CLIMATE CHANGE VULNERABILITY RISK ASSESSMENT

Proposed Upgrade of Transnet Heliport and associated Infrastructure,

Issue/revision	First submission
Job number	22/005
Date	November 2022
Prepared by	Simon Gear

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CONTENTS

1. INTRODUCTION

Transnet SOC Ltd (Transnet) is undertaking the environmental authorisation process in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended) and the National Environmental Management Waste Act, 2008 (Act 59 of 2008) for the proposed Transnet Heliport and associated Infrastructure.

The project comprises the proposed extension of the Transnet Helipad, located in Richards Bay (at 28°48'12.93"S, 32°05'30.46"E) in northern KwaZulu-Natal. the construction of a new helipad that will extend approximately 15 m from the existing shoreline into the subtidal zone of the Richards Bay estuary.

Kijiji Kijani Environmental consultants (Pty) Ltd (Kijani) was appointed by Nsovo Environmental Consulting (Pty) Ltd. (Nsovo) to provide specialist climate change input into the EIA application for the proposed heliport extension.

Kijani is a specialist air quality consultancy with extensive experience in the provision of specialist input into EIAs in South Africa. All relevant staff are fully trained in all aspects of air quality analysis and modelling and are competent to undertake such work in a professional and timely manner.

Furthermore, Kijani hereby declares their independence on this matter, in keeping with the requirements of specialist professionals as outlined by the National Environmental Management Act, 107 of 1998 (NEMA). Kijani works under the auspices of Nsovo on this project.

2. ENTERPRISE DETAILS

Table 1: Enterprise details

Enterprise Name	Transnet SOC Ltd
Trading As	Transnet
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc	State-owned Company
Registered Address	138 Eloff Street Braamfontein JOHANNESBURG 2000
Telephone Number (General)	+27 11 308 3000
Industry Type/Nature of Trade	Transport
Land Use Zoning as per Town Planning Scheme	Industrial

2.1 Location and extent of facility

Table 2: Location and extent of facility

Coordinates	28°48'12.93"S 32°05'30.46"E
Extent (km²)	0.004 km^2
Elevation Above Mean Sea Level (m)	5 m
Province	KwaZulu-Natal Province
Metropolitan/District Municipality	King Cetshwayo District Municipality
Local Municipality	uMhlathuze Municipality

The site is situated at the mouth of Richards Bay harbour, in the northern KwaZulu-Natal Province, at 28°48'12.93"S and 32°05'30.46"E; and is at sea level. Refer to Figure 1 for the location of the site.

