

Scoping and Environmental Impact Reporting Process for
the Development of New Berth 605 and Associated
Infrastructure to Support the Container Handling Facility,
Port of Richards Bay, Kwazulu-Natal

Palaeontological Impact Assessment

TNPA/2023/09/0019/43828/RFP

Desktop Report (Phase 1)

For

WSP Africa (Pty) Ltd
9 April 2025



Expertise and Details of Specialist

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Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by WSP Africa (Pty) Ltd, Midrand, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision-making process for the Project.

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Signature:

A handwritten signature in blue ink, appearing to read 'M Bamford', with a horizontal line underneath.

Executive Summary

Transnet National Ports Authority (TNPA) is proposing a new Berth 605 and associated infrastructure in support of a Container Handling Facility at the Port of Richards Bay (PoRB), KwaZulu-Natal.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop study (Phase 1) Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the moderate to low sensitive rocks of the KwaMbonambi and Sibayi Formations (Quaternary; Maputaland Group) that might preserve marine molluscs, diatoms and peat but the site is very disturbed. Nonetheless, a Fossil Chance Find Protocol should be added to the Environmental Management Programme (EMPr). Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, developer, environmental officer or other designated responsible person once excavations or drilling activities have commenced. Any impact on the Palaeontology will have **low Sensitivity Points** (<30). There are no no-go areas and no monitoring is needed as the fossils are microscopic or the same as modern taxa.

Table 1: Summary of the Paleo-Sensitivity of the Proposed Berth 605 Project Area

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	Moderate to Low	Low	Palaeontological Impact Assessment	Section 7.2. SAHRA Requirements

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1. Background

As part of a national project to improve the operational efficiency at the PoRB, TNPA proposes the construction of a new Berth 605 and associated infrastructure in support of a CHF. WSP has been commissioned to undertake the engineering and environmental tasks associated with the Berth 605 project. The Berth 605 project area falls within the PoRB Masterplan within the Bayview Precinct. Other precincts that form part of the PoRB Masterplan are South Dunes and Newark Precincts (Figures 1-3).

The PoRB is situated on the north-eastern coast of KwaZulu Natal (KZN) and falls within the uMhlathuze Local Municipality (ULM) and King Cetshwayo District Municipality (KCDM). The GPS location of Berth 605 is: 28°47'25.71"S; 32° 1'37.70"E

This project comprised a number of associated components (Figure 2):

- **New Berth Pocket and Quay Wall** – A new berth pocket and quay wall is proposed. The new proposed Berth 605 quay wall will extend from the existing Berth 606 quay wall maintaining the same cope line alignment (cope level is the top of the quay wall). On the other end of Berth 605, the quay wall will stop short of Urania Road. The quay is a mass gravity structure with a concrete foundation and walls with soil backfill internally which provides a wider footprint, but a lower density will result in a stable foundation, this is aligned to the existing Berth 606 quay wall and is considered as an economical design that has been used at the PoRB and Port of Coega. The quay wall is expected to be 366 m in length. The new quay wall is designed for a future depth of -19 m Port Chart Datum (PCD). This will ensure that the berth can be lengthened and deepened without the need for additional quay wall deepening costs.
- **End of Berth Basin Slopes** – The Berth 605 must fit within the space between the end of the existing Berth 606 and the South Dunes Road. The location of the end of Berth 606 berth pocket is defined as the end of the existing berth which is the lower retained earth wall. With a slope of 1V:3H from -14.5 m PCD to the existing ground level is 60 m long, this provides a total berth length of 338.5 m from the toe of the embankment to the start of Berth 606. This will support a vessel of 315 m Length Overall (LOA). A basin width of 305 m is applied to the bottom of the basin where a proclaimed depth of at least -14.5 m PCD is to be maintained.
- **Dredging** – The new Berth 605 quay wall will be constructed to -19m PCD to allow for further Port expansion at a point in the future. For this project, the berth will be dredged such that a proclaimed depth of -14.5 m PCD is achieved, however the design dredging depth also considers sedimentation and sounding accuracy i.e. 0.6 m below -14.5 m PCD providing a design depth of -15.1 m PCD. This dredge depth is consistent with the PoRB depths and the requirements of the design vessel. This approach limits the volume of dredge material requiring disposal.
- **Dredge Disposal** – An estimated 2.8 million cubic metres of dredged material will be disposed of at an existing authorised offshore disposal site. However, it is estimated that a bulked volume of approximately 3.6 million cubic metres will be disposed of at the offshore dump site.

