British Geological Survey

Supply of sand and crushed rock in The Gambia: Visit findings by the British Geological Survey, December 2024

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Supply of sand and crushed rock in The Gambia: Visit findings by the British Geological Survey, December 2024

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Laterite crushing plant, Bulok © BGS © UKRI 2025

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- Alagie Manjang, Deputy Permanent Secretary, Ministry of Petroleum & Energy (MoPE)
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- Anna Marie Valentine, Communications Officer, Ministry of Petroleum & Energy (MoPE)
- Martin Norman, Deputy High Commissioner, British High Commission, The Gambia.

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Summary

This report details a visit by the British Geological Survey (BGS) to The Gambia in late 2024 focused on disseminating research findings from work completed in The Gambia as part of BGS International Geoscience Research and Development (IGRD) programme. The visit and meeting in The Gambia were aimed at sharing knowledge from this recent work to Geological Department of The Gambia to support sustainable management of sand supply chains. This is a follow-up to a 2023 visit, expanding its scope to include crushed rock aggregate alongside sand. The study seeks to address shortages caused by the depletion of coastal dune sands and identify alternative materials to reduce reliance on imports. Activities consisted of laboratory training in particle-size analysis and fieldwork to better understand mineral supply chains in The Gambia.

The report findings are that marine dredged sand from Denton Bridge has temporarily resolved sand shortages in The Gambia by providing a reliable supply even during the rainy season. However, the operation is nearing its end-of-life due to resource depletion, shifting focus to alternative marine extraction sites. These sites may alleviate inland mining pressure but may pose significant coastal erosion risks. Coastal impact assessments and stakeholder involvement are critical for sustainable extraction.

Laterite fines, a byproduct of local quarrying, show potential for manufactured sand, though further characterization is required due to their high clay content fine grain sizes and strengths. Crushed laterite could substitute imported basalt aggregate for construction but requires careful use as it is weaker than traditional materials.

1 Introduction

The British Geological Survey (BGS) Sand and Sustainability project, part of the International Geoscience Research and Development (IGRD) programme, is focused on promoting international good governance of sand resources, now recognised as a significant global issue (Vander Velpen *et al.*, 2022). This report outlines the results of a second visit by BGS to The Gambia to further aid the Geological Department in management of sand mining and sand supply chains. The results of the initial visit are outlined in Bide *et al.* (2024). In summary, the work focused on understanding the existing sand resources in The Gambia. There are significant supply issues and bottlenecks in the sand supply chain due to depletion of previously mined areas from coastal dunes. There are opportunities for future supply from marine sands, alternative materials, and through a more in depth understanding of the geology of inland sand deposits.

The visit in late 2024 focused on a better understand of the supply chain, from source to market, looking in more detail at alternative materials, working with the Geological Department on good practice in marine sand extraction, and increasing the capacity of the Geological Department to carry out resource assessment for construction materials. Whereas the visit in 2023 solely focused on sand, this work also considered crushed rock aggregate, as this is a commodity that has restricted supply in The Gambia.

Activities undertaken as part of the visit in 2024 involved fieldwork to collect samples for laboratory training, fieldwork to investigate the potential for alternative construction materials in The Gambia from both hard rock and sand deposits (Figure 1) and laboratory-based training with the department staff. A full itinerary of the visit can be found in Appendix 3.

