2019
STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE EXPANSION OF ELECTRICITY GRID INFRASTRUCTURE IN SOUTH AFRICA

PART 2

Identification of Power Corridors

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PART 2. IDENTIFICATION OF POWER CORRIDORS

2.1 Introduction

As noted in Part 1 of the Strategic Environmental Assessment (SEA) report, Eskom identified the need to expand the Electricity Grid Infrastructure (EGI) corridors that were assessed as part of the 2016 EGI SEA (Department of Environmental Affairs (DEA), 2016[1]) and were recently gazetted. The Power Corridors assessed in this SEA are founded on a set of two expanded corridors, referred to as the Eskom Preliminary Corridors in this report. The SEA undertook to refine the positions of the Eskom Preliminary Corridors to ensure optimal placement in support of sustainable development, as well as the consideration of environmental and engineering constraints, together with the needs of authorities and key stakeholders. The approach undertaken for refining the corridors was developed in line with the context and study objectives described in Part 1 of the SEA Report.

The SEA Process consists of five phases, which are focused on identifying and refining the Eskom Preliminary Corridors in order to derive the Final Power Corridors (i.e. the Expanded Western and Eastern EGI Corridors). Phase 1 involved negative mapping to determine areas of environmental sensitivities and engineering constraints in the context of EGI development. Phase 2 entailed Utilisation Mapping, which aims to refine the corridors so that they best represent areas where transmission grid expansion might support the unlocking of future development.

Phase 3 is referred to as the Corridor Refinement (Pinch Point Analysis) phase, and it entailed the refinement of the corridor positions further to minimise the occurrence of environmental sensitivities and engineering constraints inside of the corridors. This phase involves aggregating the digital information captured in Phases 1 and 2 to determine optimal placement of the corridors from both an “opportunities” and “constraints” perspective i.e. where opportunities are maximized whilst ensuring suitable routing alternatives are available from a constraints (both environmental and engineering) perspective.

Phase 4 includes the specialist studies, which were commissioned in order to review, validate and enhance the sensitivity delineations defined within the Draft Refined Corridors. Based on the inputs from the specialists, public and key stakeholders, as well as the demand and utilisation mapping, the draft refined corridors will be adjusted and finalised for consideration by Cabinet. The results of this task will be used to inform the final sensitivity maps as well as the Decision-Making Tools (Phase 5).

2.2 Identification of Preliminary Corridors

The Eskom 2040 Strategic Grid Plan Study was undertaken to determine the requirements of the future transmission grid to accommodate the expected demand needs and the potential impact of future generation scenarios. Three generation scenarios were considered, including:

- 2010-2030 Integrated Resource Plan (IRP) base scenario (extended to 2040);
- Increased renewable energy scenario; and
- Increased imports scenario.

Refer to the 2016 EGI SEA Report (DEA, 2016) for more details on the above plan.

Between the completion of the 2016 EGI SEA and the subsequent gazetting of the Power Corridors assessed as part of the SEA (DEA, 2016), various long term studies were conducted by Eskom to determine the likely future transmission network that will be adequate to cater for Renewable Energy and gas generation, as well as future load. These studies indicate that there is a need to augment the final EGI Power Corridors that were gazetted for implementation on 16 February 2018 (in Government Gazette 41445, Government Notice 113), in order to cater for future Renewable Energy and gas generation. There is also a need to increase the number of corridors leading to neighbouring countries for the purposes of importing or exporting power. In this regard, interconnectors facilitate energy trading and commerce among the interconnected entities. This therefore led to the need for the expansion of the gazetted Eastern and Western EGI corridors to the border of Mozambique and Namibia, respectively. Map 1 shows the 100 km wide Expanded Eastern Corridor and Expanded Western Corridor (i.e. Eskom Preliminary Corridors) that are being assessed as part of this SEA. Substations are considered anchor points[2] in the context of the SEA Process. The positions of planned new Eskom substations are also illustrated in Map 1 based on the Eskom Transmission Development Plan 2019 – 2028. Therefore any refinement to the position of the corridors undertaken as part of the SEA Process was done within the parameters of the anchor points.

2.3 Project Description

This section describes the key components of the EGI and typical construction activities.

2.3.1 Transmission and Distribution Power Lines and Vegetation Clearing

Based on the 2016 EGI SEA Report, Eskom anticipates that a number of new transmission lines, with a capacity greater than or equal to 400 kV will be required within each of the expanded EGI corridors. The precise number of lines will be dependent on which generation scenario unfolds. Figure 1 shows a route profile in the context of a servitude and Development Envelope for a typical 765 kV power line, i.e. 40 m on either side of the power line (an 80 m wide project footprint) and 50 m on either side of the project footprint. A 765kV servitude is 80 m wide and any line parallel to that must be 80 m away from the centre line of the first 765 kV line; 55 m away from the centre line of any 400 kV line, etc. The width of a servitude is thus the distance away from any line that additional lines can be installed, always using the biggest line servitude as reference.

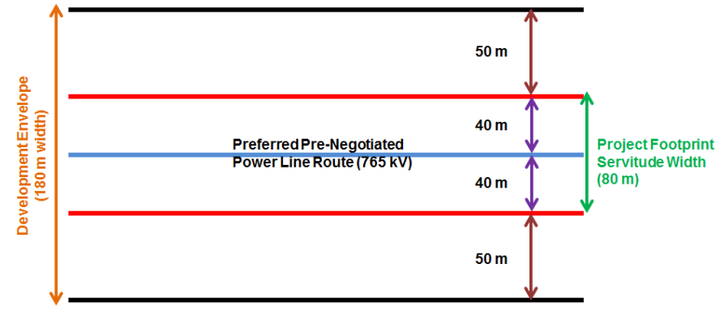


Figure 1: Route Profile: Servitude and Development Envelope for a typical 765 kV power line (DEA, 2016)

Where clearing for access purposes is essential, the maximum width to be cleared within the servitude shall be in accordance the specifications in Table 1 below.

[1] Department of Environmental Affairs, 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.

[2] Any positional change made to the corridors must not compromise the intersection of the corridors with the fixed position of the substations.

Table 1: Maximum servitude clearance distances

Nominal Voltage	Servitude building restriction widths[3]	Maximum Vegetation Clearance
11 kV	9 m	4m on either side of the centre line
22 kV	11 m	4m on either side of the centre line
88 kV	11 m	5 m on either side of the centre line
132 kV	15.5 m	8 m on either side of the centre line
220 to 765 kV	22 m to 40 m	Clear from the centre of the power line up to the outer conductor, plus an additional 10 metres on either side.
533 kV DC	15 m	8 m either side of the centre line

During maintenance, vegetation trimming will be undertaken where it is likely to intrude on the minimum vegetation clearance distance (MVCD) or where it will intrude on this distance before the next scheduled clearance. MVCD is determined by SANS 10280 (refer to Table 2).

Table 2: Minimum vegetation clearance distances

System nominal r.m.s. voltage kV	Minimum Vertical Clearances (m)	Minimum Horizontal Clearances (m)
>1 up to and including 44	3	3
66	3.2	3
88	3.4	3
132	3.8	3
220	4.4	3
275	4.9	3
400	5.6	3.2
765	8.5	5.5

2.3.2 Pylons

Each pylon will have a footprint of up 1 ha that is disturbed during the construction phase. This is required in order to excavate and fill the foundations of the pylon, as well as to assemble and then raise the pylon on-site. This translates to a footprint of approximately 166 ha per 100 km of 765 kV power line. Excavations for pylons generally extend to about 3.5 m deep.

2.3.3 Access Roads

An access road is required for construction as well as maintenance of a power line. The road is generally around 4 m wide during construction and may become a simple two-track during operation of the power line. The initial disturbance footprint of such roads is approximately 40 ha per 100 km of power line, but is sensitive to the exact width of the road as well as the habitat as roads on steep or uneven terrain create more disturbances due to the cut and fill that is usually required in order to make the site accessible for heavy vehicles. In some cases, such as specifically within agricultural fields, service roads parallel to the power line are generally not required.

2.3.4 Substations

Transmission and distribution substations are also required. These may extend up to 70 ha in extent and usually also require borrow pits, construction camps, temporary lay down areas etc. during construction. Excavations for substations generally extend between 3 m and 3.5 m in depth.

2.3.5 Construction Activities

Tables 3 and 4, below, respectively, show the typical activities in power line and substation construction (especially in the context of submitting an application for Environmental Authorisation within the gazetted corridors).

Table 3: Typical Activities in Power Line Construction

Number	Activity
1	Power Corridor sensitivity maps used to determine alternative sub-corridors
2	Sub-corridor sensitivity maps undergo validation
3	Undertake public consultation process for sub-corridors
4	Identify feasible route within sub-corridor
5	Negotiate servitudes with landowners
6	Identify development envelope for negotiated route
7	Obtain necessary approvals from Competent Authorities not mandated by NEMA e.g. Civil Aviation Authority
8	Determine specialist terms of reference for development envelope based on Development Protocols
9	Commission specialist studies
10	Produce commenting report and draft EMPr
11	Submit online application for environmental authorisation
12	30 day commenting period
13	Update report
14	Submit Final BAR/EIA
15	Decision by Competent Authority in terms of NEMA on EA application
16	Walk through with specialists
17	Geotechnical studies
18	Finalise project footprint
19	On basis of walk through update EMPr any additional requirements and final project footprint (Part B Section 2)
20	Erection of camp sites for the Contractor's workforce.
21	Servitude gate installation to facilitate access to the servitude.
22	Vegetation clearing to facilitate access, construction and the safe operation of the line.
23	Establishing of access roads on the servitude where required as per design parameters in Appendix A
24	Pegging of tower positions for construction
25	Transportation of equipment, materials and personnel to site and stores.
26	Installation of foundations for the towers.
27	Tower assembly and erection.
28	Conductor stringing and regulation.
29	Taking over the line from the Contractor for commissioning.
30	Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation.
31	Rehabilitation of disturbed areas.
32	Signing off of all Landowners upon completion of the construction and rehabilitation.
33	Handing over and taking over of the servitude by the Grid Environmental Manager.
34	Operation and maintenance of the line

Table 4: Typical Activities in Substation Construction

Number	Activity
1	Select land parcel for proposed development
2	Negotiate site with landowner
3	Download electricity grid infrastructure sensitivity maps for land parcel from DEA Screening Tool
4	Specialists to validate sensitivity maps for land parcel
5	Specialist to select preferred location for project footprint
6	EAP to determine preferred location of project footprint based on specialist recommendations
7	EAP to develop specialist terms of reference for development envelope based on Development Protocols
8	Commission specialist studies
9	Produce commenting report and draft EMPr
10	Submit online application for environmental authorisation
11	30 day commenting period
12	Update report
13	Submit Final BAR/EIA
14	Decision by Competent Authority in terms of NEMA on EA application
16	Geotechnical studies
17	Finalise project footprint (specialists to determine sensitive features and relocation plan)
18	Transportation of equipment, materials and personnel to site and stores (ongoing)
19	Vegetation clearing to facilitate access, construction and the safe operation of the substation.
18	Site establishment
20	Level substation area and excavate for cut and fill requirements (terracing)
21	Gate and fence installation
22	Construction of access roads
23	Foundation excavation
24	Steelwork assembly and erection.
25	Equipment installation
26	Stringing operations
27	Dismantling and removal of old equipment (where required)
28	Testing and commissioning
29	Rehabilitation of disturbed areas
30	Handing over of works

2.4 Phase 1 - Constraints Mapping

Constraints refer to environmental features which grid developers seek to avoid, where possible, due to the additional time and cost incurred when developing infrastructure in these areas. In the context of the constraints mapping exercise, constraints were mapped according to two categories, namely environmental constraints (or sensitivities) and engineering constraints.

This phase included the completion of a wall to wall sensitivity delineation assessment to determine areas where EGI is likely to have a negative impact on the environment (environmental sensitivities) and areas where the environment is likely to have a negative impact on EGI (engineering constraints). This mapping exercise indicates areas to be avoided (Very High sensitivity), areas which are sensitive for various reasons (High-Medium sensitivity), and areas which demonstrate no sensitivity (Low sensitivity).

