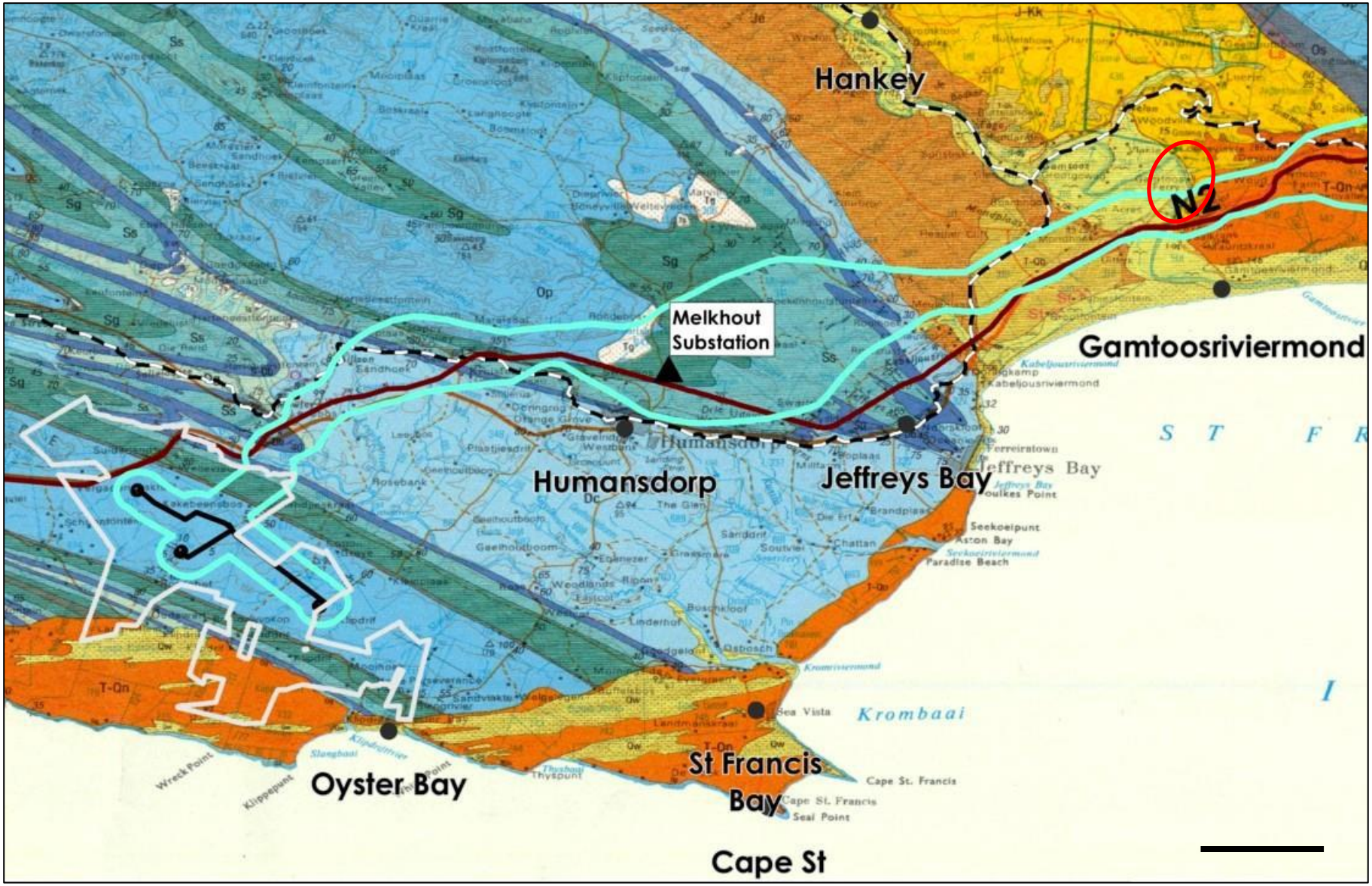


Figure 3a. Detail of the geological map show in the previous figure showing the rock units underlying the western portion of the Impofu grid connection corridor (pale blue polygon). New 132 kV transmission lines between the WEF switching stations and the new Impofu collector switching station are shown in black. The red ellipse indicates palaeontologically-sensitive cliff exposures of the Kirkwood Formation along the eastern banks of the Gamtoos River (*cf* satellite image in Fig. 35). Scale bar = 10 km.

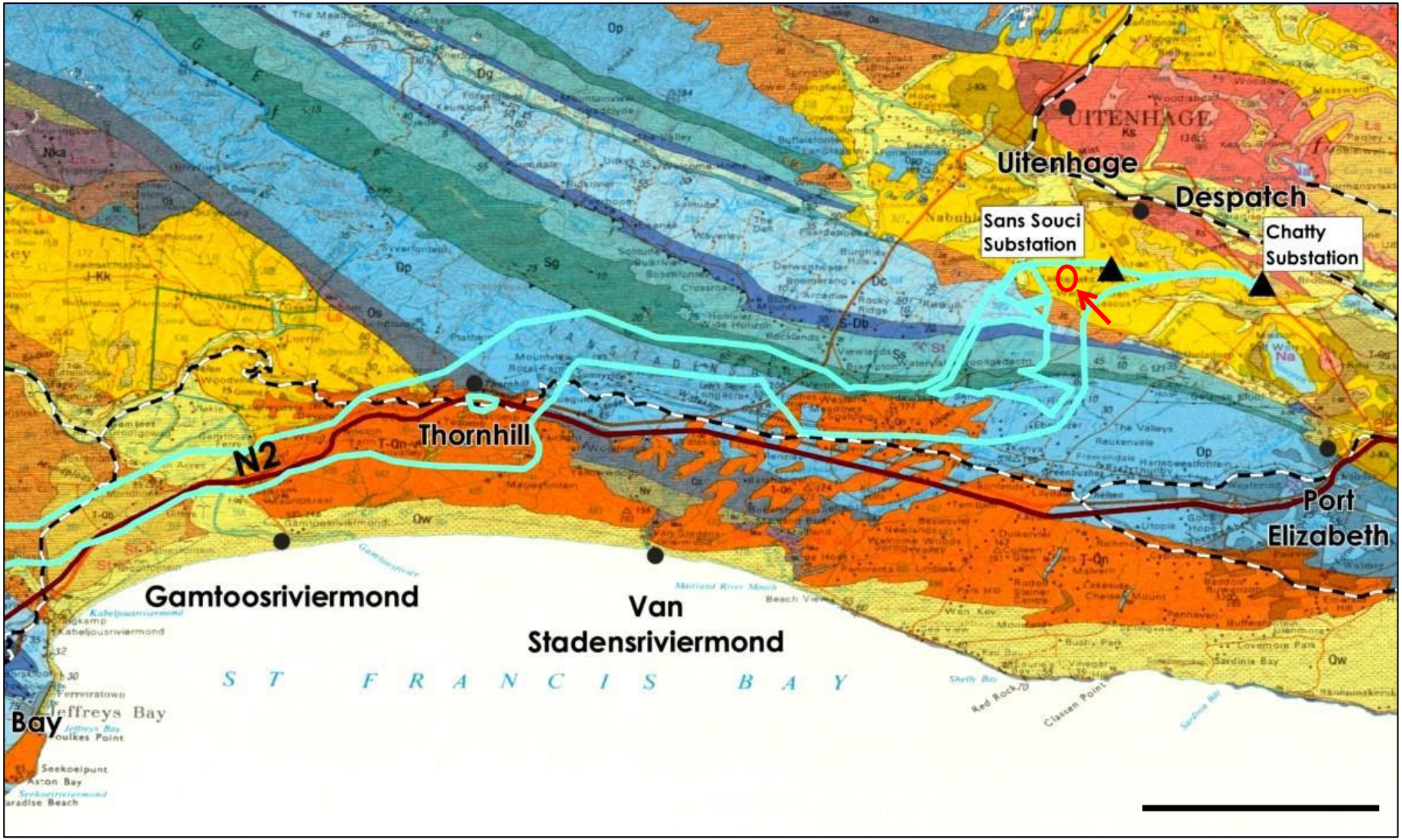


Figure 3b. Detail of the geological map shown in Figure 3 showing the rock units underlying the eastern portion of the Impofu grid connection corridor (pale blue polygon). The small red ellipse (arrowed) indicates palaeontologically-sensitive exposures of the Bethelsdorp Member (Kirkwood Formation) along pan margins just west of Sans Souci Substation (*cf* satellite image in Fig. 36). The revised corridor shown here shows route alternatives west of Chatty Substation, including along the existing powerline through Hopewell Estate. Scale bar = 10 km.

Figure 4. Flat sandy terrain with downwasted quartzitic surface gravels on the floor of the wide Gamtoos River Valley, looking towards the east (Loc. 005).

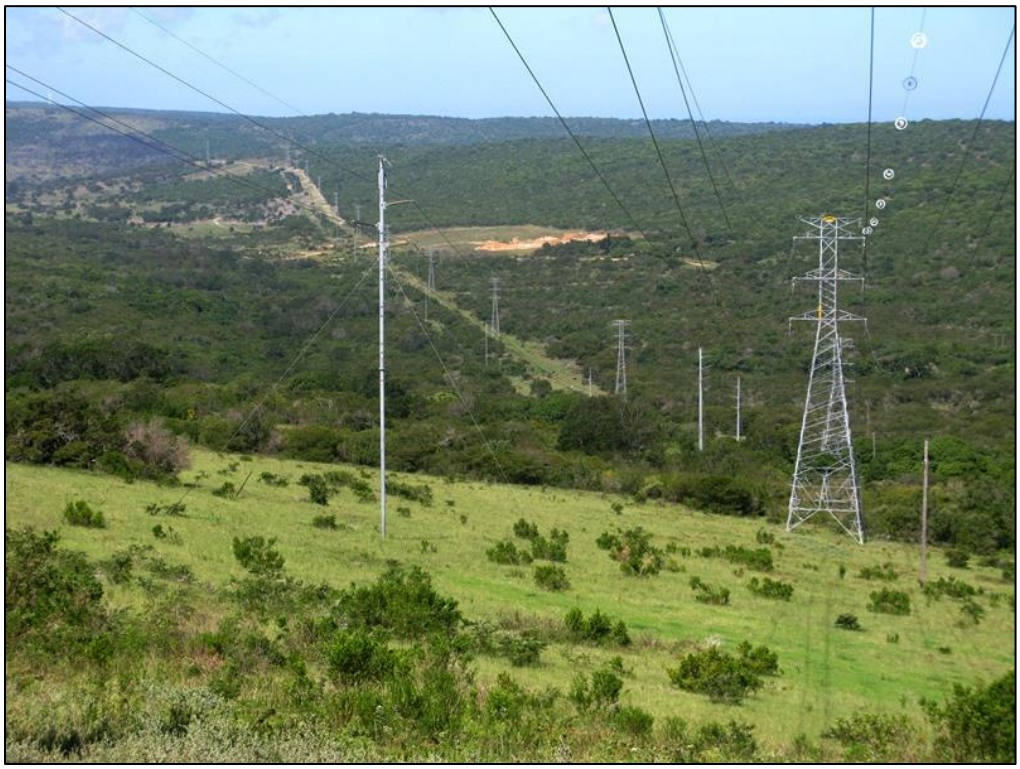


Figure 5. View south-westwards along existing powerline towards sand mine NE of Lemoenfontein showing hilly terrain east of the Gamtoos River Valley.

Figure 6. View northwards across slightly undulating, sandy terrain with thicket clumps in the region south of Uitenhage and west of Sans Souci Substation.

6.1. Geological overview of the proposed grid connection corridor

In this section of the report only a very brief overview of the main geological features of the grid connection study area are given (See previous palaeontological assessment reports listed in the References for more detail, notably those by Almond 2012b, 2013a-c, 2017). GPS locality data and brief descriptions of sites inspected during the two-day field visit are provided in Appendix 2, while selected good rock exposures are illustrated within the text below.

The proposed grid connection corridor (purple polygon in Figs. 3, 3a, 3b) can be broadly subdivided into four sectors (numbered 1 to 4 from west to east) in terms of the broad geological setting, *viz*:

1. A western-most **Sector 1** (including the Wind Farms) (*c*. 35 % of preferred grid alternative corridor length) underlain by folded Cape Supergroup bedrocks (Table Mountain (TMG) and Bokkeveld Groups) that build the southern coastal platform and low mountains along its inner margins. The latter include the Kareedouwberge as well as a low NW-SE upland ridge of braided fluvial to coastal marine quartzitic TMG rocks north of Humansdorp. The large outcrop areas of Bokkeveld Group marine bedrocks here, as well as narrow strips of Cederberg Formation mudrocks, are generally very poorly exposed and, where seen are normally highly-deformed (cleaved, folded) and chemically weathered (*e.g.* Almond 2012c, 2017). The tougher TMG bedrocks are also tightly folded along NW-SE axes, with extensive surface cover by downwasted and colluvial gravels as well as local development of ferruginous or siliceous pedocretes (Grahamstown Formation, seen, for example, north of Humansdorp).

2. A west-central **Sector 2** (*c*. 30 % of preferred grid alternative corridor length) centred on the Gamtoos River Valley which is underlain by Mesozoic continental sediments of the Uitenhage Group in the NW-SE trending Gamtoos Basin (Shone 2006, Muir *et al.* 2017a, 2017b, Muir 2018). Large outcrop areas and several good quarry and cliff exposures of the Enon and Kirkwood Formations are seen here (Figs. 7 & 8) but they have been palaeontologically neglected compared with the Algoa Basin outcrops to the east. Finer-grained, sandy to silty interbeds within the Enon succession are generally highly-weathered. The Late Jurassic to Early Cretaceous Uitenhage Group bedrocks are overlain by Late Caenozoic alluvium along the Gamtoos River (Fig. 9) as well as weathered Pleistocene aeolianites of the Nanaga Formation (Algoa Group) that extend well inland on the eastern side of the Gamtoos. Shelly Alexandria Formation beds are not encountered here.

Figure 7. Excellent quarry face sections through cobbly to pebbly fluvial conglomerates of the Enon Formation with occasional small-scale sandy channels and bars, Vlakteplaas Quarry (Loc. 003).

Figure 8. Riverine cliff sections through thick channel sandstones followed by overbank mudrocks and thin tabular sandstones of the Kirkwood Formation, eastern bank of the Gamtoos River (Loc. 010).

Figure 9. Trench exposure of sandy and pebbly alluvium underlying the Gamtoos River floodplain close to old road bridge (Loc. 009).

3. An east-central **Sector 3** (*c*. 20 % of preferred grid alternative corridor length) underlain by folded, WNW-ESE trending Cape Supergroup sediments that build a modestly elevated barrier of tougher-weathering Palaeozoic bedrocks separating the Gamtoos and Algoa Basins. Small outcrop areas of tectonically-deformed Late Precambrian (Ediacaran) metasediments of the Gamtoos Group crop out below the base of the TMG to the north of the Van Stadens and Maitland River Mouths but these ancient bedrocks are not mapped within the grid connection corridor. Otherwise, the geology of this sector closely resembles that of Sector 1 outlined above, including subordinate outcrop areas of deformed and weathered Lower Bokkeveld Group sediments in a mega-synclinal core, highly-weathered (and in part breccio-conglomeratic) Kirkwood Formation on the eastern edge of the Gamtoos Basin (Fig. 12), and an extensive mantle of leached Nanaga Formation (Algoa Group) Pleistocene aeolianites overlying these older bedrocks (Fig. 13). In the vicinity of the Van Stadens River Valley, outside the present study area, the basal part of the TMG, below the Peninsula Formation, is represented by deformed metasediments – conglomerates, sandstones and phyllites – of the Sardinia Bay Formation (Figs. 10 & 11) that were possibly deposited in a tidal shelf setting (Shone 1983, 1987, 1994, Toerien & Hill 1989, Johnson *et al.* 2006). The Sardinia Bay Formation outcrop area extends across the grid connection corridor to the NW of Thornhill but, on the basis of satellite images, is nowhere well-exposed here (highly wooded terrain). As in the Van Stadens River Valley exposures, the bedrocks here are likely to be highly-deformed.