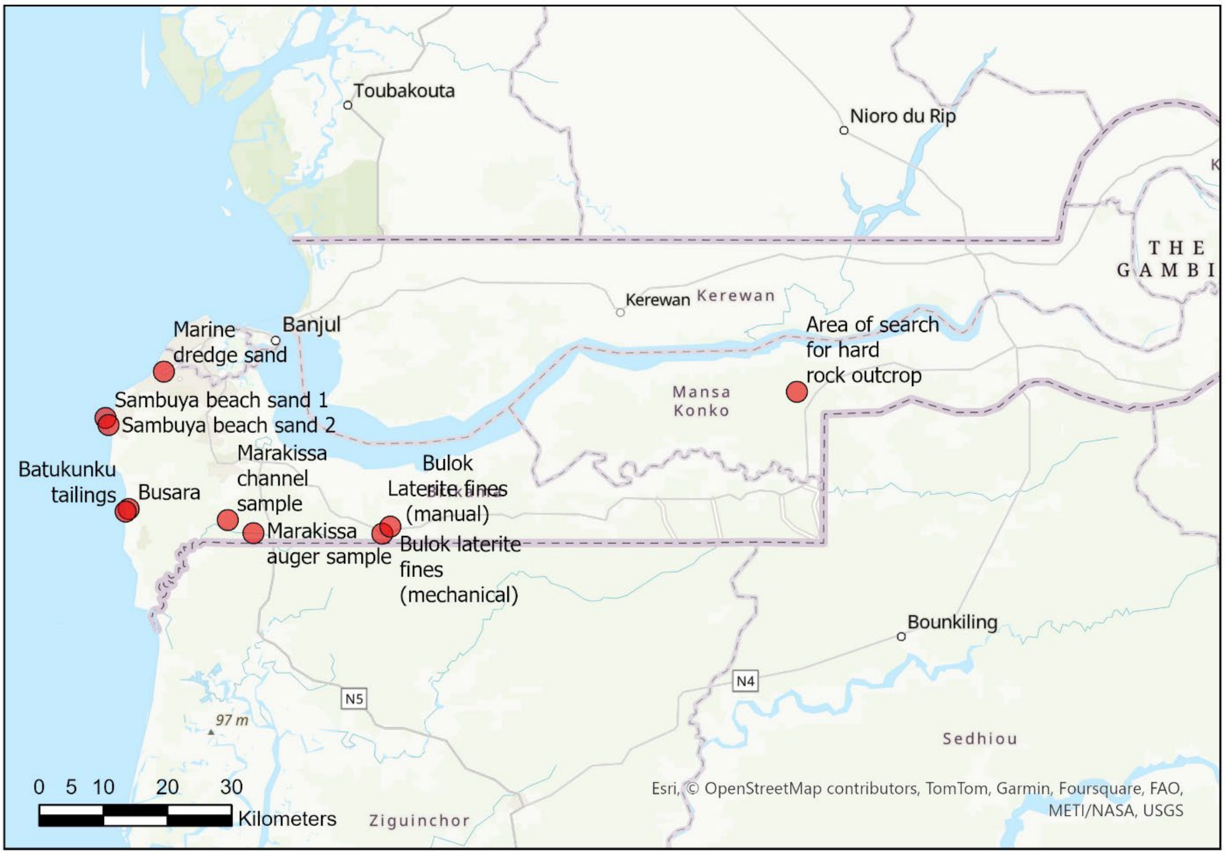


Figure 1 Sites visited during the BGS visit. Contains information from OpenStreetMap, which is made available here under the Open Database License (ODbL).

2 Laboratory based training.

One of the principle aims of the visit was to strengthen the sand characterisation capacity of the Geological Department. Laboratory equipment and staff training for particle-size analyses (a fundamental test for the quality of sand resources) was provided for the Geological Department. This will enable the Geological Department to undertake sand resource assessments and compare the physical properties of the different sand materials present in The Gambia.

The laboratory equipment supplied consisted of:

- Laboratory-standard digital balance x 1
- LED desk lamps x 2
- Dual magnification hand lenses x 4
- Grain size identification charts x 4
- Notebooks x 4
- Dual headed sieve brushes x 4
- Laboratory test sieves (certification included) 20 mm diameter with the following sieve apertures: 2 mm (9 mesh) x 2, 1 mm (16 mesh) x 2, 500 μm (32 mesh) x 2, 250 μm (60 mesh) x 2, 125 μm (115 mesh) x 2, and 63 μm (250 mesh) x 2. (Tyler mesh sizes).

Two days were spent training the staff in the laboratory facilities of the Geological Department. The samples taken as part of the supply chain work were used as test specimens since these represented the different types of sand used in The Gambia.

Figure 2 Training at the Geological Department

The training consisted of:

- Sample splitting, via coning and quartering of the samples collected, to ensure that a representative sub-sample for the test work and a reference sample was retained

- Use of a balance to accurately weigh samples
- Use of sieves to separate different size fractions and recording of size fraction weights
- Identification of grain shape and mineralogy of different size fractions, using hand lenses to understand how this may affect properties for construction applications
- Plotting of data in MS Excel to create cumulative frequency particle-size distribution plots, including use of Gradistat software (Blott and Pye, 2001).

The methodology used for training is given in Appendix 1.

2.1 RESULTS OF PARTICLE SIZE ANALYSIS

The results of the particle size analysis undertaken during the training are shown in Figure 3 (the full data is given in Appendix 2).