[3] Measured from the centre line of the power line

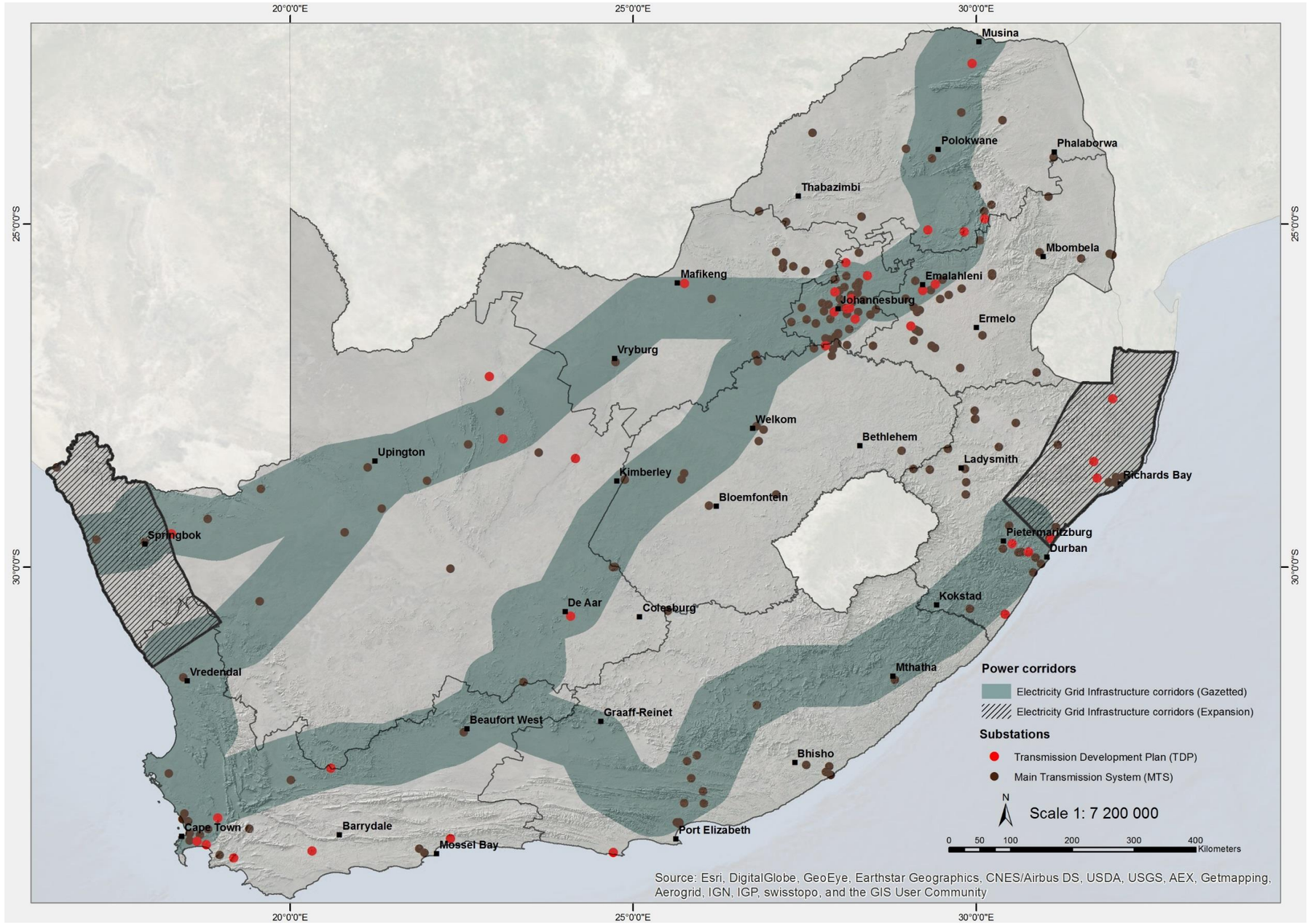
Details on the process followed for the identification of environmental and engineering constraints can be found in the DEA (2016) EGI SEA Report (Part 2 Section 2.3).

2.4.1 Constraints Criteria

This mapping exercise was based on the best available data at a national scale. The list of features, buffers and associated level of constraint (Very High, High, Medium and Low) as well as the originating datasets used during the 2016 EGI SEA were reviewed and, where available, updated datasets were used in this mapping exercise. Table 5 and Table 6 detail the features considered when compiling the environmental sensitivity map and the engineering constraints map, respectively.

2.4.2 Public Consultation

During Phase 1 of the SEA Process, several workshops, meetings and engagement processes were undertaken with authorities, the general public, sector specific and key stakeholders, and representatives on the Project Steering Committee (PSC) and Expert Reference Group (ERG). One of the objectives of the consultation process was to seek feedback from the authorities, general public and key stakeholders (including sector specific stakeholders) on potential constraints and opportunities. In addition, a dedicated consultation process was undertaken from 1 November 2017 to 13 November 2017 with provincial authorities to discuss the proposed expanded corridors and their alignment with provincial and regional planning. The opportunity was also used to identify additional information and potential concerns from provincial departments that needed to be taken into consideration going forward.



Map 1: Eskom Preliminary EGI Expansion Corridors (100 km wide) and future planned transmission substations shown in red and existing transmission substations shown in black in accordance with the Eskom Transmission Development Plan 2019 – 2028.

Table 5: Features and datasets used to prepare a high level Environmental Sensitivities/Constraints Map

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
Protected Areas	South African Protected Areas Database (SAPAD) - Q4, 2018, South African National Parks (SANParks) and Provincial	Marine Protected Areas	Very high	feature
		National Parks	Very high	feature
		Nature Reserves	Very high	feature
		World Heritage Sites (Core)	Very high	feature
		Mountain Catchment Areas	Medium	feature
		Protected Environments	Medium	feature
		Forest Nature Reserve	Very high	feature
		Forest Wilderness Area	Very high	feature
		Special Nature Reserve	Very high	feature
Protected Areas Buffers	SAPAD - Q4, 2018 and South African Conservation Areas Database (SACAD) - Q1,2017	10 KM buffer around National Parks or buffers received from SANPARKS	Medium	feature
		5KM buffer around Provincial Nature Reserves	Medium	feature
		1KM buffer around Local Nature Reserves	Medium	feature
		1KM buffer around Special Nature Reserves	Medium	feature
		Buffer around World Heritage Sites (Buffers are Site Specific)	Medium	feature
		5 km buffer around protected forests	Medium	feature
Conservation Areas	South African Conservation Areas Database (SACAD) - Q1,2017 (DEA)	Biosphere reserves (Buffer area of the biosphere reserve, core areas are already protected)	Medium	feature
		Botanical gardens	Medium	feature
		Ramsar Sites (not already protected)	Very high	feature
		1 km Buffer around National Botanical gardens	Medium	feature
		5km Buffer around Ramsar Sites	Medium	feature
	UNESCO Website / SAHRA	UNESCO tentative sites	Very high	1km
National Protected Areas Expansion Strategy	Priority Areas for Protected Area Expansion, 2017 (including updated Northern Cape Priorities) (DEA)	Protected areas expansion priority areas (Primary)	High	feature
Natural Forests	National Forest Inventory (NFI), sourced 2016, Department of Agriculture, Forestry and Fisheries (DAFF)	National Forest Inventory	Very high	1km (Medium)
Critical Biodiversity Areas	Provincial datasets (GP-2014, EC-2018, FS-2016, KZN-2012, Limp- 2013, MP-2013, NW-2014, WC-2017, NC- 2016)	CBA	Very high	feature
		ESA	Medium	feature
Threatened Ecosystems	DEA and the South African National Biodiversity Institute (SANBI) 2010	CR	Very high	feature
		EN	High	feature
		VU	Medium	feature
Thicket	Thicket Vegetation, SANBI Vegetation Map, 2012 and the STEP Remnant Layer, 2003	Thicket Vegetation Types	Very high	N/A
Species of Conservation Concern	Endangered Wildlife Trust (EWT), SANBI and BirdLife South Africa (2017)	Critical Habitat for highly restricted Species Global Extent of Occurrence < 10 km²	Very high	feature
		Confirmed occurrences of rare and threatened species	High	feature
		Suitable unsurveyed habitat for threatened, rare and data deficient species.	Medium	feature
		No known or expected threatened or rare species.	Low	feature
Bats	Roost dataset from the South African Bat Assessment Advisory Panel (SABAAP), 2017	Colony of 1 – 50 Least Concern bats + colony of 1 – 50 Low Risk Conservation Important bats	Very high	3km

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
		Colony of 50 – 500 Least Concern bats + colony of 50 - 500 Low Risk Conservation Important Bats + Colony of 1 – 50 Med-High Risk Conservation Important bats	Very high	3km
		Colony of >500 High Risk Least Concern bats + colony of 50 - 500 Med-High Risk Conservation Important bats + colony of 500 - 2000 Low Risk Conservation Important bats	Very high	3km
		Colony of 500 - 2000 Med-High Risk Conservation Important bats	Very high	3km
		Colony of >2000 Bats of any status or risk level	N/A	N/A
	Ecoregions (for bats), SABAAP, 2017	KwaZulu-Cape coastal forest mosaic	Medium	feature
		Maputaland-Pondoland bushland and thickets	Medium	feature
		Maputaland coastal forest mosaic	Medium	feature
		Zambezian and Mopane woodlands	Medium	feature
	Dolomite and Limestone, 2013, CSIR (Phase 1 REDZ)	Dolomite and Limestone	Medium	32m Buffer
	Rivers - 1:50 000 scale river lines from the Department of Water Affairs, 2015; Wetlands, updated National Biodiversity Assessment Wetland Layer, SANBI, 2017	Rivers and Wetlands	Medium	feature and 32m Buffer
Birds	BirdlifeSA exclusions Phase 1 SEA	Priority colonies	High	3km
		Transkei vulture IBA	High	3km
		Amur nests	High	3km
		Bearded vulture nest	High	3km
		Verloernvlei Flyway	High	3km
		Lesser Kestrel	High	3km
		Potberg Cape Vulture	High	3km
		Saldanha Flyway	High	3km
	Vulture Data, 2017, VULPRO	VULPRO Cape Vulture colonies	High	3km
		VULPRO Cape Vulture roosts	High	3km
		VULPRO Cape Vulture restaurants	High	3km
	Vulture Roost Sites, 2017, NMMU	NMMU Cape Vulture roost sites	High	3km
	Bearded Vulture Risk Model, 2017, KZN wildlife	Bearded Vulture collision risk model	High	3km
	Important Bird areas for South Africa, Bird Life, 2016	Important Birds Areas (Formally protected)	Very high	none
		Partially protected	High	feature
		Unprotected	High	feature
Estuaries	Estuaries, including flood plains, 2011, National Biodiversity Assessment, SANBI	All estuaries	Very high	feature
Freshwater Features	Rivers - 1:50 000 scale river lines from the Department of Water Affairs, 2015; Wetlands, updated National Biodiversity Assessment wetland layer, SANBI, 2017	Wetlands	Very high	feature
		Rivers	Very high	feature
Freshwater Feature buffers	Buffered Rivers and Wetlands	500m buffer around Wetlands	N/A	N/A
		32 m buffer around Rivers	High	32m buffer and feature
Strategic Water Source Areas (SWSAs) - Surface and Groundwater	Council for Scientific and Industrial Research (CSIR). April 2018	SWSAs (Natural areas)	High	feature
Land Cover	National Land Cover 2013/2014, DEA Habitat Modification Layer (improved land cover), SANBI 2017	Natural areas	Low	feature
		Modified areas	Low	feature
		Old fields (mapped from imagery)	Low	feature

Feature Category/Factor	Source/Dataset	Features	Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
Agricultural Land Capability	Land Capability Layer, 2016, DAFF	Land capability features with values ranging from 11-15	Very high	feature
		Land capability features with values ranging from 8-10	High	feature
		Land capability features class 6 to 7	Medium	feature
		Land capability features class 1 to 5	Low	feature
Field Crop Boundaries	Field crop boundaries, 2017, DAFF	Irrigated Areas (pivot agriculture)	Very high	N/A
		Shadenet	Very high	feature
		Viticulture	Very High	feature
		Horticulture	Very High	feature
		Other cultivated areas	High	feature
Coastline	Coastline, 2015, SANBI and Department of Rural Development and Land Reform	Buffered coastline (1km)	Very high	1km
Karoo Central Astronomy Advantage Area (KCAAA)	KCAAA Footprint, obtained via CSIR (2017)	Karoo Central Astronomy Advantage Area	Medium	feature
Square Kilometre Array (SKA) Area	SKA Core Area, 2017, from SKA via CSIR	Square Kilometre Array (SKA) study area	Very high	feature
		SKA telescopes with 20km buffer	Very high	20km
Defence	Defence Data, 2017, South African National Defence Force	Forward Airfield	Very high	1km
			Medium	10km
		Air Force Bases	Very high	8km
			Medium	28 km
		High Sites	Very high	1km
		Operational Military Bases	Very high	1km
		Military Training Areas	Very high	1km
		Bombing Ranges	Very high	28km
			High	28 - 56km
			Medium	56-111km
		Shooting ranges	Very high	1 km
		Border Posts	Very high	1km
		Ammunition Depots	Very high	10 km
		All Other DoD features (Including Naval Bases, Housing, Offices etc.)	Very high	1km
Airports (Major, Landing Strips, Small Aerodromes)	REDZs 1 SEA dataset and EGI SEA dataset, 2017	Major Airports	Very high	8km
			Medium	15 km
		Landing strips	Very high	2km
		Other civil aviation aerodromes (small aerodromes)	Medium	8km
	SACAA	Civil Aviation Radars	High	4.6 km
			Medium	15 km
	ATNS	Air Traffic Control and Navigation Sites	Medium	5 km
	SACAA	Danger and Restricted Airspace	High	As demarcated on the sensitivity maps
Paleontological heritage resources	Palaeontological Substrate, CSIR, 2013	High sensitivity areas (*) - refer to below	High	feature
		Medium sensitivity areas (**) - refer to below	Medium	feature
Heritage	Mapped Heritage Features, SAHRA, 2018	World Heritage Sites (Core)	Very high	feature
		World Heritage Sites (Buffer)	Medium	feature