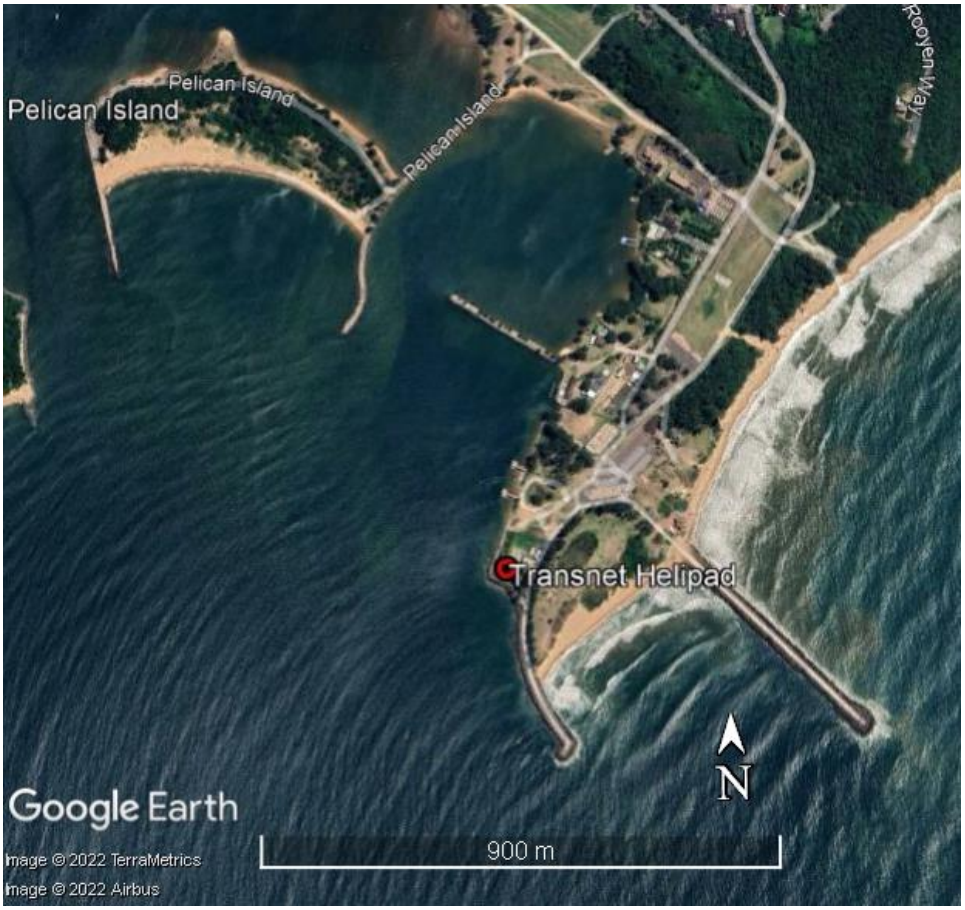


Figure 1: Locality Map indicating the existing Transnet Helipad

2.2 Relevant climate change legislation

The project is situated in the KwaZulu-Natal Province, in the King Cetshwayo District Municipality. This area **has not** been formally declared as an Air Quality Priority Area in terms of Section 18(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (AQA).

South Africa is a signatory of international climate change commitments, including the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the COP 21 Paris Agreement. As part of these commitments, the South African National Climate Change Response White Paper was published in 2011.

The National Greenhouse Gas Emission Reporting Regulations (GG No. 40762, Notice 275) in terms of NEMAQA were promulgated in April 2017.

Informed by these, South Africa tabled the Climate Change Bill (GG No. 41689, Notice 580) in October of 2021.

3. SITE DISCUSSION

The following description was compiled by Confluent Environmental (Pty) Ltd (Confluent) in September 2022 as part of the estuarine impact assessment for this project.

The Richards Bay estuary is located to the north of Durban in KwaZulu Natal province. It is located within quaternary catchments W12F (which is drained by the Mhlatuze River), and W12J (which is drained by the Mzingazi River). The current delineated extent of the Richards Bay EFZ used to historically be part of what was known as the larger uMhlathuze estuarine lake system. Five main rivers used to drain into this system and included the Mtantatweni (which drains Lake Cubhu), the Mhlatuze (the major river that drained through a delta area of swamp vegetation into the western part of the basin), the Bhizolo and Manzinyama rivers and the Mzingazi (draining Lake Mzingazi).

The development of the Richards Bay port in the early 1970s resulted in major modifications to the estuarine lake system, the most significant being that it was artificially split by a berm into northern and southern sections, what are now known as the Richards Bay and uMhlathuze estuaries, respectively. The Mhlatuze River was redirected into the southern uMhlathuze estuary and as this was the main river supplying the former estuarine lake system, freshwater inputs into northern Richards Bay estuary were considerably reduced, and the main freshwater inputs are currently received from the Bhizolo and Manzinyama rivers, which currently serve as drainage canals.

Activities associated with the development of the port, including dredging, wharf construction, infilling, widening of the mouth and stabilisation and breakwater construction have resulted in considerable modifications to the Richards Bay estuary. The widening and deepening of the pre-existing mouth to act as a port entrance channel resulted in a ***significant increase in tidal range*** *resulting in the loss of large areas of shallow subtidal and intertidal habitat*[1]*.*

[1] Weerts SP and MacKay CF (2019). 'Habitat lost and habitat gained. Development drives estuary type change - the case of Richards Bay' in Volume 3: Estuarine Realm. South African National Biodiversity Institute, Pretoria. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A

4. NATURE OF THE PROCESS

According to the Richards Bay Port's aviation insourcing strategy, the current infrastructure facilities are not adequate to accommodate additional helicopter, equipment, and personnel for rendering maintenance and operational services. For this reason, an expansion of the site is required. The proposal is to expand the footprint of the site out into the channel to the immediate west of the existing site.

The proposed additions to the Transport Helipad include three options:

- Deck on pile
- Sheet pile wall with rubble mound
- Sheet pile wall

4.1 Deck on Pile

The construction of a 31m x 26m reinforced concrete deck supported by beams resting on bored piles. The deck would extend into the water, approximately 7.3m from the adjacent navigational channel. A rock revetment will be added below the deck to prevent soil erosion due to wave action.

4.2 Sheet pile wall with rubble mound

Construction of a sheet pile wall with a sloped rubble mound structure supporting the helipad deck. An anchor block will be constructed laterally supporting the sheet pile wall. The structure will extend to approximately 2.3m from the navigational channel.

