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Project No: 312919

Flood Risk Assessment and Drainage Impact Assessment: Nigg Eastern Inner Dock Quay

Prepared for:

Global Energy Nigg Ltd

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IV19 1QU

Contents Amendment Record

This report has been issued and amended as follows:

Revision	Description	Date	Signed
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Acknowledgement

Appointment

This report has been prepared for the sole and exclusive use of Global Energy Nigg Ltd in accordance with the scope of work presented in Mabbett & Associates Ltd (Mabbett) Letter Agreement (313619/JR/050324/4.0), dated 05 March 2024. This report is based on information and data collected by Mabbett. Should any of the information be incorrect, incomplete, or subject to change, Mabbett may wish to revise the report accordingly.

This report has been prepared by the following Mabbett personnel:

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Reference of Terms

Aquifers

Scotland's groundwater bodies are classified (and reclassified) on a regular basis, into one of five categories: high, good, moderate, poor, or bad; those bodies at risk of deteriorating status are also identified. Where the status of a groundwater body is identified as poor or at risk of deterioration, these bodies are prioritised for action to improve the situation. More details can be found in the River Basin Management Plans for Scotland (SEPA, 2009a)

- Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.
- Secondary B Aquifers are 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.
- Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.
- Unproductive Strata are 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

Canal Failure

Canal failure can occur due to high-intensity rainfall or structural failure and can be dangerous due to the rapid release of large volumes of water. It is typically limited to raised canal reaches and can result in a rapid peak in flow followed by a gradual reduction.

Flood Zones

The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the SEPA Flood Maps (flood risk from rivers or the sea). This map defines three zones of different flood risk:

- High Likelihood - Each year this area has a 10% chance (1 in 10 annual probability) of flooding.
- Medium Likelihood - Each year this area has a 0.5% chance (1 in 200 annual probability) of flooding.
- Low Likelihood - Each year this area has a 0.1% chance (1 in 1000 annual probability) of flooding.

The future climate change flood maps include for the potential risk up to the 2080's – medium likelihood only.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the riverbanks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a backup of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high-water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Source Protection Zones

Source Protection Zones (SPZs) are areas of land through which water infiltrates into a groundwater borehole, well or spring that is used for public drinking water supply. These zones show the risk of contamination from potential pollution. SPZ's have been created as public facing boundaries where discrete groundwater bodies within SPZ's have been dissolved on zone number where common boundaries and overlaps have been removed. SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

- Zone 1 (Inner Protection Zone) is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius.
- Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction.
- Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source. A further Zone 4, or 'Zone of Special Interest' was previously defined for some groundwater sources.

Surface Water (Pluvial) Flooding

Pluvial flooding, also known as surface water flooding, occurs when the volume of precipitation exceeds the capacity of drainage systems, including drains and surface water sewers. This results in an inability to drain away through these systems or infiltrate into the land, causing overland flow. The intensity of pluvial flooding can be exacerbated by factors such as blocked road gullies, drains and sewers, saturated and waterlogged land, and an increase in impervious surfaces.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs because of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale-force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity, causing deep and widespread flooding. The likelihood of this occurring is low as large reservoirs are managed in accordance with the Reservoirs (Scotland) Act 2011. SEPA's online reservoir inundation map illustrates the maximum flood extents that could occur in the event of a reservoir failure.

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Appendices

1.0 Introduction

Project Understanding

On the SEPA Flood Map for Planning, the southern extent of the site is shown to be located within an area considered to have a medium likelihood (0.5% AEP) of coastal flooding by the 2080's and therefore the application requires a Flood Risk Assessment to support the application.

The aim of this report is to assess the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk (if required). This report has been prepared in accordance with the guidance contained in Scottish Government National Planning Framework 4 (NPF4) published in February 2023.

The Highland Council as Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Drainage Impact Assessment. The aim of the Drainage Impact Assessment is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

This report takes into account the following national and local policies:

- Scottish Government National Planning Framework 4 (NPF4), dated 13 February 2023
- Technical Flood Risk Guidance for Stakeholders – SEPA requirements for undertaking a Flood Risk Assessment, v13, dated June 2022
- SEPA Flood Risk and Land Use Vulnerability Guidance, v4, dated 10 July 2018
- CIRIA Guidance: The SuDS Manual (C753) (2017)[1]; and
- The Highland Council Local Development and Planning Policies.

Sources of Information

The following sources of information have been reviewed and assessed for the purpose of this FRA:

- SEPA online flood maps[2];
- British Geological Society (BGS) Interactive Map[3];
- MAGIC Interactive Map[4];
- Scotland's Environment Map[5];
- The Highland Council Flood Risk & Drainage Impact Assessment: Supplementary Guidance (2013 FRA and DIA Guidance).

Project Limitations

The wider Mabbett limitations are contained within Appendix A.

1 https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx
2https://scottishepa.maps.arcgis.com/apps/webappviewer/index.html?id=b3cfd390efa44e3b8a72a07cf5767663&showLayers=FloodMapsBasic_2743;FloodMapsBasic_2743_0;FloodMapsBasic_2743_1;FloodMapsBasic_2743_2;FloodMapsBasic_2743_3;FloodMapsBasic_2743_4;FloodMapsBasic_2743_5;FloodMapsB
3 http://mapapps.bgs.ac.uk/geologyofbritain/home.html
4 http://www.magic.gov.uk/
5 https://map.environment.gov.scot/sewebmap/

2.0 Site Details

The aim of this section of the report is to outline key environmental information associated with the baseline environment.

Area (approx.)	1.26 Ha	National Grid Reference (NGR)	279360, 869230

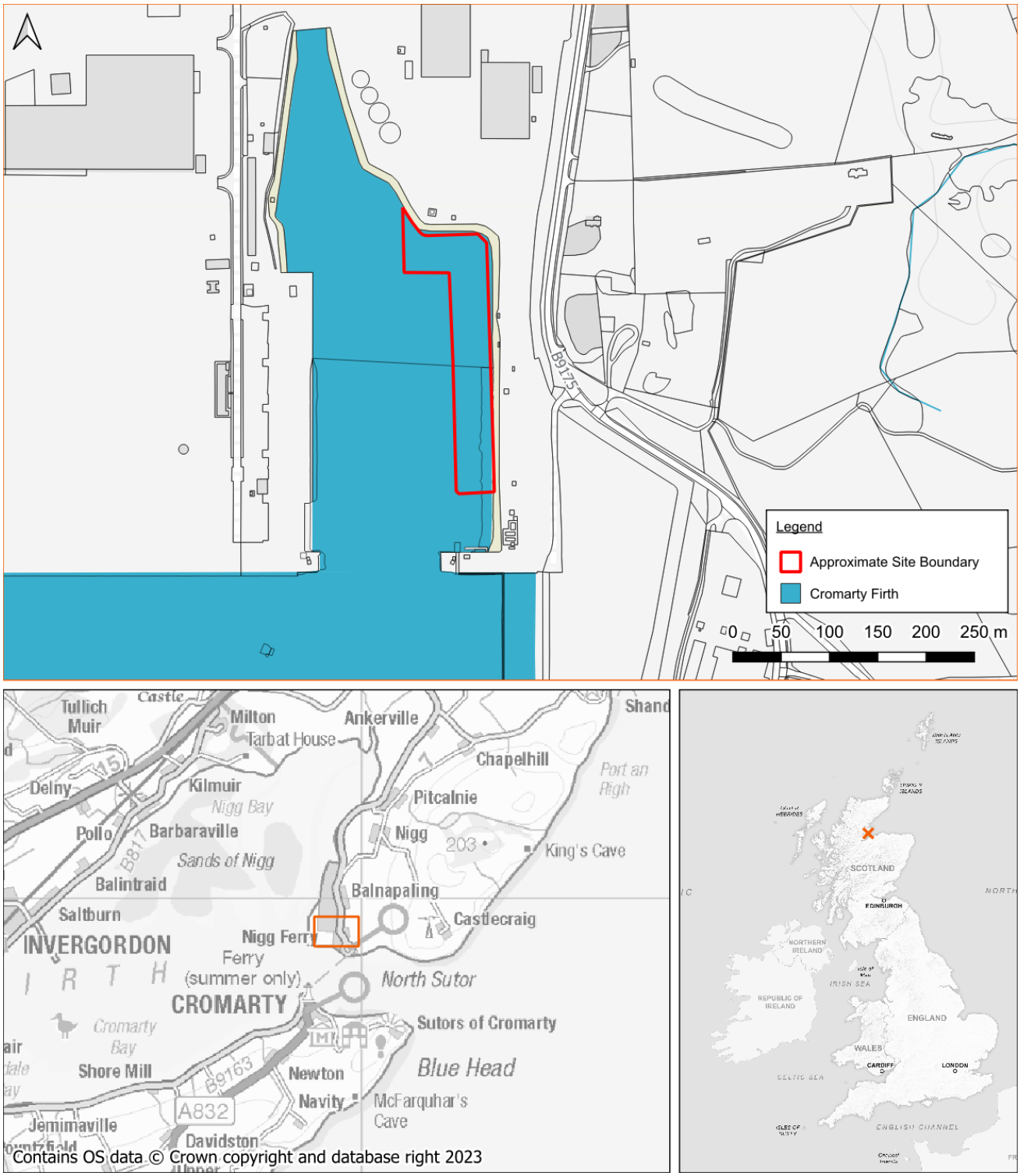


Figure 1: Site Location Plan

Site Location	The site is located within the Port of Nigg in Balnapaling village, on the north side of the Cromarty Firth. The B9175 is located approximately 60m east of the site.
Existing Site Conditions	Online mapping (including Google Maps / Google Streetview imagery, accessed 12/03/24) shows that the site is located on the water of the Port of Nigg. The site is bordered by Cromarthy Firth to the south and west, the Port of Nigg to the north and the B9175 to the east, and beyond which greenfield land. Access to the site is provided from the unnamed access road off the B9175.