Figure 10. R102 road cutting through folded quartzitic wackes and phyllitic pelites of the Sardinia Bay Formation, *c*. 1 km west of Van Stadensrivier (Loc. 025). Similar deformed siliciclastic sediments are likely to underlie the grid connection corridor to the NW of Thornhill but are not well exposed there.

Figure 11. Steeply-dipping, cross-bedded tabular wackes and thin-bedded pelites of the Sardinia Bay Formation, R102 road cutting *c*. 950 m west of Van Stadensrivier (Loc. 026).

Figure 12. Highly-weathered Kirkwood Formation sandstones and mudrocks and overlying ferricretes exposed in a R102 road cutting *c.* 4.5 WSW of Thornhill (Loc. 021).

Figure 13. Thin-bedded, orange-hued aeolian sands of the Pleistocene Nanaga Formation (Algoa Group) exposed in a sand mine NE of Lemoenfontein (Loc. 018) (Hammer = 30 cm).

4. An easternmost **Sector 4** (*c*. 15 % of preferred grid alternative corridor length) that is largely underlain by Late Jurassic – Early Cretaceous continental and marine sediments of the Uitenhage Group on the western margins of the Algoa Basin (Swartkops Subbasin). The bedrocks mainly belong to the Kirkwood Formation (Figs. 15 & 16) with narrow outcrop areas of Enon and Sundays River Formations in the SW and NE respectively. The geology and palaeontology of the study area near Bethelsdorp has been treated in part in a previous impact assessment by Almond (2012b). The TMG uplands in the southwest are highly folded, planed-off by pediment surfaces and mantled by ferruginised pediment gravels (Fig. 14). Of special note in the study area near Despatch are (a) geologically-important surface exposures of fossiliferous marine sediments of the latest Jurassic (Tithonian) Bethelsdorp Member towards the base of the predominantly continental Kirkwood Formation (*ibid*., Muir *et al.* 2017b) (Figs. 17 & 18) as well as (b) locally silcretised occurrences of alluvial fan deposits of the Eocene Damascus Formation (Hattingh 2001, his Fig. 3.1 and pp. 29-30) (Figs. 19 & 20), the only Tertiary (Neogene) sediments recorded from the Algoa Basin. The Damascus Formation outcrops south of Uitenhage have been erroneously mapped as Enon Formation on published geological maps. Relict patches of downwasted Alexandria Formation pebbly sediments (so-called “Bluewater Bay Formation”) and Pleistocene aeolianites (Nanaga Formation) cover parts of the Kirkwood Formation outcrop area, while Late Caenozoic alluvial and estuarine sediments are associated with the Swartkopsrivier (Fig. 21).

Figure 14. Gently-dipping quartzites of the Skurweberg Formation (Table Mountain Group) overlain by ferruginised gravels in an abandoned quarry, Bloemendal A/A (Loc. 216) (Hammer = 30 cm).

Figure 15. NW-facing cliff exposure of pale, weathered fluvial sediments, including small lenticular channel sandstone bodies, of the Kirkwood Formation in the Klipkuil valley, SE of Kwa-Nobuhle (Loc. 225).

Figure 16. Extensive gullied exposures of variegated overbank mudrocks with occasional thin sandstone horizons of the Kirkwood Formation, margins of abandoned brick pit near Despatch (Loc. 230).

Figure 17. Low scarp exposures of pale greyish mudrocks and yellowish tabular sandstones of the estuarine Bethelsdorp Member (Kirkwood Formation) with large ferruginous concretions in middle ground seen along a pan margin west of Sans Souci Substation (Loc. 236). Note capping of orange-brown sandy soils.

Figure 18. Possible series of several sandstone-capped shoaling cycles within the Bethelsdorp Member. The arrow indicates a horizon containing shelly marine fossils (See Figs. 31 to 34).

Figure 19. Quarry exposure on Bloemendal A/A of weathered, steeply-dipping, pale Bokkeveld Group mudrocks unconformably overlain by semi-consolidated alluvial fan gravels of the Eocene Damascus Formation (Hammer = 30 cm) (Loc. 218).

Figure 20. Silcretised coarse, proximal alluvial fan gravels of the Damascus Formation on hillslopes *c*. 100 m south of the R368 (Loc. 221).

Figure 21. Erosion gulley exposures of thick sandy to pebbly alluvial deposits overlying Kirkwood or Bokkeveld bedrocks in the Klipkuil Valley near Kwa-Nobuhle (Loc. 224).

7. PALAEONTOLOGICAL HERITAGE

The palaeontological record associated with the various sedimentary rock units within the proposed Impofu grid connection corridor has been described in several previous palaeontological assessment studies for the Humansdorp – Port Elizabeth (*e.g.* Almond 2012a, 2012 b, 2017) and is summarized below in Table 1. The following brief comments refer to the four informal geologically-defined sectors of the grid connection study area shown in Figure 3 with illustrations of palaeontological material recorded during recent fieldwork in the proposed grid connection corridor (See Appendix 2 for GPS data for all numbered fossil sites).

7.1. In **Sector 1** the Palaeozoic bedrocks of the Cape Supergroup are generally unfossiliferous due to high levels of tectonic deformation and chemical weathering, although isolated marine trace fossil assemblages have been recorded from quarry exposures into the Peninsula Formation near Rosenhof farmstead (Almond 2017). Unmapped relict patches of Pleistocene aeolianites (Nanaga Formation, Algoa Group) overlying the bedrocks are potentially fossiliferous (*e.g.* mammalian bones, teeth in fossil hyaena dens, land snails, calcretised rhizoliths) but in practice seem to be highly-leached chemically, with resulting dissolution of most original fossil remains. Based on desktop and field studies the palaeosensitivity of this sector of the grid connection corridor, as well as the associated wind farm switching stations, Impofu collector switching station and short 132 kV transmission lines between the two is generally LOW. No significant fossil sites are recorded within the electrical infrastructure footprint here (Almond 2017).

7.2. In **Sector 2** the Enon Formation (Uitenhage Group) conglomerates and minor sandstones are beautifully exposed in several active and inactive quarries but no fossil remains were recorded from these beds. The overlying Late Jurassic / Early Cretaceous fluvial sediments of the Kirkwood Formation in the Gamtoos Basin have previously yielded important plant fossil remains such as leaf compressions, woody material (lignites, impressions), amber (fossil resin) and organic-walled microfossils, but – so far – no dinosaur remains (*cf* McLachlan & McMillan 1976, Dingle *et al.* 1983, Gomez *et al.* 2002a, 2002b and refs. therein). Locally abundant impressions of woody axes and plant hash are recorded from fallen blocks of Kirkwood channel sandstones along the base of cliff exposures on the eastern bank of the Gamtoos River (Figs. Figs. 22 to 24). Most the cliff exposures here are too steep to be accessible, however. Important Pleistocene mammalian and other fossil remains might well occur within Late Caenozoic alluvial and aeolian deposits (*e.g.* Pleistocene Nanaga Formation), but are likely to be very sparse and localised; no fossils were reported from these younger units during the field study. It is concluded that the overall palaeosensitivity of this sector of the grid connection corridor is LOW with the exception of the Kirkwood Formation cliff exposures along the eastern banks of the Gamtoos River which are of HIGH sensitivity.

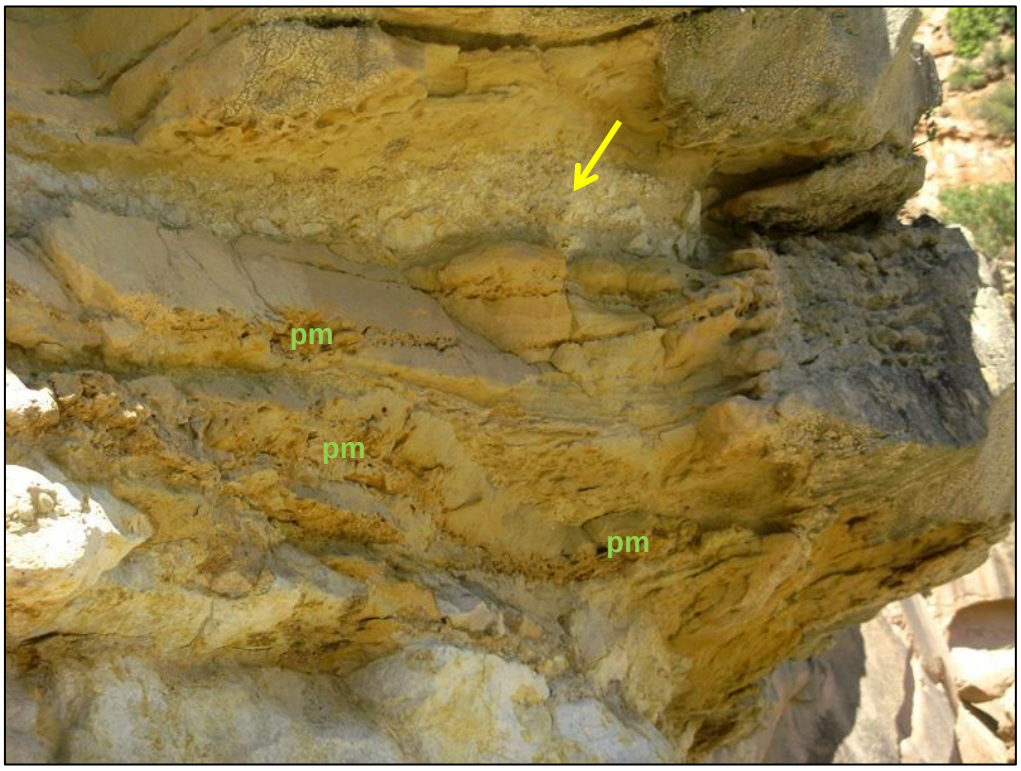


Figure 22. Lower portion of thick Kirkwood channel sandstone package showing multiple thin horizons of plant debris moulds (pm) as well as horizon of pale siltstone intraclasts (arrowed), Gamtoos River cliffs (Loc. 012).

Figure 23. Fallen block of Kirkwood channel sandstone showing concentration of aligned woody stem moulds as well as plant hash (Hammer = 30 cm), Gamtoos River cliffs (Loc. 011).

Figure 24. Ferruginous moulds of woody plant stems within Kirkwood Formation channel sandstone (Scale in cm), Gamtoos River cliffs (Loc. 013).

7.3. In **Sector 3** the Late Precambrian Gamtoos Group metasediments are not well-exposed and these beds are rated as of LOW palaeontological sensitivity since they are generally highly deformed and have so far only yielded microfossil assemblages. Good road cutting sections through the Sardinia Bay Formation (basal TMG) in the Van Stadens River Valley, outside the present study area, are also tectonically deformed, with no evidence of the trace fossils recorded from coastal outcrops (Shone 1991); this is likely to apply equally to the Sardinia Bay Formation outcrop area further inland, to the northwest of Thornhill. As elsewhere, the overlying Table Mountain Group formations are largely unfossiliferous while the overlying blanket of Nanaga Formation aeolian sands is highly leached, with no fossils recorded within sparse sand mine exposures. Kirkwood Formation sediments exposed in this sector appear to be highly weathered and ferruginised, so well-preserved fossil assemblages are not anticipated here. It is concluded that the palaeontological sensitivity of this sector of the grid connection is LOW and no significant fossil sites are recorded within the study area here.

7.4. In **Sector 4** the Table Mountain Group (TMG) bedrocks are steeply folded, truncated by pediment surfaces and overlying ferruginised pediment gravels. Potentially-fossiliferous mudrock interbeds are not exposed and are likely to be highly weathered. This applies equally to the Baviaanskloof Formation at the top of the TMG succession. Several excellent brick pit and stream gully exposures of fluvial facies of the Kirkwood Formation in low-lying region south of Uitenhage have not yielded significant continental biotas apart from low diversity invertebrate trace fossil assemblages (Fig. 25 and 26), although rare dinosaur remains (*Algoasaurus*) are reported from Despatch nearby (McLachlan & McMillan 1976). Most of the Kirkwood Formation outcrop area is mantled by unfossiliferous surface gravels, soils, alluvium and pan sediments but excellent exposures of continental facies on the margins of an inactive brick pit near Despatch include lenses of intensely-bioturbated sandstones (Figs. 25 and 26).

Palaeontologically- and geologically-important low scarp and gulley exposures of estuarine to marine mudrocks and sandstones of the Bethelsdorp Member (previously equated with the Colchester Member; Muir *et al.* 2017b) towards the base of the Kirkwood Formation occur along the southwestern margins of a large pan some 1.8 km west of Sans Souci Substation (Figs. 17 & 18). They are the best known surface exposures of these Latest Jurassic marine to estuarine rocks which are probably situated towards the base of the Kirkwood Formation succession (Muir *et al.* 2017b, Muir 2018). They have yielded a small range of invertebrate trace fossils associated with horizontally-laminated sandstones (Figs. 27 to 30) and also an impoverished shelly invertebrate fauna of flat-shelled bivalves, encrusting oysters and serpulid worms as well as cidaroid sea urchins within silty mudrock intervals (Figs. 31 to 34) (Almond 2012b; *cf* McLachlan & McMillan 1976, Dingle *et al.* 1983 who provide more extensive fossil lists for nearby localities at Bethelsdorp Salt Pan and North End Lake that are no longer accessible; McMillan 2010 reviews formainiferans from this rock unit). The Bethelsdorp Member outcrop area is of HIGH palaeontological sensitivity but only encroaches marginally into the grid connection study area (Figs. 3b & 36). The remainder of the sector is rated as of LOW palaeontological sensitivity and no significant fossil sites are recorded there.

Figure 25. Fallen block of intensely-bioturbated fluvial sandstone from the Kirkwood Formation showing dense network of intersecting hollow to sand-infilled invertebrate burrows (Scale in cm and mm) (Loc. 233).

Figure 26. *In situ* lens of highly-bioturbated fluvial sandstone within the Kirkwood Formation, showing vertical as well as oblique to horizontal burrows (Scale in cm and mm) (Loc. 233).

Figure 27. Horizontally-laminated tabular sandstone within the Bethelsdorp Member showing bioturbation by endichnial steeply-inclined burrows (Scale = c. 15 cm) (Loc. 037).

Figure 28. Bilobed horizontal to convex-downwards endichnial burrows within tabular sandstone of the Bethelsdorp Member, Kirkwood Formation (apparent branching of burrow system *may* be deceptive) (Scale in cm and mm) (Loc. 236).

Figure 29. Fallen block of tabular, brown-weathering Bethelsdorp Member sandstone showing dense network of intersecting cylindrical burrows (Scale = c. 15 cm) (Loc. 034).

Figure 30. Close-up of 4-6 mm wide horizontal cylindrical burrows seen in previous figure showing possible vague, finely-spaced meniscate backfill (Loc. 034).

Figure 31. Subrounded quartzite pebbles from the Bethelsdorp Member mudrocks showing partial covering by encrusting oysters (possibly *Amphidonta*) (Scale in cm and mm) (Loc. 237).

Figure 33. Washed-out, thin-shelled, flattened bivalves of the genus *Placunopsis* weathering out from greyish mudrocks of the Bethelsdorp Member (Loc. 237) (Shell fragments here are up to 4 cm across).

Fig. 34. Disarticulated, finely-tuberculate spines of the regular echinoid *Cidaris* washed out from the Bethelsdorp Member mudrocks (Loc. 237). Intact spines are *c*. 30 mm long and up to 4 mm wide towards the base.