4.3 Sheet pile wall

Construction of a sheet pile wall supported laterally by an anchor block. The structure will extend to within approximately 7.3m of the navigational channel. Anodes will be required for protection against corrosion.

5. CLIMATE DESCRIPTION

A long-term weather dataset was identified for the Richards Bay airport (SAWS, 2022). Following comparison to the Arboretum weather station situated at Harbour West, the South African Weather Services (SAWS) dataset was selected as an acceptable proxy for the study area.

5.1 Wind

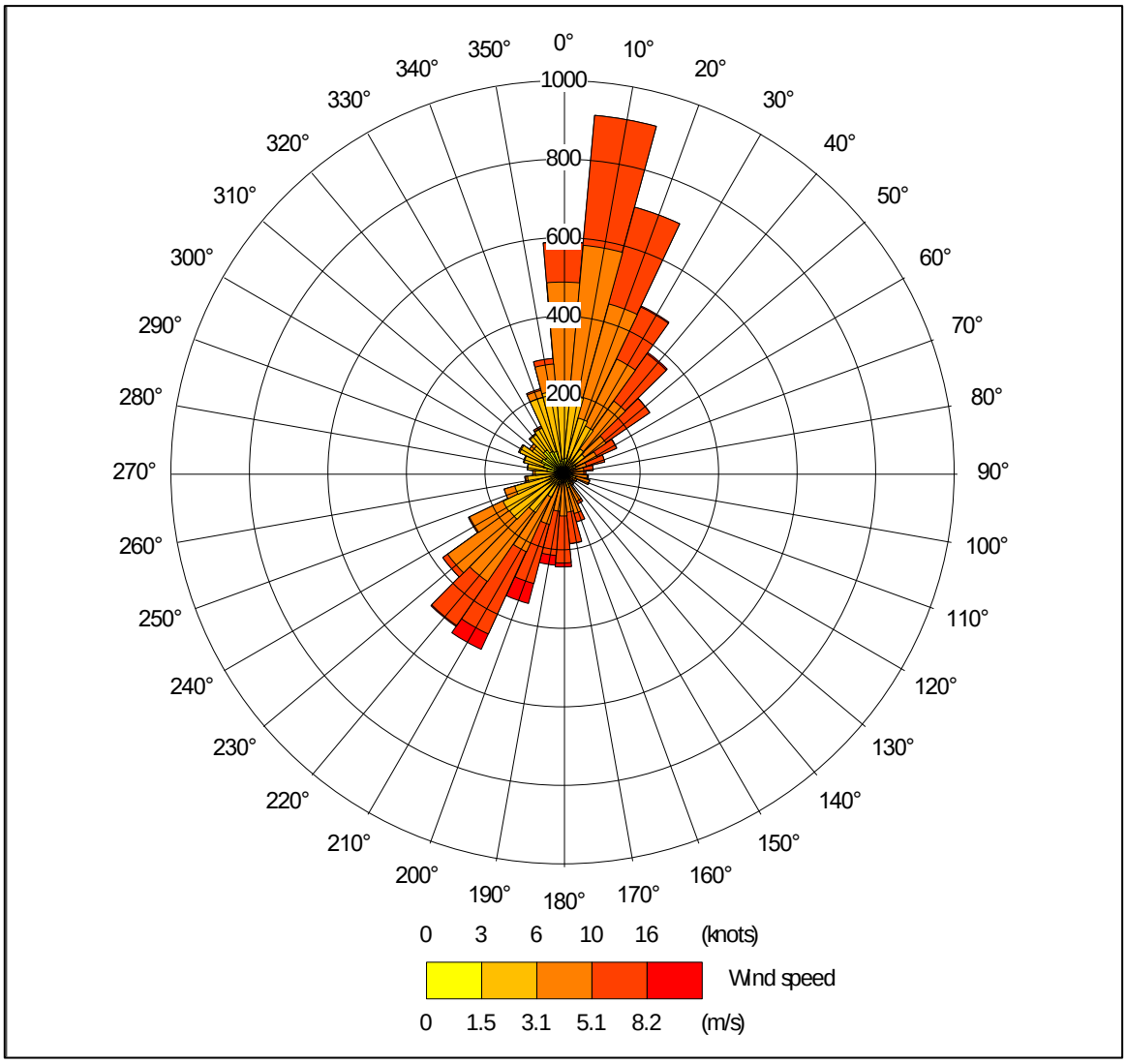
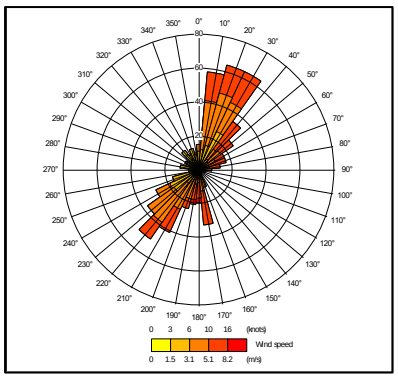