Feature Category/Factor	Source/Dataset	Features		Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
		Grade I sites		Very high	2km
		Grade II sites		Very high	1km
		Grade IIIa sites		High	150m
		Grade IIIb sites		High	100m
		Grade IIIc sites		High	50m
		Ungraded		Very high	100m
		Battlefields (Grade IIIb)		Very high	5 km
Visual	Modelled from Digital Elevation Model, 2015, NGI	Slopes > 25% or 1:4		Very high	feature
	NFEPA, 2011	Major River		High	32-500 m
	NGI, 2016	Coastal zones		Medium	1-4 km
	Provincial data sets on Game Farms and Private Reserves (2014-2017) SACAD Q2, 2017, DEA	Private reserves and game farms		Very high	0-2.5 km
				High	2.5-5 km
				Medium	5-10 km
				Low	>10 km
	Location of the SAL Telescope, sourced from the CSIR, 2017	SALT		Very high	0-25 km
	Mapped Heritage Features, SAHRA, 2015	Heritage feature: Grade I sites		Medium	feature- 1.5 km
		Heritage feature: Grade II sites		Medium	1- 1.5 km
		Heritage feature: Grade IIIa sites		Medium	150 m - 1.5 km
		Heritage feature: Grade IIIb sites		Medium	50 m - 1.5 km
		Heritage feature: Grade IIIc sites		Medium	30 m - 1.5 km
	Location of Towns, AfriGIS Towns – 2017	Town, villages and settlements outside large urban areas		Very high	0-500 m
				High	500 m - 1 km
				Medium	1 km-2 km
	NGI, Coastline 2016	National Roads and Scenic Routes		Very high	0-500m
				High	500m-1km
				Medium	1 km-2 km
	Western Cape Department of Transport, 2013, Sourced from the CSIR	Western Cape Routes		Very high	1km
Major Towns	Location of towns, AfriGIS Towns – 2017	Towns, villages and settlements and urban areas		Very high	N/A
Urban Areas and High Density Rural Settlements	Eskom SPOT Building Count, 2013 (100 m x 100 m grid cell resolution).	Grid cells containing ≥ 3 dwellings		N/A	N/A
Paleontological Heritage Resources - High Sensitivity Areas (*)	Geological Features and Substrates of Palaeontological Importance, Geology Layer, 2014, Council for Geosciences	• ADELAIDE • ASBESTOS HILLS • BOEGOEBERG DAM • BOTHAVILLE • BRULSAND • CAMPBELL RAND • CLARENS • DRAKENSBERG • DWYKA • ECCA • ELLIOT • ENON • GHAAP • KAMEELDOORNS	• KOEGAS • KUIBIS • MATSAP • MOLTENO • PRINCE ALBERT • RIETGAT • SCHMIDTSDRIF • SCHWARZRAND • STALHOEK • SULTANAOORD • TARKASTAD • VRYBURG • WHITEHILL • WITTEBERG	High	feature

Feature Category/Factor	Source/Dataset	Features		Mapping Sensitivity (Environmental Constraint)	Feature/Buffer
Paleontological heritage resources - Medium sensitivity areas (**)	Geological Features and Substrates of Palaeontological Importance, Geology Layer, 2014, Council for Geosciences	• ACHAB • ALLANRIDGE • BIDOUW • BREDASDORP • CERES • CONCORDIA GRANITE • DWYKA • FORT BROWN • GESELSKAPBANK • GLADKOP • GRAHAMSTOWN • HARTEBEEST PAN GRANITE • HOOGOOR • KALAHARI • KAMIESKROON GNEISS • KAROO DOLERITE • KHURISBERG • KONKYP GNEISS	• KOOKFONTEIN • KORRIDOR • MESKLIP GNEISS • MODDERFONTEIN • GRANITE/GNEISS • NAAB • NABABEEP GNEISS • NAKANAS • NARDOUW • NUWEFONTEIN GRANITE • RIETBERG GRANITE • SKOORSTEENBERG • STINKFONTEIN • STYGER KRAAL SYENITE • TABLE MOUNTAIN • TIERBERG • VOLKSRUST • WATERFORD	Medium	feature

1

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Table 6: Features and datasets used to prepare a high level Draft Engineering Constraints Map

Feature category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)	Feature/Buffer
Coastline (including Estuaries)	SANBI 2004	Coastline & Estuaries	Very high	10 km
Slope	25m NGI DEM	>45°	Very High	feature
		25-45°	N/A (Low)	N/A (Low)
		15-25°	N/A (Low)	N/A (Low)
		0-15°	N/A (Low)	N/A (Low)
Access/Roads	Eskom - NGI Roads Layer 2016	Roads	Low (nearest mapped road >2 km from site)	feature
Geology	Council for Geoscience, 1997	Dolomite (and other rock types)	High	feature
		Dolomite restricted to Gauteng and Mpumalanga	High	feature
Seismicity	Seismic Hazard in South Africa 2011 (Council for Geoscience Report number: 2011-0061)	Generally confined to Cape Fold Belt region of Southern Cape	N/A	N/A
Gully Erosion	DAFF Gully Erosion Datasets	Footprint of erosion/gully > 500 m^2	High	feature
Soil Erodibility	DAFF Soil Erosion Hazard Classes - South Africa and Lesotho, 2010	Hazard Class - High	High	feature
		Hazard Class - Medium	-	-
		Hazard Class - Low	-	-
Settlements	AfriGIS Towns Layer	Towns, villages and settlement spatial footprints	Very high	feature
Railway Lines (All Railways)	DRDLR Topo, 2006 - Transnet	All Railway Lines	Medium	1 km
Industrial Areas	DEA 2013/2014 land cover	Existing industrial areas	Low	feature
Industrial Expansion	SDFs, IDPs, consultation with authorities	Planned industrial activities	Low	feature
Mining	DMR, 2018 (SAMRAD Mining Applications)	(RETENTION PERMIT, RECONNAISSANCE PERMISSION/PERMIT, RECON PERMISSION, PROSPECTING RIGHT, PROSPECTING RIGHT RENEWAL, MINING_RIGHT, MINING_PERMIT, MINING RIGHT RENEWAL, EXPLORATION RIGHT, BURROW PIT, AMENDING AN EXISTING RIGHT)	Very high	feature
Mining	Transnet	Undermining. Localised areas in northern KwaZulu-Natal and Mpumalanga associated with old coal mine working	N/A	N/A
Major dams	DWA Dams Data	Dams	Very high	feature
Estuaries	National Biodiversity Assessment (NBA) 2017/18	All Estuaries	Very high	feature
Wetlands	Wetland Data 2017	All Wetlands	Very high	feature
Rivers	NFEPA River Data 2010 and NGI Mapped River Footprint	Drainage Lines	Very high (Order 6-7)	1000m buffer around feature
			High (Order 4-5)	500m buffer around feature
			Medium (Order 1-3)	10m buffer around feature
	NBA 2018 (South African Inventory of Inland Aquatic Ecosystems)	Valley Bottom include Stream (Exclude Northern Cape)	Very High	feature
WULA Agreements	NFEPA River and Wetland Data 2010	Rivers and wetlands buffered by 500 m	High	500 m buffer around feature
Natural Forests	Department of Agriculture, Forestry and Fisheries, 2017. NFI	Natural forests	NA	NA
Forestry Potential (EC)	EC Parks and Tourism Agency 2014	Potential Areas for Forestry	Medium	feature
Thicket	Albany Thicket, SANBI Vegetation Map, 2017	National	High	feature
Sugar Cane	KZN Land Cover 2011 [Sugar cane farming and emerging farming data]	Sugar Cane Farm Boundaries	High	feature
Commercial Forestry	Data on Commercial Forestry provided by DAFF in June 2016	DAFF Commercial Forests	High	feature
Field Crop Boundaries (Pivot >500 m radius)	Agriculture Field Crop Boundary Data 2016	All	Very high	feature
Field Crop Boundaries (vineyards and orchards)	Agriculture Field Crop Boundary Data 2016	All	Very high	feature

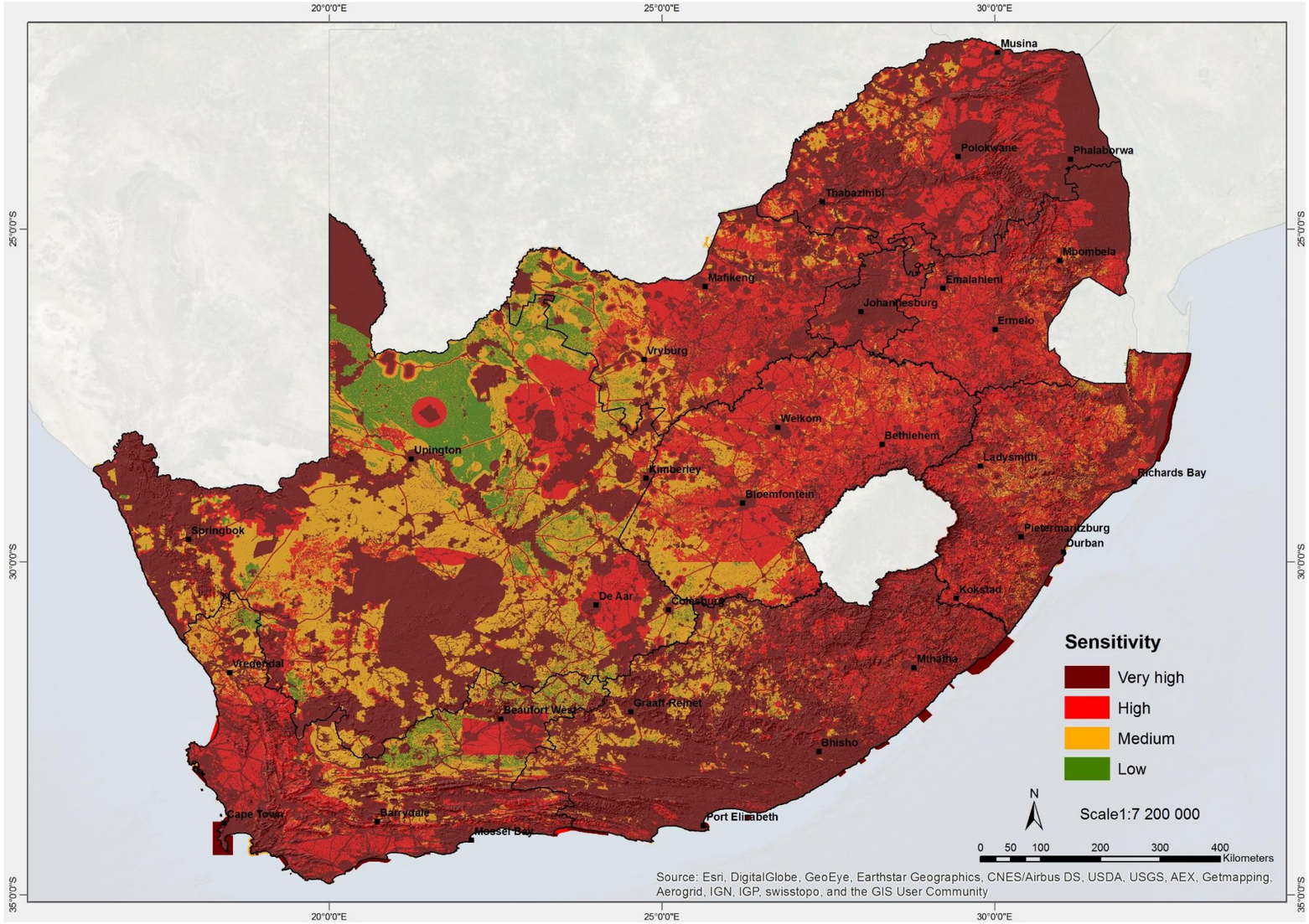
Feature category/Factor	Source/Dataset	Features	Mapping Sensitivity (Engineering Constraint)	Feature/Buffer
Field Crop - Short term	Agriculture Field Crop Boundary Data 2016	All	N/A	N/A
Field Crop - Long term	Agriculture Field Crop Boundary Data 2016	All	N/A	N/A
High incidence for lightning strikes	Eskom, July 2014	Highest 10% risk areas	Medium	feature
High incidence for fire	Eskom, November 2016 (2002-2017)	Highest 10% risk areas	Medium	feature
High incidence for wind	Eskom, July 2014	Highest 10% risk areas	Medium	feature
High incidence for flooding	Eskom, 2015 (sourced in 2018)	Highest 10% risk areas	Medium	feature
High incidence for snow conditions	Eskom, July 2014	Highest 10% risk areas	High	feature
High incidence for pollution	Eskom, July 2014	Highest 10% risk areas	High	feature
Electrical Transmission Cables (Voltages Above 60 kV)	DRDLR Topo, 2006 - Transnet	0 - 1 Km	N/A	N/A
		1 - 5 km	N/A	N/A
		5 - 10 km	N/A	N/A
		> 10 km	N/A	N/A
Electrical Transmission Cables (Voltages Below 60 kV)	DRDLR Topo, 2006 - Transnet	0 - 1 Km	N/A	N/A
		1 - 5 km	N/A	N/A
		5 - 10 km	N/A	N/A
Cable/Telecom line/Pipelines	iGas, 2017 (Rompco Gas Pipeline) Transnet, 2018 (Future and Existing Gas and Fuel Pipelines)	Gas and Fuel Pipelines (feature)	N/A	N/A
Water Pipelines	DWS, 2017 (Bulk Infrastructure)	Existing and Future Bulk Water Pipelines and Infrastructure	N/A	N/A