Table 1: Main sedimentary rock units mapped within the proposed Impofu grid connection corridor, Eastern Cape, on 1: 250 000 geology sheet 3324 Port Elizabeth (Abstracted from Almond *et al.* 2008). Provisional palaeosensitivity ratings have been assigned here to each unit, based on desktop and field data (*N.B.* These ratings have been updated from those shown on the SAHRIS palaeosensitivity maps based on recent field experience in the broader study region):
Black = LOW / NEGLIGIBLE; Blue = LOW; green = MODERATE; purple = HIGH; red = VERY HIGH

GEOLOGICAL UNIT		ROCK TYPES & AGE	FOSSIL HERITAGE	COMMENTS
NEOGENE-PLEISTOCENE DRIFT - ALLUVIUM *ETC* Late Miocene and younger (correlated with Alexandria Fm *etc*, Algoa Group)		Alluvium, aeolian sands, pan, vlei and lake sediments, soils, surface gravels *etc* in the interior (*e.g.* alluvial terrace gravels of the Kudu's Kloof Formation in the Sunday's River Valley)	Pollens, freshwater molluscs, mammal bones and teeth *etc*	Alert for fossil human as well as other mammal remains (*cf* Hofmeyer Man skull in the Karoo, *c.* 36 000 BP)
GRAHAMSTOWN FORMATION **(Tg)**		Silcretes and ferricretes associated with deeply weathered saprolite (*in situ* weathered bedrock) Late Cretaceous (are also younger Tertiary silcretes, e.g. associated with Damascus Formation)	Rare fossil plants reworked Beaufort Group silicified wood (*e.g.* East London area)	Several patches of silcretised sediment mapped on S flanks of Winterhoekberge, NW of PE, as well as N of Humansdorp.
ALGOA GROUP **(Ta)** **Incl.** **Alexandria Formation (Ta)** **Nanaga Formation (T-Qn)**		Estuarine, coastal, shallow marine silicalstic sediments, limestones, coquinites, aeolian sands Early / Middle Eocene - Holocene	Rich marine / estuarine invertebrate fauna including diverse molluscs, plus corals, bryozoans, brachiopods, echinoids, crustaceans, microfossils, sharks' teeth,trace fossils. Local concentrations of mammalian bones and teeth, animal trackways, land snails, stone artefacts within Pleistocene aeolianites (*e.g.* related to fossil hyaena dens).	Main subunits represented in the coastal interior are the Alexandria Formation (Ta)(*e.g.* local dense fossil oyster beds) with its downwasted pebbly soils ("Bluewater Bay Formation", T-Qb, which is no longer recognised) as well as older Pleistocene aeolianites of the Nanaga Formation (mostly leached and unfossiliferous away from coast) (*cf* Almond 2010, 2017).
DAMASCUS FORMATION		Alluvial fan breccio-conglomerates and debris flow deposits (locally silcretised). Eocene	No fossils recorded.	Small outcrop areas south of Uitenhage (previously mapped as Enon Formation) (See Hattingh 2001).
UITENHAGE GROUP	**Buffelskloof Formation (Kb)**	terrestrial / fluvial breccio-conglomerates Early Cretaceous	No fossils recorded so far in E. Cape. Occasional records of petrified wood in Western Cape outcrop area.	

	Sundays River Formation **(Ks)** Early Cretaceous	Shallow marine / estuarine siliciclastics	Rich marine invertebrate fauna (molluscs, echinoderms *etc*), vertebrates (*e.g.* plesiosaurs), microfossils (foraminiferans, ostracods), trace fossils	Algoa Basin of E. Cape is the key area for terrestrial and shallow marine biotas of the Uitenhage Group in RSA
	Kirkwood Formation (J-Kk) Late Jurassic to Early Cretaceous	Terrestrial (fluvial / lacustrine) siliciclastics	Variety of small to large dinosaurs (theropods, sauropods, ornithopods), other reptiles, Mesozoic mammals, important floras of petrified wood ("Wood Beds"), charcoals, leaves (ferns, cycads, conifers), freshwater invertebrates (bivalves, crustaceans) Shelly marine to estuarine biotas (molluscs, echinoids *etc*), microfossils (Bethelsdorp Member)	Fossil logs may be locally abundant embedded within bedrock or reworked into surface gravels, alluvium. However, the woody tissue is often poorly-preserved, precluding detailed taxonomic studies. Important plant floras including woody plant impressions, lignite, microfossils in carbonaceous shales as well as amber (fossil resin) recorded from Gamtoos Basin (McLachlan & McMillan 1976). Shelly marine to estuarine invertebrates as well as low-diversity trace fossil assemblages reported from Bethelsdorp Member (previously part of Colchester Mb) near Uitenhage (*e.g. ibid,* Almond 2012b).
	Enon Formation (Je) Late Jurassic to Early Cretaceous	Coarse alluvial fanglomerates, breccias and braided stream fluvial gravels	Rare transported bone fragments, coalified and silicified wood (Muir *et al.* 2017a).	Extensive good exposures of Enon beds on western flanks of Gamtoos River Valley require palaeontological investigation (cf Almond 2013c).

BOKKEVELD GROUP		**CERES SUBGROUP (Dc)** Early – Mid Devonian (Emsian – Eifelian)	Shallow marine siliciclastics (alternating sandstone- and mudrock-dominated formations)	Diverse shelly invertebrate biotas dominated by brachiopods, echinoderms, trilobites and molluscs (with several other minor groups), diverse trace fossils, rare fish remains (acanthodians, placoderms, sharks, bony fish) & primitive vascular plants (psilophytes, lycopods); microfossils	Rich fossil invertebrate biotas commoner in mudrock-dominated units (esp. Gydo and Voorstehoek Fms), with low diversity shelly coquinas in sandstones (Dga, Dh), while trace fossils are best preserved in heterolithic units (thin bedded sandstones and mudrocks). Rich fossil record of these units in E. Cape poorly recorded compared with W. Cape. Tectonic deformation and weathering in E Cape limit fossil collection, especially within mudrock-rich horizons The undifferentiated Ceres Subgroup outcrop areas near Humansdorp – Jeffrey's Bay and NW of PE are largely of low palaeosensitivity due to high levels of weathering and tectonic deformation. However, important shelly invertebrate faunules are recorded locally within Ceres Subgroup near Uitenhage (See Le Roux 2000, Almond 2017)
TABLE MOUNTAIN GROUP	**NARDOUW SUBGROUP**	Baviaanskloof Fm (Sb, S-Db) Early Devonian	Shallow marine "dirty" sandstones and subordinate mudrocks	Low diversity, brachiopod-dominated shelly marine faunas (also bivalves, trilobites, tentaculitids, bryozoans, gastropods, crinoids, trace fossils). Possible primitive vascular plants.	Correlated with Rietvlei Fm in western Cape Basin Early Devonian age well-established on fossil evidence. Shelly fossils in Elands Valley noted by Haughton et al. (1937).
		Skurweberg Fm (Ss) Silurian	Braided fluvial pebbly sandstones with thin subordinate mudrocks, especially in shallow marine- /estuarine- influenced parts of succession, especially towards east	Sparse marine / estuarine /?fluvial trace fossil assemblages (trilobite burrows, *Skolithos* "pipe rock", horizontal burrows) within more mudrock-rich part of succession (W. Cape)	Previously also known as the Kouga Fm (Sk)
		Goudini Fm (Sg) Early Silurian			Previously also known as the Tchando Fm (St)

	Cederberg Fm (Oc) Late Ordovician	Post-glacial mudrocks (**Soom Member**) grading up into shallow marine sandstones (**Disa Member**)	**Soom Member** with moderately diverse marine biota of various microfossils, "algae", soft-bodied and shelly invertebrates (eurypterids, trilobites, nautiloids, brachiopods *etc*), primitive jawless fish, some showing exceptional soft tissue preservation. **Disa Member** with low-diversity shelly invertebrate dominated by brachiopods, also rare molluscs, trilobites, shallow marine trace fossil assemblages	Cederberg Fm biota not recorded yet in E. Cape. Potentially fossiliferous mudrocks in E. Cape often affected by intense cleavage, shearing and chemical weathering, compromising both preservation and collection of fossil material (*cf* Almond 2017). This unit often obscured by Cape age deformation and poor exposure of mudrocks. Its development in the E. Cape is not well understood.
	Peninsula Fm (Op) Early – Late Ordovician	Fluvial sandstones, quartzites, subordinate mudrocks within thin marine / estuarine intercalations	Sparse shallow marine / coastal /estuarine to freshwater trace fossils, including eurypterid trackways, trilobite burrows	Traces mainly recorded from mudrock-rich, more marine-influenced parts of succession in W. Cape but also expected in E. Cape, at least where mudrock units have not been pinched out or sheared through Cape age tectonism.
	Sardinia Bay Formation (Os) Probably Early Ordovician or Cambrian	Deformed metasediments – conglomerates, sandstones, phyllites – of possible tidal shelf setting	Low diversity of acritarchs, questionable shallow marine trace fossils in coastal outcrop area (*Cruziana, Skolithos etc*) (Shone 1991, Gaucher & Germs 2006)	Stratigraphic boundaries of this unit uncertain. Correlated by different workers with Graafwater Fm or pre-Cape (Klipheuwel Group? Cango Group?) of W. Cape Reported trace fossils contested and well-preserved examples would be of considerable interest.
GAMTOOS GROUP **Van Staadens Fm (Nv)** **Kaan Fm (Nka)** **Kleinrivier Fm (Nk)** **Lime Bank Fm (Nl)** Probably Late Ediacaran **+ Undifferentiated Late Proterozoic (N)**		Highly deformed siliciclastic sediments, carbonates deposited in shallow marine, turbidite fan to alluvial settings	Acritarchs (organic-walled microfossils) in all formations Potential for stromatolites in carbonate rocks (Lime Bank, Kaan Fms) and vendobiontans in siliciclastic sediments (Kleinrivier, Van Staadens Fms)	Gamtoos Gp is correlated with Cango Caves Group of W. Cape. *NB* Vendobiontans recently (2008) discovered in Cango Caves Group (Groenefontein Fm.) of W. Cape

8. ASSESSMENT OF IMPACTS ON PALAEONTOLOGICAL RESOURCES

The proposed Impofu grid connection corridor is underlain by several formations of potentially fossiliferous sediments of the Gamtoos Group, Cape Supergroup, Uitenhage Group and Algoa Group (Sections 6 & 7). Combined desktop and field studies of the broader Impofu Wind Farm project area show that in practice the bedrocks and superficial sediments here are generally are of *low* palaeontological sensitivity due to high levels of bedrock deformation, fossil-poor sedimentary facies, as well as chemical weathering (Almond 2012, 2017, this study). The following palaeontological heritage assessment (based on the Aurecon standard impact assessment methodology and summarised in Table 2 below) applies to the *construction phase* of the grid connection including wind farm switching stations, Impofu collector switching station, short 132 kV overhead lines connecting the switching stations to the collector switching station, substation extension areas and any new access roads. Further significant impacts on fossil heritage during the operational and decommissioning phases of the grid connection are not anticipated so these phases are not separately assessed here.

The destruction, damage or disturbance out of context of legally-protected fossils preserved at the ground surface or below ground that may occur during construction of the grid connection entail direct *negative* impacts to palaeontological heritage resources that are confined to the development footprint and limited parts of the site (*very limited* extent). These impacts can often be effectively mitigated (*medium mitigatability*) but they are *permanent* and cannot be fully rectified (*low reversibility*). All of the sedimentary formations represented within the study area contain fossils of some sort (*e.g*. microfossils, trace fossils) but impacts on *scientifically important, well-preserved, unique or rare fossil material* that is worthy of special protection / conservation are likely to be *very rare / improbable*. Impacts of *some* sort on fossil heritage are definite but, given the general low palaeontological sensitivity of the study area, they are likely to be of *very low intensity* (Local impacts on highly-significant fossil remains – such as rare vertebrate fossils or rich plant assemblages – cannot be completely excluded). Most (but *not* all) of the fossils concerned are likely to be of widespread occurrence within the outcrop areas of the formations concerned; the probability of loss of *unique or rare* fossil heritage is therefore low (*low resource irreplaceability*). Given the extensive palaeontological field and desktop data now available for the study area between Humansdorp and NMBM, confidence levels for this assessment are rated as *high*.

As a consequence of (1) the paucity of irreplaceable, unique or rare fossil remains within the development footprint, (2) the high levels of chemical weathering in the study area, as well as (3) the extensive superficial sediment cover overlying most potentially-fossiliferous bedrocks within the grid connection study area, the overall impact significance of the construction phase of the proposed electrical infrastructure project *without mitigation* is assessed as *minor / negligible* (negative).

Should the recommended mitigation measures for the construction phase of the electrical infrastructure – as outlined in the Chance Fossil Finds Procedure (Appendix 1) - be fully implemented, the impact significance of the project is still likely to remain *minor / negligible* (negative). However, in this case any small residual impacts due to loss of fossil heritage would be partially offset by the *positive* impact represented by an improved palaeontological database for the Eastern Cape region as a direct result of appropriate mitigation. This is a *positive* outcome because any new, well-recorded and suitably curated fossil material from this palaeontologically under-recorded part of the Eastern Cape would constitute a useful addition to the scientific understanding of the fossil heritage here.

When considering the **No-Go Alternative** (*i.e.* no grid connection development), impacts on local fossil heritage would be essentially *neutral*. Without development natural weathering processes and

erosion will continue to steadily destroy fossils preserved near or at the ground surface (*negative*), but at the same time new fossils will be continually exposed (*positive*). This No-Go alternative would forgo potential improvements in the palaeontological understanding of the study region through any mitigated new fossil finds made during construction (*negative*).

Table 2: Assessment of impacts on fossil heritage resources during the construction phase of the Impofu grid connection

Project phase	**Construction**			
Impact	**Fossil heritage**			
Description of impact	**Disturbance, damage or destruction of fossils preserved at surface or below ground as consequence of clearance or excavations (e.g. for access roads, pylon foundations)**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**Safeguarding and reporting of chance fossil finds by ECO to ECPHRA. Recording and sampling of significant fossils by professional palaeontologist.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Very low	Natural and/ or social functions and/ or processes are slightly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Low	The affected environment will not be able to recover from the impact - permanently modified
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Minor			

8.1. Cumulative impacts

Palaeontological heritage assessments for several other comparable transmission line projects in the broader Humansdorp – Nelson Mandela Bay Municipality region have been reviewed (*N.B.* Specialist palaeontological impact assessments (PIAs) for several other powerline projects in the region have not been undertaken, or are not available). These include grid connections for the Gibson Bay Wind Farm (Almond 2013d) and Tsitsikamma Community Wind Farm (Almond 2012a) as well as a 66 kV powerline from Eskom's Melkhout Substation near Humansdorp to the existing main intake substation in Jeffrey's Bay (Almond 2016) a 132 kV line between Kareedouw – Dieprivier – Melkhout and Patensie (Almond 2013a, 2013b, 2013c). Note that not all these projects are of equal relevance for cumulative impact assessments since they do not all cover the same spectrum of potentially fossiliferous rock units. Furthermore, cumulative palaeontological impacts are influenced by any substantial development in the region, and not just by transmission lines or wind farms.

All the relevant transmission line PIA studies listed concur in that, with few exceptions, the palaeontological sensitivity of the Humansdorp - NMBM region is generally low as far as the bedrocks are concerned, especially because of the high levels of chemical weathering and tectonic deformation observed here in conjunction with low levels of bedrock exposure. The most significant fossil sites recorded so far are (1) marine trace fossils in the Peninsula Formation near Rosenhof (Almond 2012, 2017) in the Impofu West Wind Farm project area, (2) the Late Pleistocene hyaena den bone, tooth and coprolite assemblages within Nanaga Formation aeolianites in the Gibson Bay WEF project area and near Oyster Bay (Carrion *et al.* 2000, Nilssen & Smith 2015, Brink 2015), (3) rich fossil plant assemblages and fossil resin on the eastern bank of the Gamtoos River (McLachlan & McMillan 1976, p. 207, Section 2.7 above) as well as (4) estuarine to marine shelly invertebrates and trace fossils within the Kirkwood Formation near Uitenhage (Section 7.4 above). Cumulative impacts on fossil heritage of the proposed Impofu grid connection in the context other powerline developments in the region as well as the three Impofu Wind Farm projects are inferred to be *minor* as far as the Palaeozoic bedrocks are concerned (Almond 2017). This would also apply to impacts on sparse but locally-rich fossil heritage preserved within the coastal aeolianites and Kirkwood Formation *provided that* adequate monitoring of major excavations here (*e.g.* pylon footings, access roads) is carried out during the construction phase.