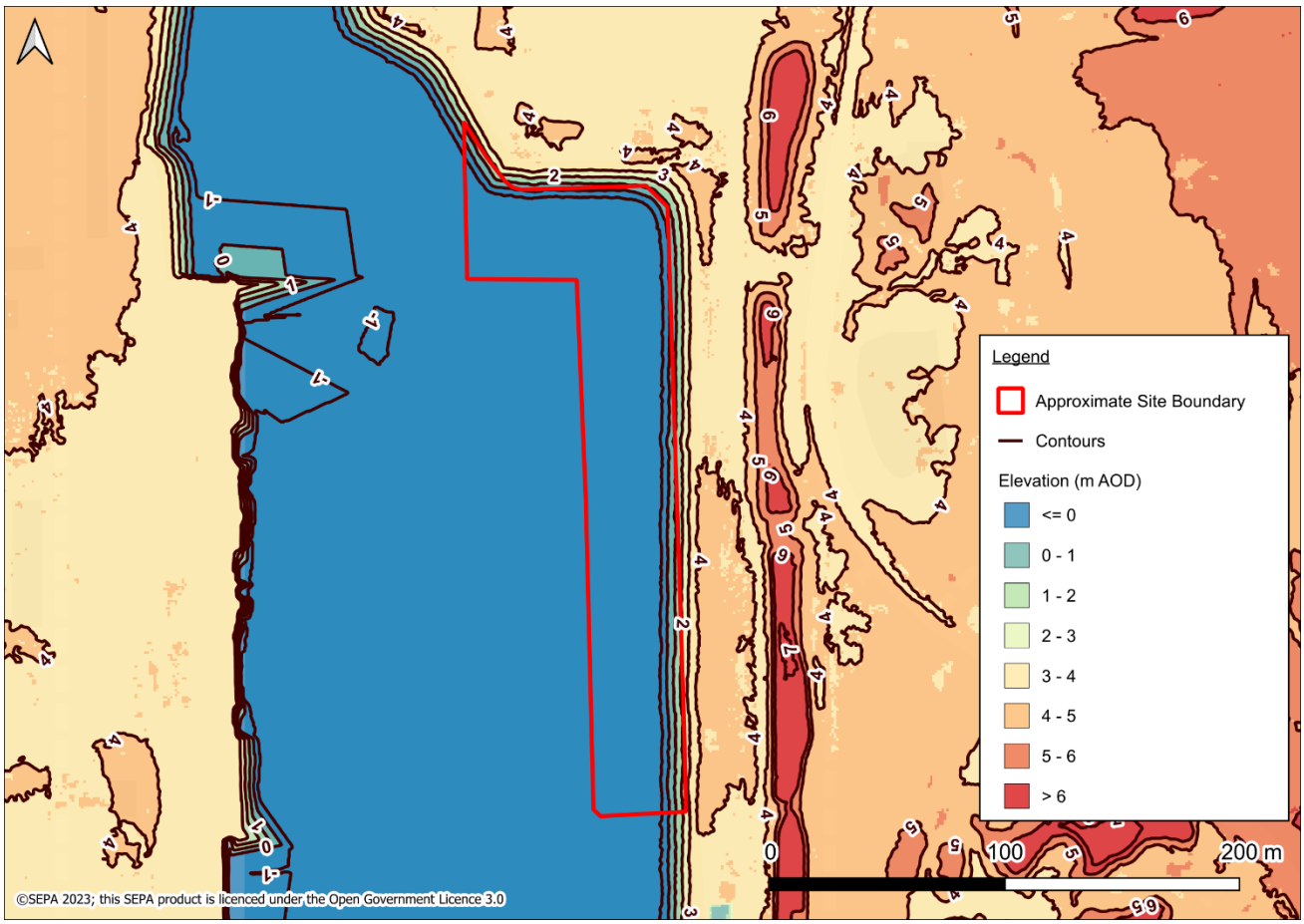


Figure 2: LiDAR Plan

Topography	Topographic levels to metres Above Ordnance Datum (m AOD) have also been derived from a 1m resolution Scottish Remote Sensing Portal composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that the site is situated on water at an elevation of 0m AOD, with the north and eastern on-land boundaries at 2m AOD (Figure 2).
Hydrology	The site is located on the Port of Nigg, on the north side of the Cromarty Firth.

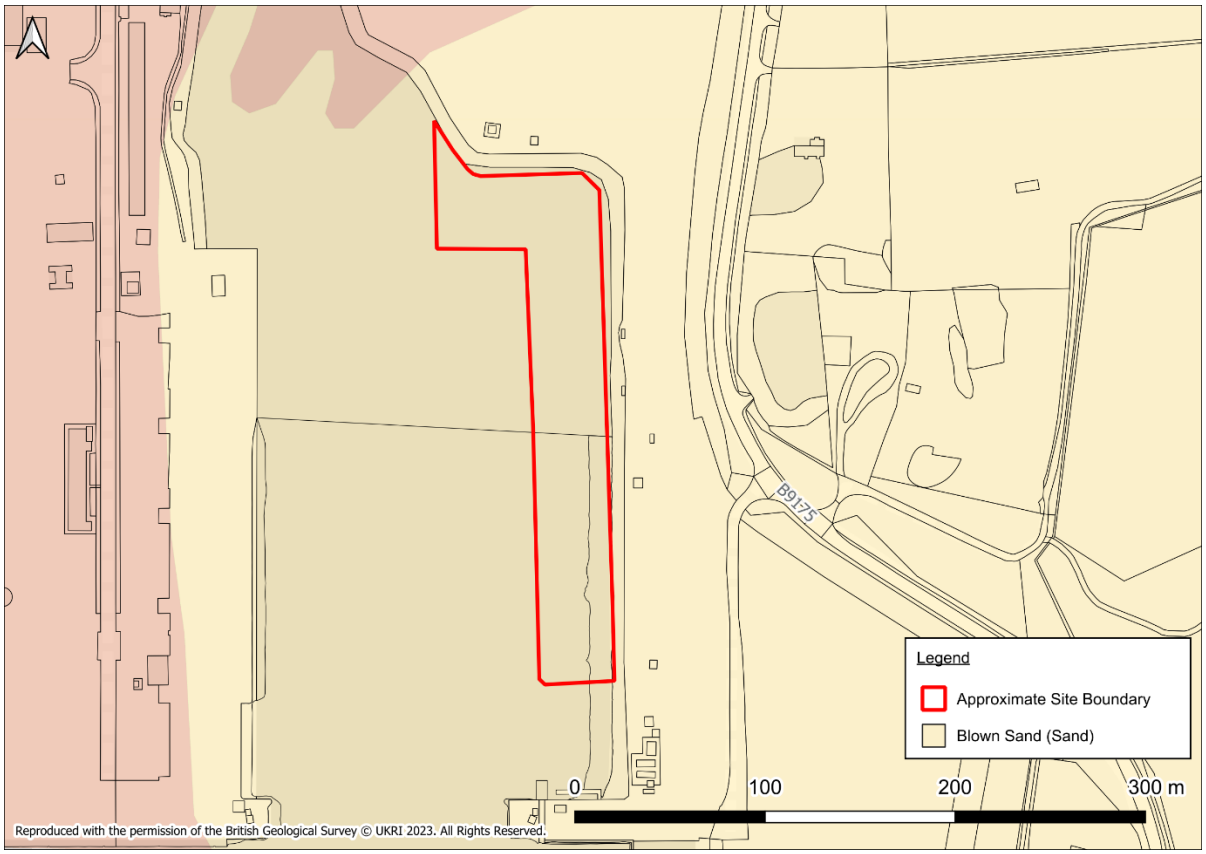


Figure 3: Superficial Deposits

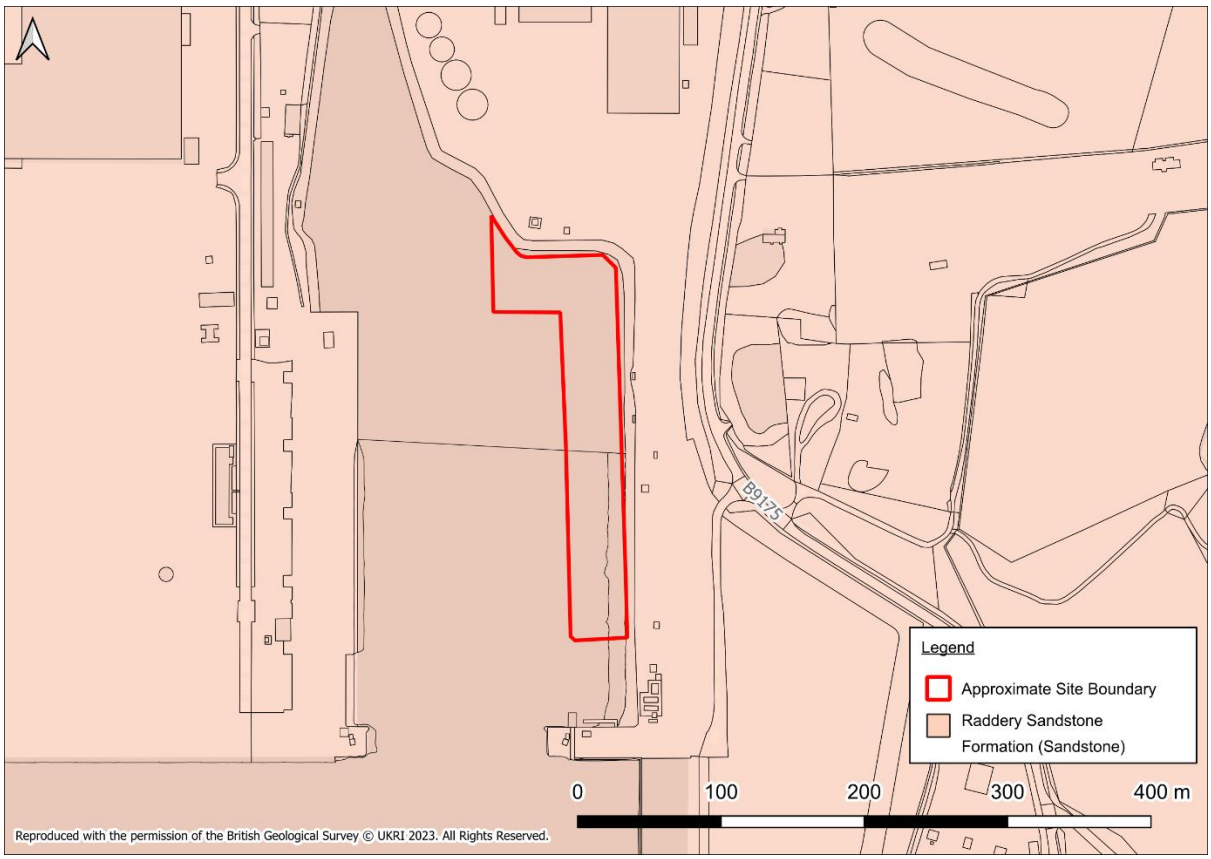


Figure 4: Bedrock Deposits

Geology	Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of Blown Sand generally comprising sand. The superficial deposits are identified as being underlain by Raddery Sandstone Formation consisting of sandstone. The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis. The closest historical BGS borehole record (BGS Ref: NH76NE1312/W4) is located on-site (NGR 279372, 869185). The borehole record indicates the following geological sequence: • Topsoil (1'0" bgl); • Fine to medium sand with fine to coarse gravel (3'6" bgl); • Medium dense light brown fine to medium sand (6'6" bgl); • Fine to medium sand with fine to coarse gravel and some cobbles (21'0" bgl); • Dense light brown fine to medium sand (24'0" bgl); • Dense grey medium sand with shell fragments (30'6" bgl); • Brown fine to medium sand (31'0" bgl); • Fine to medium sand with fine to coarse gravel (43'9" bgl); • Brown sandy silty clay (44'0" bgl); • Red-Brown slightly clayey medium sand (44'6" bgl); • Red-brown medium to coarse sandstone (49'6" bgl); • Cemented current bedded coarse sandstone (75'6" bgl); • Cemented sandstone with lenses and thin layers of red-brown mudstone (76'9" bgl); • Cemented current bedded, slightly micaceous medium sandstone (97'8") bgl); • Mudstone with occasional lenses of fine sandstone (97'11" bgl); and • Medium sandstone (99'6" bgl).
Hydrogeology	According to the SEPA's Aquifer Designation data, obtained from Scotland's Environment online mapping [accessed 12/03/24], the site's underlying aquifer classification is described as a highly productive aquifer which has flow through virtually all fractures and other discontinuities.
Local Drainage	Scottish Water sewer records (Appendix B.) find there are no public sewers within the site's near vicinity.
Development Proposals	The proposed development is for a new Eastern Quay within the Inner Dock at the Port of Nigg. Proposed development Plans are included as Appendix B.