2.4.3 Constraints Maps

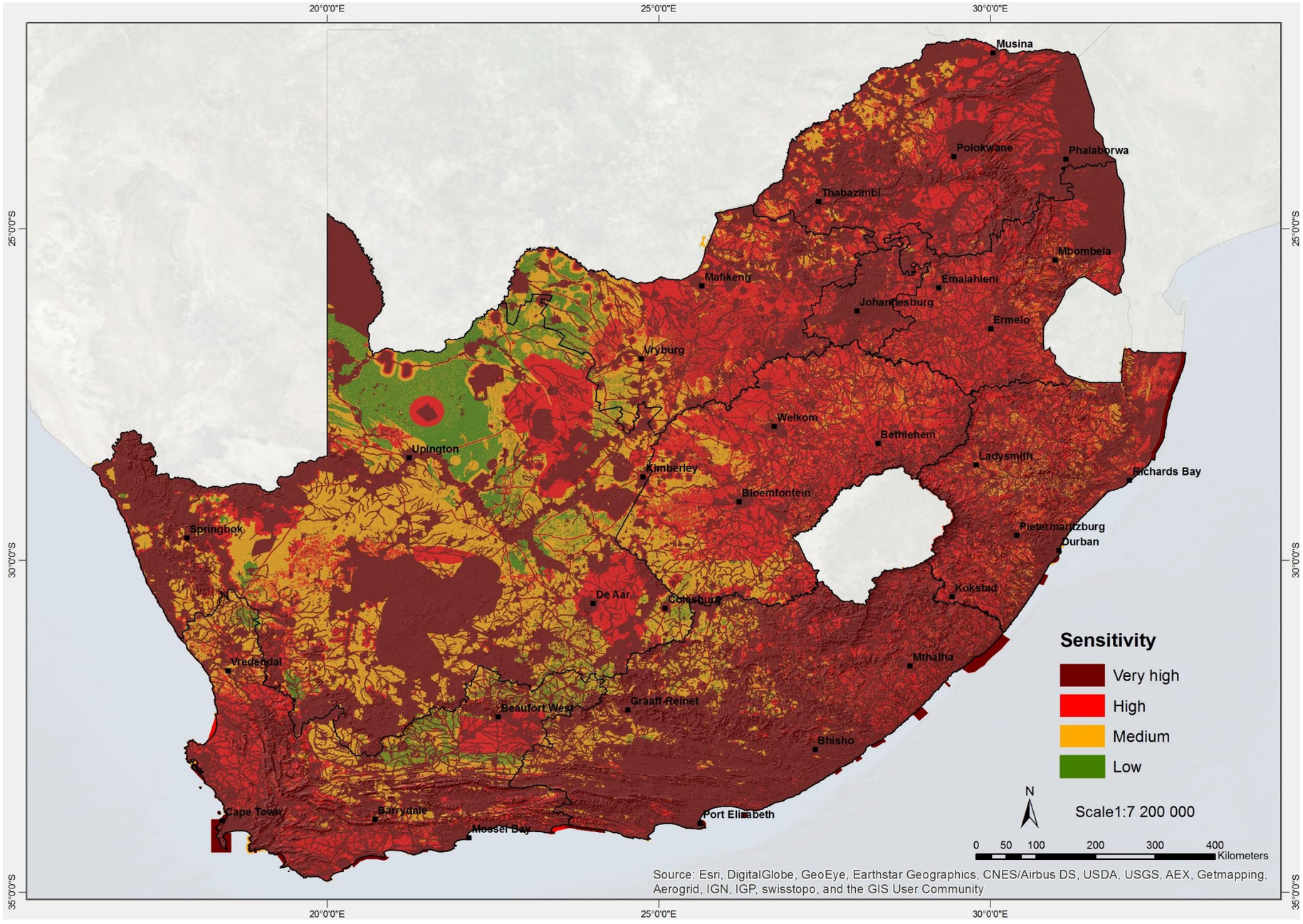
As noted above, the constraints mapping outputs were developed at a national scale for both environmental and engineering constraints. The four tiered wall to wall draft environmental constraints/sensitivities map and the interpretation of each tier of constraint is illustrated in Map 2a (excluding Rivers), Map 2b (including Rivers) and Table 7, respectively. In addition, the four tiered wall to wall draft engineering constraints map and the interpretation of each tier of constraint is illustrated in Map 3 and Table 8, respectively. The Draft Environmental Constraints/Sensitivities Corridor Maps (zoomed in and on a national scale) and Draft Engineering Constraints Corridor Map are shown in Maps 11 to 15. Note that Rivers, Mining Areas, Towns, Villages, Settlements and Visual Sensitivities have not been displayed in relevant maps due to scale (Refer to the relevant map captions in this regard).

Table 7: Environmental constraints/sensitivities interpretation

Environmental Constraints	
Constraint	**Description**
Very High	The area is rated as extremely sensitive to the negative impact of EGI development. As a result the area will either have very high conservation value, very high existing/ potential socio-economic value or hold legal protection status.
High	The area is rated as being of high sensitivity to the negative impact of EGI development. As a result the area will either have high conservation value and or existing/potential socio-economic value.
Medium	The area is rated as being of medium sensitivity to the negative impact of EGI development. As a result the area will either have medium levels of conservation value and/or medium levels of existing/potential socio-economic value.
Low	Area is considered to have low levels of sensitivity in the context of EGI development.



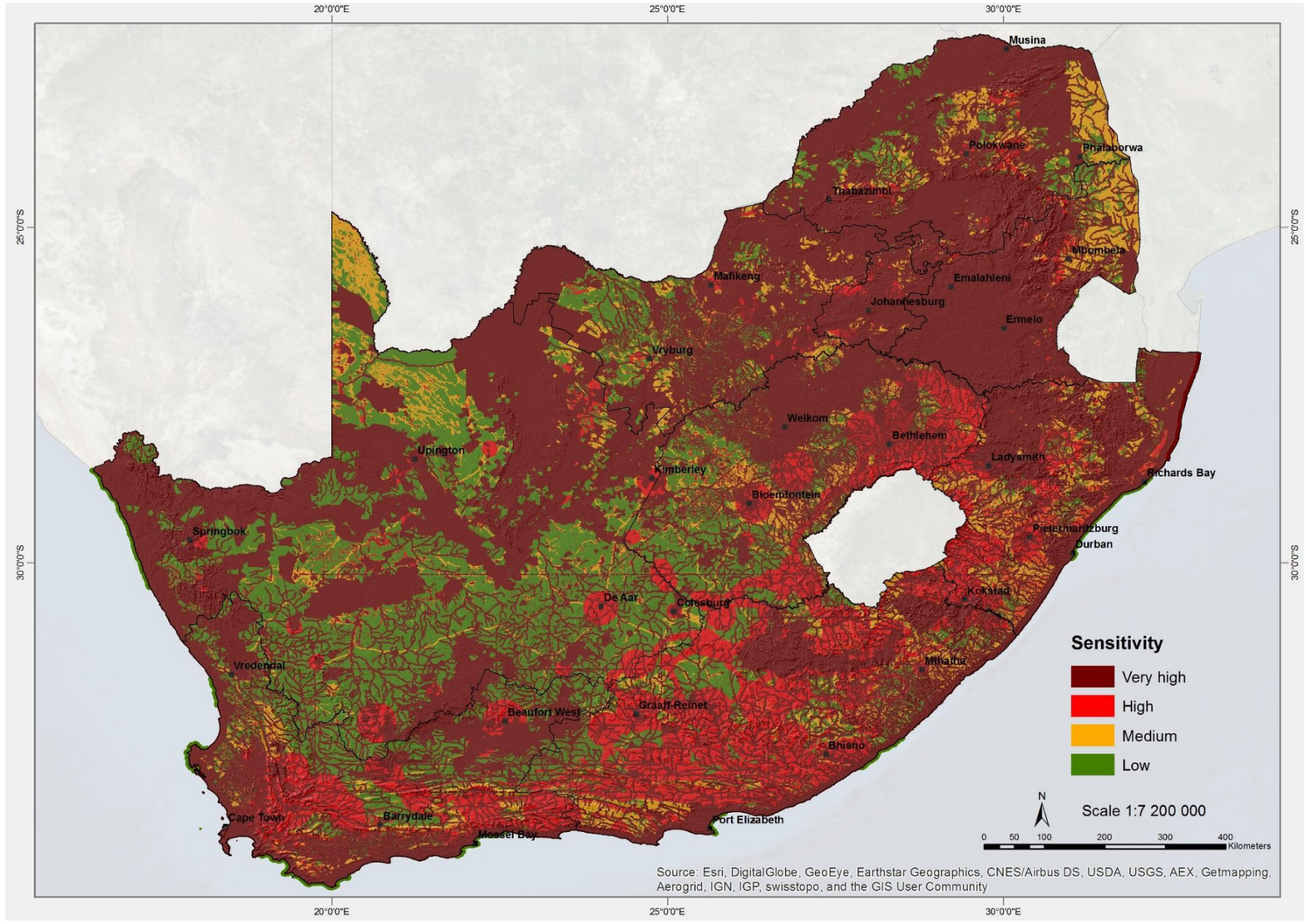
Map 2a: Draft Wall to Wall Environmental Constraints Map (Rivers have been **excluded** from this map).



Map 2b: Draft Wall to Wall Environmental Constraints Map (Rivers have been **included** in this map).

Table 8: Engineering constraints interpretation

Engineering Constraints		
Constraint	**Description**	**Feature Cost**
Very High	The lifetime cost associated with development in this area is greater than 175% the baseline lifetime cost index.	c=>1.75x
High	The lifetime cost associated with development in this area is between 150% and 175% the baseline lifetime cost index.	c=>1.5x and ≤1.75x
Medium	The lifetime cost associated with development in this area is between 120% and 150% the baseline lifetime cost index.	c=1.2x and ≤ 1.5x
Low	The lifetime costs associated with development in this area is less than 120% times the baseline lifetime cost index.	c =<1.2x



Map 3: Draft Wall to Wall Engineering Constraints Map

2.5 Phase 2 – Utilisation Mapping

Phase 2 involves mapping grid utilisation potential both inside and immediately adjacent to the Preliminary Corridors.

Details on the process followed for this mapping exercise can be found in the DEA (2016) EGI SEA Report (Part 2 Section 2.4).

2.5.1 Spatial Energy Generation Layer

Data for the energy generation layer mapping process was obtained from three sources including 1) industry consultation, 2) active renewable energy environmental impact assessment (EIA) applications and 3) the Renewable Energy Development Zones (REDZ). A 20 km x 20 km resolution was used for this exercise.

The layers will be consolidated to produce a single generation mapping output representing generation potential in MW at a 20 km x 20 km cell resolution, as indicated in Figure 2. The aggregation of the different datasets will be completed using a number of assumptions to reduce the risk of double counting.