9. RECOMMENDED MONITORING AND MITIGATION (FOR INCLUSION IN ENVIRONMENTAL MANAGEMENT PROGRAMME)

Pending the potential discovery of significant new fossil remains (*e.g.* vertebrate bones and teeth, horn cores, shelly invertebrates, trace fossils, plant fossil lenses) during the construction phase of the proposed Impofu grid connection, no further specialist palaeontological studies or mitigation are recommended for this project.

Regarding two small areas of high palaeontological sensitivity recorded within the study area:

- Any bedrock excavations within the sector spanning the Kirkwood Formation cliffs on the eastern bank of the Gamtoos River (red polygon in Fig. 35) should be carefully monitored by the Environmental Control Officer for chance fossil finds such as wood and other plant material (See Appendix 1: Chance Fossil Finds Procedure);

- The outcrop area of the Bethelsdorp Member marine beds (yellow polygon in Fig. 36) to the west of Sans Souci Substation should be treated as a No-Go area.

The suitably qualified and experienced Environmental Control Officer (ECO) responsible for the transmission line development should be made aware of the potential occurrence of scientifically-important fossil remains within the development footprint. During the construction phase all major surface clearance and deeper (> 1 m) excavations operations (*e.g.* for new access roads, pylon placements, substations) should be monitored for fossil remains on an on-going basis by the ECO. Should substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ* (See Appendix 1: Chance Fossil Finds Procedure). They should then alert the Eastern Cape Provincial Heritage Resources Agency, ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za) as soon as possible. This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense. These recommendations are summarized in the tabulated Chance Fossil Finds Procedure appended to this report (Appendix 1).

The palaeontologist concerned with any mitigation work will need a valid fossil collection permit from ECPHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies developed by SAHRA (2013).

These monitoring and mitigation recommendations are to be incorporated into the Environmental Management Programme (EMPr) for the proposed Impofu grid connection project. The operational and decommissioning phases of the development are unlikely to have further significant impacts on palaeontological heritage and no additional recommendations are made in this regard (The Chance Fossil Finds Procedure still applies).

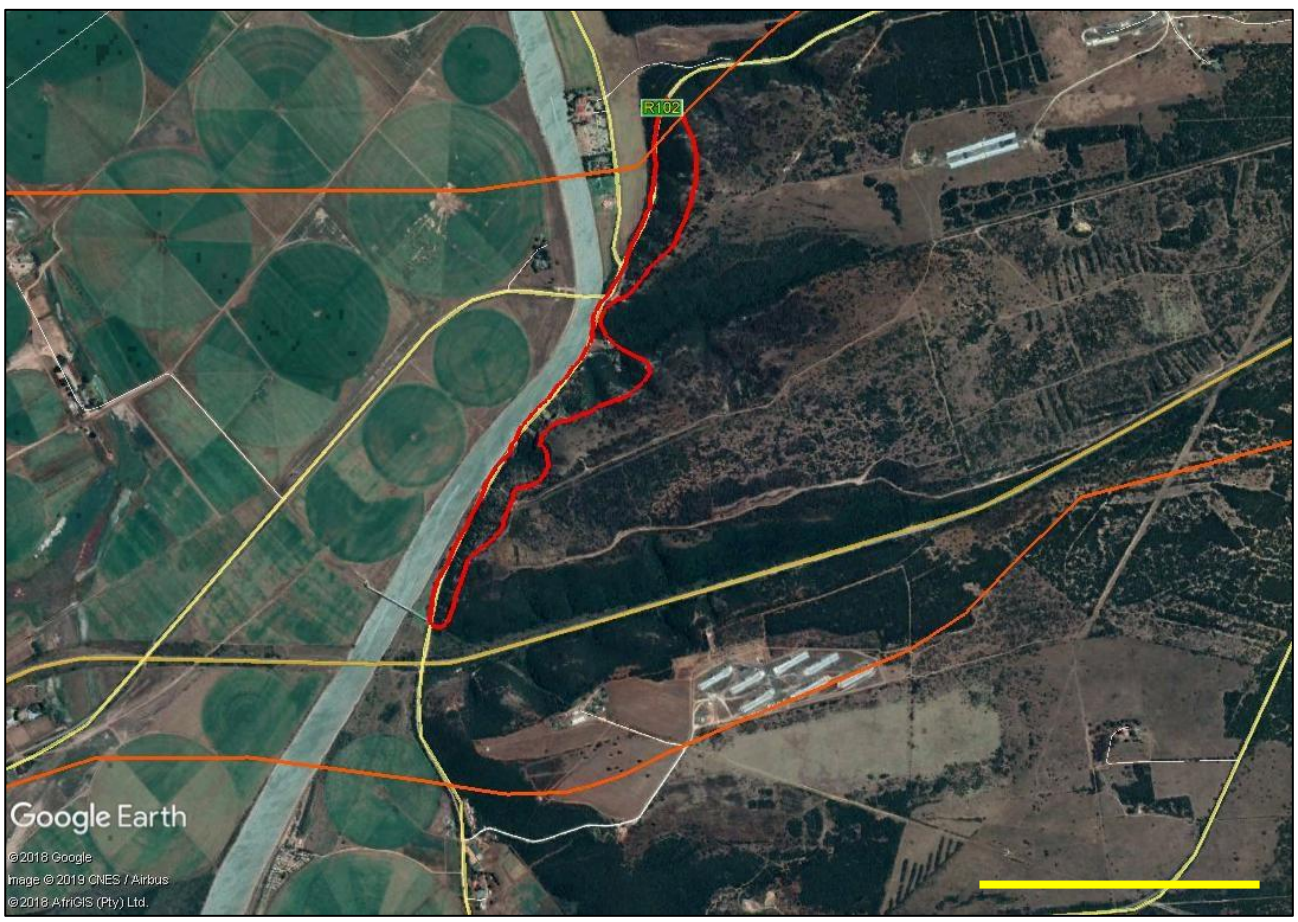


Figure 35. Google Earth© satellite image of the proposed grid connection corridor (orange polygon) showing an area of high palaeontological sensitivity (plant-rich Kirkwood Formation) exposed in steep cliffs on the eastern bank of Gamtoos River (red polygon). Any bedrock excavations in this sensitive area (*e.g.* pylon footings, access roads) should be carefully monitored for fossils by the ECO. Scale bar = 1 km.

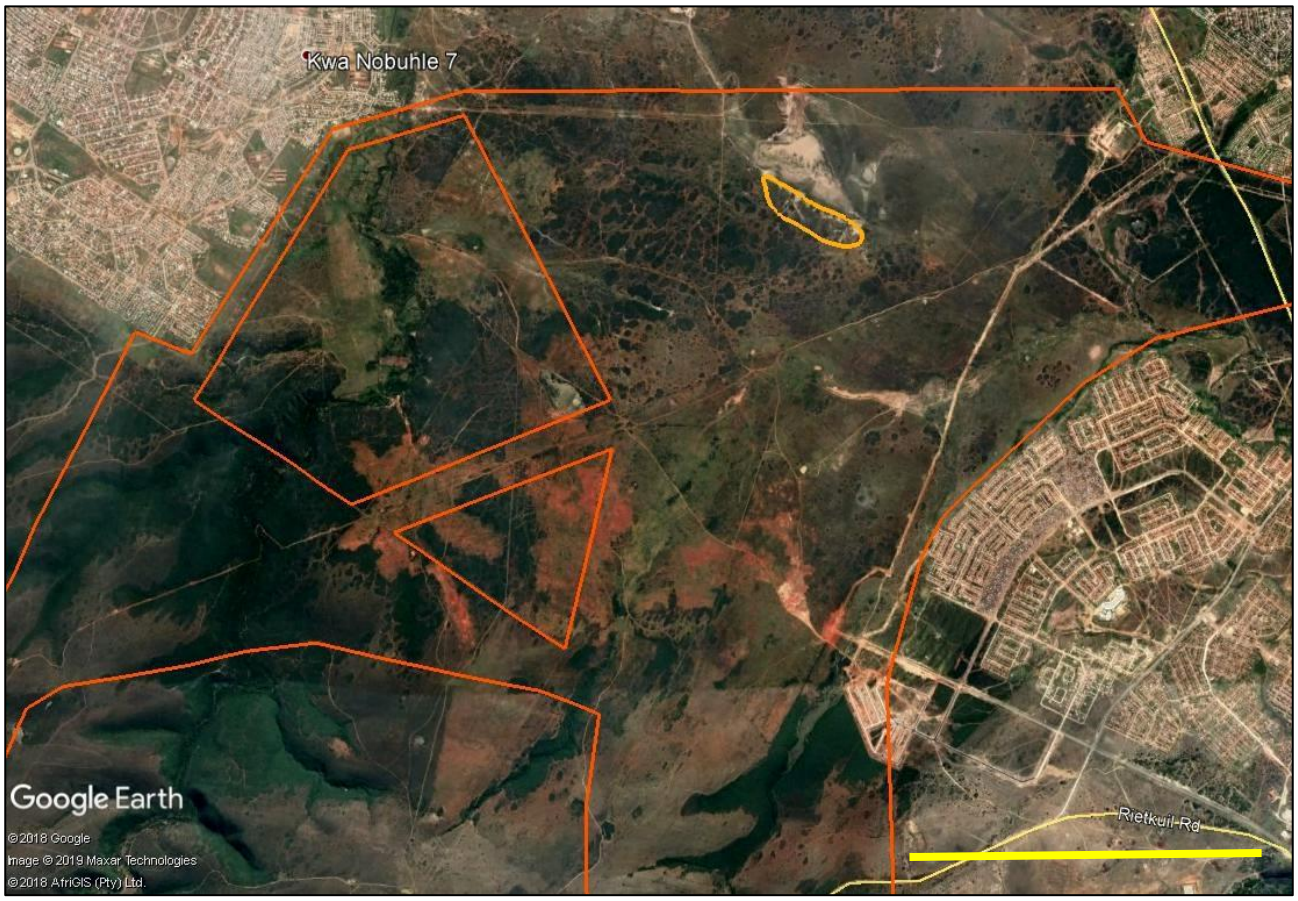


Figure 36. Google Earth© satellite image of the proposed grid connection corridor (orange polygon) showing an area of high palaeontological sensitivity (outcrop area of the fossiliferous Bethelsdorp Member) exposed along the south-western margins of a large pan *c*. 1.8 km west of Sans Souci Substation (yellow polygon). This should be treated as a No-Go area. Scale bar = 2 km.

10. CONCLUSIONS

The present palaeontological heritage basic assessment is based on several desktop and field-based studies in the Kouga region near Humansdorp and in the NMBM region as well as field studies of potentially-sensitive portions of the Impofu Wind Farms and associated 132 kV grid connection project areas (Almond 2017, this study). The proposed grid connection corridor is underlain by several formations of potentially fossiliferous sediments of the Gamtoos Group, Cape Supergroup, Uitenhage Group and Algoa Group (Sections 6 & 7, Table 1). However, on the southern coastal platform most of the fossils originally preserved in these bedrocks appear to have been destroyed by tectonic deformation and deep chemical weathering. The overlying Late Caenozoic superficial sediments such as alluvium, soils and ferricretes, are likewise of low palaeontological sensitivity. Relict patches of Plio-Pleistocene aeolianites (wind-blown sands) of the Nanaga Formation (Algoa Group) present in the subsurface on the interior coastal platform contain Early Stone Age artefacts but any associated fossils such as mammalian remains or terrestrial gastropods have probably been destroyed by weathering here. It is concluded that the great majority of the study area is in effect of LOW palaeontological sensitivity.

During the present study only two small areas of high palaeontological sensitivity have been identified within the grid connection study area: (1) steep cliff exposures of the Early Cretaceous Kirkwood Formation along the eastern banks of the Gamtoos River that are rich in fossil plant

material, and (2) low fossiliferous scarp exposures of the Late Jurassic Bethelsdorp Member (lower Kirkwood Formation) along a pan margin some 1.8 km west of Sans Souci Substation (See polygons annotated on Figs. 35 & 36). It is recommended that any excavations within the first area are carefully monitored for fossils by the ECO (See Appendix 1: Chance Fossil Finds Procedure) while the latter should be treated as a No-Go area for development.

Potential impacts to fossil heritage resources within the proposed grid connection corridor involve the disturbance, damage or destruction of fossil material within the development footprint during the construction phase. Due to the rarity of well-preserved, unique fossils of potential scientific importance within the study area, potential impacts on palaeontological heritage during the construction phase are assessed as of *negligible (negative) significance* (both before and after mitigation). The No-Go alternative (*i.e.* no grid connection) will have a neutral impact on palaeontological heritage. Cumulative impacts posed by the grid connection and associated electrical infrastructure developments are inferred to be *minor*. This also applies to cumulative impacts from other approved or proposed transmission line developments in the region. Confidence levels for this assessment are high due to comparatively good field data available for the study region.

Pending the potential discovery of significant new fossil remains during the construction phase of the proposed Impofu grid connection, no further specialist palaeontological studies or mitigation are recommended for this project in the construction phase.

There are no fatal flaws to the proposed electrical infrastructure project as far as fossil heritage is concerned. Providing that the Chance Fossil Finds Procedure outlined below and tabulated in Appendix 1 is followed through, there are no objections on palaeontological heritage grounds to authorisation of the proposed Impofu grid connection (including the proposed 132 kV overhead powerline, substation extension areas, proposed Impofu collector switching station, three wind farm switching stations and short 132 kV overhead transmission lines connecting these).

The suitably qualified and experienced ECO responsible for the electrical infrastructure development construction phase, should be made aware of the potential occurrence of scientifically-important fossil remains within the development footprint. During the construction phase all major clearance operations (*e.g.* for new access roads, pylon placements) and deeper (> 1 m) excavations should be monitored for fossil remains on an on-going basis by the ECO. Should substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the Eastern Cape Provincial Heritage Resources Agency, ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za) as soon as possible. This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense. These recommendations are summarized in the tabulated Chance Fossil Finds Procedure appended to this report (Appendix 1).

The palaeontologist concerned with any mitigation work will need a valid fossil collection permit from ECPHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies developed by SAHRA (2013).

These monitoring and mitigation recommendations are to be incorporated into the Environmental Management Programme (EMPr) for the proposed Impofu grid connection. The operational and

decommissioning phases of this development are unlikely to have further significant impacts on palaeontological heritage and no additional recommendations are made in this regard (The Chance Fossil Finds Procedure still applies).

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13. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

<table>
<tr><td colspan="3">APPENDIX 1: CHANCE FOSSIL FINDS PROCEDURE: Impofu 132 kV Grid Connection between Impofu Wind Farms near Humansdorp & NMBM</td></tr>
<tr><td>Province & region:</td><td colspan="2">EASTERN CAPE, Humansdorp, Hankey & Uitenhage Districts</td></tr>
<tr><td>Responsible Heritage Resources Authority</td><td colspan="2">ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za)</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Kirkwood Formation (including Bethelsdorp Member)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Shelly marine invertebrates, trace fossils, plant compressions, petrified wood, amber.</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.</td></tr>
</table>

APPENDIX 2

All GPS readings were taken in the field using a hand-held Garmin GPS map 62sc instrument. The datum used is WGS 84.