3.0 Relevant Planning Policy and Guidance

Introduction

The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to any proposed development on the site and relevant guidance and legislation.

Assessment of Flood Risk

The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the SEPA Flood Maps. This map defines three zones of different flood risk:

- High Likelihood - Each year this area has a 10% chance (1 in 10 annual probability) of flooding.
- Medium Likelihood -Each year this area has a 0.5% chance (1 in 200 annual probability) of flooding.
- Low Likelihood - Each year this area has a 0.1% chance (1 in 1000 annual probability) of flooding.

The future climate change flood maps include for the potential risk up to the 2080's – medium likelihood only.

Local Policy

The Highland and Argyll Local Plan District Flood Risk Management Plan

Scotland has been separated into 14 Local Plan Districts for flood risk management purposes. Published in December 2021, the Highland and Argyll Local Plan District Flood Risk Management Plan sets objectives for tackling flooding in high-risk areas and identify the actions needed to work towards those objectives over a six year period until 2028.

The plan aims to raise awareness of flood risk and states that "new development in areas with medium to high likelihood of flooding should generally be avoided". Wick is listed as a potentially vulnerable area (PVA) due to the risk of river, coastal and surface water flooding. The main source of flood risk is surface water.

The Highland Council Supplementary Guidance Flood Risk & Drainage Impact

The Highland Council Supplementary Guidance Flood Risk & Drainage Impact (adopted January 2013) contains the following guidance on flood risk and drainage:

'Policy 64 Flood Risk

Development proposals should avoid areas susceptible to flooding and promote sustainable flood management.

Development proposals within or bordering medium to high flood risk areas, will need to demonstrate compliance with Scottish Planning Policy through the submission of suitable information which may take the form of a Flood Risk Assessment.

Development proposals outwith indicative medium to high flood risk areas may be acceptable. However, where:

- *better local flood risk information is available and suggests a higher risk;*
- *a sensitive land use (as specified in the risk framework of Scottish Planning Policy is proposed, and/or;*
- *the development borders the coast and therefore may be at risk from climate change;*

A Flood Risk Assessment or other suitable information which demonstrates compliance with SPP will be required.

Developments may also be possible where they are in accord with the flood prevention or management measures as specified within a local (development) plan allocation or a development brief. Any developments, particularly those on the floodplain, should not compromise the objectives of the EU Water Framework Directive.

Where flood management measures are required, natural methods such as restoration of floodplains, wetlands and water bodies should be incorporated, or adequate justification should be provided as to why they are impracticable.

Policy 66 Surface Water Drainage

All proposed development must be drained by Sustainable Drainage Systems (SuDS) designed in accordance with The SuDS Manual (CIRIA C697) [updated C753] and, where appropriate, the Sewers for Scotland Manual 2nd Edition. Planning applications should be submitted with information in accordance with Planning Advice Note 69: Planning and Building Standards Advice on Flooding paragraphs 23 and 24 [replaced by Flood risk: planning advice [Published 22 June 2015]. Each drainage scheme design must be accompanied by particulars of proposals for ensuring long-term maintenance of the scheme.'

SEPA Land Use Planning System Guidance Note 8

'10. Pontoons and other types of small scale water related development

Certain water-based development such as pontoons, jetties, moorings, boathouses and some water based recreation structures (e.g. canyon or waterfall wires) are unlikely to have a significant impact on flood risk. Any flood related impacts of such developments can be minimised through good design which utilises flood resilient/ resistant materials. You can find useful advice on flood resilient design in PAN 69: Planning and Building Standards Advice on Flooding.'

SEPA Land Use Vulnerability

In accordance with SEPA Flood Risk and Land Use Vulnerability Guidance (July 2018), any proposed residential development should be considered 'highly vulnerable' and assessed against the 1 in 200-year flood event (0.5% AEP) for the duration of its lifetime.

SEPA Climate Change Allowances

SEPA's climate change allowances guidance (v3, April 2023) sets out required allowances for climate change that must be used for flood risk assessment following the adoption of NPF4 in February 2023. The climate change allowances listed in the guidance are a prediction of anticipated change in peak river flow, peak rainfall intensity or sea level rise caused by future climate change. Allowances for the North Highland region are provided in Table 1.

Table 1: SEPA Climate Change Allowances - North Highland Scotland Region

Source of Flooding	Climate Change Allowance
Fluvial	+ 40%
Coastal (Sea Level Rise)	+0.89m
Rainfall Intensity	+42%

For watercourses with catchments less than 30km^2, the rainfall intensity allowance should be applied to the rainfall used to calculate the flows. For watercourses with a catchment area between 30-50km2, the rainfall intensity allowance should be applied if the resultant flow increase is greater than using river flow uplift directly.

SEPA Flood Map Classification

SEPA's indicative flood maps show areas considered to have the potential of flooding from rivers (fluvial), coastal, and surface water (pluvial) sources. Whilst the nature of these maps means that they do not necessarily represent flooding in high detail at a site-specific level, they can provide an understanding of general areas that may be prone to flooding from a particular source. Table 2 provides the annual exceedance probability (AEP) for each probability band.

Table 2: SEPA Flood Map Classifications

Source of Flooding	High Probability (AEP)	Medium Probability (AEP)	Low Probability (AEP)
Fluvial Present Day	10%	0.5%	0.1%
Fluvial Future (2080s)	-	0.5% (incl. allowance for future climate change)	-
Coastal Present day	10%	0.5%	0.1%
Coastal Future (2080s)	-	0.5% (incl. allowance for estimated sea level rise)	-
Pluvial Present Day	10%	0.5%	0.1%

4.0 Assessment of Flood Risk

The aim of this section of the report is to assess and summarise the existing flood risk at the site.

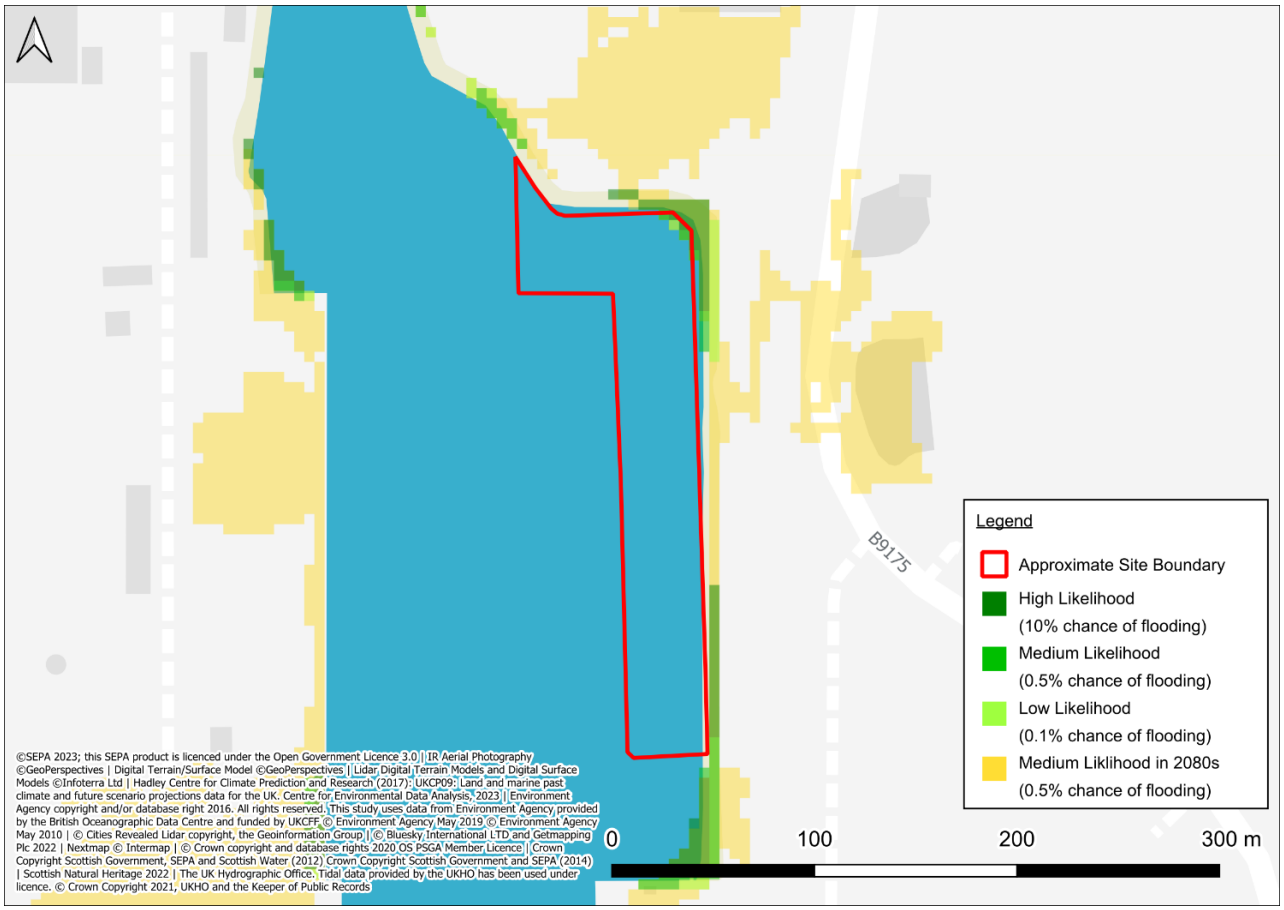


Figure 5: SEPA's Coastal Flood Map

Tidal Flood Risk	The nearest waterbody is Cromarty Firth, a tidally influenced Firth from the North Sea. As the site is wholly within Cromarty Firth itself, there are no SEPA flood risk extents associated with the area. However, the northern and eastern boundary which the landward areas, are shown to range from a low annual likelihood to a high annual likelihood. These areas are also shown to be at a medium likelihood in the 2080s climate change scenario. SEPA mapping finds that there have been no historic reports of flooding within the site's area. Coastal modelling of Cromarty Firth was undertaken by Mabbett Ltd in 2023. The 0.5% AEP event model finds the water level of Cromarty Firth, at the site, to reach a maximum elevation of 4.58m AOD (Appendix D). During the 0.5% AEP event+ climate change, the water level of Cromarty Firth, at the site, is modelled to reach a maximum elevation of 5.8m AOD (Appendix D). The proposed development plans (Appendix C) show the proposed dock to be situated at 6m CD (equivalent to 3.78m AOD). However, the proposed port is a water compatible development and therefore will not be at risk from the Cromarty Firth tidal influences. A Flood Warning and Evacuation Plan is recommended for any site users to follow during or following a flooding event.