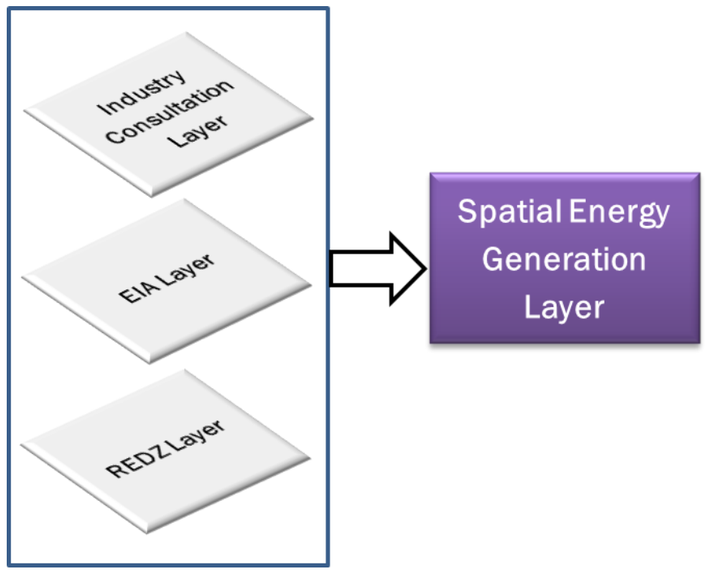


Figure 2: Aggregation process for the Spatial Energy Generation Layer

2.5.2 Spatial Electricity Demand Layer

Data for the electricity demand mapping process were obtained from three sources including 1) industry consultation, 2) provincial and local government spatial development plans and 3) national scale strategic development plans (e.g. Special Economic Zones, Industrial Development Zones, and Strategic Infrastructure Projects). All mapping was initially undertaken at a 20 km by 20 km scale. However, where actual proposed and planned development boundaries were sourced from stakeholders, these were used instead of the grid system. The same consultation process as was used in the 2016 EGI SEA was followed to obtain inputs from Industry and from Provincial and Local government.

Additional details on the consultation with provincial and local government are given in Section 2.5.2.1 below.

2.5.2.1 Spatial Development Framework Layer

A detailed review of the Spatial Development Frameworks (SDF) of provincial, district and local municipalities located inside of the focus areas was undertaken. The review involved mapping areas illustrated within relevant SDFs as being set aside either for future mining related activity, industrial expansion, transport developments, agriculture, tourism or for urban expansion. In total, 35 local municipalities and 1 metropolitan municipality is located totally or partially (>5% of the municipality area) inside the Buffered Corridors (refer to Map 4). Of these municipalities, a number of the SDFs were not considered suitable[4] for the purposes of this exercise. In the absence of a suitable local municipal SDF, and where available, the relevant district municipality SDF or provincial SDF was reviewed instead. Where required the relevant Integrated Development Plans (IDPs) of municipalities were also considered. Municipalities and provinces were provided with an opportunity to actively engage with the mapping outputs from the SDF and IDP review process through a dedicated consultation process undertaken in April - May 2018. The consultation exercise also enabled municipalities to provide feedback and request updates to the SDF and IDP mapping outputs based on more recent and unpublished draft SDFs as well as local and regional knowledge. The Project Team has been following up with Municipalities to request information for use in the Spatial Electricity Demand Layer since the exercise was initiated in 2018.

The feedback obtained from the municipalities with regards to the abovementioned consultation process will be used as input into the Spatial Electricity Demand Layer (as described in Section 2.5.2 of this Part of the SEA Report).

2.5.2.2 Consolidation of the Electricity Demand map

The above will be consolidated to produce a single electricity demand mapping output representing load potential in MW at a 10 km by 10 km cell resolution or based on actual localities of the proposed planned energy intensive activities, as shown in Figure 3. The aggregation of the spatial datasets will be undertaken using a number of assumptions to reduce the risk of double counting.

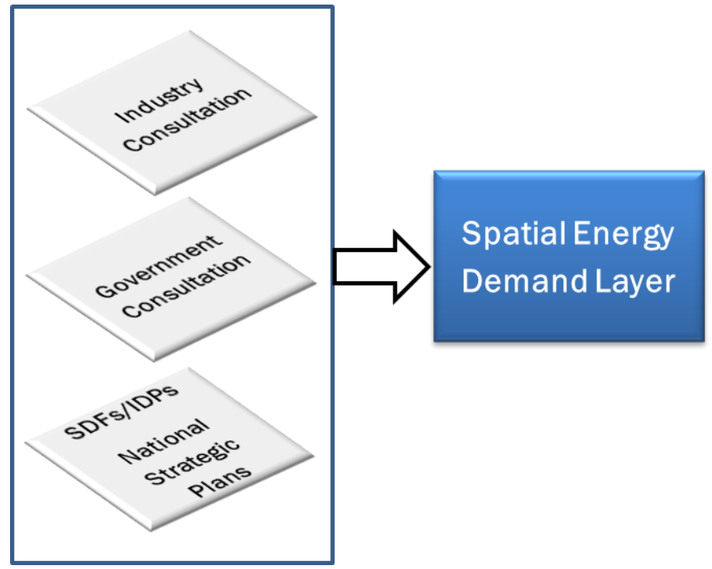
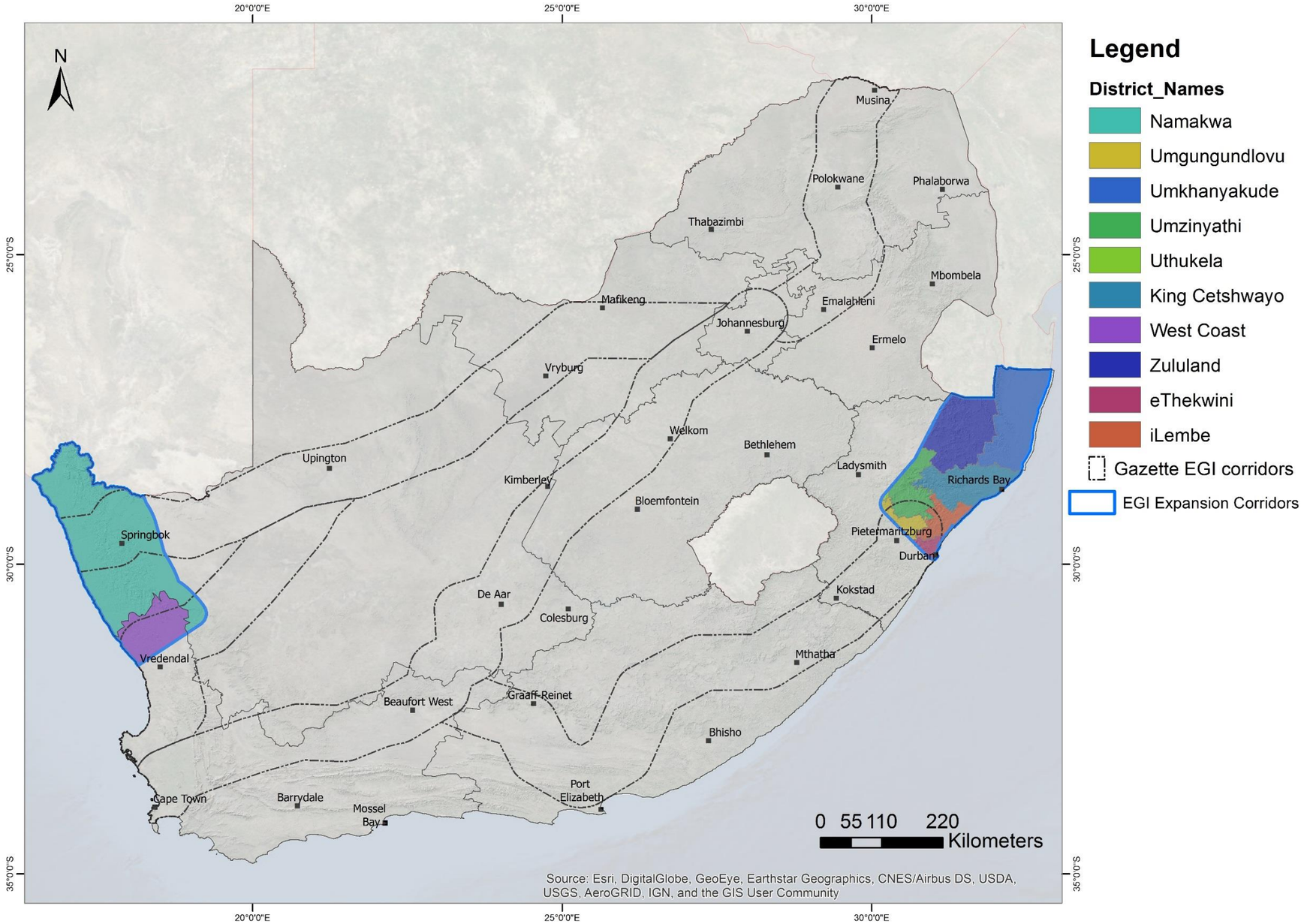


Figure 3: Aggregation process for the Spatial Energy Demand Layer

[4] Suitable refers to plans that are available, < five years old and contain spatial information concerning plans for industrial expansion and or mining.



Map 4: Affected District Municipalities within the Eskom Preliminary Corridors buffered by 25 km inland. Note that the Gazetted EGI corridors are also shown on this map.

2.6 Phase 3 – Pinch Point Analysis

Phase III involved synthesising and overlaying the various mapping outputs to determine whether available routing options exists end to end for each of the corridors assessed. Only Very High sensitivity areas were considered in the analysis. The remaining sensitivity layers were consolidated and referred to as available routing space in the analysis. Due to their sensitivity, these Very High sensitive areas potentially impact the design of the EGI, and consequently the location of the corridors. Some examples of features rated with a Very High sensitivity includes the SKA, active mining areas, Protected Areas, mountainous areas, critical biodiversity areas, threatened ecosystems and water related features.

A complete pinch point was defined as a point within a Corridor where no clear power line routing opportunities exist without having to traverse an area delineated as Very High sensitivity from either an environmental or engineering perspective. Partial pinch points, instances where fewer than five unique routes through different land parcels without having to traverse an area delineated as Very High sensitivity, were also identified.

In the event of a complete or partial pinch point, the area outside and immediately adjacent to that point in the corridor was considered from an environmental and engineering constraints perspective. Where relief (less sensitive area) was shown to be present, and without compromising the intersection of the corridors with the key anchor points, the corridor boundary was shifted in the direction of relief. Where no obvious relief was shown to be present, the position of the corridor remained unchanged. The output from this process was a final set of corridor positions i.e. the Power Corridors, which represents areas of highest demand for grid infrastructure without compromising on the environment.

Refer to the *2016 EGI SEA Report* (DEA, 2016) for further details on the Pinch Point Analysis methodology.

As noted in Part 1 Section 1.3.5, two pinch point analyses will be undertaken as part of this SEA process.

2.6.1.1 Draft Pinch Point Analysis

The first Draft Pinch Point Analysis was undertaken at the end of Phase 1 to guide and inform the location of the corridors to be assessed by the specialists in Phase 4. The draft refinement of the preliminary corridors used outputs from the environmental and engineering constraint mapping (Phase 1), together with expert inputs from the energy and environmental sector.

Using the Spatial Analysis suite of tools in GIS, a single layer of all Very High sensitive areas was created at a national scale. This layer was then overlaid with the preliminary 125 km wide corridors (Map 5). This process enabled the Project Team to highlight and identify bottle necks or pinch points within the landscape.

Extension of the Western Corridor

The pinch-point analysis for the draft Western Corridor extension showed very little relief (Map 7) within the 100 km wide corridor. Currently, the main features representing the areas of high sensitivity within the corridor includes Protected Areas (Richtersveld National Park, nature reserves and a world heritage site), Northern Cape Critical Biodiversity Areas, and mining areas. Initially the possibility of moving the Western Corridor extension inland was explored, to provide some relief and more routing options. However, in consultation with Eskom and iGas, the decision was taken to maintain the corridor footprint as is because a shift further inland would translate into having to traverse the Orange River at its widest.

Currently, the spatial data representing the footprint of the Orange River is as a line only, however on the ground the river is much wider than 500 m. Pylons for EGI need to be spaced 500 m apart to maintain line stability (e.g. prevent line sagging), thus the Orange River width inland would pose more of an environmental and engineering constraint if the corridor were to be shifted inland.

Furthermore, the footprint of the Western Corridor (Map 7) is able to connect to the existing substation at the Namibian border, and the corridor includes the footprint of the powerline currently planned for construction between 2017 and 2020.

Lastly, from a biodiversity perspective, the Northern Cape is what is termed a “high option landscape” in biodiversity planning speak, and is under little development pressure. This means that there are a lot more natural areas left in the province to meet “biodiversity targets”. Consequently, the Critical Biodiversity Area network in the Northern Cape is more flexible in terms of development than any other province, so the Critical Biodiversity Areas sensitivity in the province is not as critical as in others e.g. Mpumalanga or KZN.

The Western corridor extension was thus not moved as part of this pinch point analysis. It is important to note that the 125 km specialist assessment corridor includes more areas of relief. A slight shift may occur once the specialist assessment phase is completed and the final corridors are refined.

Extension of the Eastern Corridor

The pinch-point analysis for extension of the EGI Eastern shows little relief (Map 8) within the 100 km wide corridor. Currently, the main features representing the areas of high sensitivity within the corridor includes Protected Areas (iSimangaliso National Park, nature reserves), KZN Critical Biodiversity Areas, bat ecoregions and human settlements (towns and villages). There are currently options for routing further inland, within the corridor.

As noted above, the purpose of the extension is to facilitate for the import of power from neighbouring Mozambique. While the option of shifting the Eastern expanded corridor further inland exists, it is not advisable as it would then mean having to route EGI through Swaziland first, before connecting to Mozambique, which is not economically feasible. Consequently the Eastern Corridor extension has not been shifted, but the specialist and/or streamlined project specific Environmental Assessment phase should be able to allow routing options.