LOC.	GPS DATA	COMMENTS
001	33 59 27.2 S 24 55 59.4 E	Road cutting just E of Kabeljousrivier. Highly-weathered, pale mottled orange-hued siltstone, massive – possibly a silty interval within the Enon Formation Capped by well-rounded, quartzitic pebbles and cobbles (latter mapped as Blue Water Bay Fm)
002	33 58 44.8 S 24 54 07.4 E	Large roadside quarry west of Meuleplaas excavated into Enon Formation. Massive pale grey, pebbly to cobbly clast-supported quartzitic conglomerates with numerous weathered, pale orange to grey horizons and lenses of siltstone as well as cross-bedded sandstone. Occasional matrix-supported conglomerate horizons with polished quartzite pebbles. Minor clasts of siltstone and sandstone. Local development of pebble imbrication. Succession flat to gently southwards-dipping. Probably faulted. Bedrocks mantled by ferrruginised downwasted surface gravels (possibly related to "Bluewater Bay Formation").
003	33 57 06.3 S 24 56 22.4 E	Large working quarry N of Vlakteplaas homestead. Extensive exposure through thick succession of gently-dipping Enon Formation conglomerates. Thick (sev. m) packages of grey, clast-supported pebbly to cobbly conglomerates with pale grey weathered siltstone and sandstone interbeds, some clearly lenticular channel infills. Capped (variously gradational to sharp contact) by several meters of dark brown, ferruginised surface gravels, unconsolidated but locally well-calcretised with indurated sandy cement, occasional ferricretised gravels. Surface gravels possibly related to "Bluewater Bay Formation". No evidence for basal shelly gravels of Alexandria Formation.
004	33 57 04.5 S 24 56 22.7 E	Vlakteplaas Quarry – semi-consolidated upper brown-weathering gravels along N margin with matrix of grit, fine gravel and soil. Cobbles with rusty patina. Curious pelleted ferricrete (?) fabric between cobbles. No fossil oysters or other shells.
005	33 56 40.2 S 24 56 32.5 E	Views of flat terrain on floor of wide Gamtoos River Valley. Mantled with alluvial sands and quartzitic gravels.
006	33 55 59.0 S 24 57 46.7 E	Roadside quarry between Mondplaas and Green Acres excavated into Enon Fomation conglomerates. Weathered orange and pale grey-mottled siltstone interval on floor of quarry (Uitenhage Group or *possibly* underlying Ceres Subgroup). Vertical section through alluvial gravels and sands at western end of quarry.
007	33 56 01.7 S 24 58 32.9 E	Roadside borrow pit along powerline near Rustig farmstead exposing several meters of orange-hued, semi-consolidated, massive, well-sorted sands with occasional larger lonestones. Probably weathered Nanaga Formation aeolianites rather than alluvium.
009	33 55 20.6 S 25 01 30.2 E	Views of steep Kirkwood Formation cliffs along eastern banks of Gamtoos River, between old road bridge and newer N2 bridge to the south. Roadside trench cuts down into Gamtoos sandy alluvial deposits with pebbly lenses.
010	33 55 21,0 S 25 01 40.2 E	Steep riverine cliff exposures of the Kirkwood Formation along the eastern bank of the Gamtoos River close to old road bridge. Thick pale grey-green to orange-hued, erosive-based channel sandstones towards base of exposed succession not pebbly except for thin intraclast horizons towards base. Interbedded thinner sandstones and pale, weathered overbank mudrocks higher up within succession. Sandstones locally cross-bedded and honeycomb-weathered (*i.e.* possibly sl. calcareous).
011	33 55 16.8 S 25 01 42.8 E	Roadside fallen blocks of Kirkwood Fm channel sandstone with abundant ferruginised moulds of woody plant material, including highly-comminuted plant debris / hash. Overbank mudrocks beneath base of major channel sandstone are highly-weathered, kaolinitised, with lenticular sandstone interbeds.
012	33 55 18.8 S 25 01 42.0 E	Base of major Kirkwood channel sandstone package with multiple thin, lenticular horizons of plant debris moulds between or within lowermost sandstone units as well as several horizons – at channel base and higher up - of poorly-sorted, pale grey mudrock and sandstone intraclast breccio-conglomerates (reworked consolidated channel bank material) with sparse cobbly quartzite extrabasinal clasts (breccias *c*. 20 cm thick). Highly-weathered overbank mudrocks beneath channel sandstone package, with occasional fresher-looking purple-grey siltstone lenses.
013	33 55 20.1 S 25 01 41.7 E	Roadside fallen blocks of Kirkwood Fm channel sandstone with abundant ferruginised moulds of woody plant material.
014	33 55 30.5 S 25 01 34.8 E	Locally gullied base of cross-bedded major channel sandstones as well as well-developed intraformational breccio-conglomerates with occasional exotic quartzite clasts at base and margins of channel sandstone bodies. Chemical and solution weathering of sandstones expressed as Liesegang rings and honeycomb-weathered surfaces. Good channel cut-and-fill sections (axes E-W, presumably along basin axis). Possible soft-sediment deformation within overbank siltstones to the south.

018	33 54 58.0 S 25 05 08.1 E	Sand mine NE of Lemoenfontein. Cut face exposures through foresets of orange-hued, semi-consolidated aeolian sand dunes of Nanaga Formation. No ferricretes or quartzite lonestones seen.
021	33 54 11.4 S 25 05 22.2 E	Long R102 road cuttings *c*. 4.5 km WSW of Thornhill. Intercalated, weathered channel sandstones and overbank mudrocks of the Kirkwood Fm, dipping towards the NE. Mudrocks with occasional polished pebble lonestones, orange-hued and pale mottled. Upper part of section secondarily ferruginised, with ferricrete development. Bedrocks overlain by pebbly horizon and brown soils.
022	33 54 13.3 S 25 05 41.9 E	R102 road cuttings through Kirkwood Formation *c*. 4 km WSW of Thornhill. Thick channel sandstone packages, locally thin-bedded, with minor, highly-weathered, kaolinitised overbank mudrocks. Succession dips to northwest. Eastern end of cuttings show coarse, rubbly breccio-conglomerate facies (oligomict, quartzite clasts) with sandstone interbeds (upward-fining units). Possibly developed proximal to basin-edge fault line and may interfinger north-westwards with, and/or underlie, channel sandstone and mudrock facies further into basin. Uitenhage Group succession overlain by diamictite-like matrix-supported pebbly sandstones, pebble lenses and dark orange-hued Nanaga Fm aeolianites; these younger deposits may infill a palaeo-gulley within the Uitenhage Group bedrocks.
023	33 54 15.8 S 25 06 19.9 E	*c.* 3.3. km WSW of Thornhill, R102 road cutting through rubbly grey breccio-conglomerates – possibly marginal facies of Uitenhage Group in Gamtoos Basin. Alternatively this is the basal conglomeratic unit of the Sardinia Bay Formation (and Table Mountain Group, younging to the NE in this area).
024	33 54 38.1 S 25 10 54.0 E	R102 road cuttings through Sardinia Bay Formation (basal Table Mountain Group) *c*. 1.3 km west of Van Stadensrivier. Pale grey, weathered, prominently cross-bedded quartzites, medium-bedded, tabular, medium- to thick-bedded. Thicker beds closely jointed (possibly spaced cleavage).
025	33 54 39.4 S 25 11 00.8 E	R102 long road cuttings through Sardinia Bay Formation *c*. 1.0 km west of Van Stadensrivier. Darker grey "phyllitic" mudrock interbeds between subordinate channel sandstone packages. Beds dip steeply to SW, tabular bedding planes flat to undulose, brittle, well-jointed, local development of boudinage in sandstones / quartzites. Vague ripple marks on some upper bedding plane surfaces.
026	33 54 37.7 S 25 11 06.2 E	R102 long road cuttings through Sardinia Bay Formation *c*. 950 m west of Van Stadensrivier. Steeply dipping packages of medium to thin-bedded tabular wackes intercalated with phyllitic pelitic packages. Well-developed tabular cross-bedding within wackes. Some highly tabular wackes and heterolithic packages reminiscent of turbidite fan facies (but not tabular cross-sets). Generally moderate to high levels of tectonic deformation, especially of politic units, with development of major quartz veins locally.
027	33 54 36.8 S 25 11 34.9 E	R102 road cutting through thick-bedded, cross-bedded quartzites of Peninsula Fm *c*. 240 m NW of Van Stadensrivier, close to lower contact with Sardinia Bay Formation.
029	33 54 47.9 S 25 12 12.9 E	R102 road cutting (*c*. 800 m east of Van Standensrivier) through thin- to medium-bedded quartzites of the Peninsula Formation showing generally high levels of deformation (folding, fracturing).
030	33 50 45.1 S 25 26 17.7 E	Trench near NW margin of Booysen Park new development showing section through dark orange-brown sandy soils overlying pale fine gravelly material – *possibly* reworked calcrete and Kirkwood Formation mudrock.
031	33 50 37.6 S 25 26 19.4 E	Trench close to SE edge of Kakkerlaksvlei exposing pale brownish sandy soils overlain by grey soil with dispersed quartzite cobbles (brown-patinated).
032	33 50 32.2 S 25 26 12.7 E	Kakkerlaksvlei – dried up *vlei* with sandy to silty, pale grey soils and sparse surface gravels (vein quartz, quartzite, calcrete). Low banks of poorly-sorted alluvial sands and gravels; clasts of weathered / etched TMG quartzite, sandstone, vein quartz, reworked calcrete - angular to subrounded, occasional rounded pebbles and cobbles. Patchy exposures of well-developed vuggy to solid cream- to slightly pinkish coloured calcrete hardpan along pan margins, locally with enclosed pebbles.
034	33 49 53.6 S 25 25 41.0 E	Bethelsdorp Member (Kirkwood Fm) low scarp exposures along SW edge of large pan. Prominent-weathering, tabular, laminated sandstone blocks with low diversity trace fossil assemblages dominated by 4-6 mm wide horizontal, unbranched cylindrical burrows preserved in positive or negative relief, on bedding planes or endichnially. Some infilled burrows retain faint meniscate backfill.
035	33 49 55.1 S 25 25 47.5 E	Several large collapsed or downwasted blocks of Bethelsdorp Member tabular sandstone with well-preserved cylindrical trace fossils on bedding planes (5-6 mm wide). Burrows visible from above within upper part of *in situ* sandstone bed. Branching of burrows is probably only apparent. Faint traces of relict meniscate backfill in positive relief burrows.
037	33 49 57.1 S 25 25 50.0 E	Two closely-spaced tabular sandstones (up to 50 cm thick) within Bethelsdorp Formation – possibly successive deepening cycles. Poorly-preserved vertical to oblique burrows at base of, and within, upper, orange-hued laminated sandstone.
038	33 49 59.9 S 25 25 57.6 E	Small (3-6 cm) oblate and prolate, blackish-brown sphaeroidal concretions, possibly of ferruginous carbonate, weathered out of Bethelsdorp Formation. Some preserve traces of burrows on surface.
039	33 50 02.2 S 25 26 01.2 E	Subtly colour-banded estuarine mudrocks of Bethelsdorp Member.

216	33 52 34.8 S 25 25 21.2 E	Bloemendal A/A, extensive inactive gravel road material quarrying area just N. of R368 Stanford Road. Excavated into weathered, locally ferruginised, well-jointed, highly fractured, cross-bedded Skurweberg Formation quartzites and sandstones (Table Mountain Group). Quartzites dip south and truncated by flat, gravelly pediment surface at *c*. 200 m amsl., with deeply incised valley just to N (Northern edge of coastal platform; see Hattingh (2001) Fig. 3.1). Bedrocks overlain by angular, rubbly quartzite regolith (0.5 m), subangular to well-rounded, purple-brown silcrete-patinated and ferricrete gravels and grey-brown soils with suspended gravels (up to 2 m).
217	33 52 13.3 S 25 25 54.9 E	Bloemendal A/A. Hillslope exposure of steeply S-dipping, pale-grey, mature, thick-bedded Skurweberg Fm quartzites showing conchoidal fracture, low angle tabular cross-bedding.
218	33 51 48.2 S 25 26 13.6 E	Bloemendal A/A. Extensive shallow borrow pit for mudrock road material N of R368 Stanford road. Excavated into pale grey to pinkish-hued, cleaved, deeply-weathered, locally ferruginised mudrocks mapped as Ceres Subgroup (Lower Bokkeveld Group). Bedrocks truncated by pediment surface and mantled by well-consolidated pediment gravels of subangular to well-rounded TMG quartzite clasts, schistose sandstone, cleaved Bokkeveld mudrock. These consolidated, clast- to matrix-supported gravels up to several m thick and now assigned to the Early Tertiary (probably Eocene) Damascus Formation (Hattingh 2001) but previously mapped as Enon Formation. Pale grey to pinkish diamictite of weathered Bokkeveld mudrock slurry with suspended blocks of weathered mudrock, reworked quartizitic pebbles probably represent debris flow deposits (debrits).
219	33 51 56.7 S 25 26 17.6 E	Road cutting along R368 Stanford Road transecting gravels of Damascus Formation covered by brown soils. Clasts of subangular to well-rounded quartzite, sandstone.
220	33 51 51.4 S 25 26 31.1 E	Erosion gulley exposure N of R358 near Chatty, Damascus. Damascus Fm colluvial gravels overlying deeply-weathered silty to sandy colluvial deposits with ferruginous mottling, 3D polygonal network of pale veins and ridges, sparse, dispersed, angular quartzitic grits and gravels. Overlain by grey-brown soils and surface graveks.
221	33 51 53.3 S 25 26 38.8 E	Hillslopes *c*. 100 m south of R368. Silcretised proximal debris flow gravels at top of Early Tertiary Damascus Formation alluvial fans in type area of formation (see Hattingh 2001 Fig. 3.1 and pp. 27-29). Silcretised gravel breccio-conglomerates several meters thick, poorly-sorted, rubbly, crudely-bedded, matrix- to clast-supported, locally ferruginous. Angular to subrounded lasts of TMG quartzite. Sandstone lenses cross-bedded.
222	33 51 27.2 S 25 26 14.1 E	Trench exposure of thick (> 1.5 m) orange-brown, sparsely pebbly soils overlying Kirkwood Fm
223	33 50 46.9 S 25 25 49.4 E	Small pan surrounded by orange-brown soils, sparse downwasted quartzitic surface gravels and pebbly to cobbly calcrete nodules. Calcrete hardpan developed beneath modern soils. Occasional patches of concentrated surface gravels in region as well as gravel lenses beneath soils exposed in erosion gullies – brown, grey and purplish quartzite, vein quartz and reworked Pleistocene calcrete clasts, some moderately to well-rounded.
223a	33 50 32.7 S 25 25 00.0 E	Kakkerlaks Vley 400. Large shallow pan or vlei (Kakkerlaksvlei). Marginal exposures of well-developed calcrete hardpan beneath surface orange-brown soils and gravels. Grey-brown silty soils with sparse gravels within pan itself (some flaked quartzite clasts).
224	33 50 33.6 S 25 24 23.0 E	Klipkuil valley, SE of Kwa-Nobuhle. Deep *donga* incision downstream of dam exposing several meter thickness of pebbly alluvial gravels and orange-brown, silty to sandy soils with sparse quartzite and calcrete clasts. Weathered Kirkwood or Bokkeveld greenish mudstone bedrock at base of erosion gulley.
225	33 50 31.8 S 25 24 23.3 E	Klipkuil valley, SE of Kwa-Nobuhle. Extensive, thick and well-exposed, NW-facing cliff section through gently dipping, pale grey-green, greenish and pinkish silty overbank mudrocks and lenticular channel sandstones of Kirkwood Formation. Channel sandstones yellowish-brown, up to few m thick, lenticular in geometry (contrast highly tabular sandstones of Bethelsdorp Member), sharp-based, not pebbly, deeply-weathered. Mudrocks contain dispersed polished sandstone pebbles typical of Kirkwood debrites. Ledge of younger, gently-dipping, sparsely-gravelly Caenozoic alluvium abuts against Kirkwood cliff locally.
226	33 50 24.1 S 25 24 27.0 E	Weathered, crumbly and cracked cliff exposure of grey-green Kirkwood Fm mudrocks near Klipkuil pond.
227	33 50 29.2 S 25 24 29.8 E	Stream gullies with boulder- and cobble-sized clasts of TMG quartzite and greenish Kirkwood sandstone (up to > 1m across), calcrete – downwasted High Level Gravels related to Damascus Formation (Hattingh 2001, Fig. 3.1). Some boulders well-rounded. Mantled by orange-brown soils.
228	33 48 56.0 S 25 26 34.4 E	R368 road cuttings between Campher Park & Khayamnandi. Pinkish-brown weathered Kirkwood overbank mudrocks with capping of alluvial gravels (well-rounded TMG pebbles, quartzite), brown soils Gravel-based channel cut-and-fill structures incising Kirkwood bedrocks.
230	33 48 43.5 S 25 25 28.2 E	Industrial Park area, large flooded quarry (previous brick pit). Extensive quarry margin low cliff exposures through grey-green, blue-grey, orange, cream and pink-hued, subordinate, subhorizontal to gently-dipping Kirkwood overbank mudrocks ("variegated marls") and thin grey-green channel sandstones. Near-surface calcretes with complex crystalline network fabric (possibly replacement after gypsum).