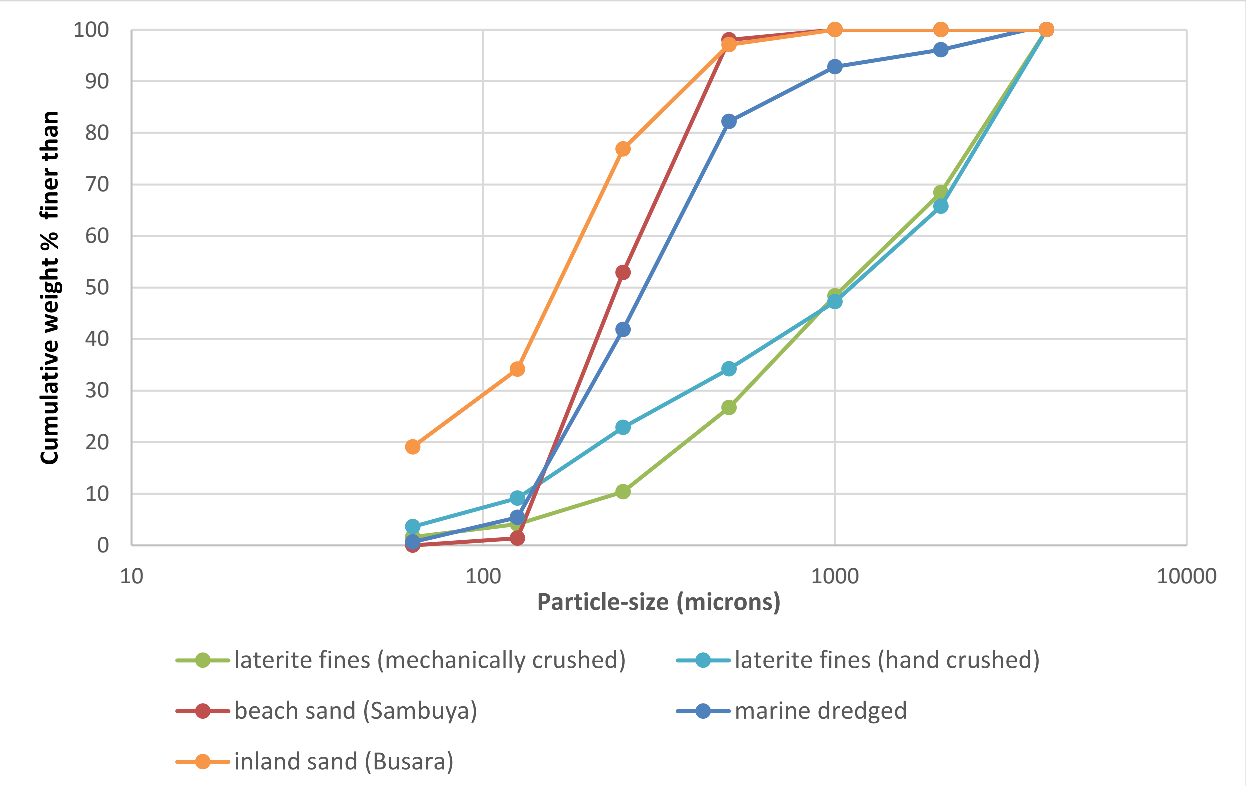


Figure 3 The results of particle size analysis undertaken during training.

The training included interpretation of cumulative frequency charts that are used to portray particle size data (Figure 3). The Y axis is the cumulative weight percentage finer than a given size. The X axis is the particle size in microns. This includes a consideration of the gradient of the line which reflects the sorting of the material, the steeper the line the more closely spaced the size of the particles. For example, the beach sand tested has a restricted range of sand grain sizes due to the sorting action of wave processes. The laterite fines had a mixed range of grain sizes. The average grain size (known as D_{50}) is commonly used to compare sand size data, for example the laterite fines both have a D_{50} of approximately 1000 microns (1 mm) whereas the other sand samples have D_{50} between 150 and 300 microns.

3 Sand supply chain in The Gambia

To better understand sand supply chains, the BGS team visited several quarries and a local construction material depot in The Gambia. Sites visited included:

- the Batukunku heavy mineral sands operation, where a sample of tailings was taken,
- the beach at Sambuya, adjacent to a proposed dredging area,
- an inland sand mine at Marakasa,
- an inland sand mine at Busara and
- two laterite operations around Bulok (one using manual labour to process material and one using a mechanical crusher and screen).
- a sample was also taken of marine sand dredged at Denton bridge from a stockpile of material at a building site,
- Kololi Tipper Garage

The construction material depot, Kololi Tipper Garage, was particularly relevant in understanding the end use of the various materials extracted in The Gambia and the markets for these materials. Such understanding is important to ensure that any alternative materials considered for use in construction meet market demands.

Figure 4 Kololi Tipper Garage, crushed laterite in the background and marine sand in the foreground

The site consisted of a depot where large trucks unloaded material into stockpiles. This material was available for inspection by prospective customers and loaded onto smaller trucks for delivery to construction sites. The varied types of material available at the depot gave a good snapshot of the range of construction materials used in The Gambia. This included the following:

Marine sand (from Denton Bridge): This was a grey, shell-rich, medium-grained sand. Used predominantly for precast concrete blocks, and sand for concrete. This is in great demand and the prices are rising.	
Coastal sand: A well sorted medium to coarse-grained, yellow sand. This a by-product of processing the heavy minerals sands. There may be other coastal sand extraction sites, but most of the costal operations are now illegal. This is the highest quality sand as it contains few impurities from clays and shells and is used for structural concrete.	
Inland sand: A yellow to pale yellow, medium to fine-grained, well sorted sand. This is used for plaster, block making and non-structural concrete (where it is often blended with other sands). It is the cheapest sand.	
Crushed and screened laterite: A pale yellow to red material ranging from 2– cm in particle size. There were multiple grades of laterite present, from clean single-sized material to mixed clay-rich material. Depending on the grade this is used as a coarse aggregate in concrete. Due to its high clay content it is often blended with basalt to reach the required strength as a fill and foundation material.	
Crushed basalt: An angular, black, granular material around 2–4 cm in size imported from Senegal. This is used as a premium coarse aggregate in structural concrete manufacture.	
Demolition waste: Used as fill and road building material.	

All these materials had different prices and were used for different purposes (although they could substitute for each other depending on cost or end use).

Many of the sand products contain what would normally be considered as deleterious materials for construction, such as fine material and shells. These weaken concrete and could be removed by simple washing and screening to 'upgrade' materials. Such screening equipment is being used in The Gambia for crushed laterite extraction. It was not observed during this trip for sand production.

4 Alternative construction materials

Building on knowledge from the visit in 2023 (Bide et al., 2024) during this visit the potential for alternative sand sources were considered. Alternative sources of sand, away from active sedimentary environments of rivers and beaches, is a way of both increasing resilience by diversifying supply and moving extraction to areas where the environmental impacts are easier to manage in line with good practise guidelines for sand extraction (Bide et al., 2023).

4.1 MARINE SAND

The supply of sand from the dredging operation at Denton Bridge has reduced the urgency of the sand crisis in The Gambia. This supplies a significant volume of material, available all year round, including during the wet season. This operation was deemed acceptable as it removed a spit of sand that was attributed to be a cause of coastal erosion. As the spit becomes depleted, new sources of marine sand would be required to ensure that the supply of sand continues. The Geological Department have created ‘zones’ for offshore sand dredging (along the Gambian coast from Batukunku to Kantong) that was taken into consideration land use factors, such as existing and planned coastal infrastructure and other uses, such as tourism and fishing.

In addition, it is of the upmost importance that any removal of marine sand is far enough offshore to ensure there is no link with the coastal environment and avoid coastal erosion. Dredging close to the shore, such as that at Denton Bridge (where extraction is approximately 300m offshore), would require robust evidence that it would not lead to coastal erosion. Sand extraction in near coastal waters, particularly in the wave dominated zone, are likely to result in coastal erosion.