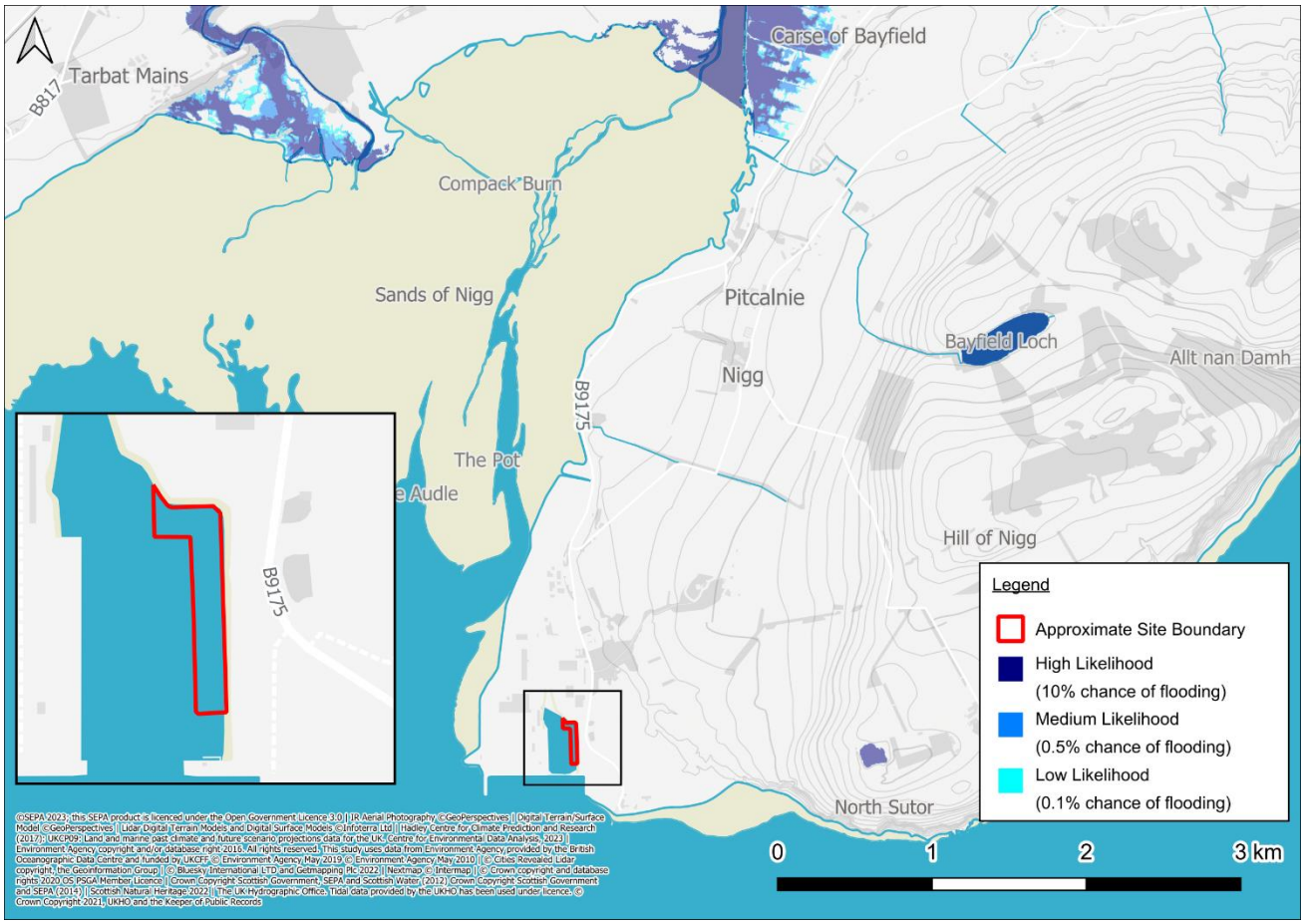


Figure 6: SEPA's Fluvial Flood Map

Fluvial Flood Risk	There are no fluvial watercourses in the vicinity of the site, and the main source of flooding is tidal rather than fluvial (discussed above). Figure 6 confirms this, as the site is located wholly outside of any SEPA fluvial flooding extents. It can therefore be concluded that the site is at **Low** risk of fluvial flooding.

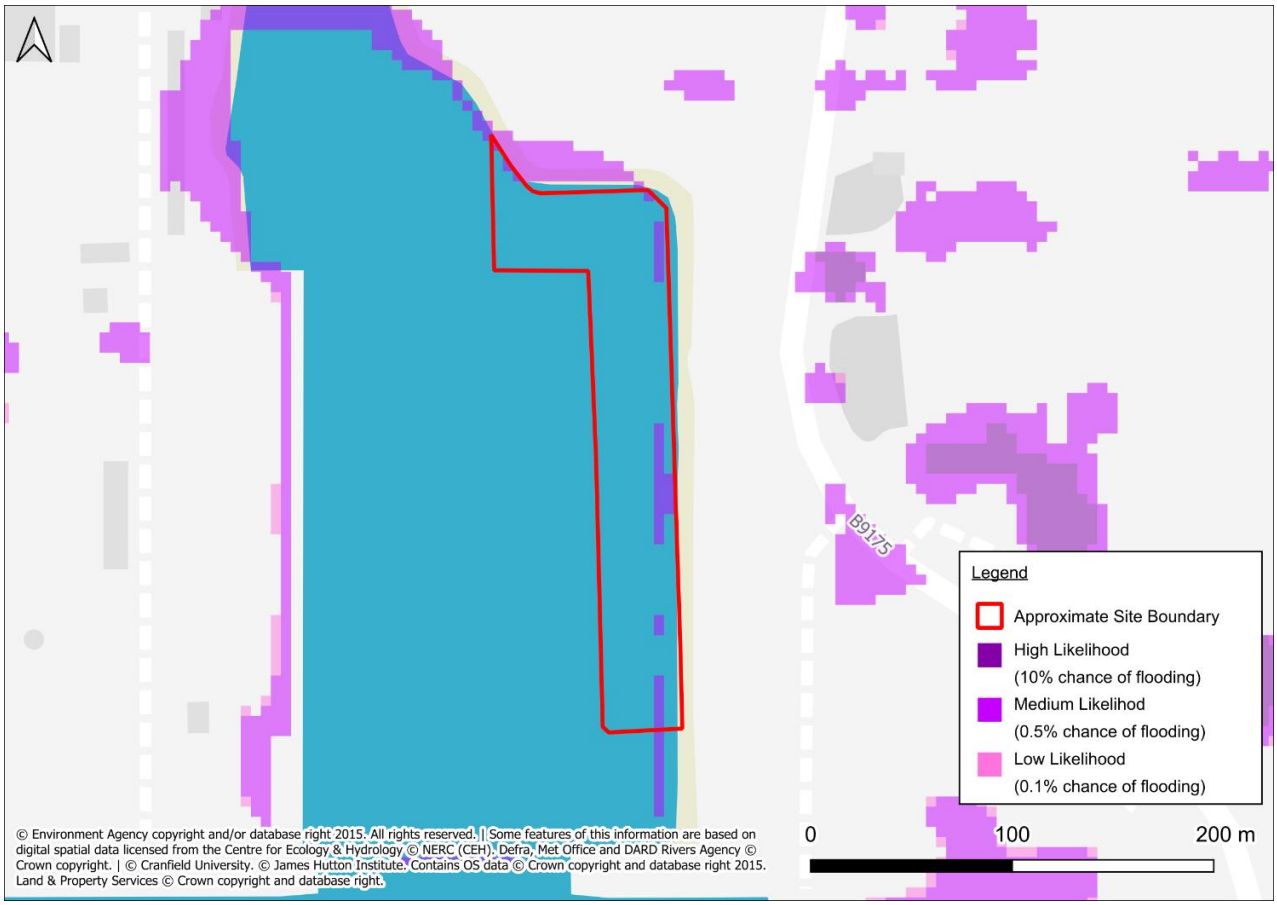


Figure 7: SEPA's Surface Water Flood Map

Surface Water Flood Risk	The site is located wholly on Cromarty Firth and therefore any surface water extents shown in Figure 7 are associated with topographic depressions. The main source of flooding is tidal which is discussed above. It can therefore be concluded that the site is at **Low** risk of surface water flooding.	
Ground water Flood Risk	According to BGS mapping, the site is underlain by Blown Sand superficial deposits and Raddery Sandstone Formation Bedrock. The BGS borehole record on-site finds the site is predominately underlain by sand and sandstone deposits, with some mudstone. Groundwater in this area will be dominated by tidal levels within the firth and given the site is elevated above the firth groundwater is inconsequential at the site. SEPA mapping finds that the site is not located within an area considered to be at risk from groundwater flooding. It can therefore be concluded that the risk of groundwater flooding is **Low.**	
Artificial Sources Flood Risk	**Sewer Flooding**	Based on the existing nature of the site, the site it is unlikely served by a drainage system. In the proposed development, surface water will be captured by a system of surface mounted drainage channels connected by gravity which outfall to the Inner Dock through the front quay retaining wall. Given the nature of the proposed site, any surcharging surface waters will discharge into the Firth. It is understood that there are no combined or foul sewers proposed. Therefore, the risk of sewer flooding is **Negligible to Low.**

	Reservoir and Canal Flooding	There are no canals within the vicinity of the site, therefore there is a **Negligible** risk from this source. The SEPA 'Reservoirs Flood' map shows that the site is not at risk from any nearby reservoirs following a breach. Therefore, there is a **Negligible** risk from this source.
Residual Flood Risks	A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop the quay from waves. The Port of Nigg has systems in place to alert to the likelihood of low atmospheric pressure combined with onshore high wind and spring tide levels. Over-topping during such occasions is an accepted risk. Further investigation and design of appropriate mitigation measures would be carried out at the detailed design stage. In the event of the defences failing or an exceedance event occurring, the residual risk to people working within the site can be managed through the implementation of an appropriate site management plan, which recognises the residual risks and details what action is to be taken by staff in the event of a flood to put occupants in a place of safety.	

Summary of Flood Risk

It can be concluded that the site is at low risk of flooding from all sources as the development is water compatible. Therefore, no site-specific mitigation measures are considered necessary.

Source of Flooding		Assessed Level of Risk	Further Comments
Tidal Flood Risk		Low	N/A
Fluvial Flood Risk		Low	N/A
Surface Water Flood Risk		Low	N/A
Groundwater Flood Risk		Low	N/A
Artificial Sources Flood Risk	Sewer Flooding	Negligible to Low	N/A
	Reservoir and Canal Flooding	Negligible	N/A

5.0 Drainage Impact Assessment

Introduction

The site is currently rock armoured side slope of the Port of Nigg inner dock and is not formally drained. The proposed development will introduce 1.26 Ha of hardstanding in the form of the quay extension over Cromarty Firth.

NPF4 requires that all development proposals will:

- Not increase the risk of surface water flooding to others, or itself be at risk;
- Manage all rain and surface water through sustainable urban drainage systems (SuDS), which should form part of and integrate with proposed and existing blue-green infrastructure. All proposals should presume no surface water connection to the combined sewer; and
- Seek to minimise the area of impermeable surface.

The increase in hardstanding area will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.

Drainage Hierarchy

The recommended surface water drainage hierarchy (Paragraph 080 of the NPPG: Flood Risk and Coastal Change) is to utilise soakaway systems or infiltration as the preferred option, followed by discharging to an appropriate watercourse. If this is not feasible, the final option is to discharge to an existing public sewer.