The output of this first pinch point analysis is the Draft Refined Corridors (Map 5).

2.6.1.2 Final Pinch Point Analysis

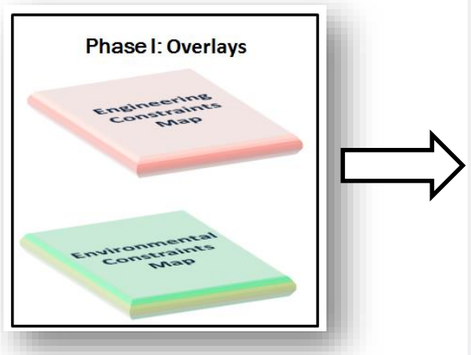
A final Pinch Point Analysis will then be undertaken to identify any further pinch points and determine the Final Corridors based on the outputs of Phase 2 (i.e. Utilisation Mapping) and Phase 4 (Scoping Level Pre-Assessment), as well as the public review of the Specialist Studies, using the process noted in Section 2.6.1.1. The output from this Final Pinch Point Analysis will be a set of final refined corridor positions, which represents areas of highest anticipated demand for EGI, while still reducing the risk of significant impact to the environment.

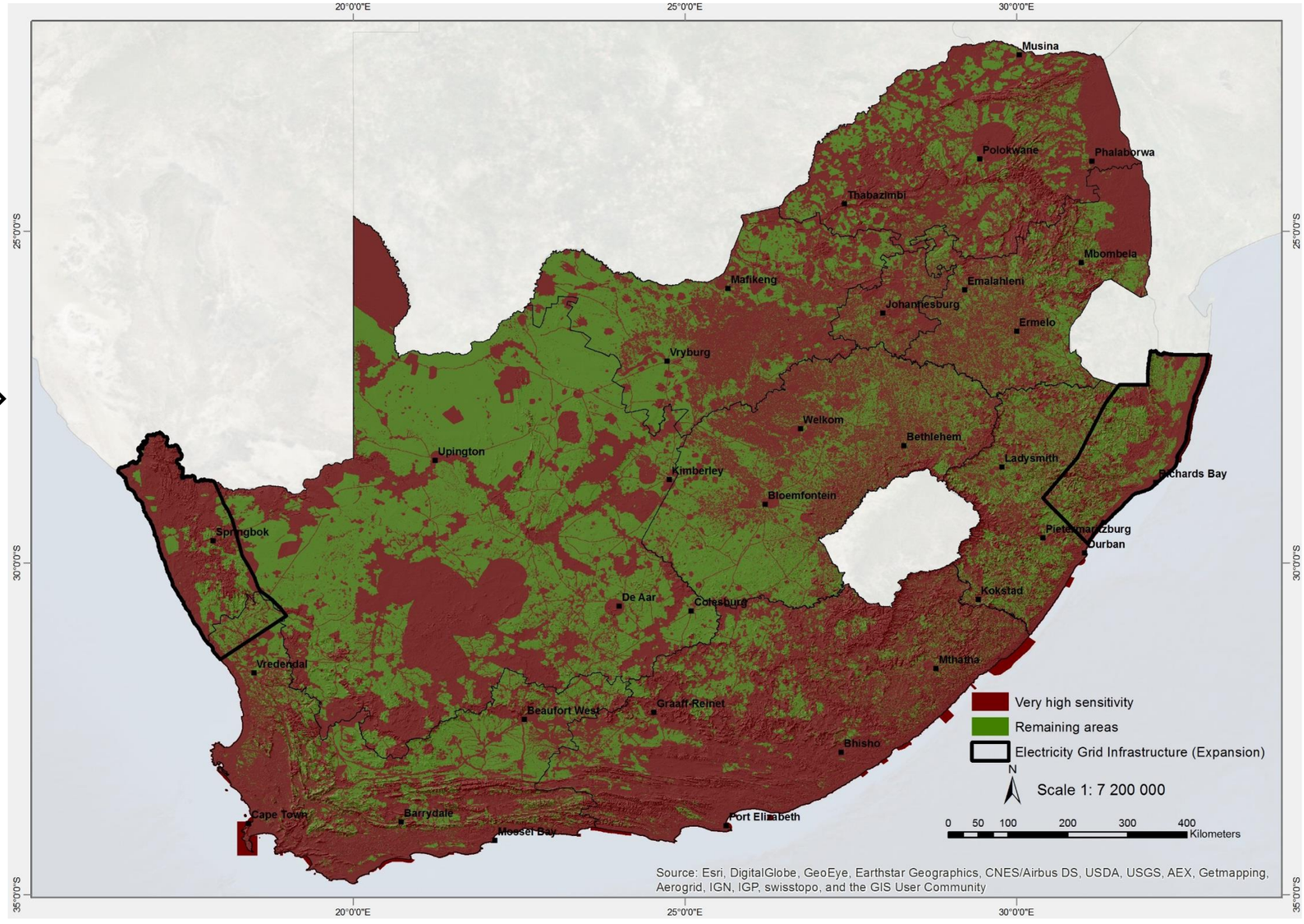
2.7 Public Consultation

As noted in Section 2.4, in addition to consulting key stakeholder groups through the ERG and PSC, as well as engagement with key and sector specific stakeholders, public consultation was conducted throughout the duration of the SEA through the exchange of information and data via a dedicated online platform (i.e. project website: https://gasnetwork.csir.co.za/). Additional public engagement was undertaken through newspaper advertisements at key stages of project delivery, as well as two Public Outreach programmes. Table 9 below lists the various mechanisms used to engage the public as part of this SEA. Currently, the specialist assessment reports are being released for public review. Formal comments from stakeholders are received throughout the SEA Process; however only comments received during the dedicated public commenting period will be included in the Issues and Response trails.

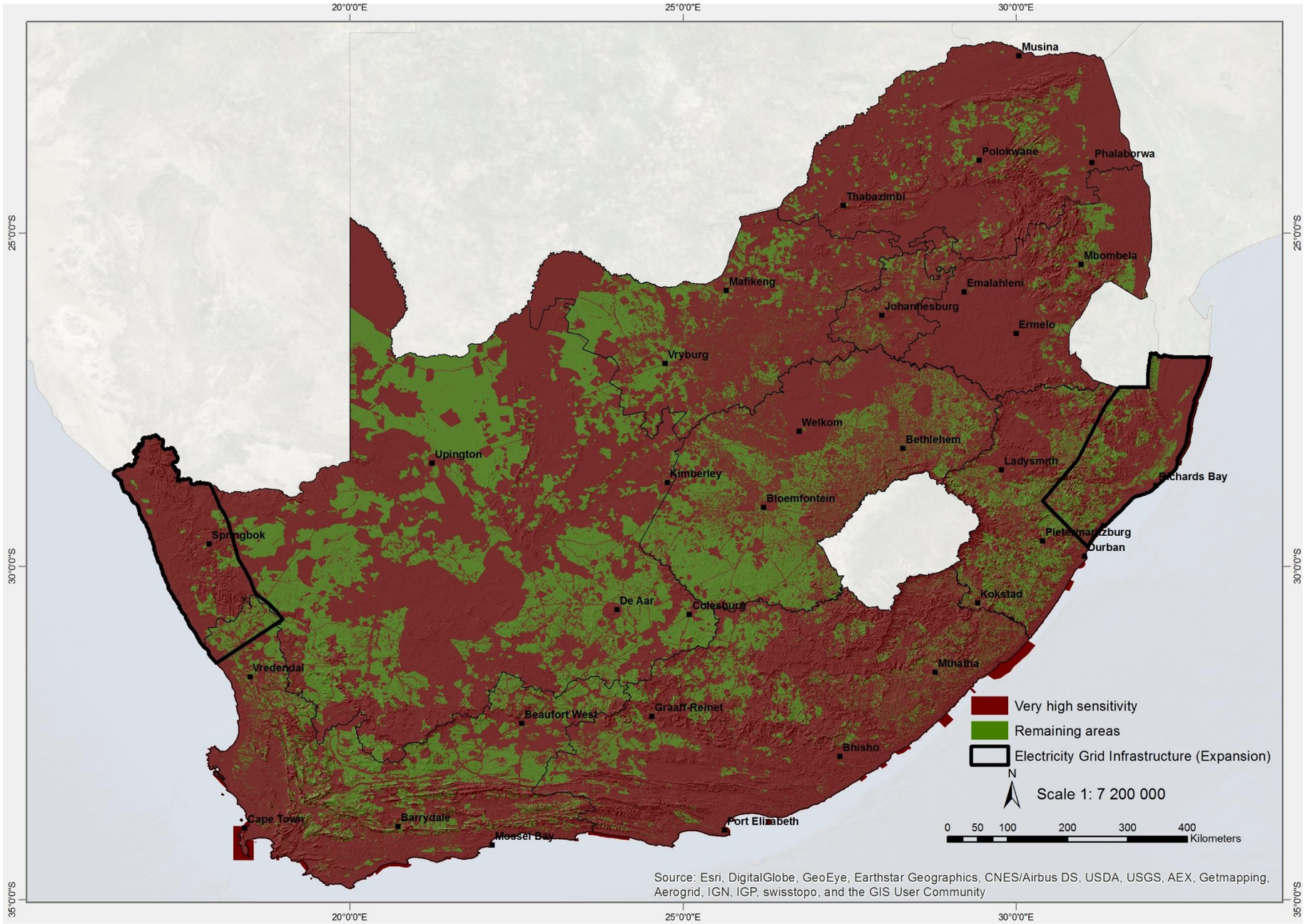
Table 9: Summary of Public Engagement undertaken during the SEA

Date	Mechanism	
July 2017	Advertisements placed in the following newspapers to inform stakeholders of the SEA (as part of the Project Initiation):	
	• The Star • Cape Argus • Diamond Fields Advertiser	• Daily News • Farmers Weekly • Engineering News
October 2017	Advertisements placed in the following newspapers to notify stakeholders of the planned public meetings for the Public Outreach – Round 1:	
	• Business Day • Cape Argus • City Press • Daily Dispatch	• Daily News • George Herald • The Gemsbok • The Star
1 November 2017 to 8 November 2017	Public Outreach – Round 1 at the following locations:	
	• Cape Town • East London • Johannesburg	• Durban • Springbok • George
6 July 2018	Article published online in Engineering News provide a progress update on the SEA.	
August 2018	Advertisements placed in the following newspapers to provide an update on SEA Process: • Cape Argus • Daily News • Diamond Fields Advertiser • The Star	
September 2018 and October 2018	Advertisements placed in the following newspapers to notify stakeholders of the planned public meetings for the Public Outreach – Round 2:	
	• Business Day • Cape Times • City Press • Daily Dispatch • Daily News • EP Herald	• George Herald • The Gemsbok • The Star • Pretoria News • Diamond Fields Advertiser
8 October 2018 to 22 November 2018	Public Outreach – Round 2 at the following locations:	
	• George • Port Elizabeth • East London • Durban	• Johannesburg • Upington • Springbok • Cape Town

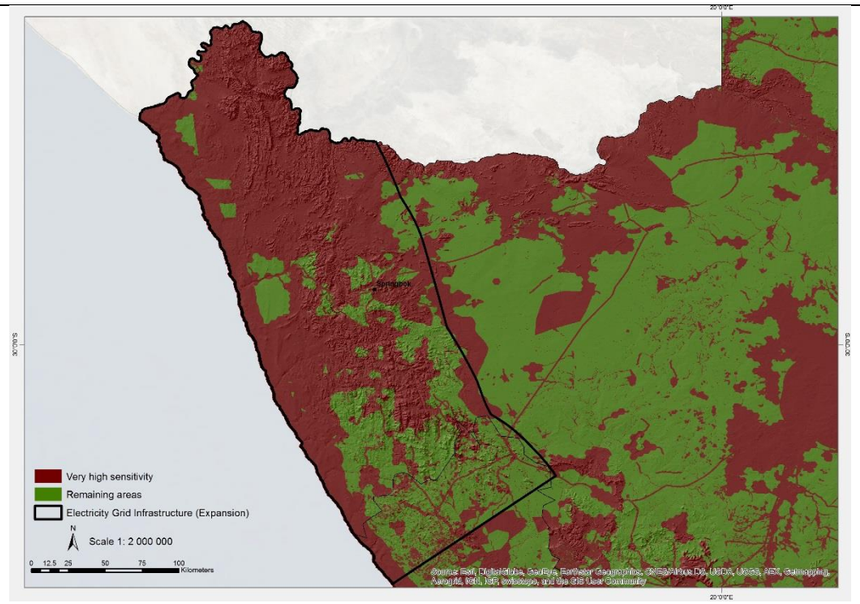




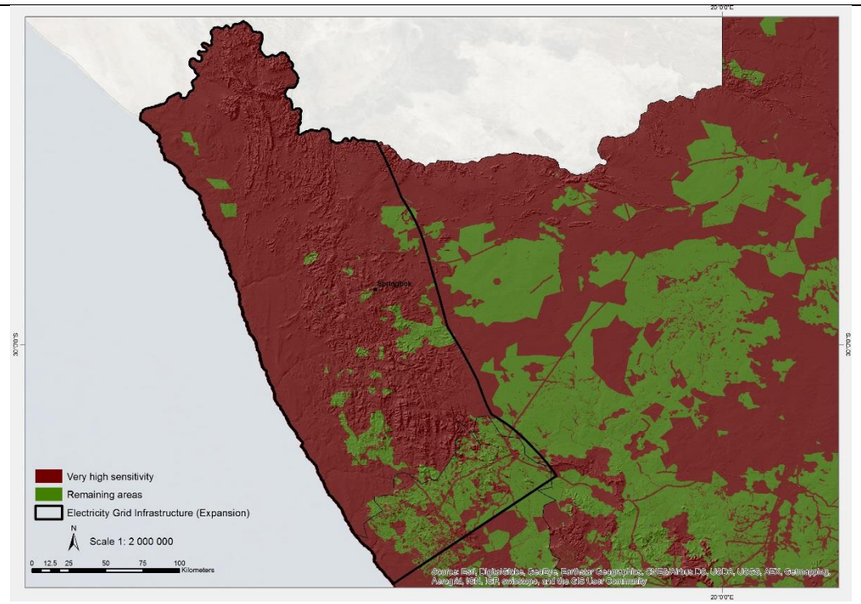
Map 5: Consolidated environmental sensitivity map with Preliminary EGI Expansion corridors overlay (excluding Rivers, Mining Areas, Towns, Villages and Settlements)