One of the future uses of marine sand would be to remediate the former dune areas along the coast from Batukunku to Kantong. Prior to extraction of the dune sand, this area would have been prime real estate for coastal development, particularly for tourism. Extensive extraction of the dune sand has left behind an unusable area of swampy wetland. It is proposed that marine sands are used to restore the voids by dune sand extraction. However, this will be of little help if coastal erosion, as a result of marine dredging, results in the loss of the beach and the last remaining coastal barrier dunes.

It should be noted that erosion may not occur in the immediate vicinity of dredging. This is due to nearshore sediment circulation cells and the local hydrographic regime. The erosion may occur several kilometres from the dredging. The likelihood of this erosion can be estimated via hydrodynamic modelling to gain a thorough understanding of sediment transport in the littoral zone. This would enable the siting of dredging operations far enough offshore to ensure that they do not affect sediment transport in the littoral zone.

The requirements for coastal impact studies are detailed in the British Marine Aggregates Producers Association (2013) illustrative guide to good practice. The main aspects of an assessment into the potential coastal impacts of marine aggregate extraction should include the following criteria:

- Changes in nearshore wave conditions as a result of changes in the patterns of wave transformation (e.g. refraction) over the dredged area
- Changes in nearshore wave conditions as a result of the alteration of sandbanks, or other significant seabed features, by the proposed dredging
- Changes in the nearshore tidal currents due to bed lowering in the dredging area
- Any draw-down into the dredged area, of beaches or sandbanks
- Changes in sediment transport patterns, interrupting supply to coastal sandbanks or beaches
- Changes to the form and function of any nearby sandbanks.

4.2 LATERITIC ROCKS

Lateritic rocks (or laterite) are a product of intense weathering of rocks at the surface typically in tropical climates. They consist of an extremely altered mix of clays and iron and aluminium oxides, which can form hard crusts and agglomerations. Laterite is common in The Gambia and covers large parts of the interior of the country. It forms cliffs in many locations around the coastline.

Lateritic rock forms a significant component of the supply of coarse aggregate for concrete in The Gambia. It is used as a partial substitute for crushed hard rock imported from Senegal. Construction sites will typically have large piles of this bright orange material that is supplied 'as dug' or as screened material. During the visit, the BGS team visited several operations working laterite for such purposes. These were a range of different scales of operation and types of products.

Traditionally in The Gambia, laterites are dug either manually or by mechanised means and either sold 'as dug' or screened on site. This typically involves an upright A-frame with a wire mesh screen. Dug material is thrown up against using a shovel, separating coarse from fine laterite. The BGS team also visited fully mechanised operations with large crushing and screening plants. Here material was dug using backhoe excavators, emptied into a jaw crusher and screened into several stockpiles of different particle size grades (typically coarse and medium grades, and waste quarry fines).

If correctly crushed and screened to remove fine material, some types of lateritic rocks have been proven to form a suitable alternative to sand, although this is not without technical challenges (Ukpata et al., 2024; Yaragal et al., 2019).

There is potential for production of manufactured sand from the lateritic quarry fines (<4 mm in particle size). This may be a suitable alternative to natural sands. In a global context, 'manufactured sand' is often seen as a more sustainable alternative to natural sand. Many countries have made efforts to shift sand supply chains away from natural sands towards manufactured sand (Wang et al., 2024). Manufactured sand can be produced either from by-product quarry fines (which results from the crushing of hard rock to produce aggregate) or produced specifically by the crushing of suitable rocks. The requirement for crushing and screening requires a much greater capital investment and technical expertise to manage the process.

Significant volumes of fine material were observed at sites working laterite during the BGS visit, much of which contains sand size material. Samples were taken to assess the suitability of this for the production of a manufactured sand product.

Extraction of laterite for the production of manufactured sand would pose less of an environment impact compared to the working of natural sands. Laterite is typically worked well above the water table. This would avoid the creation of swampland, that often results from the extraction of natural sands, which are unfit to be returned back to productive agricultural land.

Also, if properly processed, a substantial amount of ultrafine material remains from screening of the fine component, which is often not saleable. This material can be used to restore former quarrying sites so they may be suitable for other land uses once mineral extraction has been completed.

Considerable variations in laterites were seen in the quarry sites visited, ranging from a soft clay-rich material to well cemented coarse-grained sandstones to a hard iron silicate mass. There appears to be selective mining of the lateritic sandstones at manual operations indicating that the variations may well be beneficial in some cases for aggregate properties. However, without better understanding of their lateral and vertical thickness of these different laterite types (to understand if sufficient volumes may be present) it is not possible to suggest if they may be viable alternatives to imported crushed rock aggregate.

4.3 POTENTIAL FOR HARD ROCK WITHIN THE GAMBIA

The BGS visit also focused on the potential for crushed rock aggregate as well as sand supply. There are currently no hard rock deposits known in The Gambia and current geological maps do not identify any at the surface. It should be noted that due to the covering of thick lateritic deposits, that obscure the geology in many parts of the country, identification of such geological formations is difficult, and can only be achieved via drilling, geophysical methods or more detailed geological mapping. The Gambia is entirely reliant on imports of crushed rock from Senegal, from granitic and basaltic rocks. Piles of these angular grey materials can be observed around construction sites. During the BGS visit an effort was made to identify if similar rocks may be present in The Gambia. Preliminary fieldwork was undertaken to identify if similar rocks that occurred in Senegal also occurred in The Gambia, (Figure 1). Unfortunately, although areas of well cemented hard lateritic deposits were identified no igneous rocks were discovered. The BGS team also visited existing lateritic rock quarrying sites where variable well cemented lateritic deposits were present which had lower clay contents than was typical for these rocks and seemed to be much harder. Such rocks may form suitable alternatives for crushed rock, however they appeared in discrete bands often only a metre or less thick. Therefore these laterite bands may not be present in the required volumes to constitute as viable alternatives. More geological investigations would be required to understand their extent.