- **Scour Protection** - The concept design evaluated the necessary scour protection to prevent excessive erosion, which will compromise the structural integrity of nearby infrastructure, such as Urania Road, or cause excessive sediment movement within the berth pocket. The movement of material within the berth is also of significant concern. The depth of the berth pocket is impacted when material erodes from one area and is deposited elsewhere in the berth pocket. Consequently, maintenance dredging will be required to maintain the required berth pocket minimum navigation depth. A revetment (sloped embankment) will be constructed on the seaward side of the Urania Road. This slope must be protected against wave and propeller action to maintain the structural integrity of the Urania Road. A riprap scour protection system has been considered.
- **New Rail Siding** – Based on the design throughput and the current requirement of a 50-wagon container train and 2 locomotives, it is proposed that the rail siding will consist of two rail lines that are 370m each in length, each servicing 25 rakes. The existing Mhlatuze Yard will be used for shunting and staging purposes to service the new proposed rail siding.
- **New Access Road** – a new shared access road and vehicle access control point to the PoRB, the CHF) and the adjacent vacant land surrounding the CHF is proposed. The new road will be an estimated 735 m length with a lane width of 3.7 m and a reserve width of 30 m. It will consist of two (2) lanes each direction and three (3) intersections; at Urania Road, at Ventura Road and one to the CHF. The shared access road will also have a security control facility as the road is accessible from outside of the Port's security perimeter. Street lighting will be provided for as part of the new road network extension. It must be noted that the road itself and the berth will not be traffic generating, the traffic that will be generated is associated with the operation of the CHF.
- **Footprint of the CHF and Apron Area** – The CHF will be built and operated by the operator therefore this S&EIR process only considers the disturbance footprint of the CHF and not the associated permits that it will require when operational. The total area considered is 6.75 Ha for the CHF with estimated dimensions of 270 m x 250 m. The apron area is an operational area located behind the quay wall and is used for the movement of trucks. The apron area is an estimated 33 m wide and 400 m in length.
- **Provision of Electrical Supply to Feed the Facility Operations and Equipment** – The preferred alternative is applicable where the required electrical demand is within the available capacity of the current existing 11 kV network. A new feed will be taken from the existing 11 kV network to provide electrical power to the new CHF and quay wall. However, while there is existing capacity on the current 11 kV network, this is limited and may not be able to provide for the full electrical demands in the future. To protect against restricting future electrical supply constraints, a new 11 kV Switching Station fed from the existing Primary Substation is proposed.
- **Water** – The concept design allows for water to be sourced from the municipal supply. There are three municipal feeds into the port, supplied by two separate municipal

reservoirs. This provides adequate supply contingency, and therefore, no additional storage has been included in the system. The existing 225mm diameter water main will be extended along with the new quay wall to supply ship water along the new quay. At the end of the new quay wall extension the water main will follow Urania Road to tie into the existing 150mm diameter pipe in the vicinity of the existing gate house. Connections to new buildings will be off takes from either the existing network directly, or via extensions to the existing network brought to the boundary of the proposed CHF. A tie in point will be provided. Connections to new buildings will be off takes from either the existing network directly, or via extensions to the existing network brought to the boundary of the proposed CHF. A tie in point will be provided which will consist of approximately 500 m of pipework with a diameter of 150 mm. Inside the quay wall, water will be provided to landing valves for ships and firefighting.

- **Building water** - A new 75mm diameter pipe will branch off from the 150mm diameter water pipe to supply a metered connection for the handling facility. Any connections to new buildings will be made from the metered supply point, located on the western side of the site, just south of the Seafarers club. The Container Handling Facility operator will be responsible for the water network within the facility.
- **Ship water** - The proposed new water main line will tie into the existing 225mm diameter asbestos cement water pipe, that is in the existing quay of berth 606, located on the eastern side of the new berth 605. The new pipe will be 200 mm diameter, within the new quay wall, with 75 mm off takes to the landing valves. The 200mm diameter pipe reduce in size to a 160 mm diameter, where the pipe exits the new quay wall and is parallel to Urania Road and will tie into the existing 150mm diameter asbestos cement pipe north of the existing security access to complete the ring.
- **Fire water** - The fire water in the PoRB is off the water reticulation network. Allowance for fire-hydrants will be made where there isn't a dedicated firefighting system. This allowance is for normal hydrants outside the container handling facility boundary along the lengths of pipelines that will be installed to service the new quay wall extension.
- **Sewerage** – The existing sewer network has been evaluated to identify areas that require upgrades to accommodate the extension of the sewer network for the new proposed CHF. The sewerage system will allow for wastewater from new toilets, basins, baths and showers. The proposed sewer will be designed to tie into the closest existing pipe network or an existing pump station closest to the proposed CHF. Sewerage inside the CHF will be designed to accommodate for approximately 160 people. The new sewerage pipeline will have a connection point at the northwestern boundary of the CHF. It will be approximately 100 m in length and 160 mm pipe diameter. The preferred alternative involves designing a sump to accommodate the

facility's sewer through gravity flow, with pumping from the sump to the existing pumpstation PS20, located north of the facility. The final sewer pipe route will be determined during the design phase.