Surface Water Discharge to Soakaway	The site will be constructed as a pier over Cromarty Firth as a solid construction comprising an anchored tubular steel front wall infilled behind with crushed rock material. Infiltration should not be utilised within areas of Made Ground and as such there would be no ground beneath the drainage system to discharge to. Therefore, it is considered that discharging to ground is not feasible.
Surface Water Discharge to Watercourse	Where soakaways are not suitable a connection to watercourse is the next consideration. The site is located over Cromarty Firth; therefore it is proposed that the surface water runoff is discharged straight to this waterbody.
Surface Water Discharge to Sewer	As described above, a connection to Cromarty Firth is feasible and therefore a connection to the public surface water sewer is not required.

Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) should be incorporated onsite where practical to drain surface water runoff. The following SuDS options have been considered:

Soakaways	As described above, the quay will comprise a solid construction comprising an anchored tubular steel front wall infilled behind with crushed rock material, therefore infiltration devices are not suitable.
Swales, Detention Basins and Ponds	Due to the lack of external space and limited structure depth, the use of swales, detention basins and ponds would not be feasible.
Filter Drains/Strips	The proposed development will comprise an anchored tubular steel front wall infilled behind with crushed rock material. Weep holes will be provided in the front wall where surface water will be captured by a system of surface mounted drainage channels to discharge into Cromarty Firth.

Bioretention systems	Bioretention systems (including rain gardens and raised box planters) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. The heavy industrial nature of the pier precludes the potential for bioretention systems.
Porous/Permeable Paving	The proposed development is an industrial port where heavy equipment associated with the loading and unloading of cargo will frequently use the dock and therefore the use of permeable surfaces wouldn't be appropriate.
Green Roofs	There are no buildings proposed, therefore green roofs cannot be incorporated int to the site.
Rainwater Harvesting	The attenuation benefits provided through the use of rainwater harvesting are considered to be limited. However, rainwater harvesting techniques could be incorporated within the final design.
Underground Attenuation Tanks	As runoff rates do not need to be restricted (as Cromarty Firth is a tidal waterbody), tanks would not be appropriate for the site.

Preferred Drainage Scheme

As runoff rates do not need to be restricted (as Cromarty Firth is a tidal waterbody), the inclusion of SuDS will provide surface water treatment prior to discharge into Cromarty Firth.

Surface Water Treatment

Appropriate treatment would be incorporated through the use of SuDS to ensure that the quality of water discharged is acceptable. The surface mounted drainage channels will include catch pits at changes in direction and the outflow flow will pass though oil separators with sampling chambers included. This can be confirmed at the detailed design stage.

Maintenance

Maintenance of drainage features will be the responsibility of the site owner. Maintenance of shared surface water drainage systems can be arranged through appointment of a site management company.

Foul Water Discharge

The proposed development doesn't produce wastewater which could be considered trade effluent, nor are there any welfare facilities proposed. Therefore, a foul connection is not required, and foul water hasn't been considered further.

6.0 Conclusions and Recommendations

Conclusions

As the site is wholly within Cromarty Firth itself, there are no SEPA flood risk extents associated with the area. However, the northern and eastern boundary which the landward areas, are shown to range from a low annual likelihood to a high annual likelihood. The development is considered to be a water compatible use.

The risk of flooding to the proposed building from tidal sources is considered to be low, although there is a residual risk due to the pier deck being overtopped by waves. The Port of Nigg has systems in place to alert to the likelihood of low atmospheric pressure combined with onshore high wind and spring tide levels. Over-topping during such occasions is an accepted risk. Further investigation and design of appropriate mitigation measures would be carried out at the detailed design stage.

The risk of flooding from fluvial, surface water, groundwater and artificial sources has also been assessed and found to be low.

Surface water runoff from the proposed development would discharge to the Cromarty Firth, as per the existing situation. As the waterbody is tidal at this location, surface water would discharge unrestricted. Treatment would be achieved through the use of SuDS, such as surface mounted drainage channels which will include catch pits at changes in direction. The outflow flow will pass though oil separators with sampling chambers included. This can be confirmed at the detailed design stage.

Appendix A – Limitations

Limitations

This report contains recommendations from Mabbett, which are based on the information listed in the report and reflect the professional opinions of an experienced Environmental Consultant. Mabbett obtained, reviewed, and evaluated information from the Client and others to prepare this report. The conclusions, opinions, and recommendations presented in this report are based on this information. However, Mabbett does not guarantee the accuracy of the information provided and will not be held responsible for any opinions or conclusions reached based on information that is later proven to be inaccurate.

This report was prepared exclusively for the Client and for the specific purpose for which Mabbett was instructed. It is not intended for use by anyone other than the Client without Mabbett's written consent. Any unauthorized use of this report is at the sole risk of the user. Anyone using or relying on this report, other than the Client, agrees to indemnify and hold harmless Mabbett from any claims, losses, or damages arising from the performance of the work by the Consultant.

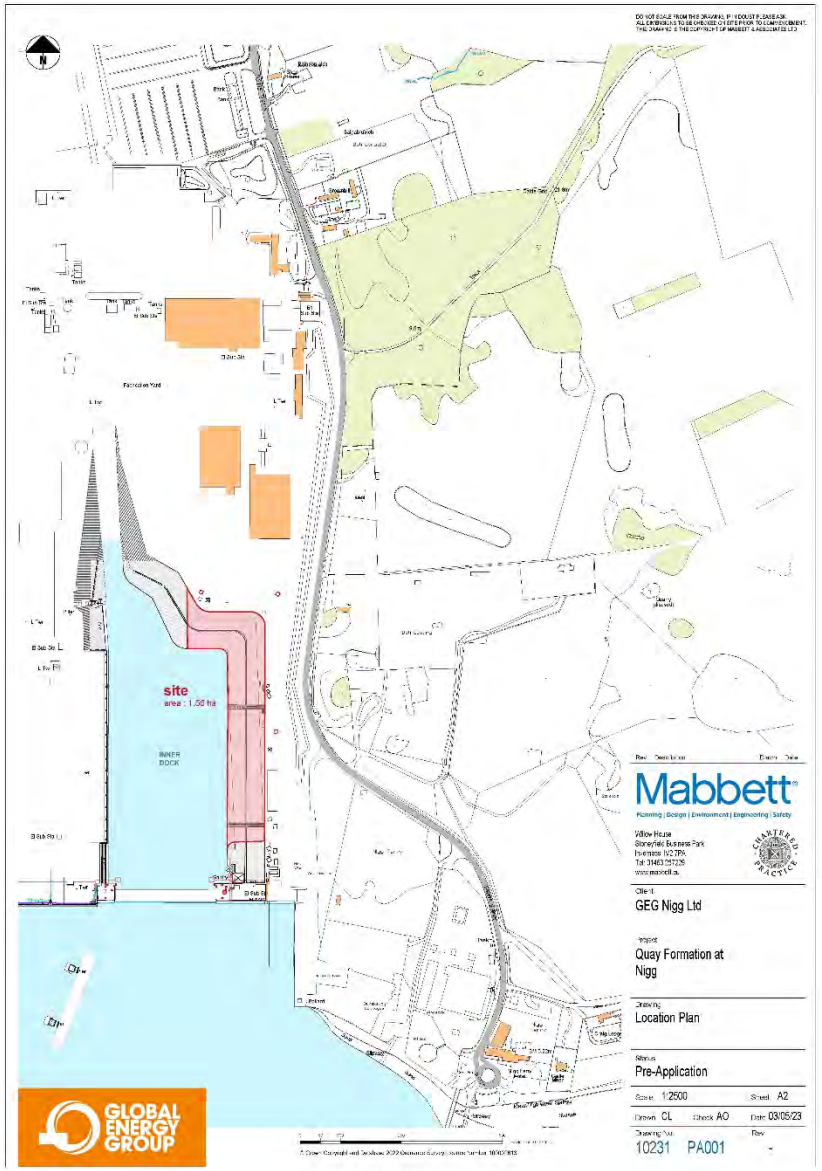
Appendix B – Scottish Water Sewer Plans

Appendix C – Proposed Development Plans

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

View of site from the South

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG



Location and Site Boundary

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

Aerial view from the West

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

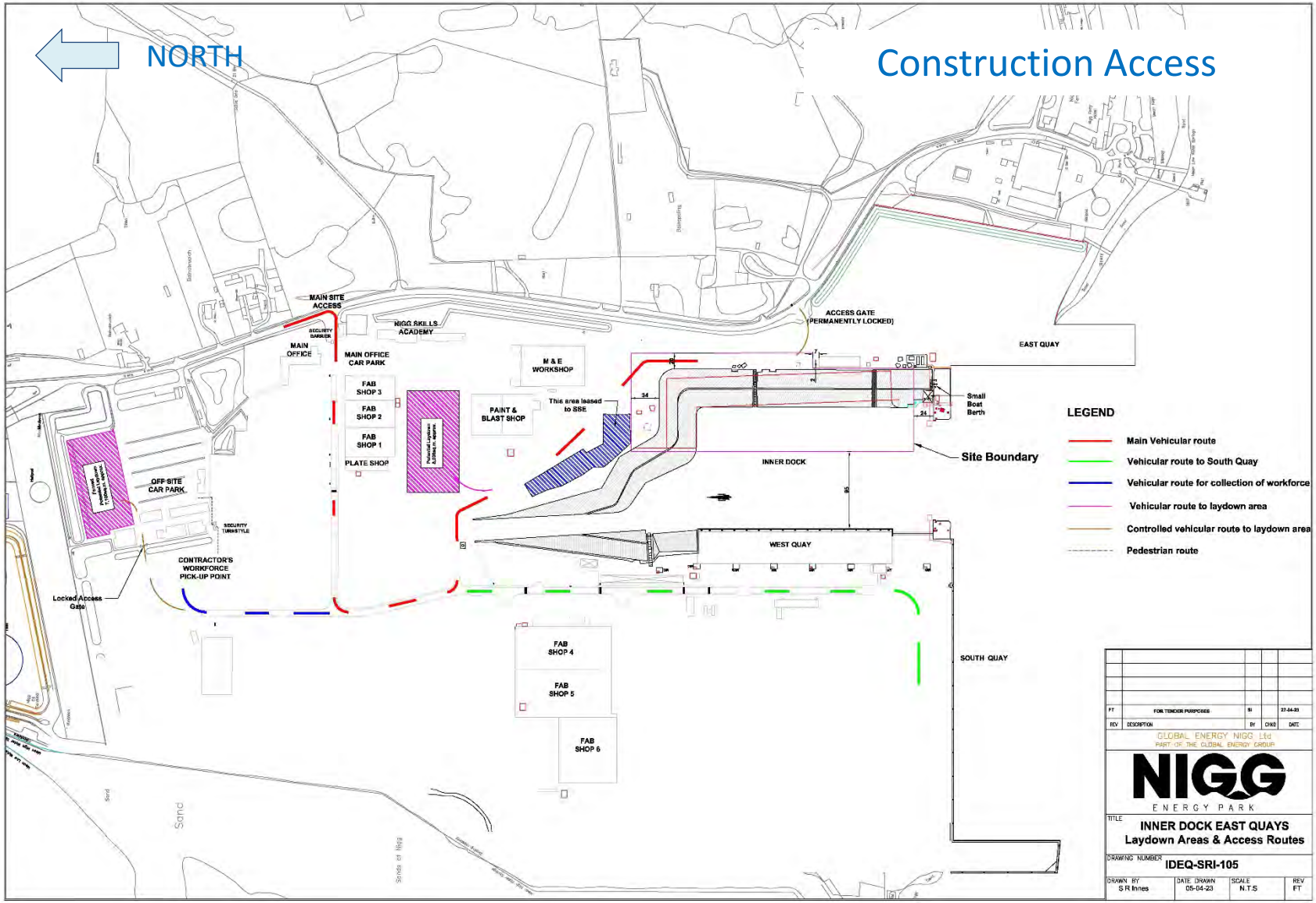
PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

view from middle of the inner dock when ‘dry’ towards the East and proposed berthing quay