4.4 OTHER CONSTRUCTON MATERIALS

Modern construction in The Gambia consists of 2–6 storey buildings made of a reinforced concrete structure with pre-made lightweight concrete blocks filling in spaces between the reinforced structure. During the visit there was several suggestions that fired clay bricks could replace the lightweight concrete blocks (which consume a great deal of sand). However, discussions with the sellers at the sand depot and minerals developers confirmed that currently clay bricks in The Gambia were considerably more expensive than concrete blocks. This was attributed in part to a lack of manufacturing capacity; only two brick factories are currently operational in the country. Clay is a comparatively abundant resource locally. There is the potential for clay bricks in The Gambia to replace the considerable amount of sand used in block manufacture, however it would first require investment in manufacturing capacity, and associated infrastructure, and a change in current building and architectural trends.

5 Conclusions

The report summarises the activities completed during a visit to the Geological Department in The Gambia. The work is being carried out as part of the BGS Sand and Sustainability project, within BGS' International Geoscience Research and Development programme'. Over the course of the visit training was provided in sample preparation and particle size analysis of unconsolidated sediments, as well as visits to key mining sites in The Gambia. Wider research findings being developed from the project were also disseminated.

Sand supply in the Gambia provides a case study for the situation faced by many rapidly countries with limited resources, in terms of extraction from increasingly depleted traditional sources forcing rapid and drastic supply chain changes. The situation and lessons learnt from how sand supply bottlenecks have arisen, and are being subsequently delt with in The Gambia form practical examples for the wider project aims of how to make sand supply chains more sustainable. The production of marine dredged sand at Denton Bridge has, for the time being, alleviated the crisis in The Gambia's sand supply. One advantage of this operation is that it can sustain supply throughout the rainy season where inland deposits become flooded, and roads in coastal areas become impassible to sand trucks.

The long-term impacts of removing such large amounts of sand from the coastal environment is not clear. As the lifetime of the operation at Denton bridge comes towards an end, due to depletion of the sand spit being extracted, attention has begun to focus on other sites for marine sand extraction.

New sites for marine extraction of sand would no doubt relieve pressure on inland areas, where concerns are raised regarding damage to agricultural land and coastal sites, where mining has largely been banned.

The risk of coastal erosion from these new marine sand extraction sites is high. Extraction is likely to emulate that carried out at Denton Bridge, where dredging uses floating barges located a few hundred metres from the shoreline. There is no evidence that coastal processes have been assessed or taken into consideration for the new proposed marine dredging areas. It is likely that marine extraction will have a direct impact on coastal erosion by depleting the nearshore environment of sand.

If marine sand is extracted that is linked, either geologically or via tidal and wave generated currents to the shore, drawdown of sediment from the beach will occur.

Best practice recommends that sand extraction occurs far enough offshore to ensure that there is no link to coastal processes. This is generally several kilometres from the shoreline and involves specialised dredging ships that can operate in deeper water.

Dredging vessels that are used for marine dredging have a high capital cost. These may not be affordable for The Gambia. If less-capital intensive methods such as dredging barges are used, studies need to be undertaken to understand how this will impact the coast. An introduction to studies required for coastal impact assessment can be found in guidance from the British Marine Aggregates Producers Association (2013). Relevant stakeholders need to be involved in this process.

Particle size and mineralogical analysis of fines from laterite crushing operations indicate this material is finer and more clay rich then existing sand sources. Further characterisation of the laterite fines would be required to determine their suitability for the production of manufactured sand.

Crushed laterite may be a suitable alternative to coarse aggregate (basalt) imported from Senegal. This would help to secure supplies of indigenous coarse aggregate in The Gambia. However, care would need to be exercised in the use of this material to produce concrete for construction as it is relatively weak.

No alternative hard rocks that could be used for construction aggregate were observed during the visit. Due to thick sediment cover and lateritic soil profile in The Gambia, it is difficult to map geological features and identify suitable hard rock resources. It is possible that further geological investigations may reveal hard rock deposits. Considerable variations in lateritic deposits were observed. It is possible that some of these laterites may be suitable for use as construction aggregate. The lateral and vertical heterogeneity of the laterite needs to be better understood before a concerted effort is made to use this as a resource.

Appendix 1 Particle-size analysis training material

PARTICLE-SIZE ANALYSIS METHODOLOGY FOR SAND

Particle-size analysis is carried out to determine the particle-size distribution of unconsolidated sand samples This is typically carried out using a set of sieves (otherwise known as screens) to separate the sand particles based on their particle size. The sand can be sieved wet or dry. This methodology is for dry sieving.

The sieves used in this method are shown in the following table alongside their mesh number (this is the number of apertures per linear inch; the smaller the aperture the larger the mesh number). The sieves are stacked one on top of each other with the largest aperture sieves at the top.

Sieve aperture size*	Mesh No.	Retained material size range
2 mm	10	>2 mm
1 mm	18	2 mm to 1 mm
500 microns	35	1 mm to 500 microns
250 microns	60	500 to 250 microns
125 microns	120	250 to 125 microns
63 microns	230	125 to 63 microns
Passing through 63 microns aperture sieve		<63 microns

*British Standard BS EN 933-2: 2020. Tests for geometrical properties of aggregates. Part 2. Determination of particle size distribution – Test sieves, nominal size of apertures.