- **Stormwater** – With the hydrological analysis complete and design flows computed, the stormwater pipes were sized. The minimum size of stormwater pipelines is 600mm diameter, which considers effective maintenance of the stormwater network. With the hydrological analysis complete and design flows computed, the stormwater pipe system has been designed to accommodate a 1 in 5-year storm. The proposed handling facility, as well as any future development adjacent to berth 605 will require major floods to flow overland into the bay. The area will therefore have to be designed and shaped to accommodate overland flow during a major storm, to prevent water ponding and to control flood damage to any infrastructure. The minimum size of stormwater pipelines is 450mm diameter, which considers effective maintenance of the stormwater network. Conventional catchpits, at 50m to 80m spacing, have been shown along the proposed access road. The access road stormwater is then routed in a pipe system to the bay at a slope of 0.5%. The pipeline will be approximately 360 m along the quay line and 400 m on the other side with a 900mm pipe diameter. It will have a velocity of 0.6 m/s for self-cleaning, to prevent sand settling inside the pipe and blocking. There will also be cross drainage at the new rail siding which will be 400 m in length and 600 mm diameter. The existing network discharges into the bay through the existing quay wall.
- **Provision for Temporary Laydown and Stockpile Areas** – Areas for temporary stockpiles and laydown areas have been designated and will be further assessed as part of the project. An approximate area of 4.2 Ha, 220 m in length and 170 m wide to be used as a potential lay down area for the project. In addition, two temporary stockpile areas are proposed. The first image is an area of approximately 2.4 Ha, 250 m in length and 100 m wide. The area is located SE of the CHF. The second area is split into two areas across the Harbour Arterial Road. These areas cover an area of approximately 6 Ha. The infilling of approximately 6 Ha of the basin is also being considered for stockpiling (this infilled area also forms part of the basin to be dredged).

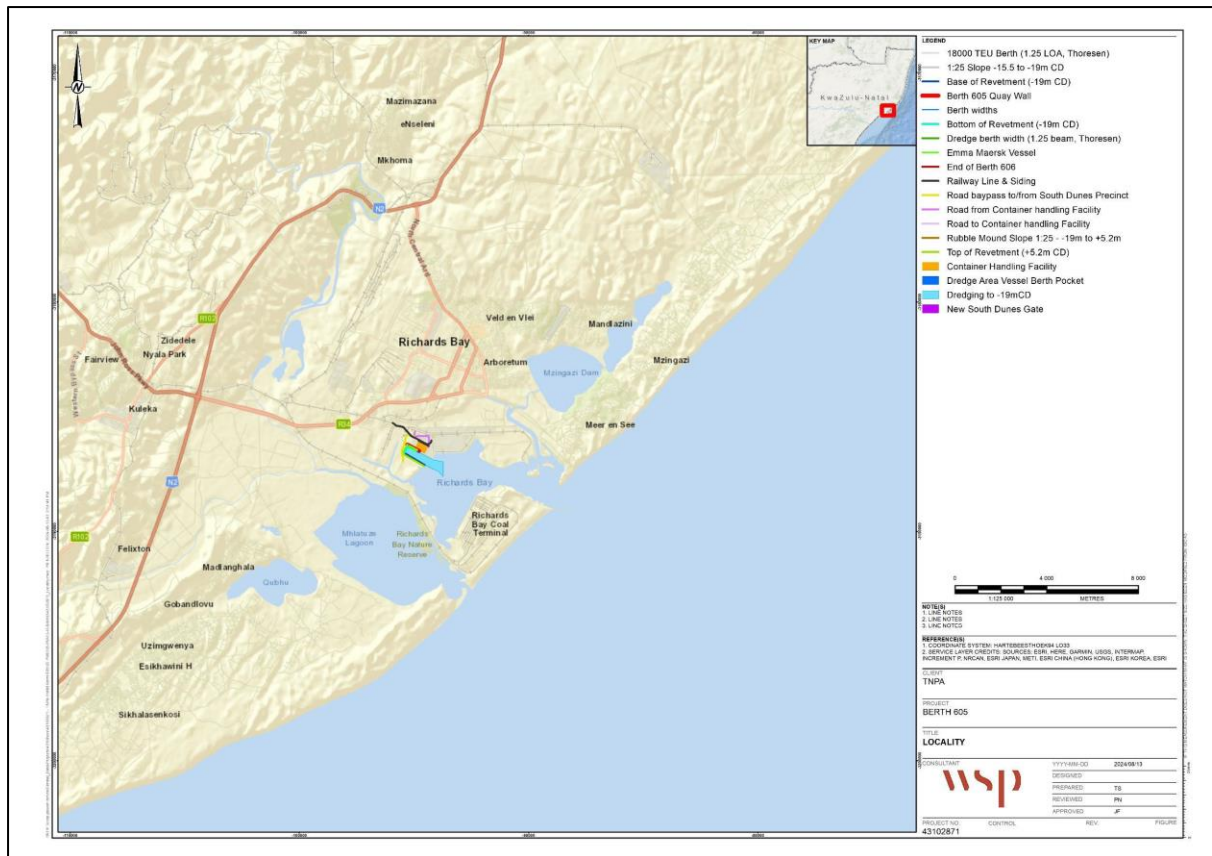


Figure 1: General area and location of the Port of Richards Bay facilities. Map provided by WSP.