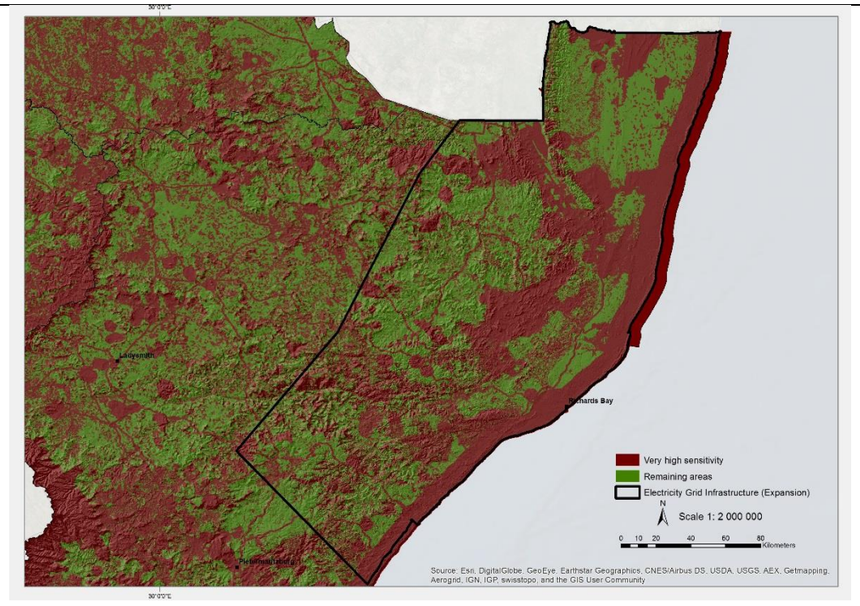
Map 6: Consolidated environmental sensitivity map with Preliminary EGI Expansion corridors overlay (including only mining applications that have been granted, and excluding Rivers, Towns, Villages and Settlements)



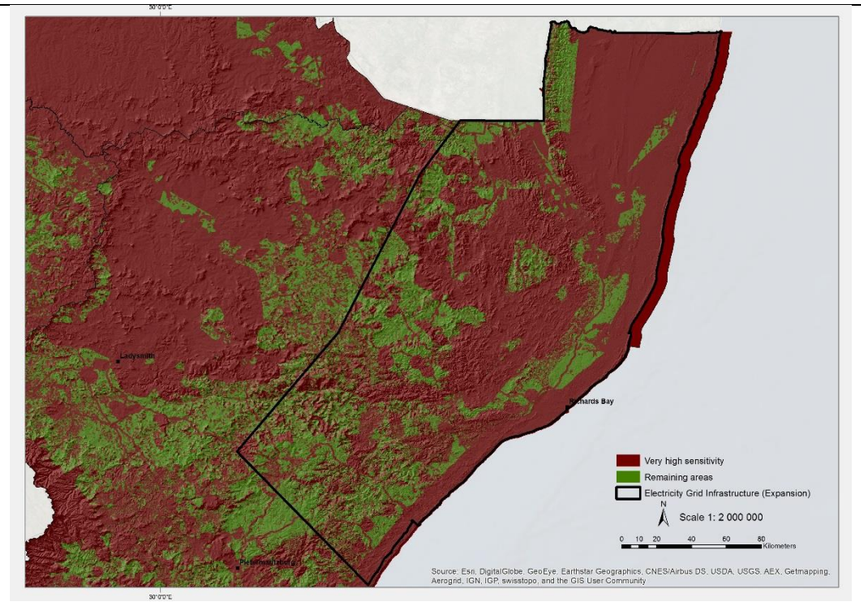
Map 7: Pinch Point Analysis: Zoomed in map of the Expanded Western EGI Corridor (Rivers, Mining Areas, Towns, Villages and Settlements excluded due to scale).



Map 8: Pinch Point analysis: Zoomed in map of the Expanded Western EGI Corridor (including only mining applications that have been granted, and excluding Rivers, Towns, Villages and Settlements).



Map 9: Pinch Point analysis: Zoomed in map of the Expanded Western EGI Corridor (Rivers, Mining Areas, Towns, Villages and Settlements excluded due to scale).



Map 10: Pinch Point analysis: Zoomed in map of the Expanded Western EGI Corridor (including only mining applications that have been granted, and excluding Rivers, Towns, Villages and Settlements).

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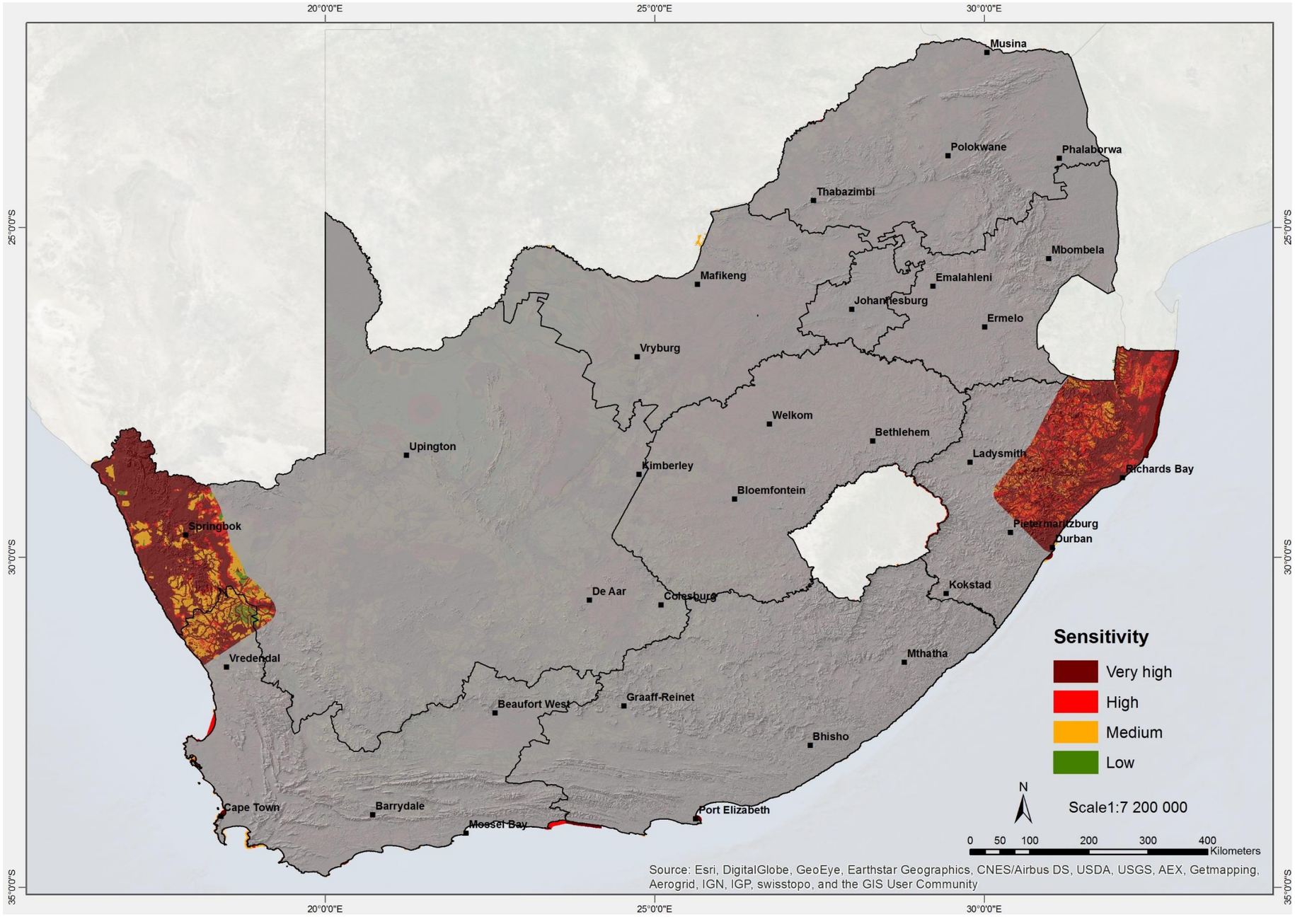
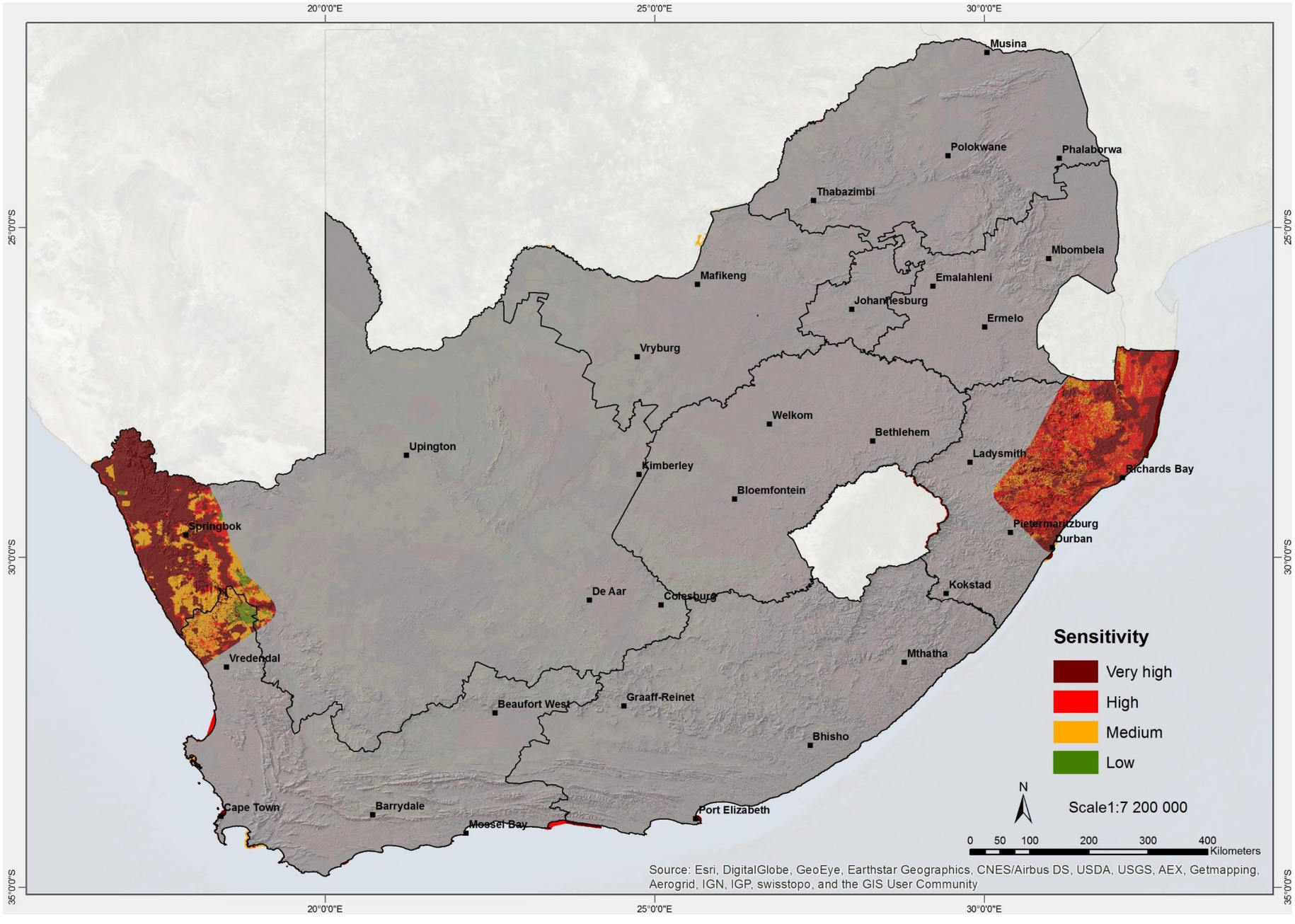
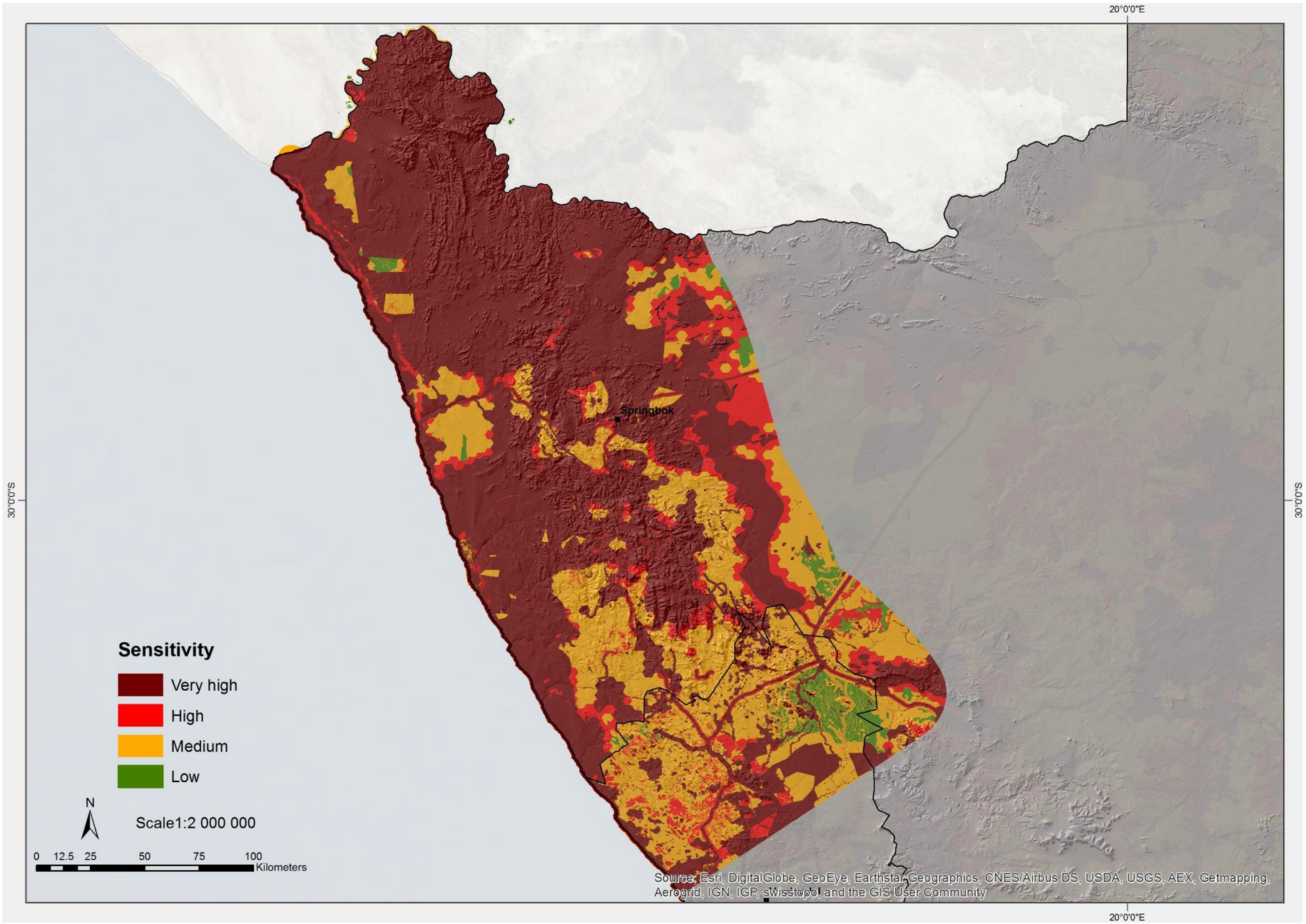