<u>Sieving Methodology</u>

1. Dry a sub-sample of sand (minimum 200 grams**) and record the weight of the sand sample.
2. Pour the sand into the sieve stack and carefully shake the sieves to allow the finer particles to drop through the sieve apertures to the sieve below.
3. Brush the retained material on the top sieve to allow the finer particles to pass through.
4. Remove the top sieve and pour out the retained sand. Turn the sieve upside down and brush out any particles trapped in the sieve. Weigh the sand and place into a labelled bag.
5. Repeat steps 3 and 4 until all the sieves have been cleaned out.
6. Record the weight of each of the sieve fractions and calculate the weight percentage.

**BS EN 933-1:2012. Tests for geometrical properties of aggregates. Part 1. Determination of particle size distribution. Sieving method.

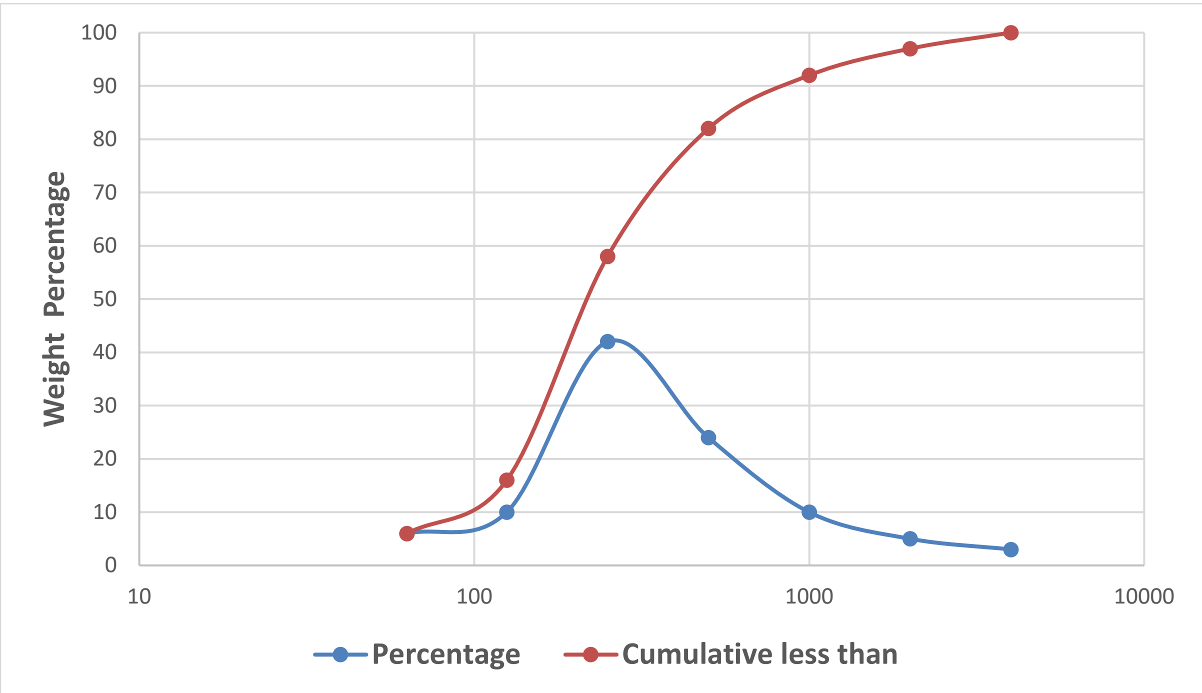
Particle-size analysis data

Record the particle-size data in a table as follows:

Size fraction	**Weight** (grams)	**Percentage** (weight %)	**Cumulative less than** (weight %)
>2 mm	15	3.0	100.0
-2 +1 mm	25	5.0	97.0
-1 mm +500 microns	50	10.0	92.0
-500 +250 microns	120	24.0	82.0
-250 +125 microns	210	42.0	58.0
-125 +63 microns	30	10.0	16.0
<63 microns	300	6.0	6.0
Total	500	100.0	

NB This data has been created purely for illustration.

Use the data to create a semi-logarithmic cumulative frequence particle-size chart, as per the example below (which uses the data in the table).



Appendix 2 Data from particle size analysis training

Sample No.		1	2	3	4	5	6	7	8	9
	Location	Batukunku tailings	Sambuya beach sand 1	Sambuya beach sand 2	Marine dredge sand	Marakasa channel sample	Marakasa auger sample	Busara	Laterite fines (manual)	Laterite fines (mechanical)
	Total weight	1382	1731	2079	1449	1419	1620	1441	1110	1062
	Reference weight	660	877	1498	822	643	775	627	509	526
	BGS reference sample	174	194	179	168	200	239	207	173	123
	Test sample for sieving	544	659	404	461	573	615	603	413	415
Sieve weights (grams)	>2 mm	Not tested	0	Not tested	22	Not tested	Not tested	0	137	142
	>1 mm		0		15			0	87	77
	>500 microns		13		49			18	94	54
	>250 microns		297		186			125	71	47
	>125 microns		339		168			264	27	57
	>63 microns		9		22			93	11	23
	<63 microns		0		3			118	7	15
	end sieve weight	0	658	0	465	0	0	618	434	415
	percent	0%	100%	0%	101%	0%	0%	102%	105%	100%
Sieve percentages (Weight Percentage)	>2 mm	Not tested	0	Not tested	5	Not tested	Not tested	0	32	34
	>1 mm		0		3			0	20	19
	>500 microns		2		11			3	22	13
	>250 microns		45		40			20	16	11
	>125 microns		52		36			43	6	14
	>63 microns		1		5			15	3	6
	<63 microns		0		1			19	2	4