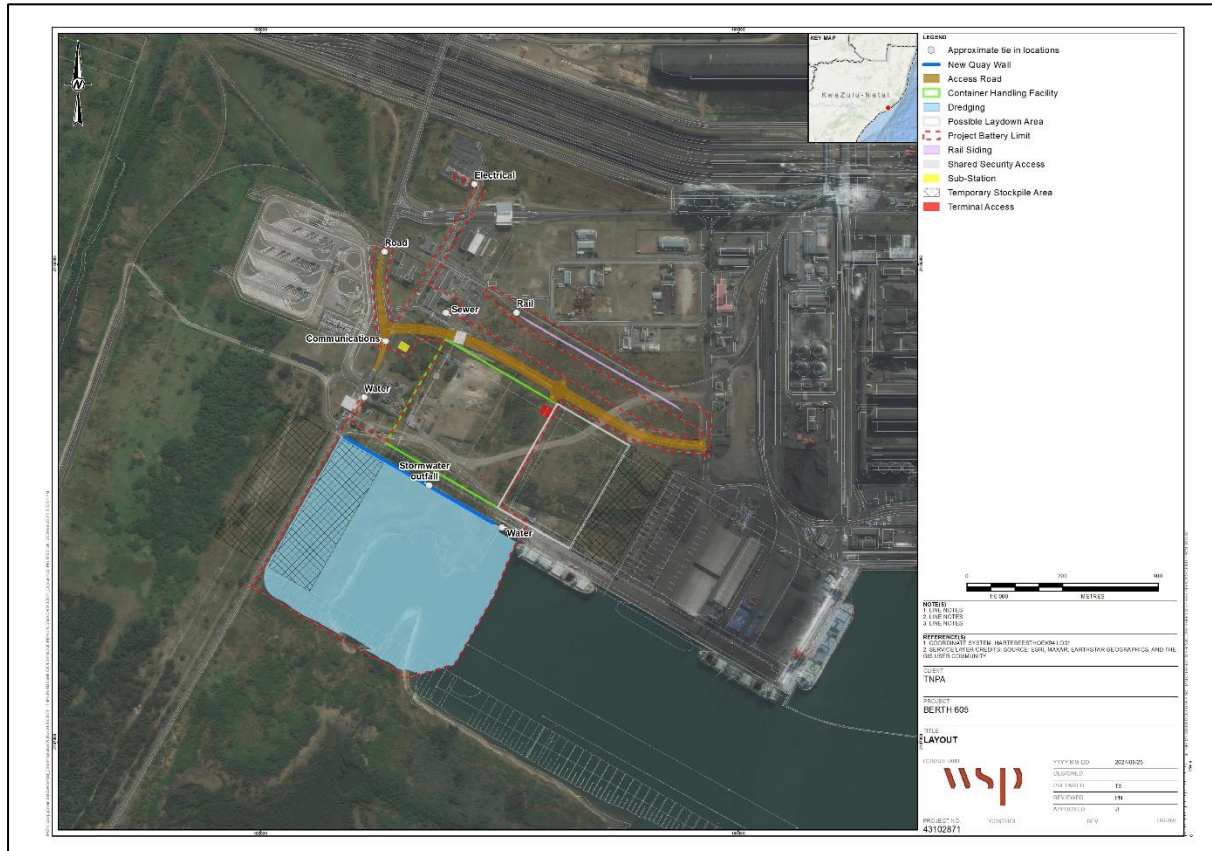


Figure 2: Aerial map of the different components of the Richards Bay Project.

A Phase 1 PIA was requested for the New Berth 605 project. To comply with the regulations of the SAHRA in terms of Section 38(8) of the NHRA, a desktop study (Phase 1) PIA was completed for the proposed development and is reported herein.

Table 2 below indicates the compliance of this report to Appendix 6 of the EIA Regulations 2014, as amended.

Table 2: National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6). Includes the requirements from GNR Appendix 6 of GN 326 EIA Regulation 2017.

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
ai	Details of the specialist who prepared the report,	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
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;	N/A
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, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMP	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
nii	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	Sections 6, 8
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies of any comments that were received during any consultation process	N/A
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

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases; eg <https://sahris.sahra.org.za/map/palaeo>
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance, as is the case here;
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representativity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