Figure 2: Annual wind rose for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 2022)



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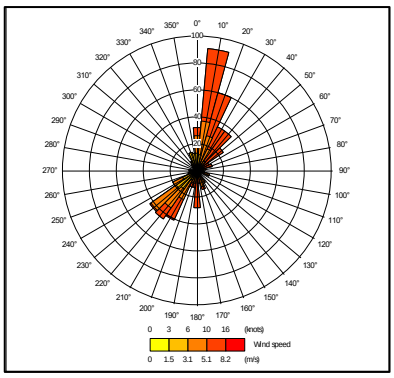

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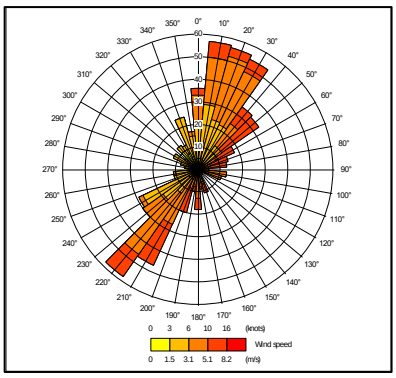

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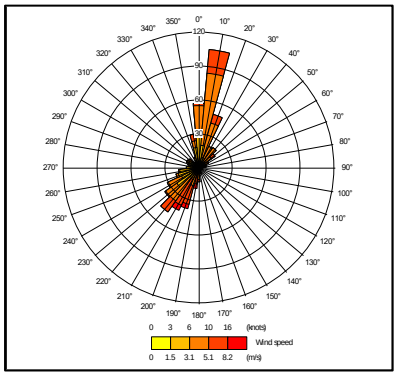

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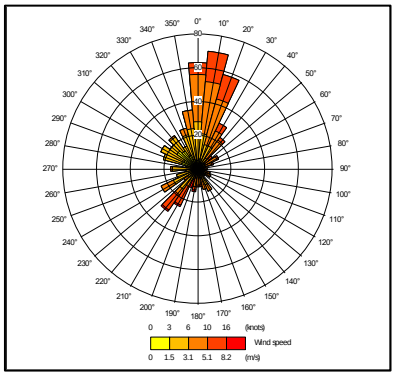

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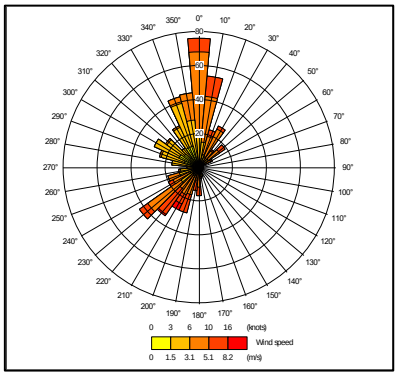

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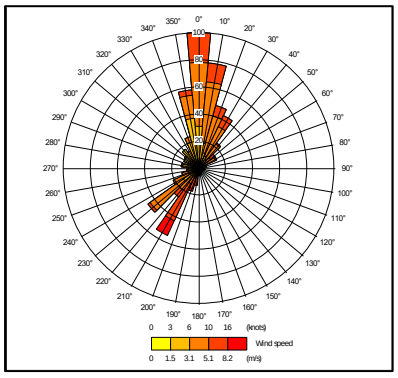

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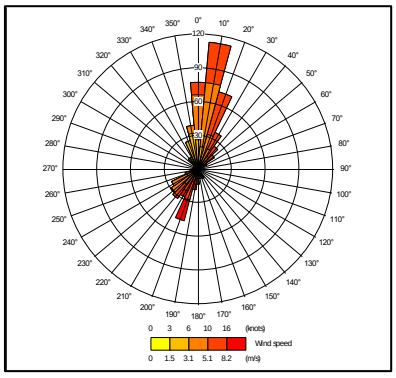
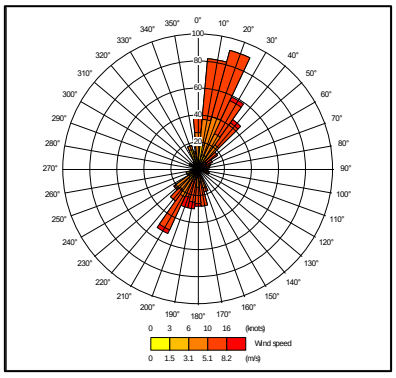