Appendix 3 BGS activities report

BGS sand mining project team (Tom Bide, project leader and construction minerals geologist; and Clive Mitchell, industrial minerals geologist) travelled from the UK to The Gambia for a 10day mission to support the sand mining and construction material activities of the Geological Department of the Ministry of Petroleum and Energy (MoPE). This was a follow-up to a visit in November 2023 (Bide *et al.*, 2023) The mission was facilitated by The Geological Department and MoPE who provided a high level of logistical support without which the successful output of the mission would not have been possible. All sites visited are shown in Figure 1.

Sunday 24th November 2024

The BGS team flew from the UK to The Gambia. Alieu Jawo, Director, Gambian Geological Department, and colleague Muhammed Karaga met the team and took them to their hotel.

Monday 25th November 2024

The day started by meeting Director Alieu Jawo to discuss the scope and activities of the BGS mission. The BGS team were supported by Muhammed Karaga who provided transport and practical assistance. The team were also introduced to the staff of the Geological Department.

Discussions with the Director focused on the proposed dredging of the Gambian coast for construction sand. The proposal, 'Marine Sand Resource Potential', delineates four discrete zones along the Gambian coast from Batukunku to Kantong as follows:

- Zone A (Tujering to Batukunku)
- Zone B (Sanyang to Kachumeh)
- Zone C (Gunjur and Sambouya)
- Zone D (Kartong).

It was agreed that a better understanding of the coastal sedimentary environment was needed to inform the proposed dredging of the Gambian coastline.

The laboratory of the Geological Department was briefly inspected. The BGS team prepared a presentation for a meeting with the Minister of Petroleum and Energy. A brief training exercise was carried out with Geological Department staff to demonstrate panning of sand for recovery of heavy mineral concentrates. The sample used has been collected from an artisanal gold mining site in Badari, Fulladu East District, Upper River Region. The BGS team will send the concentrate for gold assay.

Tuesday 26th November 2024

The BGS team spent the morning at the Ministry of Petroleum and Energy (MoPE). The meeting with Honourable Minister Nani Juwara was cancelled as he had been summoned away to a meeting with President Adama Barrow. A meeting was held with MoPE Permanent Secretary (PS) Lamin Camara, Deputy Permanent Secretary (DPS) Alagie Manjang and DPS Mansata Darboe. The PS was keen to see an embedded BGS technical presence in MoPE. This was followed by a presentation to MoPE staff by the BGS team on the IGRD sand mining project and activities planned for the current visit to Gambia. MoPE communications officer, Anna Marie Valentine posted the meetings on X: https://x.com/MoPEGambia/status/1861398763236905385.

In the afternoon, the BGS team presented laboratory equipment to the Geological Department. This consisted of two sets of stainless-steel sieves (the sieves had a range of apertures including 2 mm, 1 mm, 500 microns, 250 microns, 125 microns and 63 microns), sieve brushes, particle size comparison cards, portable electronic balance, two portable lights, hand lenses, and notebooks. This was photographed by the MoPE communications officer.

<u>Wednesday 27th November 2024</u>

The BGS spent the first part of the morning at the Geological Department. Discussions with Director Alieu Jawo regards field work plans for the next few days. The aim was to visit different sand deposits to collect samples for training on Monday 2nd and Tuesday 3rd December 2024. The field team consisted of the following from the BGS and Geological Department:

- Tom Bide, Mineral Resource Geologist, BGS
- Clive Mitchell, Industrial Minerals Geologist, BGS
- Lamin Nyassi, Senior Geological Technician, Geological Department
- Ousman Jallow, Mine Supervisor, Geological Department
- Ebrima Touray, Geological Technician, Geological Department
- Muhammed Karaga, Driver, Geological Department
- Anna Marie Valentine, Communications Officer, MoPE

The sites visited were as follows:

- <u>Batukunku, Kombo South District, West Coast Region</u>

  Beach adjacent to proposed dredging offshore block A1, two locations:

  - N 13.34327° W 016.81129°, No sample collected.
  - N 13.33330° W 016.80677° Sample of tailings from Heavy Mineral sand operation (Sample 1).

- <u>Sambuya, Kombo South District, West Coast Region</u>

  Beach adjacent to proposed dredging offshore block B1, two locations:

  - N 13.21557° W 016.77862° No sample collected.
  - N 13.21177° W 016.78278° Two samples of beach sand (samples 2 and 3).

- <u>Ministry of Petroleum and Energy (MoPE), Kanifing District, Banjul Region</u>

  Stockpile in MoPE car park, one location:

  - N 13.4078608° W 016.7293245° One sample of marine dredged sand (sample 4).

The field team returned to the Geological Department for a late lunch. A late afternoon meeting was held with Momodou B Sarr, Advisor to the Minister, MoPE.

<u>Thursday 28th November 2024</u>

The BGS team were collected early from the hotel and taken to the Geological Department. The field team assembled and set off for the second day of fieldwork. The sites visited were as follows:

- <u>Marakissa, Kombo Central District, West Coast Region</u>

  Sand extraction site operated by BB Mining Co.

  - N 13.19954° W 016.63983°, two samples of sand: channel sample (30cm depth, sample 5) and auger sample (to a depth of 1metre, sample 6).