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

Current view from the South end of the inner dock looking North

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG



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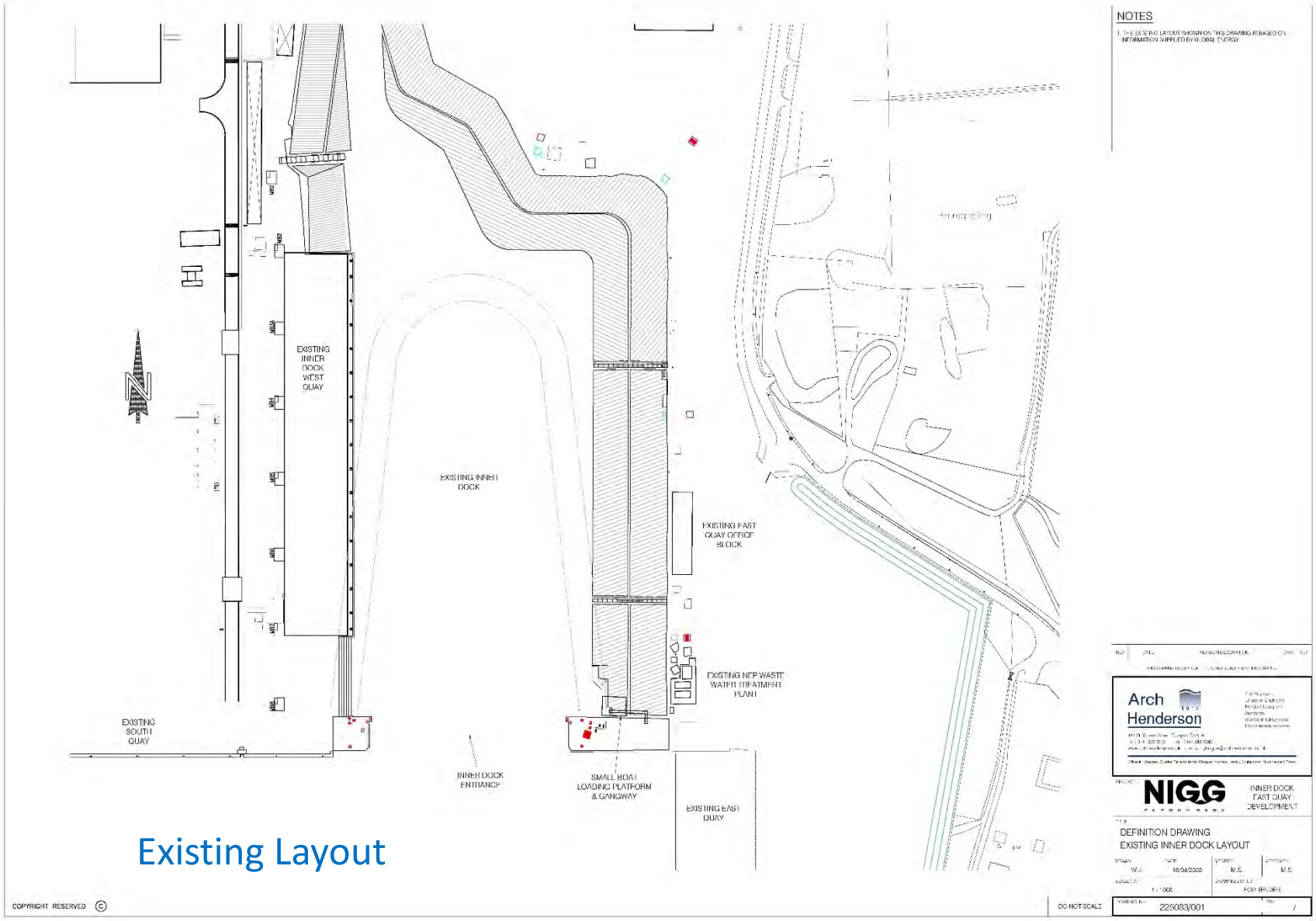
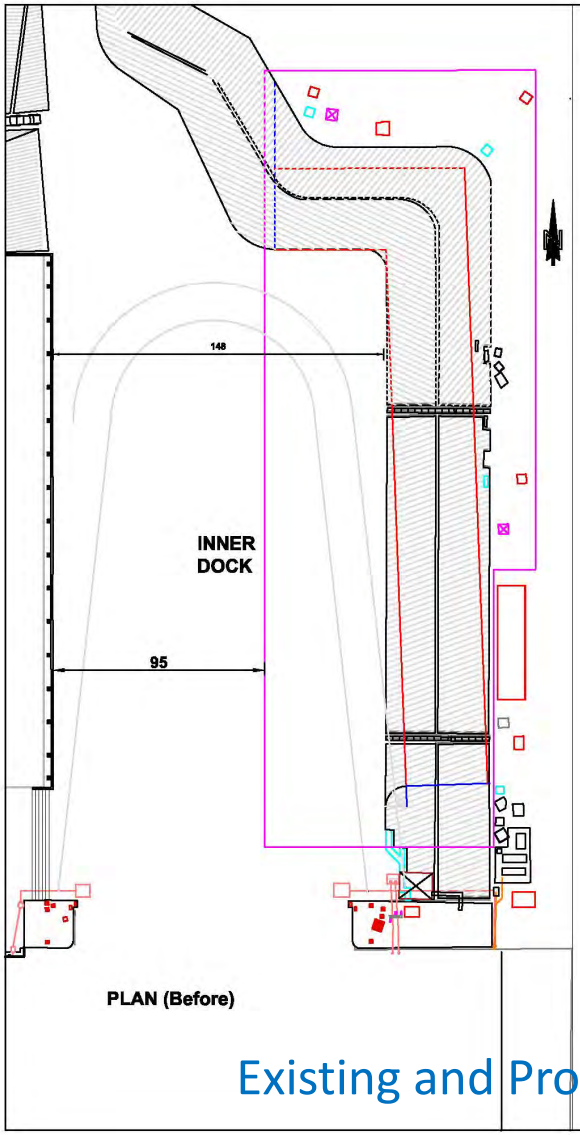
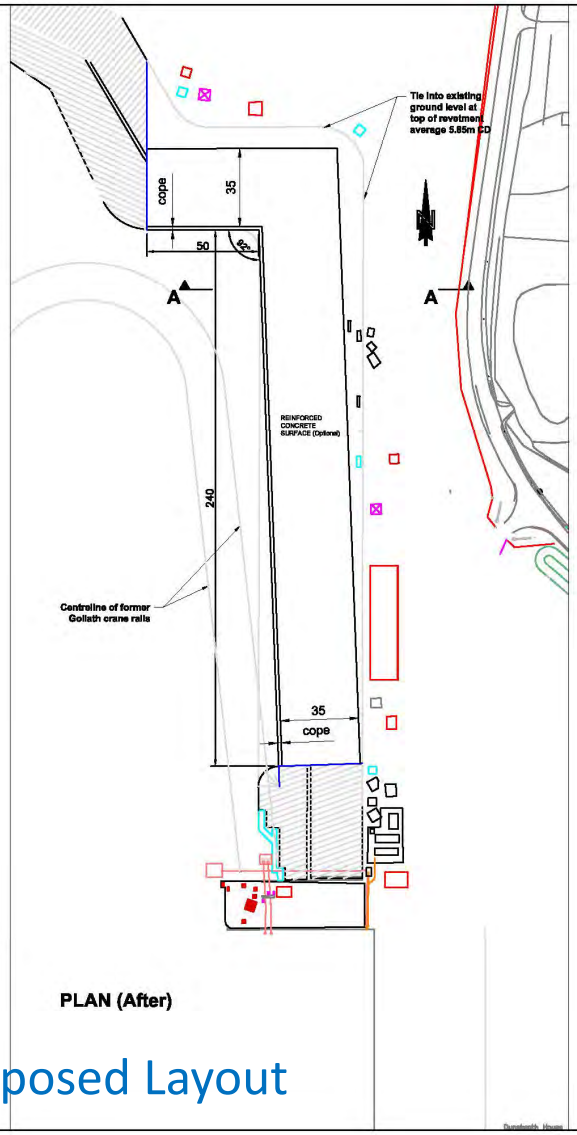
PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG

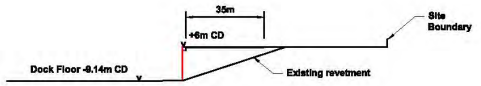


Existing Layout

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG







SECTION A-A

REV	DESCRIPTION	BY	CHKD	DATE
04	Length of main quay reduced to 240m. Substation T6 relocated	SI		11-04-23
03	concrete surface reduced to 35m width	SI		06-03-23
02	South Facing Quay layout altered. Section AA amended	SI		21-02-23
01	Goliath Crane rails added East Quay Office Block added	SI		02-02-23
–	–	–	–	–