August



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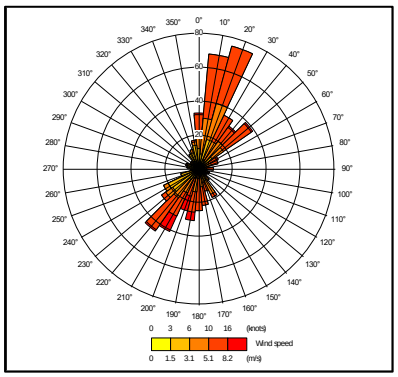
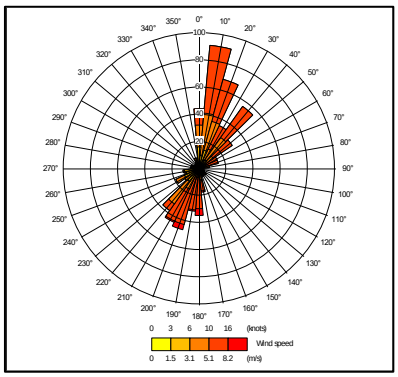
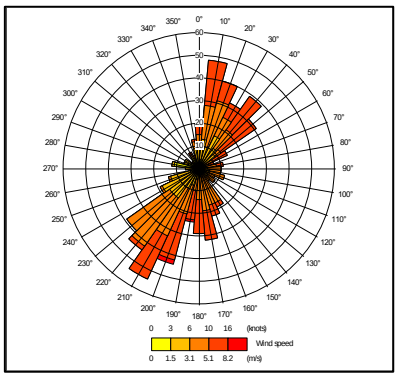


October



November



December

Figure 3: Monthly wind roses for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 2022)

The prevailing winds are from the north and north northeast, with an occasional southerly component, strengthening in mid-summer. As a result, any dispersion from the site is likely to vary with the passage of weather systems up the coast but will be primarily to the south of the site.

5.2 Precipitation

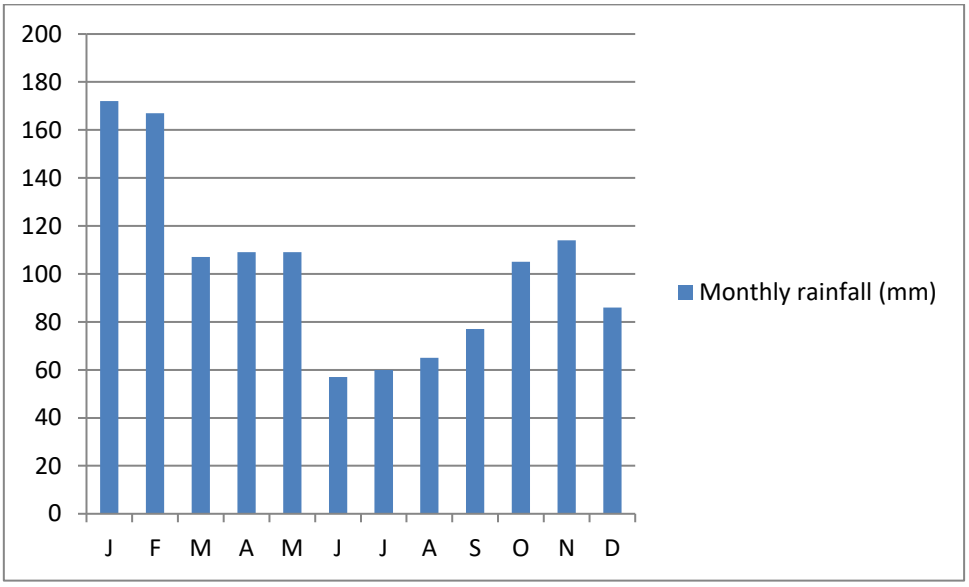


Figure 4: Average monthly rainfall figures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (mm per month)

The site is on the northeast coast of South Africa, in an area known for its warm, moist sub-tropical climate. The region is known colloquially as the KwaZulu-Natal north coast. This region is characterised by regular, year-round rain and spells of very hot and humid weather. The annual average rainfall for the region is just over 1200 mm per year (approximately twice the rain received by Johannesburg). Rain peaks in late to mid-summer, in January and February, but the region is also likely to receive rain all year round.

Figure 5: Average relative humidity at 08h00, 14h00 and 20h00 for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (%)

The KwaZulu-Natal north coast is known for its periods of high humidity with the summer months particularly susceptible to this weather. Winter is progressively dryer with a return to high humidity by October.