231	33 48 56.3 S 25 25 27.7 E	As above. High levels of invertebrate bioturbation of thin (10-30 cm) lenticular, grey-green channel sandstones. Ill-defined vertical burrows at channel sandstone base, *plus* networks of open or sand-infilled cylindrical endichnial burrows (*c*. 5 mm wide).
232	33 49 09.7 S 25 25 18.4 E	Low cliffs of Kirkwood Fm mudrocks to south of main abandoned brick quarry.
233	33 49 11.0 S 25 25 22.3 E	Cliff exposures of Kirkwood Fm colour-banded overbank mudrocks with intensely bioturbated thin, lenticular, vuggy channel sandstones. Dense network of intersecting, irregular subcylindrical burrows (open and cast in sand).
234	33 49 14.2 S 25 25 21.2 E	Sandy alluvium overlain by pale brown soils. Shallow streams with pebbly alluvial gravels.
235	33 49 52.2 S 25 25 42.1 E	Large pan or quarry area 1.8 km west of electrical substation, due N of Kakkerlaksvlei. Extensive low cliff exposures of flat-lying to gently-dipping marine-influenced (possibly estuarine) sediments of the Bethelsdorp Member (previously Colchester Member; Muir *et al.* 2017) of the Kirkwood Formation along SW margins of the pan. Pale grey to grey-green overbank mudrocks with occasional yellowish sandier zones and thin (few dm), prominent-weathering, highly-tabular, horizontally-laminated or occasionally wavy-rippled , non-pebbly, medium-grained, buff sandstones (may be dark brown-weathering or show calcareous honeycomb weathering), up to 40 cm thick. Large (sev. dm wide), cracked sphaeroidal, rusty-brown ferruginous carbonate concretions low down in exposed succession. Occasional highly-polished grey quartzite pebbles within overbank mudrocks. Mesozoic bedrocks overlain by orange-brown sandy soils.
236	33 49 56.6 S 25 25 48.9 E	Good steep scarp exposures of Bethelsdorp Member succession with numerous fallen blocks of tabular sandstone facies (up to *c*. 50 cm thick). Well-exposed cushion-shaped to sphaeroidal ferruginous carbonate concretions (30-40 cm diam.). Also pale flattened, irregular-shaped, greyish concretions within mudrock – probably calcareous (show possible solution weathering); form major component of locally-derived scree gravels. Capped by orange-brown sandy soils (*cf* Nanaga Fm). Apparently branching endichnial burrows with longitudinally bilobate bases (*c*. 1 cm wide). Bethelsdorp succession dips gently to N.
237	33 49 57.6 S 25 25 48.5 E	Narrow south-directed erosion gulley incising Bethelsdorp Member deposits with good exposures of stratigraphy (possibly 2-3 successive upward-shallowing and –coarsening cycles: basal yellowish sandy zone, thick package of grey to grey-green silty mudrocks with large sphaeroidal ferruginous carbonate concretions towards the top, upper yellowish unconsolidated sandy horizon, prominent-weathering tabular sandstone towards top of exposed succession. *N.B.* Absence of lenticular channel sandstones, palaeosols, lilac and orange variegated mudrocks of terrestrial Kirkwood facies, presence of large ferruginous concretions, tabular laminated sandstones, shelly horizons). Laterally-persistent horizon low down in grey-green silty succession (but above ferruginous concretion horizon) with loose small oyster shells as well as oysters encrusting subrounded grey quartzite pebbles - possibly a form of *Amphidonte* (*Ceratostreon*). Weathering-out lenses of thin-shelled bivalve *Placunopsis* - most specimens fragmentary but a few intact and articulated specimens also present – and occasional disarticulated spines of regular echinoid *Cidaris*, possible encrusting spirorbid tubes on pebbles (*cf* McLachlan & McMillan 1976). Shelly material possibly concentrated on seabed by winnowing.
238	33 49 59.5 S 25 25 49.8 E	Cracking silty mudrocks of Bethelsdorp member with thin, brittle ferruginous mineral plates. Abundant small lenticles of pale creamy concretionary material – possibly carbonate – weathering out as scree gravels.
239	33 49 56.9 S 25 25 46.6 E	Western occurrence of shelly and pebbly horizon within Bethelsdorp Member. Possible encrusting spirorbid tubes on pebbles
240	33 50 02.7 S 25 26 02.5 E	Low scarp exposures of grey silty beds of Bethelsdorp Member at SE end of vlei. Occasional isolated fossil oyster shells, oyster-encrusted quartzite pebbles and cobbles.
241	33 49 34.7 S 25 25 45.6 E	Gulley and low cliff exposures of continental Kirkwood facies with variegated mudrocks, including pinkish and lilac hues, highly polished grey quartzite lone stone pebbles. Occasional washed-out elongate-subcylindrical calcrete structures (c. 2 cm wide) – possibly infilled burrows or rhizoliths (age unclear – possibly Late Caenozoic – occur *in situ* close to modern land surface).

Annexure D8

Visual Impact Assessment

Proposed Impofu Grid Connection

Eastern Cape Province

for

Red Cap Impofu (Pty) Ltd

Visual Basic Assessment

July 2019

Prepared for

Aurecon South Africa (Pty) Ltd

Prepared by

Quinton Lawson, Architect

in association with

Bernard Oberholzer, Landscape Architect

NEMA requirements for Specialist Reports		
	Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended	**Section**
1 (1)(a)	(i) the specialist who prepared the report; and	Page 3
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 4
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA)	an indication of the quality and age of the base data used for the specialist report;	Section 3
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 12
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 2
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 11 and 12
(g)	an identification of any areas to be avoided, including buffers;	Section 9
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Maps 4 and 5
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Section 14
(k)	any mitigation measures for inclusion in the EMPr;	Sections 12 and 13
(l)	any conditions for inclusion in the environmental authorisation;	Sections 13
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 13
(n)	a reasoned opinion-	Sections 12 and 14
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Refer to EAP
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to EAP
(q)	any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

Visual Specialists

The Visual Impact Assessment (VIA) was prepared by the following:

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Expertise

Bernard Oberholzer has a Bachelor of Architecture (UCT) and Master of Landscape Architecture (U. of Pennsylvania), and has more than 20 years' experience in undertaking visual impact assessments. He has presented papers on *Visual and Aesthetic Assessment Techniques*, and is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared for the Dept. of Environmental Affairs and Development Planning, Provincial Government of the Western Cape, 2005.

Quinton Lawson has a Bachelor of Architecture Degree (Natal) and has more than 10 years' experience in visual assessments, specializing in 3D modeling and visual simulations. He has previously lectured on visual simulation techniques in the Master of Landscape Architecture Programme at UCT.

The authors have been involved in visual assessments for a wide range of residential, industrial and renewable energy projects. They prepared the 'Landscape/Visual Assessment' report for the *National Wind and Solar PV Strategic Environmental Assessment*, as well as the *National Electricity Grid Infrastructure SEA* in association with the CSIR, for the Department of Environmental Affairs in 2014-2015.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number: NEAS Reference Number:	12/12/20/ or 12/9/11/L
	DEA/EIA

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013.

PROJECT TITLE

Proposed Impofu Grid Infrastructure, Eastern Cape: Visual Assessment

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4.2 The specialist appointed in terms of the Regulations_

We, Quinton Lawson and Bernard Oberholzer declare that --

General declaration:

We act as the independent specialists in this application;
We will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
We declare that there are no circumstances that may compromise our objectivity in performing such work;
We have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
We will comply with the Act, Regulations and all other applicable legislation;
We have no, and will not engage in, conflicting interests in the undertaking of the activity;
We undertake to disclose to the applicant and the competent authority all material information in our possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by us for submission to the competent authority;
all the particulars furnished by us in this form are true and correct; and
We realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signatures of the specialists:

Quinton Lawson, Architect and Bernard Oberholzer, Landscape Architect
Name of company (if applicable):

30 July 2019
Date:

Contents

Tables

Figures

Maps

1 Purpose and Scope of the Study

The Impofu Grid Connection is the proposed transmission line serving the three proposed Impofu wind farms being assessed near Oyster Bay in the Eastern Cape. The grid connection will consist of a 132kV transmission line between the switching stations of the proposed wind farms and the Nelson Mandela Bay Municipality's Chatty substation to the east.

The visual assessment forms part of the larger Basic Assessment being prepared by Aurecon. The scope of the visual assessment includes the following phases:

1. A screening phase, including a desktop study and field work to determine no-go and sensitive areas. As well as alternative power line routes to determine a preferred route in 2017;
2. A visual impact assessment of the grid connection, for inclusion in the Basic Assessment Report (BAR).

2 Visual Assessment Methodology

The methodology involves a number of standard procedures including those in the Guideline for Involving Visual and Aesthetic Specialists (Oberholzer, 2015):

- Quantify and assess the existing scenic resources/visual characteristics along the transmission line route, including a photographic survey.
- Determine view corridors and important viewpoints in order to assess the visual influence of the proposed project.
- Determine visual issues, including those identified in the public participation process.
- Review the legal framework that may have implications for visual / scenic resources.
- Assess the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project.
- Identify possible mitigation measures to reduce negative visual impacts for inclusion into the project design, including input into the Environmental Management Plan.
- Determine any cumulative visual impacts in relation to the proposed grid connection.

3 Sources of Information

The main sources of information for the visual assessment included the following:

- 1:2 000 000 Geological map of South Africa, Council for Geoscience, 2008.
- 1:250 000 and 1:50 000 topographical maps of South Africa, Surveys and Mapping.
- Google Earth satellite imagery, 2018.

Other sources of information are listed in the references.

4 Site Investigation

A visit to the Impofu project site (comprising the Impofu North, East and West Wind Farm areas) and grid corridor, including a photographic survey, was carried out on 27 and 28 September 2017, and again on 24 July 2019. The context and route taken on the field trip are indicated on Maps 1 and 2. The season was not a consideration, nor has any major effect for carrying out a visual assessment.

5 Assumptions and Uncertainties

A range of six pylon types of varying heights for a 132kV transmission line has been provided by the Developer, all of which may occur on the route. It is unknown where each pylon type will be used along the route, although it is unlikely that option 6 (lattice structure) will be used unless it is specifically requested by the landowner or is required to structurally span a longer distance. Following on from a detailed screening study, inclusive of a multi-criteria decision making (MCDM) workshop, only one preferred route for the transmission line was provided for assessment, and falls within a 2km corridor.

6 Regulatory Framework

The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA (Act No. 107 of 1998), and NEMA EIA Regulations (2014), as amended, apply as the proposed wind energy facility is a listed activity requiring a scoping study and EIA. The need for a visual assessment has been identified.

The National Heritage Resources Act (NHRA) (Act No. 25 of 1999), provide legislative protection for natural, cultural and scenic resources. This report deals with visual considerations, while archaeological, paleontological and historical sites are covered by the heritage specialists.

The 'Guideline for Involving Visual and Aesthetic Specialists' issued by DEA&DP, Provincial Government of the Western Cape, was followed in the absence of a similar guide for the Eastern Cape.

7 Description of the Project

The grid connection involves a 132kV overhead powerline between the three proposed Impofu wind farms and Port Elizabeth in the east, over a distance of some 120 km. According to the description provided by Aurecon (March 2018), each of the three switching stations for the proposed wind farms will be connected to a central collector switching station by means of a 132kV line.

From the central switching station, a single 132kV power line connects to the Eskom Melkhout Substation north of Humansdorp and thereafter crosses the broad Gamtoos River Valley, as well as the van Stadens River inland, entering the Nelson Mandela Bay Municipal area via the Sans Souci Substation and ending at the Chatty Substation, (see Maps 1 and 2).

The substations for each of the three wind farms form part of the separate wind farm visual impact assessments, while the switching stations form part of the current grid connection assessment.

The main feature in terms of the visual assessment will be the pylons supporting the high voltage overhead line. The type and spacing of the pylons depend on the topography and alignment of the line.

Examples of the pylons, and their relative visibility at a range of distances, are given in Figure *1* and Figure *2* below. A full list of proposed infrastructure facilities is given in Table *1* below.