3.1. Project location and geological context

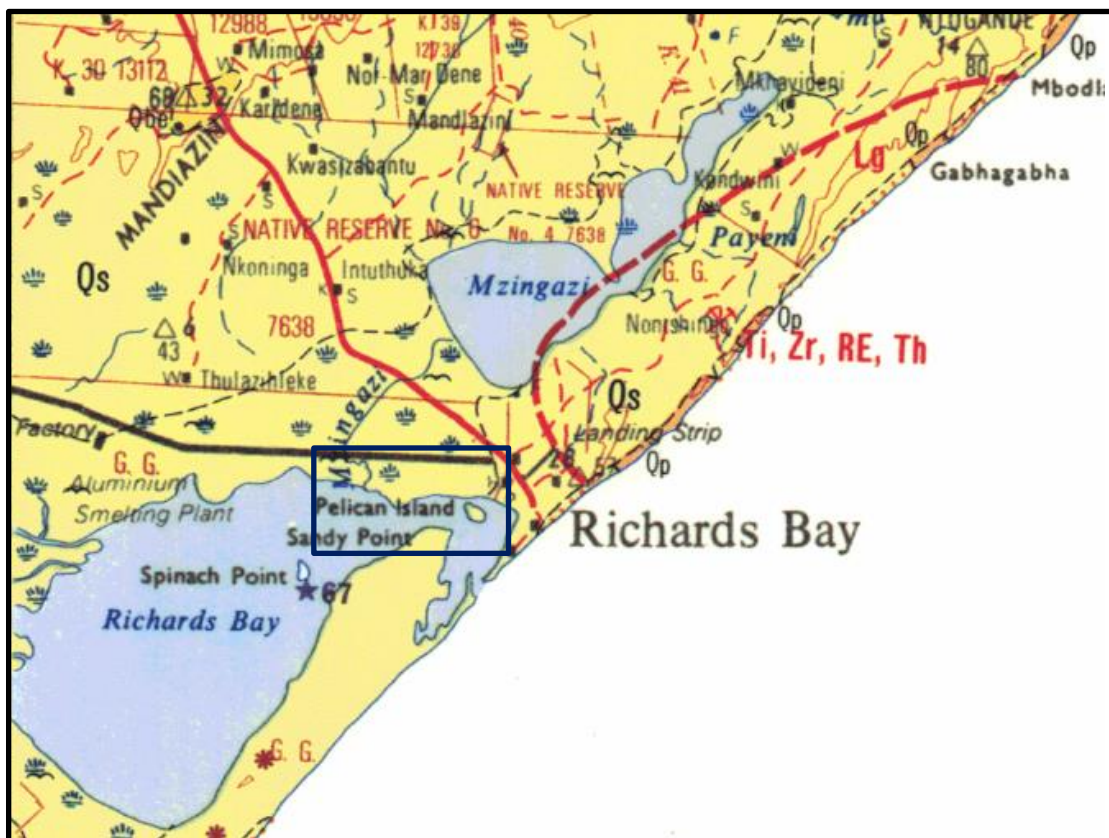


Figure 3: Geological map of the area around the PoRB New Berth 605 (within the black). Abbreviations of the rock types are explained in Table 3¹.

Table 3: Explanation of symbols for the geological map and approximate ages

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary Sands	Alluvium, sands, scree	Quaternary Ca 0,5 Ma
Q	Quaternary sands, dune sands	Sands, aeolian sands	Quaternary Ca 10 kya
Qp	Port Durnford Fm, Maputaland Group	Dune sand, coquina	Late Pleistocene Ca 700 kya

SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project (Johnson et al., 2006; Partridge et al., 2006).