- <u>Busura, Kombo Central District, West Coast Region</u>

Sand extraction site operated by Fatajo Mining Co.

- N 13.18160° W 016.60347°, sand sample from active extraction area (sample 7). NB this was a busy site with approximately 20 trucks queueing to collect sand.

- Bulok, Foni Brefet District, West Coast Region

  Laterite extraction sites as follows:

  - N 13.18046° W 016.42416°, Colley & Sons Mining Co., manual extraction and screening to produce crushed rock aggregate. One sample of laterite fines (sample 8).
  - N 13.19059° W 016.14222°, Gopi Group Ltd, mechanical crushing and screening. One sample of laterite fines (sample 9).

- Dumbutu, Kiang West District, Lower River Region

  Potential hard rock site (for construction aggregate), approximately 5 km north of Dumbutu.

  - N 13.37952° W 015.84274°, samples of laterite collected by the Geological Department.

Friday 29th November 2024

BGS team spent the day at the Geological Department.

The BGS team attended a meeting where Afrobel Dredging and Mining Co. presented the findings of their latest survey into their marine dredging licence block area to the Geological Department. The survey was contracted to Unicorn and Oryx Ltd, a Nigerian consultancy. The presentation was delivered by John B Akinnibosun, Geotechnical Consultant. The survey was a bathymetric and geotechnical of the marine area to the east of Bakau, Kombo St. Mary in Kanifing District, Banjul Region. The area is 1.5 km by 0.7 km (104 hectares) with water depth from 0.86 m nearshore to 4.91 m furthest offshore. The testing of the sand indicated it consisted of 30% coarse sand, 30% medium sand, 35% fine sand and 5% silt. A brief meeting was held later with Momodou Jallow, CEO, Afrobel Dredging and Mining Co.

The BGS team also met with Ansumana Marenah, CEO of Julakeh Mining Co. who is interested in sand dredging and other mining opportunities in The Gambia. He mentioned his son, Muhammed Marenah who is CEO of Fatajo Mining and Construction Company (coincidentally the site of sand sample 7).

The BGS prepared the samples of sand that were collected over the last few days for the laboratory training on Monday 2nd and Tuesday 3rd December. The samples are listed below:

Sample No.	Description	Location	Latitude (North)	Longitude (West)
1	Tailings from Heavy Mineral sand operation	Batukunku	13.33330°	016.78278°
2	Beach sand.	Sambuya	13.21557°	016.77862°
3	Beach sand.	Sambuya	13.21177°	016.78278°

4	Marine dredged sand	MoPE	13.4078608°	016.7293245°
5	BB Mining Company sand (channel sample)	Marakissa	13.19954°	016.63983°
6	BB Mining Company sand (auger sample)	Marakissa	13.19954°	016.63983°
7	Fatajo Mining & Construction Company	Busura	13.18160°	016.60347°
8	Colley & Sons Mining Co., laterite fines (manually crushed)	Bulok	13.18046°	016.42416°
9	Gopi Group Ltd, laterite fines (mechanically crushed)	Bulok	13.19059°	016.14222°

Saturday 30th November 2024

Day off.

Sunday 1st December 2024

Working at the hotel.

Monday 2nd December 2024

The BGS team were taken to Kololi Tipper Garage which is a construction material sales market. The market sells the following:

- Quarried sand, this is preferred for ready mixed concrete.
- Marine dredged sand. We were told this is good for concrete blocks (however, there was evidence of blocks cracking around large shells). Consumers have the perception that this sand is salty and is not suitable for use in concrete.
- Construction and demolition waste material, mostly for construction fill.
- Laterite aggregate of various sizes produced manually; this is used for foundation concrete.
- Laterite aggregate of various sizes produced mechanically; this is used for structural concrete.
- Basalt aggregate was the premium quality aggregate on sale and this is mostly used for concrete. Imported from Senegal. The resource is becoming depleted and may not be available in the near-medium term.

The rainy season in The Gambia (June to October) often leads to sand shortages and price increases of construction material.

Laboratory training with staff of the Geological Department took place in the afternoon. This involved the following:

- Sample splitting: The sand samples were split by coning and quartering. A quarter was retained as a reference material (bagged and stored), a quarter to be sent to the BGS for further work and the remaining half of the sample for particle-size analysis.
- Particle-size analysis: The samples were dry sieved using the sample using the sieve series: 2 mm, 1 mm, 500 microns, 250 microns, 125 microns and 63 microns. The size fractions were weighed and the data expressed as a weight percentage.

- Particle size charts: The size data was plotted using a semi-logarithmic cumulative frequency particle size chart.
- Petrographic analysis of size fractions: The size fractions were examined using hand lens. The aim was to record mineralogical composition with approximate percentage, particle shape, presence of grain coatings, and presence of aggregated particles.

Tuesday 3rd December 2024

The BGS team continued the laboratory training with staff of the Geological Department.

Wednesday 4th December 2024

The BGS Team met with the Deputy High Commissioner Martin Norman, and colleague Jo Ashley, at the British High Commission (BHC). The BGS team gave a summary of the BGS work in The Gambia. Potential support for the marine sand licencing responsibilities of the Geological Department was discussed. This could take the form of UK experts being brought out to provide advice and guidance, for example from The Crown Estate or UK Hydrographic Office.

The BGS team set off from Gambia to the UK.

Thursday 5th December 2024

The BGS arrived back in the UK and travelled home.

References

The British Geological Survey holds most of the references listed and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at https://of-ukrinerc.olib.oclc.org/folio/

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