Figure 1: Illustration of monopole pylons at a range of distances

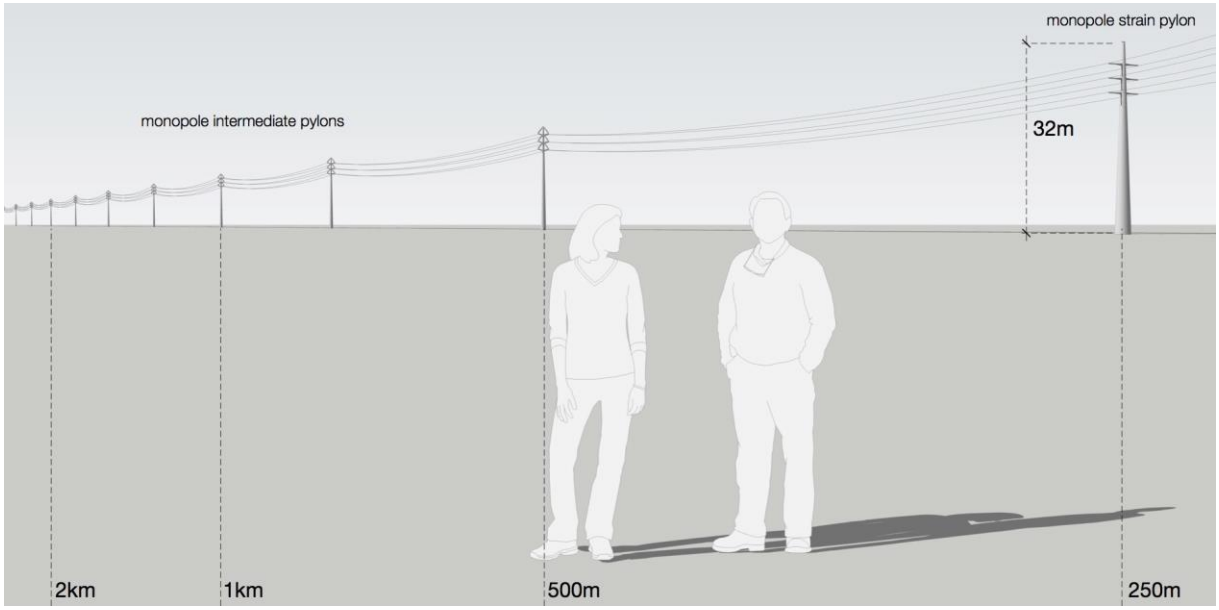

Figure 2: Illustration of lattice pylons at a range of distances

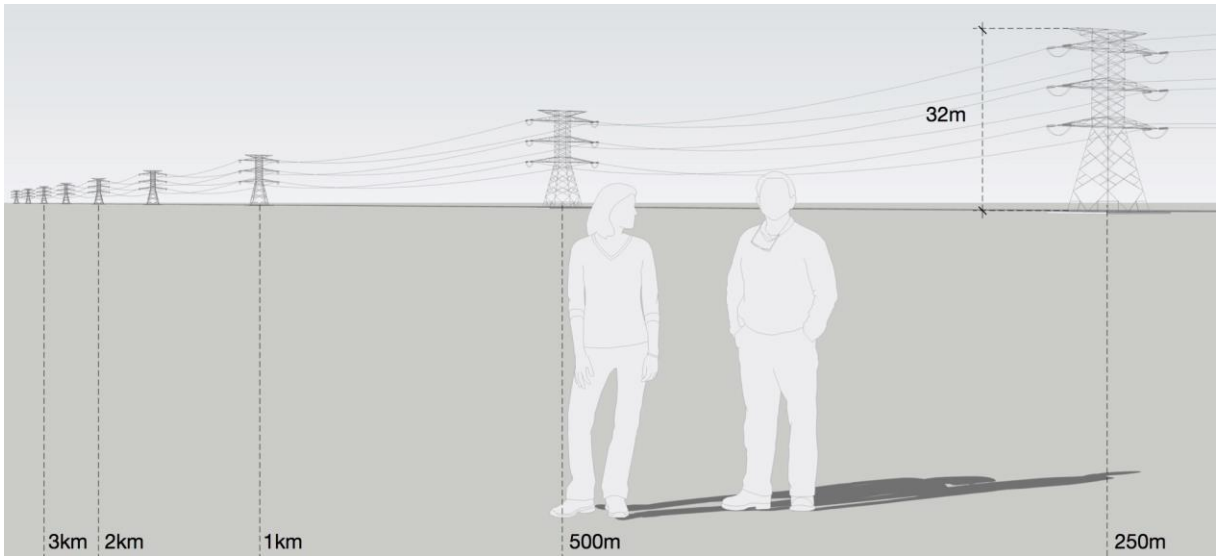

Table 1: Description of Proposed Grid Connection Facilities

Facility	Extent/Footprint	Height	Comments
132kV overhead power line corridor **Power line servitude**	Approx. 120 km length. Approx. 2km wide. 31m wide	n/a	2km corridor being assessed, for a final 31m servitude footprint. Farming can continue in the 31m servitude. Tall trees and buildings not permitted.
3 switching stations (1 for each wind farm)	150 x 75m	Approx. 5m plus masts.	Located next to wind farm substations. Includes 2.4m perimeter fence.
Collector switching station	150 x 150m	Approx. 5m plus masts.	Includes 2.4m perimeter fence.
San Souci Substation extension	150m extension to existing substation	Approx. 5m plus masts.	Includes 2.4m perimeter fence.
Melkhout and Chatty substation extensions	50m extension to existing substations	Approx. 5m plus masts.	Includes 2.4m perimeter fence.
Monopole pylons 3 types for intermediate use and for various strain angles.	Base diameters vary from 1.2 to 2.7m.	26-32m	Galvanised steel with no stays. 2 types with no stays. 1 type with 2 stays.
2 single monopoles 10m apart Strain angle 30-90^0	Approx. 1.2m x 2 pylons	20-24m	Galvanised steel structure 5 to 7 stays.
Triple monopole 10-15m apart for long spans	Approx. 1.2m x 3 pylons	16-18m	Galvanised steel structure 5 to 9 stays.
Lattice structure for very long spans	Base with 4 legs, 15 x 15m area.	28-32m	Only used if specifically requested by landowner.
Service access roads	Access to each pylon.	n/a	Single track gravel road. Existing access roads used as far as possible. Road to fall within servitude as far as possible.
Temporary construction/ assembly sites	To be determined	n/a	Short term.

Consideration of Alternatives:

Besides the current preferred grid connection route, no alternatives, other than the no-go option, are being considered for the assessment. All other route alignments were screened out of the project scope during the screening phase, via the use of a multi-criteria decision making (MCDM) assessment with specialist input.

8 Description of the Study Area

A description of the landscape and scenic features, as well as potential visual receptors of the study area, are indicated in Table 2 below, and on Map 4.

Table 2: *Characteristics of the Study Area*

Landscape setting	For purposes of mapping and this description, the proposed Impofu grid connection corridor has been divided into four stretches, each with their own characteristics, as indicated on Maps 3a, 3b, 3c and 3d. **Map3a:** The corridor starts at the proposed collector substation for the three proposed Impofu wind farms, in a rural cattle-farming area. It crosses the *Kromrivier* valley and N2, before running along the base of a ridgeline, parallel with the existing Eskom power line. The corridor crosses the N2 twice more skirting to the north of the settlements around Humansdorp before linking to the Melkhout Substation. **Map 3b:** The section between the Melkhout Substation and the wide Gamtoos River valley is a largely rural landscape with scattered farmsteads, the corridor running parallel with the existing Eskom power line along this section, with crossings of the *Rondebosrivier* and *Kabeljousrivier* valleys. **Map 3c:** The eastern bank of the Gamtoos River has steep slopes and ridgelines, the corridor largely following the existing Eskom power line across both agricultural and more natural landscapes. The proposed powerline would cross the N2 Route twice before bypassing Thornhill and entering the Vanstadensberg range. **Map 3d:** The corridor passes through the Longmore Forest Estate and Lady Slipper Valley, the proposed route then following an existing powerline along the western boundary of the Hopewell Private Nature Reserve. To the east, rural settlements and townships become more populous until the San Souci and Chatty Substations are reached.
Geology and landforms	The geology has a major influence on landforms, which in turn tend to determine the type of scenic resources that occur along the grid connection corridor. Softer formations, such as the shales, mudstones and limestone tend to be more gently undulating, while the harder formations of quartzitic sandstone form the steep-sided ridgelines and mountain ranges of this part of the Eastern Cape. The corridor can be divided into several landscape types. The western part is characterised by a flattish coastal plain of aeolianite and dune sand on which the wind farms are proposed. The undulating area around Humansdorp consists of Bokkeveld shales, while further inland the visually more pronounced ridges are composed of quartzitic sandstones of the Table Mountain Group of rocks, (Geological Survey, 2008). The broad flattish Gamtoos Valley consists of younger mudrock, sandstone and conglomerates, together with alluvium along the river, and aeolianites and dune sand closer to the coast. This trend continues east of the Gamtoos, the landscape becoming more rugged (and more scenic in places) where the corridor traverses the quartzitic sandstones, such as those of the *Vanstadensberg* range to the north of the N2. The landforms within the grid corridor have been dissected by a number of rivers, including the *Kromrivier,* in the west, on which the Impofu Dam is located, as well as the *Rondebosrivier and Kabeljousrivier*. The Gamtoos River forms a broad flat estuarine plain with wetlands. In contrast, the Van Stadens River is in a deep ravine in the quartzitic sandstone.
Vegetation cover and land use	Most of the lowland vegetation has been converted to agriculture, including pasture lands. The Bokkeveld shales have been largely transformed by agriculture but patches of 'Shale Renosterveld' remain. The quartzitic sandstone ridges, with their steeper slopes have various 'Sandstone Fynbos' vegetation types. Closer to the coast, ridges are covered by 'Gamtoos Thicket' and 'Albany Coastal Belt Thicket' (Mucina and Rutherford, 2006). A more detailed description of the vegetation cover is given in the botanical specialist report.

	Copses and avenues of exotic trees such as gums, pines and beefwoods, have historically been planted around farmsteads. These tend to provide more visual screening than the indigenous vegetation and open farmland. Infestations of black wattle have invaded large areas, mainly along stream courses. Humansdorp is the only major settlement within the study area corridor, along with smaller settlements, such Thornhill. A number of townships occur at the eastern end of the corridor, including those around Chatty, south of Uitenhage. The eastern section, in the area of the San Souci Substation, is more urbanised, with a number of existing power lines converging on the Substation. The Chatty Substation at the Eastern end of the corridor, is similarly urbanised with township development, including the nearby Dwesi. The broad coastal plain between Oyster Bay and Jeffreys Bay has a high number of existing and proposed wind farms, along with a number of connecting power lines. These include existing 132kV power lines for the Kouga, Gibson and Tsitsikamma Community wind farms.
Scenic features and receptors	The proposed grid corridor has a largely rural character with green pastures grazed by cattle and sheep, while natural areas of fynbos or thicket are found on the more inaccessible slopes. There are numerous farmsteads along the corridor, with Humansdorp being the largest settlement. There are a number of smallholdings, settlements and townships in the general area north and south of the San Souci Substation at the eastern end of the corridor. These include Khayamnandi and Booysen Park. Receptors of significance within the grid corridor include the Hopewell Private Nature Reserve. Other receptors would be users of the N2 National Road and the R102 Main Road, which extend along most of the corridor length, the N2 being an extension of the 'Garden Route'. The *Kromrivier* ravine and Impofu Dam are significant water features in the area, along with the Gamtoos River valley and rural Lady Slipper valley. There are a number of scattered farmsteads within the proposed powerline corridor.

9 Visual Constraints and Sensitivity Mapping

Criteria normally used for determining visual sensitivity, along with the reasoning for these, are listed in Table *3* below. The criteria are divided into inherent scenic resources of the study area, and potential sensitive receptors. The various visual constraints are indicated on Maps 4a to 4d.

An attempt has been made to quantify and spatialize the various criteria by means of buffers, based on guidelines prepared in the past for powerlines in general. Recommended buffers for larger Eskom power lines, derived from the draft National Electrical Grid Infrastructure SEA (2015), are indicated in Table 4 as a starting point, although the buffers for the proposed 132kV power line could probably be slightly less, given their smaller size. The buffers would also vary depending on view shadows and actual site conditions. In addition, the proximity of existing power lines would have a bearing on actual visual sensitivity ratings.

Scenic resources and sensitive receptors within the study area have been categorised into very high, high, moderate and low visual sensitivity areas, as indicated in Table 5 and Maps 5a to 5d.

The visual sensitivity mapping helped to guide the testing of various scenarios for the power line route during the screening phase, the current preferred route largely avoiding visually sensitive areas, as well as constraints identified in other specialist studies. Furthermore, engineering and land ownership constraints had to be taken into account, resulting in a number of pinch points for the routing of the power line.

Table 3: Criteria for Determining Visual Sensitivity

Scenic Resource	**Contributing Factors**
Topographic features	Landscape features in the area contribute to scenic and natural heritage value. These include features that provide visual interest or contrast in the landscape such as ridges, steep slopes and ravines. Intact wilderness or rural landscapes tend to have increased scenic value.
Water features	Water bodies, such as rivers and dams, generally have aesthetic, scenic, recreational and amenity value. Sensitivity generally relates to their national, regional or local significance.
Cultural landscapes	Cultural landscapes, often along fertile river valleys, tend to have rural scenic value and historical or cultural significance. These form part of the Heritage Assessment.
Sensitive Receptors	**(includes residents, commuters, visitors and tourists)**
Protected areas	These include nature reserves, which have wilderness and scenic attributes in addition to their biological conservation role, serving as important visitor / tourist destinations. Visual significance is increased by their protection status.
Game reserves / resorts	Private nature reserves, game farms, recreation resorts and tourist accommodation are important for the local economy, and tend to be sensitive to loss or degradation of scenic quality.
Human settlements	Towns, villages and farmsteads, particularly residential and resort areas, tend to be sensitive to visual intrusions, including the effect on property values and tourism.
Scenic routes and arterial roads	Scenic and arterial routes tend to have historical, recreational and tourism importance, and are therefore visually sensitive. The N2 and R102 are the major arterial routes in the study area.
Heritage sites	These form part of the heritage study, but could have visual implications.

Table 4: Recommended Visual Buffers for Eskom Overhead Power Lines (based on National Grid SEA and derived for 440kV or larger lines)

Landscape features/criteria	**Visual Guidelines (2015)[1]**	**Potentially affected area**
Topographic features	500m	e.g. ridgelines and cliffs.
Coastal zone (scenic value)	1 km	Relates to Integrated Coastal Management (ICM) regulations.
Major rivers, water bodies	500m	*e.g. Impofu Dam*.
National roads	500m	e.g. N2 national Road.
Arterial roads	250m	e.g. R102 Main Road.
Scenic routes and passes	1km	e.g. Gamtoos River Bridge and Pass.
Nature reserves / protected areas	1km	
Private nature reserves/ game farms (tourism value)	-	e.g. Hopewell Private Nature Reserve
Towns / settlements	250m	e.g. Humansdorp.
Cultural landscapes	-	e.g. Archaeological or historical sites.

[1] Lawson, Q. and Oberholzer, B. 2015. National Electricity Grid Infrastructure SEA: Visual Specialist Report.

Table 5: Visual Sensitivity Mapping Categories for Impofu 132kV Grid[1]

Scenic Resources	No-go areas	High visual sensitivity	Moderate visual sensitivity	Low visual sensitivity
Topographic features	Landscapes of national scenic value within 500m	Landscapes of regional scenic value within 500m	Landscapes of local scenic value within 500m	-
Water features	Features of national scenic value within 500m	Features of regional scenic value within 500m	Features of local scenic value within 500m	-
Coastal zone	Prominent coastal features	500m coastal zone	1 km coastal zone	-
Cultural landscapes	Cultural landscapes of national significance	Cultural landscapes of regional significance	Cultural landscapes local significance	-
Protected Landscapes / Sensitive Receptors				
National Parks / RAMSAR sites	Protected park area	within 500m [2]	within 1 km	-
Nature Reserves / Biosphere Reserve.	Protected reserve area	within 500m [2]	within 1 km	-
Private reserves / game farms	Protected private reserve	within 500m [2]	within 1 km [2]	-
Settlements / towns / resorts	Settlements / resorts	within 250m [2]	within 500m	-
Farmsteads / residences	Farmstead / residence	within 250m [2]	within 500 km	-
Scenic routes	-	within 500m [2]	within 1 km	-
National route N2	-	within 250m [2]	within 500 km	-
Arterial route R102	-	within 250m [2]	within 500 km	-

[1] Buffers indicated are for the 132 kV power lines.
[2] Buffers could be less if receptors are in a view shadow.

10 Key Visual Issues

The potential visual issues identified by the specialists during the Basic Assessment process include the following:

- Potential scarring in the landscape caused by earthworks for access roads, particularly on the steeper slopes;
- Potential visual impact on scenic resources, such as the *Kromrivier* ravine, Impofu Dam, and Gamtoos River crossing.
- Potential visual effect of powerlines on the rural landscape and on surrounding farmsteads and settlements, Hopewell Private Nature Reserve etc.;
- Potential visual clutter of switching stations;
- Potential visual intrusion caused by security lighting at switching stations.

Additional issues may be added during the public participation process.

11 Visual Impact Determinants

The visual assessment of the proposed grid connection is based on a number of quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance, including the considerations described below.

11.1 Visibility

A number of significant viewpoints have been identified, together with their relative distances and anticipated visibility of the Impofu connection grid in Table 6 below. The viewpoints were selected based on proximity to the proposed power line and the potential sensitivity of identified receptors, including users of the N2 and R102 Routes.

Degrees of visibility are listed below, but are subject to foreground topography or trees. See Figures 1 and 2 for a comparison of visibility at various distances, and the panorama photographs in Figures 3 to 7, in which the red solid line represents the proposed route of the overhead powerline (and not the actual line).

High visibility:	Prominent feature within the observer's viewframe 0-250m
Moderate-high visibility:	Relatively prominent within observer's viewframe 250-500m
Moderate visibility:	Only prominent with clear visibility as part of the wider landscape 500m--1km
Marginal visibility:	Seen in very clear visibility as a minor element in the landscape 1-3km

11.2 Visual Absorption Capacity (VAC)

This is the potential of the landscape to screen the proposed overhead powerline from view. The terrain of the grid corridor route is generally open and visually exposed, i.e. has a low visual absorption capacity.