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NIGG ENERGY PARK

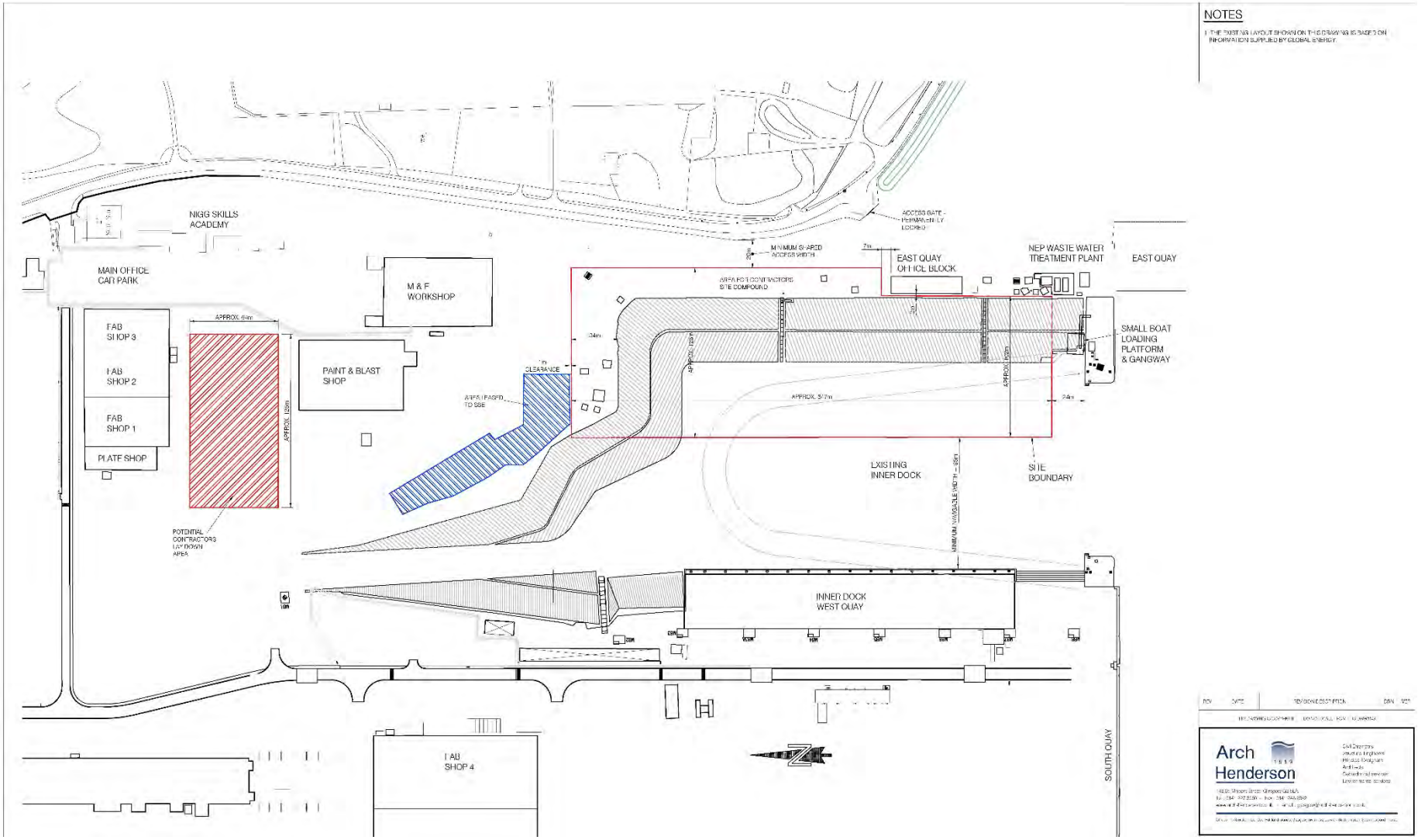
TITLE
INNER DOCK EAST QUAY Definition Drawing

DRAWING NUMBER
IDEQ-SRI-100

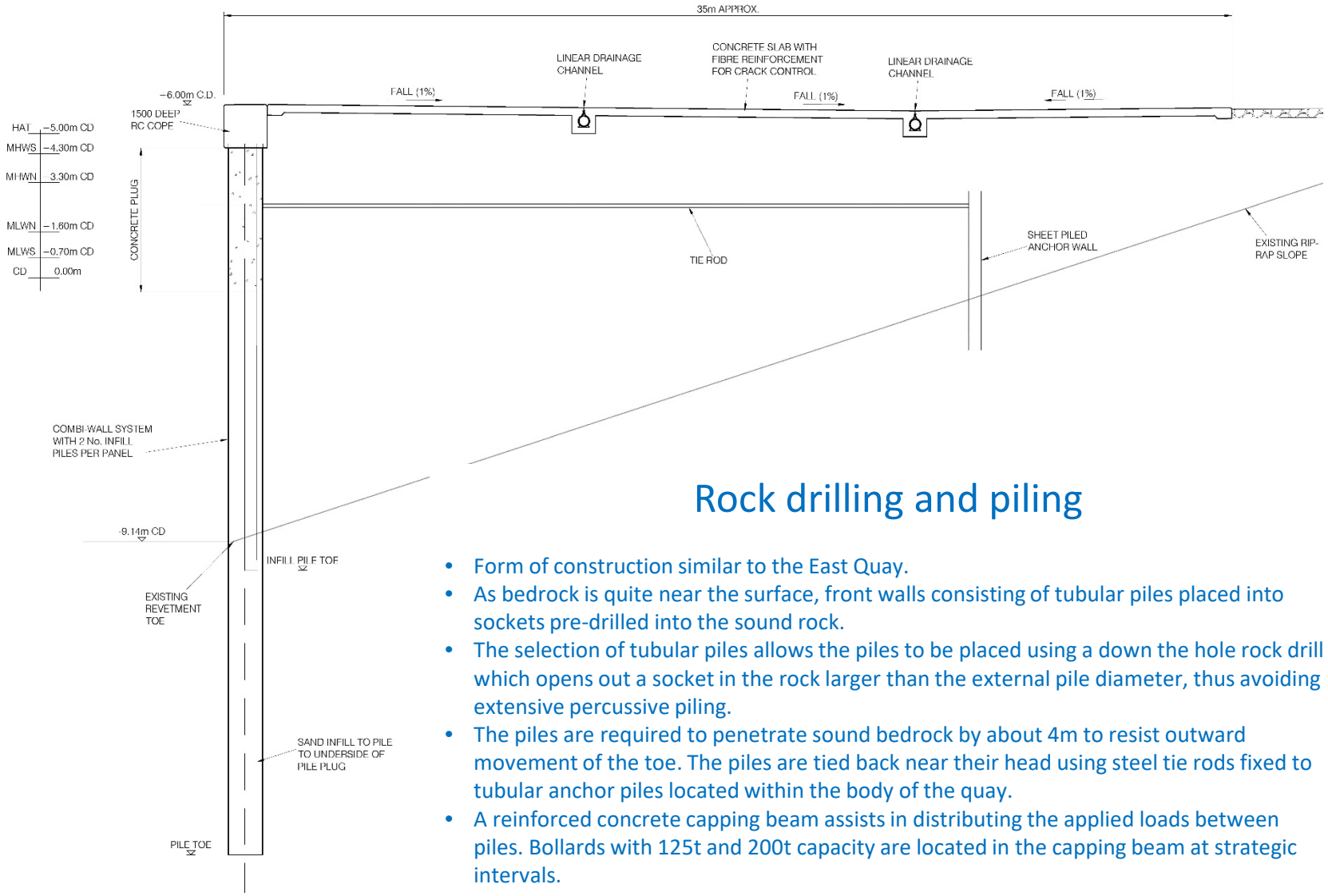
DRAWN BY	DATE DRAWN	SCALE	REV
S R Innes	24-01-23	1:2000 @ A3	02

Existing and Proposed Layout

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG



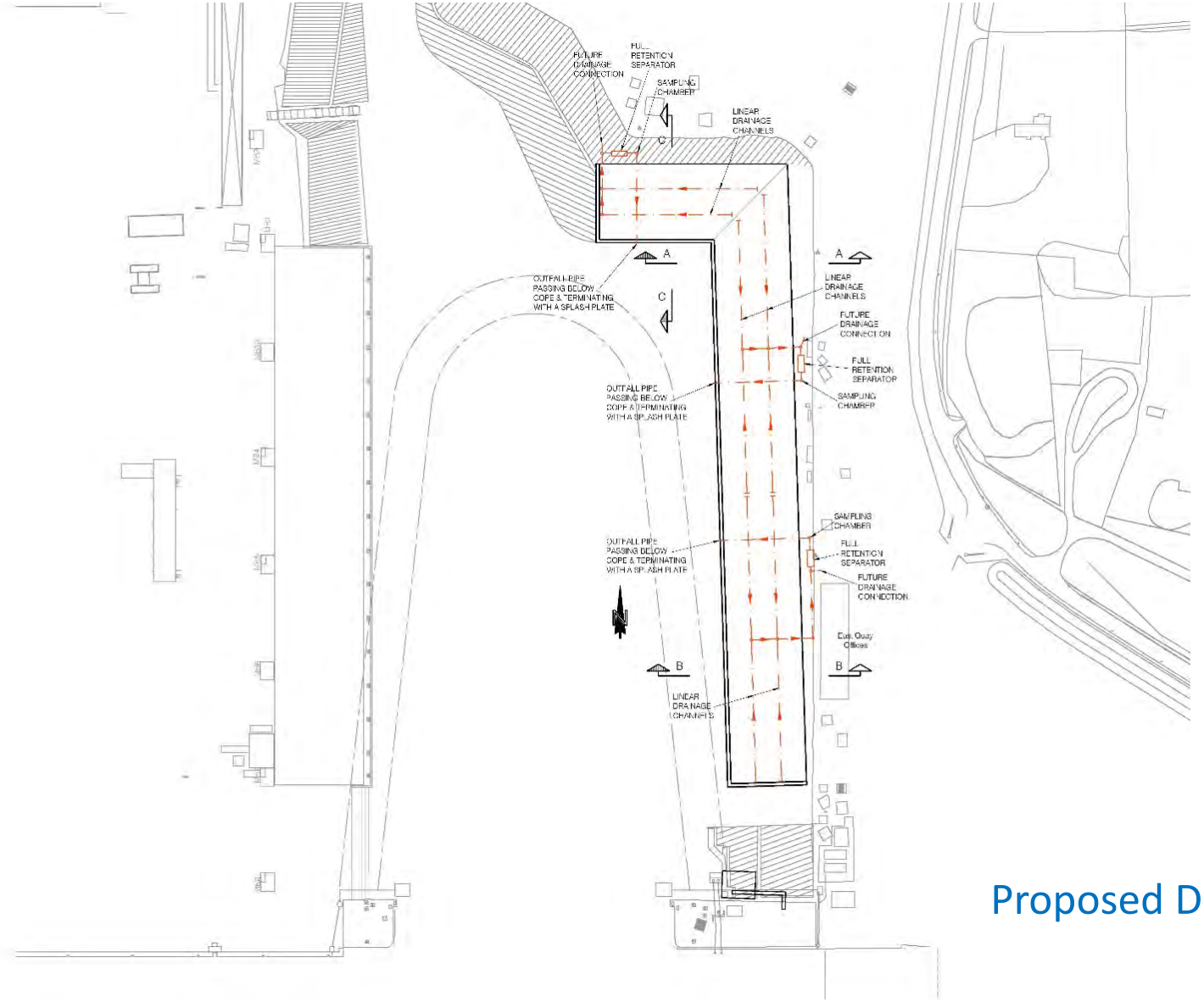
Extent of construction works and contractor's laydown area



Rock drilling and piling

- Form of construction similar to the East Quay.
- As bedrock is quite near the surface, front walls consisting of tubular piles placed into sockets pre-drilled into the sound rock.
- The selection of tubular piles allows the piles to be placed using a down the hole rock drill which opens out a socket in the rock larger than the external pile diameter, thus avoiding extensive percussive piling.
- The piles are required to penetrate sound bedrock by about 4m to resist outward movement of the toe. The piles are tied back near their head using steel tie rods fixed to tubular anchor piles located within the body of the quay.
- A reinforced concrete capping beam assists in distributing the applied loads between piles. Bollards with 125t and 200t capacity are located in the capping beam at strategic intervals.

PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG



Proposed Drainage

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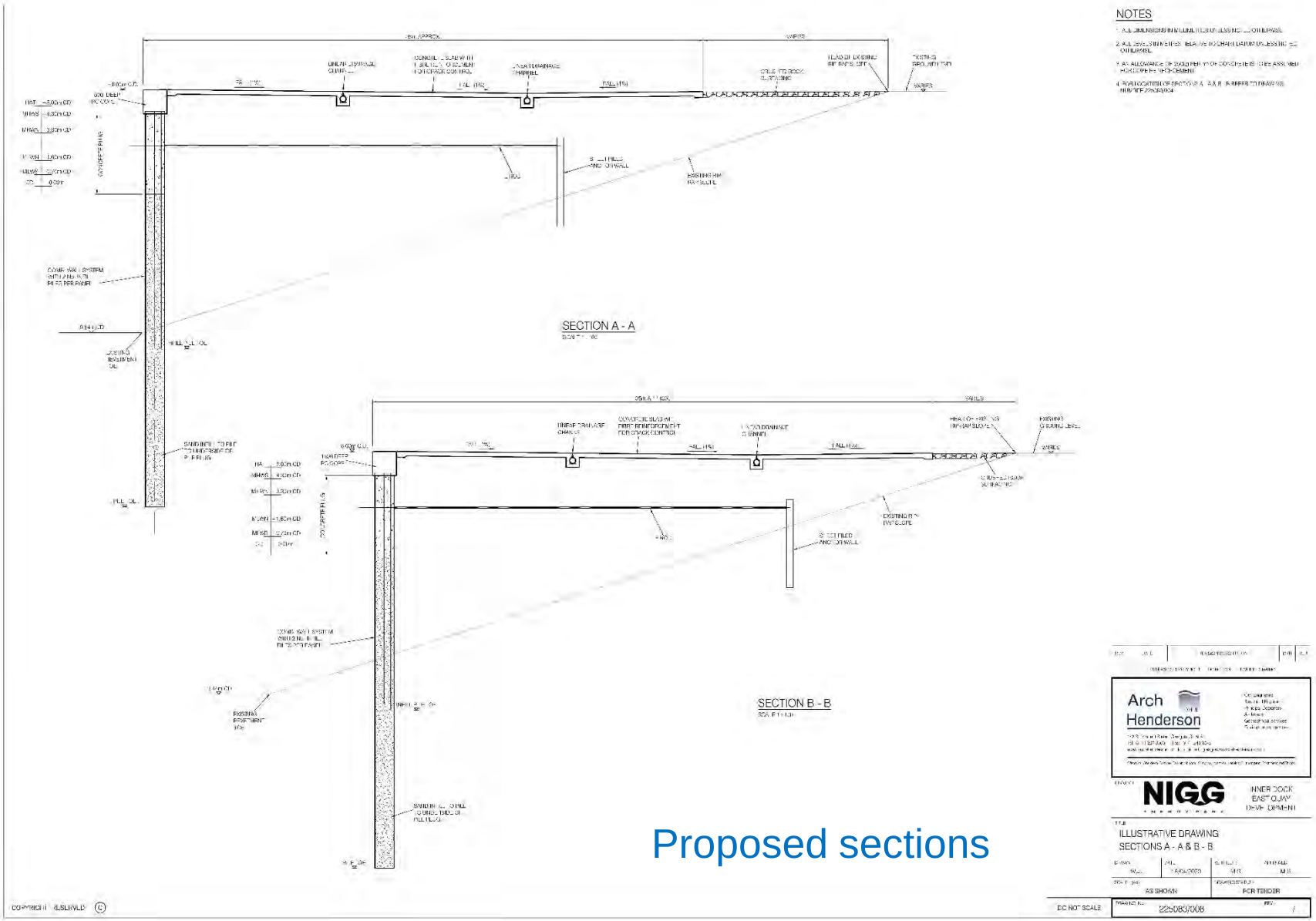
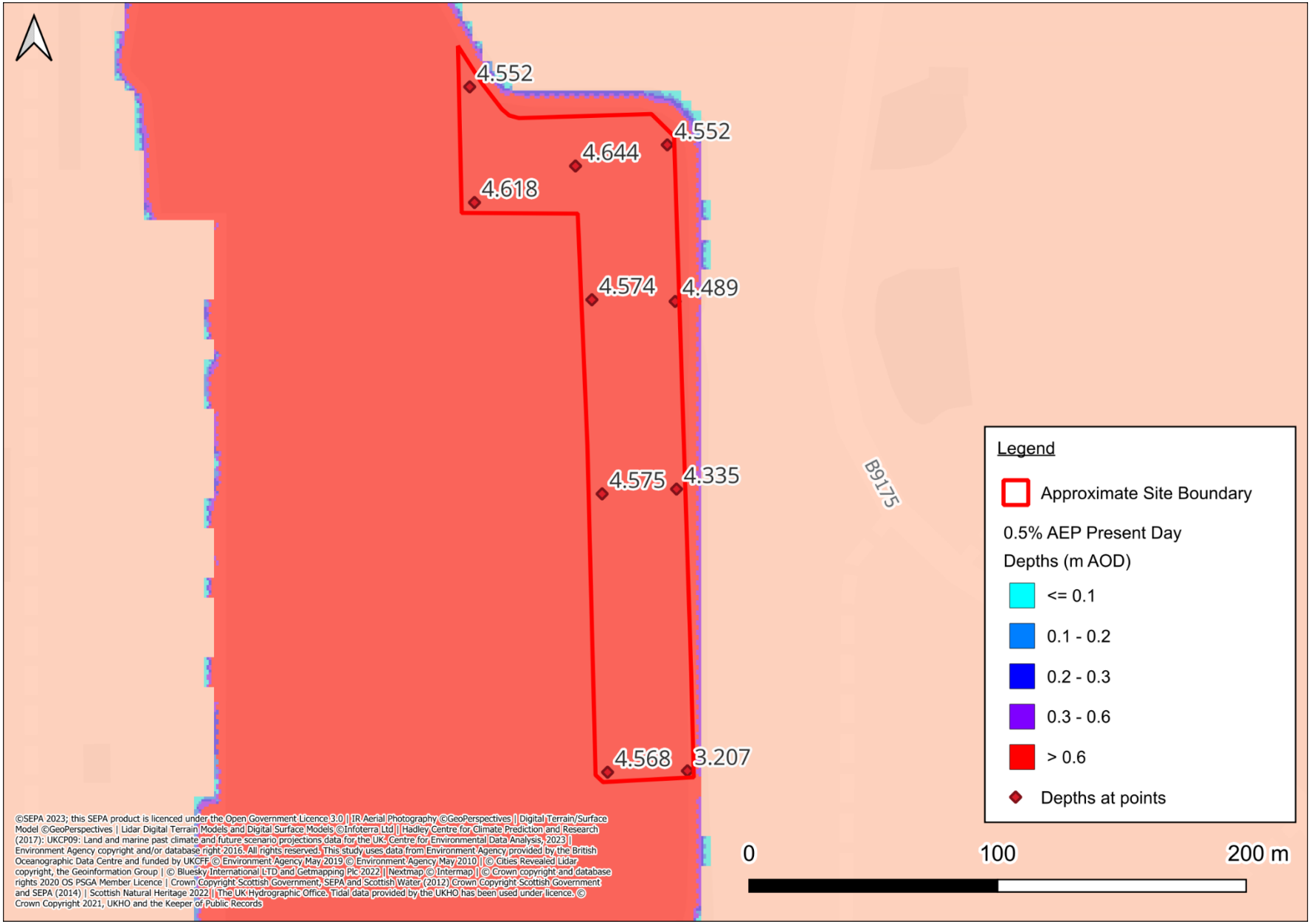
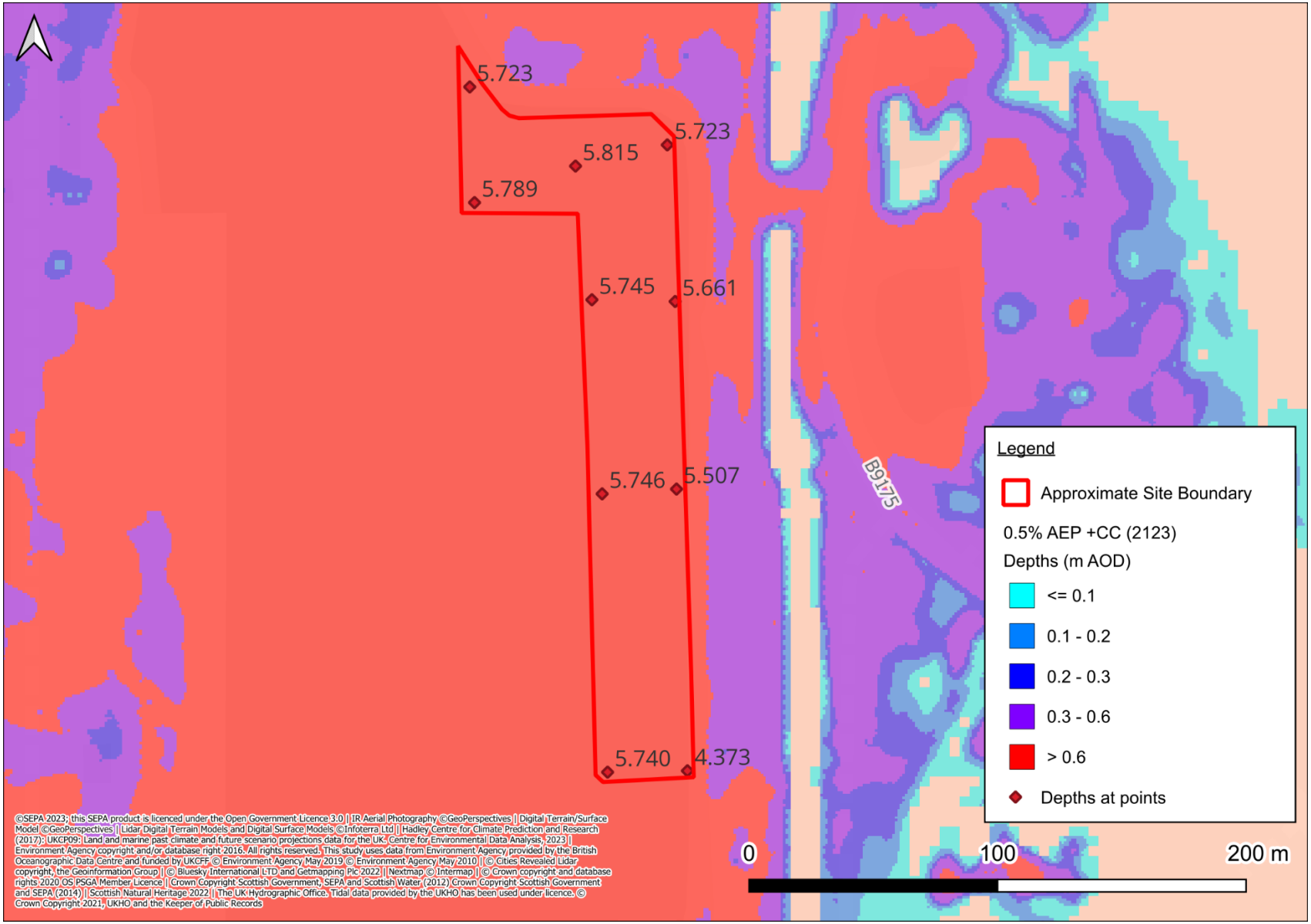
PROPOSED INNER DOCK EAST QUAY EXTENSION AT THE PORT OF NIGG



Proposed sections

Appendix D – Modelled Flood Depths

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5.723
5.815
5.789
5.745
5.661
5.746
5.507
5.740
4.373
B9175
Legend
Approximate Site Boundary
0.5% AEP +CC (2123)
Depths (m AOD)
<= 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.6
> 0.6
Depths at points
0
100
200 m
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