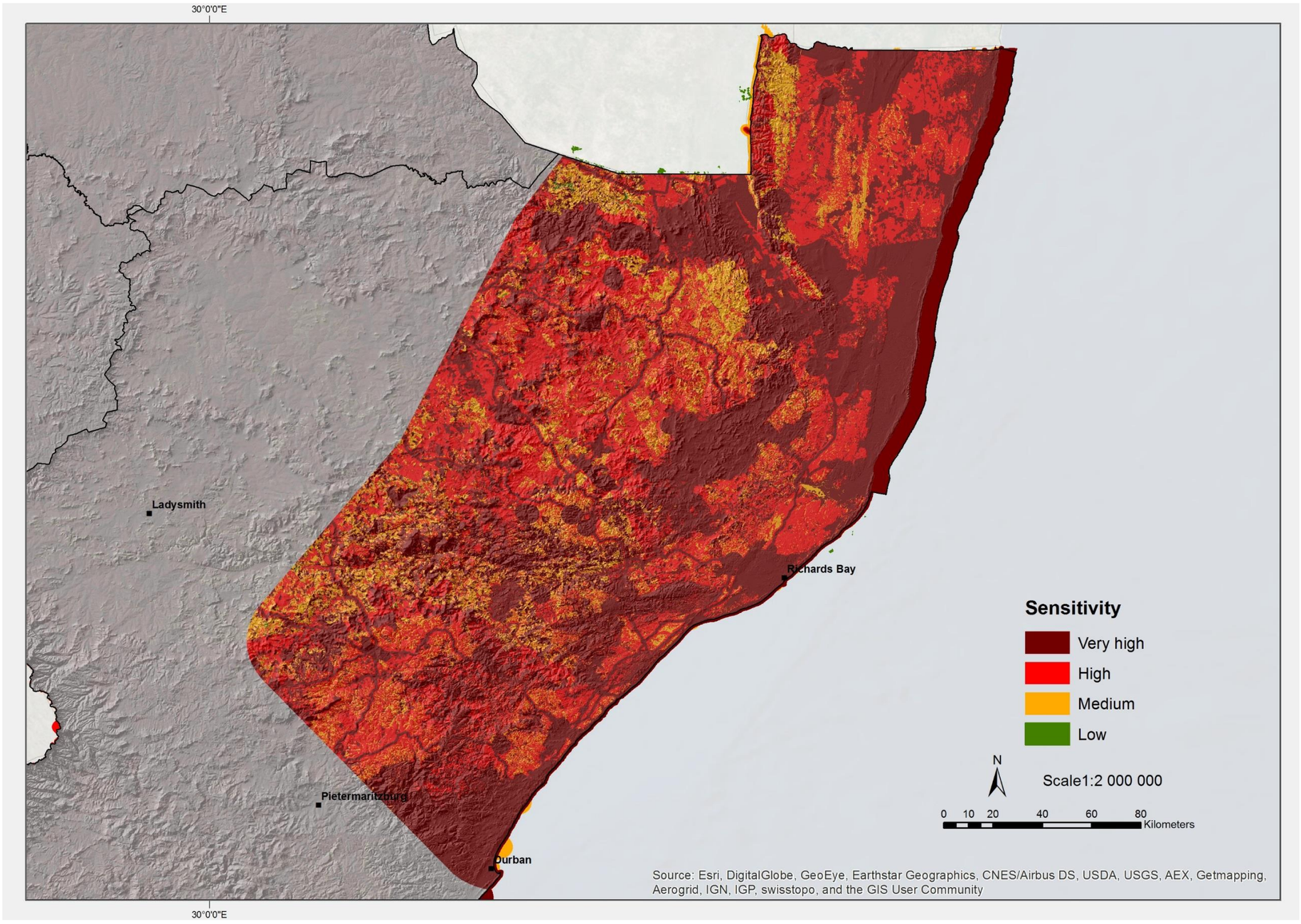
Map 11: Draft Environmental Constraints/Sensitivities for the Draft Refined Corridor Map (Rivers have been included in this map)



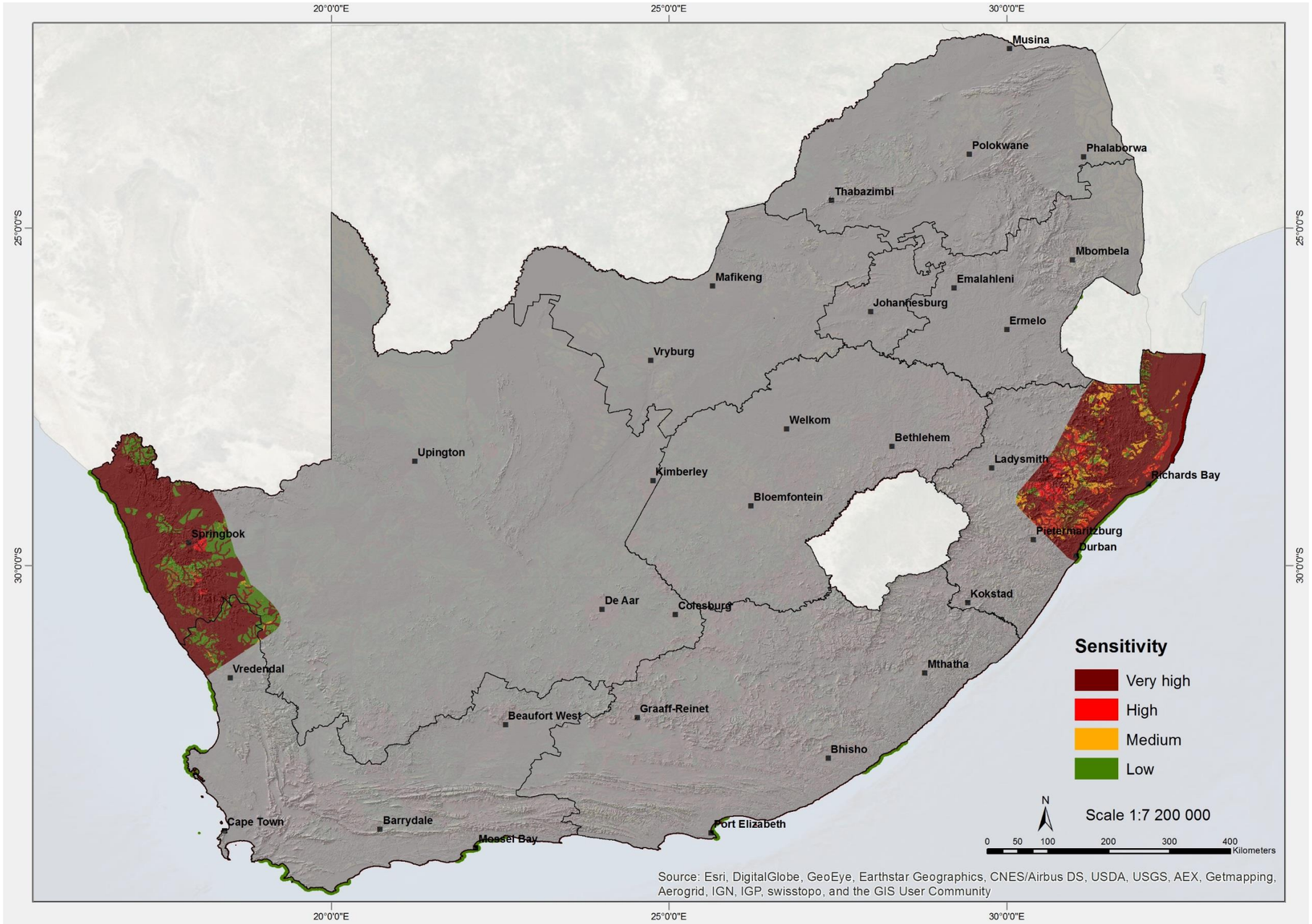
Map 12: Draft Environmental Constraints/Sensitivities for the Draft Refined Corridor Map (excluding Rivers and Visual Sensitivities)



Map 13: Zoomed in Draft Environmental Constraints/Sensitivities for the Draft Refined Western Expanded EGI Corridor Map (excluding Rivers, Towns, Villages and Settlements).



Map 14: Zoomed in Draft Environmental Constraints/Sensitivities for the Draft Refined Eastern Expanded EGI Corridor Map (excluding Rivers, Towns, Villages and Settlements).



Map 15: Draft Engineering Constraints for the Draft Refined Corridor Map