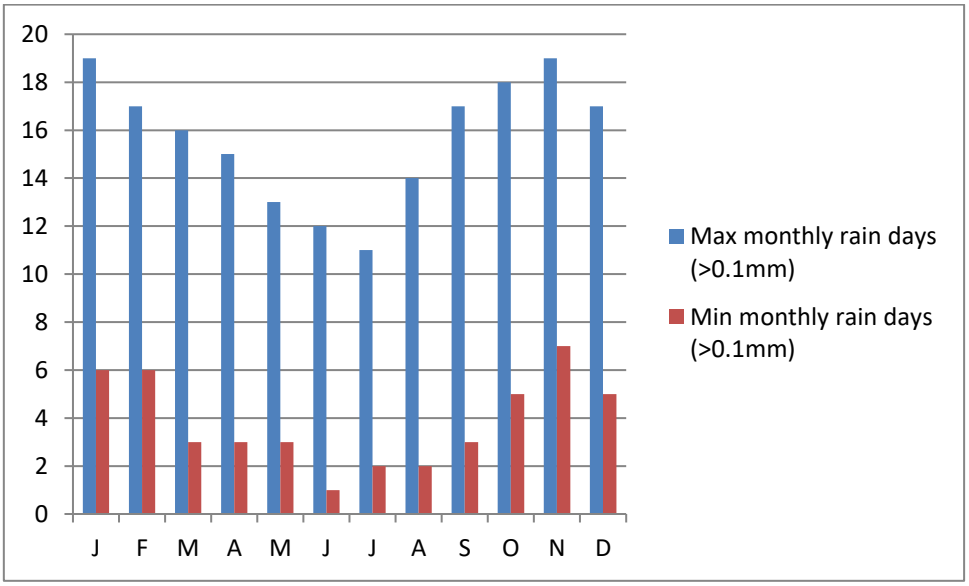


Figure 6: Average monthly rain days (days where precipitation exceeds 0.1mm) for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (number of days per month)

The region is characterised by consistently good rainfall, with even the driest winter months receiving at least one day of rain. In summer, rain can be an almost daily occurrence.

5.3 Temperature

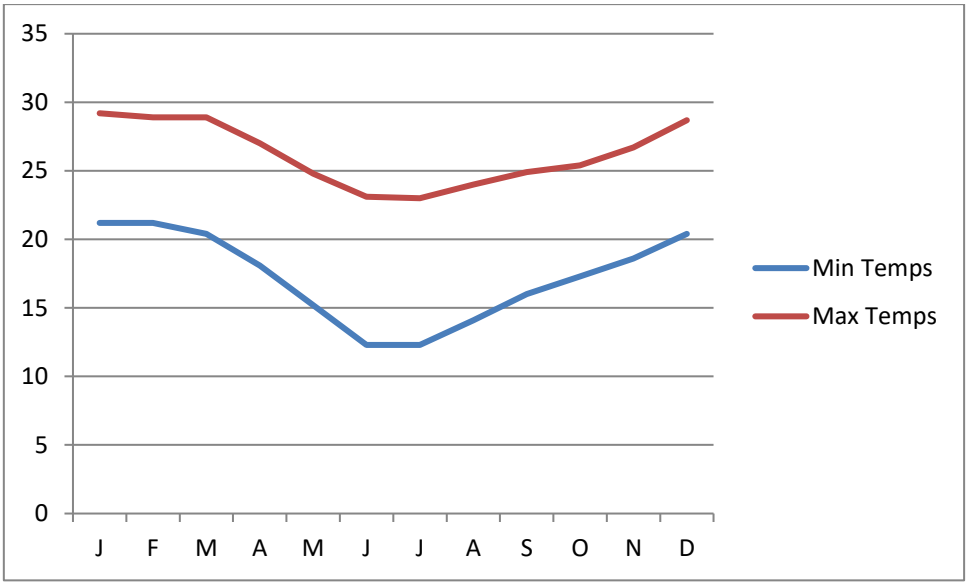


Figure 7: Average daily minimum and maximum temperatures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (°C)

The climate is consistently warm and moist, with minimum temperatures seldom, if ever dropping below the 10-degree mark. The area experiences hot conditions during the summer, with the warmest period in December and January, when maximum temperatures average close to 30°C. Winters are mild with daytime temperatures reaching into the mid-twenties on most days and overnight temperatures never dropping below freezing. Despite it being nominally the dry season, winter remains consistently wet with occasional rain.