¹ Map enlarged from the Geological Survey 1: 250 000 map 2732 St Lucia

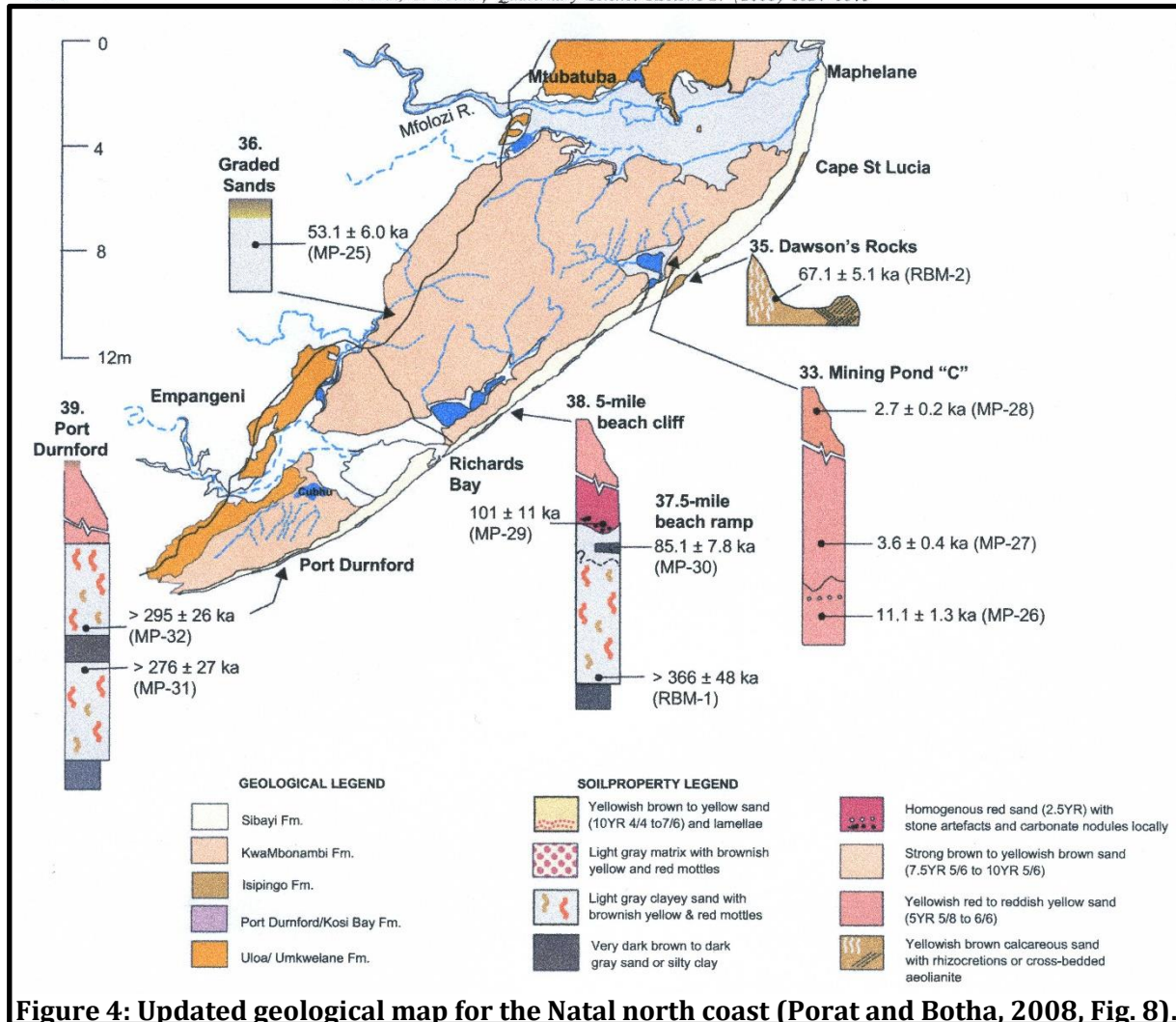


Figure 4: Updated geological map for the Natal north coast (Porat and Botha, 2008, Fig. 8).

The site lies in the northeastern coast of South Africa where the Quaternary sands of the Maputaland Group cover the older underlying rocks (Figures 3–4).

The Cenozoic deposits of littoral marine, estuarine, fluvial, lacustrine and aeolian origin have developed along the coastal margin of South Africa over the last 60 million years. Onshore deposits are relatively thin but offshore deposits are much thicker, especially in the extensional rift basins and as cones at major river mouths (Dingle et al., 1983; Roberts et al., 2006). Reasons for this discrepancy in thickness are that the passive coastal margins are buoyant and the continent has undergone at least two phases of epeirogenic uplift (Partridge and Maud, 1987; but see Braun et al., 2014).

Five groups of coastal deposits are recognised and they vary in width, extent and gradient. In the region the deposits are known as the Maputaland Group.

The Cenozoic Maputaland stratigraphy has been revised over the last few decades and the most recent iteration recognises seven formations (Botha, 2018). The basal Uloa Subgroup is composed of the Uloa Formation and the overlying Umkweleane Formation (previously the Berea Formation, noted on the maps). The upper Umfolosi Subgroup has

been divided into five formations, from the base upwards, the Port Durnford Formation, Isipingo Formation (six members), the KwaMbonambi Formation (two members) and the youngest Sibayi Formation (two members).

The basal Uloa Formation was deposited during the mid- to late Miocene and is composed of calcified beach gravels with coquina and subtidal channel sands with oysters, representing a dynamic coastline and sealevel changes. It lies on a basement ranging from Archaean to Oligocene rocks. The Umkwelane formation is slightly younger at late Miocene and comprises the aeolianite and decalcified aeolianite to “Berea-type” reddish brown soil profile (Botha, 2018). The overlying Port Durnford Formation occurs in the east and is composed of older dune sands and Late-Middle Pleistocene clay and sand with coquina and mammal fossils.

The Kosi Bay Formation is the dominant stratum in the area and ranges from the middle to Late Pleistocene. It has a discontinuous basal lignite bed dated to more than 295 ka. The rest of the formation has been divided into members of the Isipingo Formation representing different beaches and aeolianites of the glacial and interglacial phases of the late Pleistocene.

The Lake Sibayi Formation is the name given to the stacked parabolic dunes and palaeosols of Late Pleistocene to Holocene age. It is overlain, or rather replaced, by the KwaMbonambi Formation coastal plain parabolic dunes.

Figure 3 (GSC map) does not differentiate the Quaternary sands but in Figure 4 (Porat and Botha, 2008), the northern part of the Port of Richards Bay is on the KwaMbonambi Formation and the south and coastal margin are on the Sibayi Formation.

3.2. Palaeontology

The latest Pleistocene to Holocene Sibayi Formation could preserve marine molluscs and shells and trace fossils such as worm burrows and nannofossils (microscopic marine organisms) while the KwaMbonambi Formation could preserve diatomite and peat (Roberts et al., 2006). The latter are only visible after extraction in a laboratory and study under a microscope. The area around the harbour has been greatly modified naturally by flooding and high water, as well as construction and infrastructure for the various stages of the harbour development. Any deposits would be very contaminated and of no scientific value.

The palaeosensitivity is shown in Figure 6 with the KwaMbonambi Formation shown as moderately sensitive (green) and the Sibayi Formation sands shown as having low sensitivity (blue). There is no known palaeosensitivity for the offshore sites and bay deposits that will be dredged.



Figure 5: SAHRIS palaeosensitivity map for the proposed New Berth 605 and associated facilities in the Port of Richards Bay shown roughly within the red rectangle².

² Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

4. Impact Assessment

4.1. Assessment of Impacts and Mitigation (WSP format).

The significance of identified impacts was determined using the approach outlined below ³This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Table 3a: Impact assessment factors					
Occurrence		Severity			
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude of impact		

To assess these factors for each impact, the following four ranking scales are used:

Table 3b: Impact assessment scoring methodology		
Magnitude	Duration	
10- Very high/ unknown	5- Permanent (>10 years)	
8- High	4- Long term (7-10 years, impact ceases after site closure has been obtained)	
6- Moderate	3- Medium-term (3 months- 7 years, impact ceases after the operational life of the activity)	
4- Low	2- Short-term (0-3 months, impact ceases after the construction phase)	
2- Minor	1- Immediate	
Scale	Probability	
5- International	5- Definite/Unknown	
4- National	4- Highly Probable	
3- Regional	3- Medium Probability	
2- Local	2- Low Probability	
1- Site Only	1- Improbable	
0- None	0- None	
Significance Points= (Magnitude + Duration + Scale) x Probability		

Table 3c: Significance of impact based on point allocation		
Points	Significance	Description
SP>60	High environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30-60	Moderate environmental significance	An impact or benefit which is sufficiently important to require

³ terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998.

		management and which could have an influence on the decision unless it is mitigated.
SP<30	Low environmental significance	Impacts with little real effect and which will not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

For the method outlined above, the following definitions were used:

- **Magnitude** is a measure of the degree of change in a measurement or analysis (e.g., the area of pasture, or the concentration of a metal in water compared to the water quality guideline value for the metal), and is classified as none/negligible, low, moderate or high. The categorization of the impact magnitude may be based on a set of criteria (e.g. health risk levels, ecological concepts and/or professional judgment) pertinent to each of the discipline areas and key questions analysed. The specialist study must attempt to quantify the magnitude and outline the rationale used. Appropriate, widely-recognised standards are to be used as a measure of the level of impact;

- **Scale/Geographic** extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international;

- **Duration** refers to the length of time over which an environmental impact may occur: i.e. immediate/transient, short-term (0 to 7 years), medium term (8 to 15 years), long-term (greater than 15 years with impact ceasing after closure of the project), or permanent; and

- **Probability of occurrence** is a description of the probability of the impact actually occurring as improbable (less than 5% chance), low probability (5% to 40% chance), medium probability (40% to 60% chance), highly probable (most likely, 60% to 90% chance) or definite (impact will definitely occur).

Table 3d: Phases of the project and the potential impact on the palaeontology of the site.

Phase	Palaeontology
Construction	Important as fossils occur in the ground and may be disturbed when excavations occur
Operational	Although coal was formed by the alteration of peat (buried plant matter) by high temperature and pressure to form coal, the coals themselves are too altered for any organic matter to be recognisable. Rarely one can find fossil plant impressions in the shales between coal seams or above and below but this material is usually discarded.
Decommissioning and closure	Not relevant if no new excavations are made

Table 3e: Impact Assessment for the New Berth 605 project (where mitigation is the removal of scientifically important fossils or a representative sample thereof. With the relevant SAHRA or AMAFA permit. Section 8).

Feature	Pre-mitigation	Post-mitigation
Magnitude	4 – low	2 - minor

Duration	5 – permanent	1 - immediate
Scale	1 – site	1 - site
Probability	2 – low	2 - low
Significance	$(4+5+1) \times 2 = 20$	$(2+1+1) \times 2 = 8$
	SP <30 – Low significance	SP <30 – Low significance
		Positive
PHASE	Construction only	Construction only

4.2. Mitigation

The impact on the palaeontological heritage can be reduced greatly by a palaeontologist conducting a pre-construction site visit to look for fossils and removing any scientifically important fossils with the relevant AMAFA permit. (See Section 8 and Appendix A).

4.3. Positive/Negative Impact

The discovery and removal of fossils as a direct result of this project has a positive impact because prior to this the particular fossils or fossil deposit were unknown to science.

4.4. Additional Environmental Impacts

As far as the palaeontology is concerned, there are no additional impacts because the fossils are inert and inactive.

4.5. Cumulative Impacts

As far as the palaeontology is concerned, there are no cumulative impacts because each site is unique and may or may not have fossils. Fossil bones may be scattered over the landscape but their distribution is erratic and unpredictable. If a bone-bed or plant outcrop occurs this would be an aerielly small concentration of fossils and very unlikely to extend beyond tens of metres. Therefore, projects on adjacent land parcels are unlikely to add any impact on this project.

4.6. No-Go areas

There are NO no-go areas because the fossils, if present, can be removed ad curated in a recognised institution such as a museum or university that has the facilities to store and research the fossil material.

4.7. Impact Phase

It is only the **Construction Phase** that there could be any impact on the palaeontological heritage because this is when the ground will be broken for excavations for foundations and infrastructure. Fossils occur in the ground. The operational and de-commissioning phases will not affect the palaeontology.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. Since there is an extremely small chance that fossils from the KwaMbonambi Formation may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and only some might contain fossil plant, insect, invertebrate and vertebrate material. It is not known what lies below the soils. The soils and sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on the fossil record and the updated geological studies it is unlikely that any fossils occur in the project footprint. In addition, the area is very disturbed. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the undisturbed sands but they would be microscopic. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations and drilling have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample (Section 8).