Power lines located on ridgelines tend to be more visible in the landscape, particularly when seen in silhouette, such as the existing Eskom power lines on the eastern ridge of the Gamtoos River, as seen from the N2 Route. On the other hand, power lines tend to be less visible when seen against a backdrop, such as a belt of trees or a hillside.

11.3 Landscape Integrity

Visual quality tends to be enhanced by scenic or rural quality and intactness of the landscape, as well as absence of other visual intrusions. Natural or pristine landscapes tend to have higher visual quality and therefore higher value. Cultural landscapes, such as rural or farming scenes also have visual scenic value. On the other hand, industrial activity and visual 'clutter', including substations and power lines, detract from these scenes.

The western part of the proposed grid corridor has already been altered by wind farms in the area, and parts of the corridor have existing Eskom and connecting power lines. The proposed power line would potentially add to the visual effect of multiple power lines in the landscape.

To minimise visual clutter in the landscape, new power lines should generally be combined with existing power line corridors to minimise further intrusion or fragmentation of pristine or rural landscapes. An exception could be where existing power lines have been located in a visually sensitive area, so that additional power lines would exacerbate the visual impact, i.e. lead to high cumulative visual impacts.

11.4 Visually Sensitive Resources

Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local, regional or even national significance, usually, but not only, of tourism importance.

Within the corridor study area, the *Kromrivier* ravine and Gamtoos Valley along with a number of sandstone ridges, are features of local and regional scenic value, while the N2 National Route and R102 Main Road are important visual corridors.

Table 6: Distances and Visibility from Viewpoints

Viewpoint	Location	Co-ordinates	Distance	Visibility
vp1	N2 at Kromrivier Ravine	34.041707 S 24.582716 E	1.25km	Marginal Visibility varies with distance
vp2	N2 west of Humansdorp	33.993648 S 24.698323 E	279m	Moderate - High Visibility varies with distance
vp3	N2 east of Humansdorp	34.006806 S 24.779888 E	583m	Moderate Visibility
vp4	Kabeljousrivier Valley	33.992011 S 24.915960 E	3.1km	Marginal Visibility
vp5	N2 at Gamtoos River Valley	33.934179 S 25.008549 E	865m	Moderate - High Visibility varies with distance
vp6	N2 east of Gamtoos River	33.916039 S 25.067567 E	82m	Highly Visible
vp7	R102 east of Thornhill	33.900636 S 25.151127 E	70m	Highly Visible
vp8	R102 at Thornhill junction	33.898611 S 25.143307 E	193m	Highly Visible
vp9	N2 near Thornhill	33.894519 S 25.150403 E	94m	Highly Visible
vp10	Lady Slipper Forestry Area	33.856532 S 25.204674 E	598m	Moderate Visibility
vp11	R334 at Lady Slipper turn-off	33.888414 S 25.296192 E	20m	Highly Visible
vp12	Rocklands Road near Rendallton	33.892988 S 25.328424 E	440m	Moderate - High Visibility
vp13	R368 at Sans Souci Substation	33.832560 S 25.456877 E	95m	Highly Visible
vp14	Mnquma Street, Kwadwesi	33.837837 S 25.517148 E	127m	Highly Visible
vp15	R75 at Chatty Substation	33.834598 S 25.518176 E	463m	Moderate - High Visibility varies with distance

The overall visual impact intensity is determined in Table 7 below by combining all the factors above, namely visibility, visual absorption capacity, landscape integrity and visually sensitive resources. Visual impact intensity is then used to determine overall visual impact significance in Section 12.

Table 7: Visual Impact Intensity

Visual Criteria	**Comments**	**Intensity**
Visibility of overhead powerline	Visible from parts of the N2, R102 and a number of farmsteads / settlements.	Moderate
Visibility of switching stations	Visible from district roads, but form part of substation complexes.	Low
Visual absorption capacity	Visually exposed plain and ridges (in places).	Moderate
Landscape integrity / intactness	Rural farming character. Existing wind farms in the west. Existing powerlines in along most of the route.	Moderate
Landscape / scenic sensitivity	Scenic Kromrivier ravine / Impofu Dam, Gamtoos River Valley, N2 and R102 routes, and nature reserves.	Moderate - high
Impact intensity	Summary	**Moderate**

12 Visual Impact Assessment

The quantification of visual impacts for the proposed Impofu grid connection and switching stations is based on the methodology provided by Aurecon (2018), described below and summarised in Tables 8 to 11. These include the nature of the visual impacts being assessed.

Status (positive or negative type impact):
The status of the visual impact, is considered to be **negative**, given the height of the pylons and the length of the proposed powerline route, in relation to the landscape character and scenic resources of the area, along with a number of visually sensitive receptors.

Extent (spatial scale):
The zone of visual influence would be approximately 120km in length and 2km in width. The assigned value would therefore be **Municipal**.

Duration (temporal scale):
The predicted life-span of the proposed power line and switching stations is expected to be more than 15 years, and therefore the assigned numerical value is **on-going**. The construction phase would be **short-term**.

Intensity (magnitude or degree of alteration):
Based on the potential visual impacts outlined in table 7 above it is expected that the intensity of the impacts would be **moderate** for the power line and switching stations.

Consequence:
Consequence is calculated as a combination of intensity + extent + duration in conjunction with status.

Probability (likelihood):
The likelihood of the potential visual impacts occurring is **certain** (without mitigation) given the scale of the proposed grid connection and the exposed nature of the terrain, with little opportunity for screening or mitigation.

Significance:
Significance is determined by combining consequence with probability, firstly without mitigation and then with mitigation measures in place. The level of significance is calculated automatically in the spreadsheets (Tables 8 to 11).

Confidence:
The confidence rating for the visual impact findings is **high** based on the field work, as well as the precedent of similar power lines in the area.

Reversibility:
The potential visual impacts would only be reversible over the long term if the power line and switching stations are decommissioned and the site rehabilitated. However, it is likely that these facilities will be needed to increase the capacity of the electrical infrastructure for some time into the future. The assigned rating is therefore given as **medium**.

Table 8: Construction Phase - Power Line and Switching Stations

Project phase	**Construction**			
Impact	**Potential visual intrusion of construction activities on the rural landscape and scenic resources.** **Potential visual scarring of the landscape caused by earthworks for access roads, particularly on steeper slopes.**			
Description of impact	**Noise and dust generated by construction cranes and trucks in the erection of pylons and building of access roads.**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	**Pre-construction Phase:** **1) Avoidance of high visual impact areas where possible.** **2) Avoidance of steep slopes (steeper than 1:5 gradient) where possible.** **3) Use of monopoles, where possible, to minimise visual clutter.** **4) Switching stations to be located in unobtrusive positions, avoiding ridgelines or hillcrests where possible, and to be screened by earth berms and tree planting if required.** **5) Existing roads / tracks to be used as far as possible and new access / maintenance roads kept as narrow as possible.** **Construction phase:** **6) Construction camps and storage/stockpile areas to be located in unobtrusive positions in the landscape, away from main roads, farmsteads and scenic areas.** **7) Construction camps to be clearly delineated and limited in size to only that which is essential.** **8) Construction activities to be restricted to normal working hours, where praticable.** **9) Adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO).**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur
Confidence	High	Substantive supportive data exists to verify the assessment	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Moderate - negative**	
Comment on significance	Although **moderate significance** with mitigation, there would be some residual visual impacts relating to noise and general disturbance caused by construction activities.			
Cumulative impacts	**Minor significance** because of the combined construction of the power lines and switching station, which would have some cumulative impact, but would be limited to the area around the switching station, and would be short term.			

Table 9: Operation Phase - Power Line

Project phase	Operation			
Impact	**Potential visual intrusion of proposed power line on the rural landscape, settlements, scenic resources and overall sense of place. Affected areas are indicated on the visual sensitivity maps (Maps 5a to 5d).**			
Description of impact	**Overhead power lines and pylons, including a number of crossings over the N2 and R102 Routes. Visual clutter of pylons on the skyline and resulting silhouette effect.**			
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts		
Potential mitigation	**1) Little or no potential for screening or visual mitigation of power lines during operation.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Moderate - negative**	
Comment on significance	**Moderate significance** takes into account residual visual impacts of pylons in the rural landscape, particularly where these are visible on the skyline. Lack of potential for visual mitigation at the operation phase. Impact partly offset by existing power lines in the landscape, particularly where existing corridors are shared.			
Cumulative impacts	**Moderate significance**, because of combined visual effect of several existing power lines in the area and three additional proposed wind farm projects, resulting in increased visual clutter in the landscape, particularly when viewed from the N2 and R102 Routes. Partly offset by the existence of existing wind turbines and power lines.			

Table 10: Operation Phase – Switching Stations

Project phase	Operation			
Impact	**Visual intrusion of switching stations on the rural farming landscape.**			
Description of impact	**Visual clutter of switching structures, fencing and lighting.**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**1) Lighting at switching stations to be minimised through use of reflectors, low-level bollard lights and movement sensors so that lights only come on when required.. 2) Signage to be minimised as far as practical. 3) Switching station structures and fencing to be regularly maintained to prevent eyesores.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	On-going	Impact will last between 15 and 20 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	**Moderate-low** significance because visual impacts are localised and some visual screening can be used for mitigation.			
Cumulative impacts	**Moderate** significance because of combined effect of switching stations with adjacent substations, wind turbines and power lines. Partly offset by existing surrounding wind farms and infrastructure.			

Table 11: Decommissioning Phase - Power Line and Switching Stations

Project phase	**Decommissioning**			
Impact	**Visual intrusion of remaining structures and access roads on the rural landscape.**			
Description of impact	**Visual clutter created by disused pylons, switching stations.**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**1) Powerlines removed and switching stations demolished or recycled for new uses.** **2) Access roads no longer required to be ripped and regraded.** **3) Exposed or disturbed areas revegetated or returned to grazing pasture or natural vegetation to blend with the surroundings.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Almost certain / Highly probable	It is most likely that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Minor - negative**	
Comment on significance	**Minor significance** after mitigation because disused structures and access roads could be removed and the site rehabilitated. Some access roads and conconcrete slabs would remain. Decommissioning may only occur in the very long term.			
Cumulative impacts	**Minor significance** assuming removal of above ground infrastructure.			

Visual assessment of the no-go alternative

In the no-go alternative, the absence of a new power line would mean that there would be no additional visual intrusion on the rural landscape and on settlements in the area. Landscape features and skylines would therefore remain intact where other powerlines do not exist. The downside is that the evacuation of energy from the proposed Impofu wind farms would not be possible.

It is envisaged that the potential visual impact significance of the no-go alternative would be neutral as there would be no further visual impacts.

Visual assessment of Cumulative impacts

The development of the proposed grid connection and switching stations, when seen together with the existing power lines in the vicinity, would result in cumulative visual impacts resulting in further change to the largely rural character to the area.

The combined potential visual impact of several existing and proposed power lines in the area could result in increased visual clutter on the skyline, particularly when viewed from the N2 and R102 Routes, and surrounding farmsteads and settlements.

Besides the proposed Impofu grid connection between the collector switching station and the Melkhout Substation, there are existing grid connections serving the Gibson Bay and Tsitsikamma Community wind farms, along with the Kouga Wind Farm grid connection (Melkhout-Kromrivier), which all connect at the Melkhout Substation.

Additional proposed grid connections, currently approved, include the Dieprivier-Kareedouw power line to the north of the proposed Impofu wind farm site, which because of its distance

from the proposed Impofu grid connection, will have no bearing on cumulative visual impacts. The proposed Oyster Bay and Melkhout-Kromrivier grid connections are also some distance away to the east and would only run parallel with the Impofu grid connection for about 7 km immediately to the north of Kruisfontein near Humansdorp. The Melkhout-Kromrivier grid connection is existing and only the minor additional Oyster Bay connection, although already approved, is still to be erected. These are shown on Maps 3 and 3a.

The fact that the area can be seen as part of the renewable energy node in the west, and that the proposed power line follows the same corridor as existing Eskom power lines in places, needs to be taken into consideration.

Furthermore, there are a number of existing Eskom power lines converging on the San Souci Substation in the east, in the vicinity of the Hopewell Private Nature Reserve and outlying townships, resulting in a landscape that is already largely transformed.

For these reasons, the cumulative visual impact significance is considered to be **moderate to minor** in the western and eastern sections of the power line corridor, and **moderate** in the more rural central sections of the corridor.

13 Environmental Management Programme

Visual input into the Environmental Management Programme (EMPr) is discussed below. This should be included in the authorization for the project.

13.1 Construction Phase Monitoring:

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including siting of any construction camps and stockpiles (as prescribed in the mitigation measures in Section 12), dust suppression and litter control measures.

Responsibility: ECO / Contractor.

Timeframe: Preparation of EMPr during the planning phase. Monitoring during the contract phase.

13.2 Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of rehabilitated areas, as well as control of any signage, lighting and wastes at the switching stations, with interim inspections by a delegated ECO.

Responsibility: Red Cap Management and ECO.

Timeframe: During the operational life of the project.

13.3 Decommissioning Phase Monitoring:

Ensure that procedures for the removal of pylons and switching station structures during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority.

It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and the vegetation or grazing cover reinstated.

The revegetation measures are not described here as they would fall under the auspices of the vegetation/biodiversity specialist.

Responsibility: ECO / Contractor / qualified rehabilitation ecologist or horticulturist.

Timeframe: During the decommissioning contract phase, as well as a prescribed maintenance period thereafter (usually one year).

14 Findings and Recommendations

The planning of the route for the proposed grid connection has followed an iterative process to determine a 2km corridor for a preferred alignment of the power line. Where possible, this alignment follows the existing Eskom 132kV overhead powerline. However, a number of environmental, engineering and land ownership constraints were placed on the proposed power line alignment, which limited the potential for mitigation of the alignment.

In order to determine the potential visual impacts of the proposed Impofu grid connection, a range of visual and scenic features have been mapped, including recommended buffers for these on Maps 4a to 4d. Using the visual sensitivity categories outlined in Table 5, it was possible to prepare visual sensitivity maps presented in Maps 5a to 5d. These maps provided a strong indication of where visual impacts are likely to occur, along with pinch points for the routing of the proposed Impofu power line.

Using the assessment methodology provided by Aurecon, potential visual impacts were automatically calculated in a spreadsheet, as shown in Tables 8 to 11. The visual impact significance of the proposed power line and switching stations are summarized in Table 12 below.

Table 12: Summary of Potential Visual Impacts Without and With Mitigation

	Without Mitigation	With Mitigation
Construction Phase	Moderate - negative	Moderate-minor - negative
Operation Phase: power line	Moderate - negative	Moderate - negative
Operation Phase: switching station	Moderate - negative	Minor - negative
Decommissioning Phase	Moderate - negative	Minor - negative

The proposed corridor in which the powerline servitude will be located largely succeeds in avoiding most visual constraints, although a number of pinch-points are indicated on Maps 5a to 5d. Micro-siting of powerlines could be considered if necessary, within the 2 km corridor during the pre-construction phase depending on negotiations with landowners.

Visually sensitive scenic resources tend to be around the Impofu Dam and Gamtoos River. In addition, a range of visually sensitive receptors were identified in Table 2, which informed the selection of viewpoints indicated on Map 2 and in the photographic panoramas.

The proposed powerline would affect the rural quality, or sense of place, of the general area as a result of potential cumulative visual impacts, particularly when combined with other existing Eskom and wind farm connecting power lines.

The overall finding was that the proposed grid connection corridor would have a cumulative visual impact of **moderate** significance, largely as a result of the existing Eskom power line corridor being used for part of the routing and the fact that similar 132kV lines already exist in most parts of the study area.

It is the opinion of the Visual Specialists that the current preferred Impofu grid connection does not present a potential fatal flaw in visual terms. Should the route of the proposed grid connection be changed outside of the 2 km and 5 km corridors that have been mapped, the visual implications would need to be re-assessed.

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