6. CLIMATE CHANGE VULNERABILITY ASSESSMENT

Engelbrecht et al. (2019)[2] ran a series of modelling projections for various climate change mitigation scenarios. These are known as representative concentration pathways (RCPs) and are measured in units of radiative forcing ($W.m^{-2}$ by the year 2100). For each RCP scenario, 3 figures representing the 10th, 50th (median) and 90th percentiles of the ensemble of model projections under the RCP are represented. In this way, it is possible to gain some understanding of the uncertainty range that is associated with the projections.

These range from RCP 2.6 which is the ambitious policy scenario and is considered no longer plausible to RCP 8.5, where mitigation is low and is representative of a continuation of current mitigation policies. For the purposes of this document, the RCP 8.5 scenario and its implications are discussed. For each RCP scenario, 3 figures representing the 10th, 50th (median) and 90th percentiles of the ensemble of model projections under the RCP are represented in Engelbrecht et al (2019). In this way, it is possible to gain some understanding of the uncertainty range that is associated with the projections.

6.1 Temperature

The statistical analysis of temperature trends over Africa reveals that southern African temperatures are rising at a rate of about twice the global rate of temperature increase. Temperature increases on their own, even before considering changes in rainfall, thus pose a significant risk to the southern African region[3].

Rapid rises in the annual-average, near-surface temperatures are projected to occur across southern Africa from 2021 to 2050, with the northern KwaZulu-Natal coast expecting increases in average temperature of approximately 2 to 3°C. Projected changes in annual average temperature of 4 to 5°C are plausible from 2071 to 2100.

[2] Engelbrecht, F., Le Roux, A., Arnold, K. & Malherbe, J. 2019. Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at:
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537

[3] Engelbrecht, F., Le Roux, A., Arnold, K. & Malherbe, J. 2019. Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at:
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537

Table 3. Projected change in average annual temperature for uMhlathuze District Municipality, for the RCP 4.5 and 8.5 scenarios, for the period 2021–2050, relative to the baseline period (1961–1990)[4].

Percentile:	10th	90th
RCP 4.5	1.61°C	1.79°C
RCP 8.5	1.97°C	2.19°C

6.2 Rainfall

Under all RCP scenarios, rainfall is projected to increase over the central interior and east coast. A minority of ensemble members project general rainfall increases over eastern South Africa. Consistent with the projected decreases in rainfall, extreme rainfall events are projected to increase in frequency.

The projected changes in rainfall patterns under the low mitigation, RCP 8.5 scenario are very similar to the patterns projected under high mitigation.

Table 4. Projected change in average annual rainfall uMhlathuze District Municipality, for the RCP 4.5 and 8.5 scenarios, for the period 2021–2050, relative to the baseline period (1961–1990)[5].

Percentile:	10th	90th
RCP 4.5	-50.30mm	-17.25mm
RCP 8.5	66.78mm	61.73mm

6.3 Extreme rainfall events

Seasonal variability in rainfall, in particular, is expected to increase, with wetter wet periods and more extreme droughts forecast[6]. With this in mind, it is worth noting that historical flood lines may need to be reassessed and decisions on the placement of infrastructure be made extremely conservatively. [7]

[4] Le Roux, A., van Niekerk, W., Arnold, K., Pieterse, A., Ludick, C., Forsyth, G., Le Maitre, D., Lötter, D., du Plessis, P. & Mans, G. 2019. Green Book Risk Profile Tool. Pretoria: CSIR. Available at: riskprofiles.greenbook.co.za

[5] Le Roux, A., van Niekerk, W., Arnold, K., Pieterse, A., Ludick, C., Forsyth, G., Le Maitre, D., Lötter, D., du Plessis, P. & Mans, G. 2019. Green Book Risk Profile Tool. Pretoria: CSIR. Available at: riskprofiles.greenbook.co.za

[6] WIREs Clim Change 2014, 5:605–620. doi: 10.1002/wcc.295

[7] Engelbrecht, F., Le Roux, A., Arnold, K. & Malherbe, J. 2019. Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at:
https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537

For the purposes of the table below, an extreme rainfall event (including severe thunderstorms and lightning) is defined as 20 mm of rain occurring within 24 hours.

Table 5. Projected change in number of extreme rainfall events per year for uMhlathuze District Municipality, for the RCP 4.5 and 8.5 scenarios, for the period 2021–2050, relative to the baseline period (1961–1990)[8].