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	Moderate to low	Low	Paleontological Impact Assessment	Section 7.2. SAHRA Requirements

7. References

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Braun, J., Guillocheau, F., Robin, C., Baby, G., Jelsma, H., 2014. Rapid erosion of the Southern African Plateau as it climbs over a mantle superswell, Journal of Geophysical Research; Solid Earth 119, 6093–6112. doi:10.1002/2014JB010998.

King, L.C., 1953. A Miocene marine fauna from Zululand. Transactions of the Geological Society of South Africa 56, 59-91.

King, L.C., 1970. Uloa revisited: A review of the essential data from this classic locality and a statement of Tertiary history of the Zululand coastal area. Transactions of the Geological Society of South Africa 73, 151-157.

Roberts, D.L., Botha, G.A., Maud, R.R., Pether, J., 2006. Coastal Cenozoic deposits. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 605-628.

Stapleton, R.P., 1977. Planktonic foraminifera and the age of the Uloa Pecten Bed. Bulletin of the Geological Survey of South Africa 60, 11-17.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Taverner-Smith, R., Mason, T.R., Christie, A.D.M., Smith, A.M., van der Spuy, M., 1988. Sedimentary models for coal formation in the Vryheid Formation, northern Natal. Bulletin of the Geological Survey of South Africa, 94. 46pp.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 7). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site an AMAFA permit must be obtained. Annual reports must be submitted to AMAFA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to AMAFA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossils from the Maputaland Group



Figure 7: Photographs of fossil and modern molluscs from coastal deposits to assist the ECO in recognising fossils.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD July 2024

Present employment: Professor; Director of the Evolutionary Studies Institute.
Member Management Committee of the NRF/DSI Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa

Telephone : +27 11 717 6690
Cell : 082 555 6937
E-mail : marion.bamford@wits.ac.za;
marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.

1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.

1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer

1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa

Royal Society of Southern Africa - Fellow: 2006 onwards

Academy of Sciences of South Africa - Member: Oct 2014 onwards

International Association of Wood Anatomists - First enrolled: January 1991

International Organization of Palaeobotany – 1993+

Botanical Society of South Africa

South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016

SASQUA (South African Society for Quaternary Research) – 1997+

PAGES - 2008 –onwards: South African representative

ROCEEH / WAVE – 2008+

INQUA – PALCOMM – 2011+onwards

v) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
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Honours	13	0
Masters	13	3
PhD	13	7
Postdoctoral fellows	14	4

vi) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year

Biology III – Palaeobotany APES3029 – average 25 students per year

Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology;

Micropalaeontology – average 12 - 20 students per year.

vii) Editing and reviewing

Editor: *Palaeontologia africana*: 2003 to 2013; 2014 – Assistant editor

Guest Editor: *Quaternary International*: 2005 volume

Member of Board of Review: *Review of Palaeobotany and Palynology*: 2010 –

Associate Editor: *Cretaceous Research*: 2018-2020

Associate Editor: *Royal Society Open*: 2021 -

Review of manuscripts for ISI-listed journals: 30 local and international journals

viii) Palaeontological Impact Assessments

27 years' experience in PIA site and desktop projects

Selected from recent projects only – list not complete:

- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe
- Glosam Mine 2022 for AHSA
- Wolf-Skilpad-Grassridge OHPL 2022 for Zutari
- Iziduli and Msenge WEFs 2022 for CTS Heritage
- Hendrina North and South WEFs & SEFs 2022 for Cabanga
- Dealesville-Springhaas SEFs 2022 for GIBB Environmental
- Vhuvhili and Mukondeleli SEFs 2022 for CSIR
- Chemwes & Stilfontein SEFs 2022 for CTS Heritage
- Equestria Exts housing 2022 for Beyond Heritage
- Zeerust Salene boreholes 2022 for Prescali
- Tsakane Sewer upgrade 2022 for Tsimba
- Transnet MPP inland and coastal 2022 for ENVASS
- Ruighoek PRA 2022 for SLR Consulting (Africa)
- Namli MRA Steinkopf 2022 for Beyond Heritage
- Adara 2 SEF 2023 for CTS Heritage
- Buffalo & Lyra SEFs 2023 for Nextec
- Camel Thorn Group Prospecting Rights 2023 for AHSA
- Dalmanutha SEFs 2023 for Beyond Heritage
- Elandsfontein Residential 2023 for Beyond Heritage
- Waterkloof Samancor 2023 for Elemental Sustainability
- Zonnebloem WTP 2023 for WSP
- Elders Irrigation 2023 for SRK

- Leghoya WEFS 2023 for Red Cap & SLR

ix) Research Output

Publications by M K Bamford up to July 2024 peer-reviewed journals or scholarly books: over 180 articles published; 5 submitted/in press; 14 book chapters.

Scopus h-index = 32; Google Scholar h-index = 40; -i10-index = 121 based on 7261 citations.

Conferences: numerous presentations at local and international conferences.