Percentile:	**10th**	**90th**
RCP 4.5	-2.44 days	0.34 days
RCP 8.5	0.02 days	1.38 days

6.4 Sea level rise

In recent decades, sea level around South Africa has increased at a rate of around 3 mm year per year, consistent with estimates of global mean sea level rise over that time. Allison et al. (2022)[9] produced sea level projections for eight locations around the coast of South Africa under low (RCP2.6) and high (RCP8.5) emissions scenarios. In the year 2100 locations around South Africa are projected to experience sea level rise (relative to 1986–2005) of approximately 0.5 m (0.25–0.8 m) following RCP2.6, or around 0.85 m (0.5–1.4 m) following RCP8.5. These increases are around 7%–14% larger than projections of global mean sea level, due to the local amplification of increases in several components of the sea level budget.

Table 6. Projected change in mean sea level at Richards Bay, for the RCP 2.6 and 8.5 scenarios, for the period 2021–2100, relative to the baseline period (1986–2005)[10].

Percentile:	**5th**	**90th**
RCP 2.6	0.25m	0.55m
RCP 8.5	0.5m	1.3m

[8] Le Roux, A., van Niekerk, W., Arnold, K., Pieterse, A., Ludick, C., Forsyth, G., Le Maitre, D., Lötter, D., du Plessis, P. & Mans, G. 2019. Green Book Risk Profile Tool. Pretoria: CSIR. Available at: riskprofiles.greenbook.co.za

[9] Lesley C Allison et al 2022 Environ. Res. Commun. 4 025001

[10] Lesley C Allison et al 2022 Environ. Res. Commun. 4 025001

7. CLIMATE CHANGE IMPACT ASSESSMENT

While the project may be impacted on by climate change issues, it is not anticipated that the project itself will contribute to climate change through increased carbon emissions. For this reason, no carbon emissions calculation is undertaken.

7.1 Reporting requirements

The proposed Transnet Helipad extension is not expected to trigger the reporting requirement for greenhouse gases under the National Greenhouse Gas Emission Reporting Regulations (GG No. 40762, Notice 275).

8. CONCLUSION AND IMPACT SUMMARY

It is clear that building so close to the waterline will expose the project to risks associated with increased rainfall, increased flood events and increased sea level. It is therefore recommended that the engineers closely interrogate the summary provided in Section 6 of this report and adjust their designs accordingly to mitigate this risk.

There is no impact of the project on global climate change identified.

8.1 Alternatives

The three construction alternatives were not individually interrogated for resilience to climate change impacts. It is recommended that the engineers responsible select the design best suited to withstand rising sea levels and an increased likelihood of flood events.

8.2 Impact ratings

Table 7. Direct impact rating table

Project activity or issue	Potential impact	Nature of impact	Significance before mitigation						Significance after mitigation as per EMPr					
		+ / -	E	D	M	P	S	SR	E	D	M	P	S	SR
Climate change														
Helipad extension	Climate change	n/a	5	4	0	4	36	**M**	5	4	0	4	36	**M**

Table 8. Cumulative impact rating table

Project activity or issue	Potential impact	Nature of impact	Significance before mitigation						Significance after mitigation as per EMPr					
		+ / -	E	D	M	P	S	SR	E	D	M	P	S	SR
Climate change														
Helipad extension	Climate change	n/a	5	4	0	4	36	**M**	5	4	0	4	36	**M**

9. DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

PROJECT TITLE

Proposed Upgrade of Transnet Heliport and associated Infrastructure, Port of Richards Bay, KZN – Climate change vulnerability and risk assessment

Specialist:	Kijiji Kijani Environmental Consultants		
Contact person:	Simon Gear		
Postal address:	26 Fairbridge Rd, Roosevelt Park ext 1		
Postal code:	2195	Cell:	082 821 4975
Telephone:	082 821 4975	Fax:	-
E-mail:	simon@kijanigreen.co.za		
Professional affiliation (s) (if any)	Pr. Nat. Sci (in assessment)		

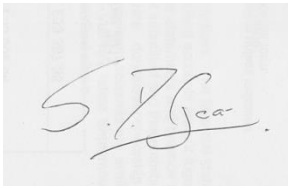
Project consultant:	Nsovo Environmental Consulting		
Contact person:	Masala Mugwagwa		
Postal address:	Beaulieu Office Park, Block 1, Ground East, Corner of Papenfus and Stallion Road, Midrand		
Postal code:	1684	1684	1684
Telephone:	087 803 9294	087 803 9294	087 803 9294
E-mail:	masala.mugwagwa@nsovo.co.za		

The specialist appointed in terms of the Regulations

I, Simon Gear, declare that

- I act as an 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 71 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

Kijiji Kijani Environmental Consulting

Name of company (if applicable):

10 November 2022

Date: