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Rev	Purpose	List of Updated/Modified Sections
01	Added paragraph (2 nd) on the assessment of New Sediment Accumulation made in April 2022. HOLD points removed	2.1
01	Added reference 12	5
01	Added Appendix 4	Appendix 4

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1. INTRODUCTION

Green Maritime Limited were requested by Edinburgh Marina Granton Harbour Ltd, 2nd Floor, 34 Lime Street, London, EC3M 7AT, to provide a Navigational Risk Assessment for works at Granton Marina, Edinburgh, during the construction phase of the Granton Harbour Regeneration Scheme.

The Order of Works determined from the Stakeholder Agreement [1] is:

- Dredging of harbour basin and disposal at sea and on land
- Construction of the north mole extension
- Repair to existing North Mole revetment
- Construction of new western harbour quay wall
- Construction and laying out of the marina

Development associated with the proposed marina element of the Granton Harbour Regeneration Scheme, comprises the construction of a harbour wall, incorporating a 225m length of sloping masonry revetment wall and a 110m length of vertical sheet extension to existing quay wall and backfilling; the laying out of a 340-berth marina; construction of an extension to existing north mole and harbour dredging, repair of the existing face of the North Mole with rock.

1.1 Instructions Received

Green Maritime Limited were requested to provide a navigational risk assessment for works at Granton Marina, Edinburgh, during the construction phase of the operations for the development of the marina.

1.2 Documents Provided

The following documentation was provided by Steven Cameron of Cameron Planning:

- Edinburgh Marina CEMP_12052022
- 00009904 - Marine Construction Licence
- 00009904 - Annex One
- Edinburgh Stakeholder Agreement Draft 011122 0.1

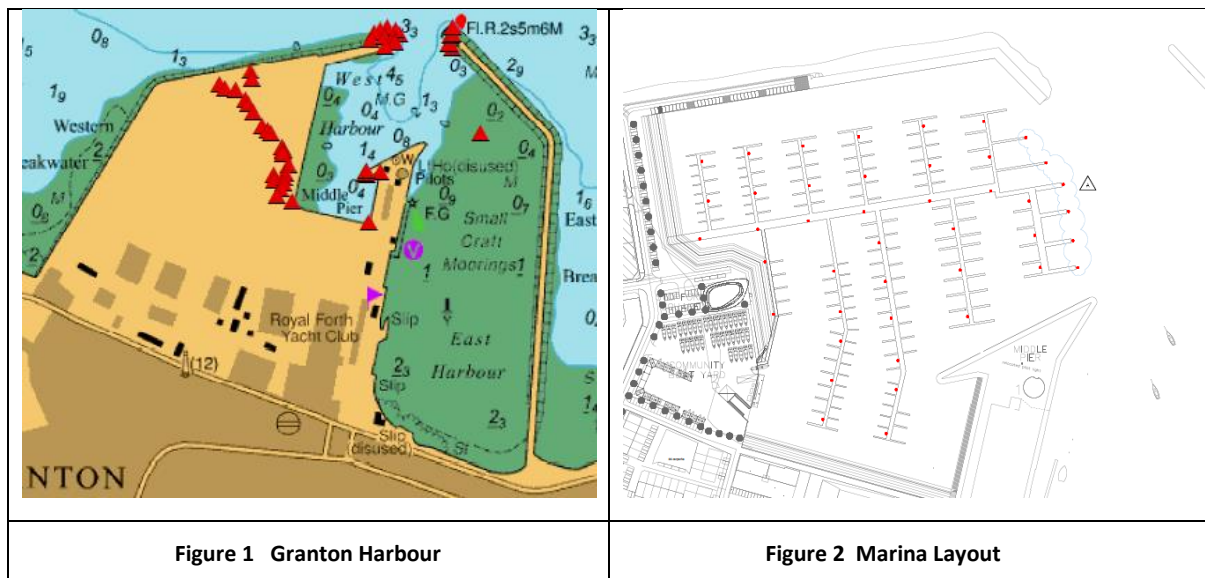
Additional documentation was sourced from marine Scotland website.

- edinburgh_marina_emp_dredging_-_amended_25_09_2019

2. PLANNED WORKSCOPES & MARINE ACTIVITIES

The Order of Works determined from the Stakeholder Agreement [1] is:

- Dredging of harbour basin and disposal at sea and on land, month 1 to 3
- Construction of new western harbour quay wall, month 3 to 6
- Construction of the north mole extension, month 7 to 8
- Placement of rock armouring, month 8 to 10
- Construction and laying out of the marina & associated services, month 10 to 15



2.1 Dredging of Harbour Basin and Disposal at Sea and on Land

The area of the Western Harbour will be dredged to a finished dredge level sufficient for the planned operation of the marina. The depth varies across the marina with shallower waters for smaller craft close to the shore.

It is noted that the original submission [2], the sediment plan accounted for 241,365m³ of spoil recovered from the marina basin, of which 86,980m³ was planned for disposal at sea at Oxcars and Narrows Deep. A Bathymetric Survey was conducted at Granton Marina in April 2022 and this survey identified an increase in sediment volume of 9,983m³ [12] within the harbour area, the conclusions stated to Marine Scotland is “*we are of the opinion that the temporal extension to the Marine License to July 2025 will have no significant impacts on the site or surrounding area and its notable environmental features*”, see Appendix 4 to this report.

Backhoe dredging will be utilised to effectively remove sediments (predominately silt), as well as boulders and weathered/weaker rock outcrop and looser material will be dredged directly

from the seafloor by the BHD. Figure 3, below shows the typical backhoe dredger arrangement with a long reach excavator positioned on the barge; it also shows the self-propelled disposal barge that is used to take the dredged material to the disposal ground.

The marine plant shall consist of MV Shearwater, or similar, which is a self-contained, self-propelled, bottom dumping hopper vessel with a Caterpillar excavator mounted on its bow.



Figure 3 Shearwater (Backhoe Dredger)

During the dredging campaign, only the dredger will be operational. The dredging programme will be in two phases. The first phase will remove material up to 1.2m depth, the second phase will Dredge material from 1.2m to final dredge level at each location, the second phase may overlap with the civil works for the other site construction.

The dredged spoil will be disposed of at sea as set out in the approved Marine Licence where this is possible, the remainder will be brought to land and either utilised within the development i.e. use as backfill or disposed of off-site.

Volumes for dredging and recovery are detailed below:

Zone (refer to Figure 4)	Volume for Disposal at Sea (top 1.2m ³)	Volume for Disposal on Land (m ³)	Net Volume dredged (m ³)
A	N/A		
B	20344	7936	28280
C		47094	47094
D	25698	20620	46318
E	27349	40928	68277
F	10073	21400	31472
G	3516	16408	19924
H (infill)			19322

Table 1 Dredge Removal Volumes

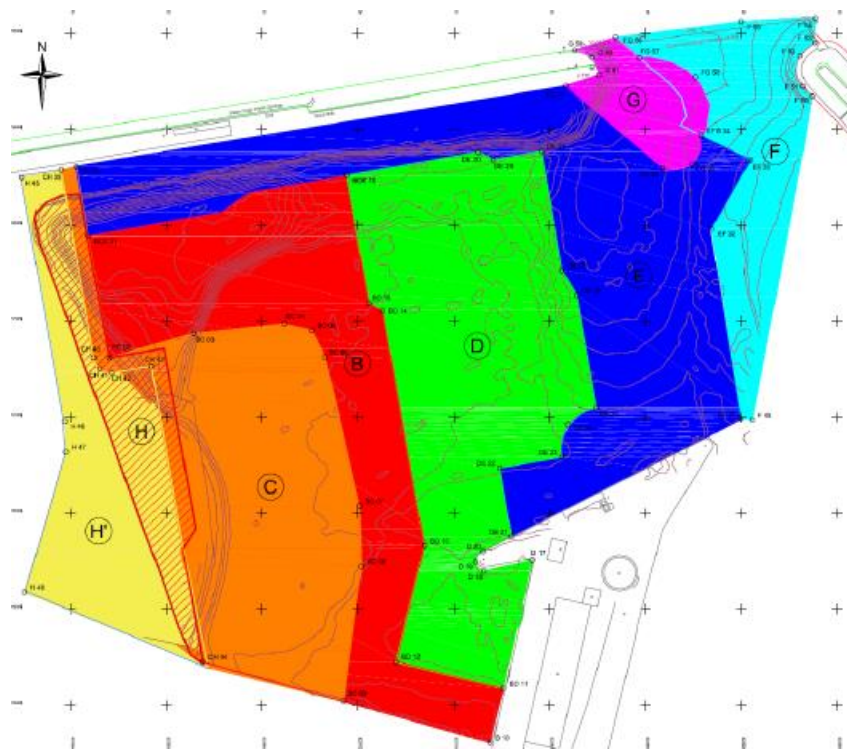


Figure 4 Marine Dredge Areas

2.2 Construction of new Western Harbour Quay Wall

On the west side of the marina basin, a quay wall is to be formed and this will be a continuation of the existing quay wall along the south boundary. The existing sheet pile wall was installed from a barge, and it is likely that the same methodology would be used for the additional length of wall, positioned at high water and stabilised on jack up legs (a small jack

up is considered here as well as a spud leg barge positioned by a tug). Individual sheet pile sections will be lowered vertically into the seabed, interlocked with the adjacent pile sections, driven to staged depths to maintain the continuity and allow adjustments. Once driven to full depth, the top of the pile is cut off to the design level. At this stage, the piles will be free standing but not capable of being backfilled, ties will be installed between the piles and a secure anchorage point on shore. The wall will be backfilled with suitable material available from elsewhere on the site and this is done from the shore side. The top of the wall is completed by a reinforced concrete capping beam that is cast in-situ to tie the top of the piles together.

The west boundary of the marina basin is formed with a natural stone-faced revetment that will enclose and protect an area of reclaimed land. The core of the revetment is expected to be a combination of material recovered from elsewhere on the site and imported structural fill. The facing rocks will be imported to site by road. Along the top of the revetment, a concrete capping detail with integral channel for planting and parapet along the top provides the transition

The revetment can be constructed using land-based plant and machinery working progressively along the line of the revetment until completed. The fill behind the revetment can be placed behind once the revetment is structurally sufficient to protect the infill.

The revetment needs to be founded on a sound stratum and so the first operation will be excavation of the bed sediments down to a suitable formation level. The core can then be built up in layers before being sealed behind within a geotextile. This will protect the integrity of the core and prevent future washout of material. The rock armour facing will then be placed on the outer face of the revetment and if the bed was excavated below dredge level, some bed material can be reinstated up to this level. Infill behind the revetment will comprise material from elsewhere on the site that has been tested for suitability. The reclaimed area will be suitable for car parking and landscaping.

2.2.1 Identified Hazards during Construction of Western Harbour Wall

The following hazards are considered relevant to the operations for the piling operations at the Western Harbour Wall,

- Work barge
 - Alternative 1 - Barge jacked up in the basin off the western harbour wall (SSA/ punch through/ failure of leg/ swell conditions through the entrance)
 - Alternative 2 – spud leg barge positioned at western harbour wall
- Work barge moving to relocate along the western harbour wall (SSA/ punch through/ failure of leg/ recovery of legs from seabed/ failure of manoeuvring system/)
- Collision with installed piles (sinking of barge due to hull penetration)
- Collision with middle pier (sinking of barge due to hull penetration)

- Transfer of personnel to and from the barge by launch
- Transfer of personnel to and from the barge by bridge
- Loss of person overboard from barge
- Loss of person overboard from quayside
- Launch of emergency boat from jack up
- Utilisation of RNLI lifeboat to recover personnel from water – South Queensferry RNLI station and access to Marina
- Operation of dredger whilst piling is underway from jack up barge

2.3 Repairs to Existing North Mole Inner Revetment

Part of the marine works programme is the “clean-up”, repair and stabilisation of the inner revetment face of the existing North Mole. This entails the removal of rubble overburden that has been dumped there over the years. In addition to the works on the revetment, there will also be cosmetic repairs and betterment work taking place on the quay top surfaces of the North Mole itself.

None of these works will have any impact upon users of the East Harbour and there will be no waterborne works traffic using the harbour entrance.

It is not clear from the documentation provided whether this work will be done from the sea or from the shore, however it is assumed for the purposes of this risk assessment that it is done from the sea by barge and backhoe. The workscope associated with this activity are:

- Locally reduce the level of the seabed to design dredge level
 - (Backhoe dredger)

The hazards associated with the repairs to the North Mole Revetement are:

- Collision / grounding of dredger when transiting from Granton Marine to Oxcars (ebb tide) or Narrows Deep (flood tide), proximity of anchorages, vessels arriving / departing Leith or transiting Leith Roads
- Dropped objects
- Blocking of Harbour (Marina) Entrance

2.4 Construction of the North Mole Extension

2.4.1 Dredging of North Mole Base Formation and Disposal at Sea and on Land

Dredging in advance of the north mole is likely to be by backhoe dredger. Sediment testing has been undertaken across the marina site with some material identified as suitable for

disposal at sea site at an approved site and the remainder brought ashore for disposed or treatment and reuse.

2.4.2 Construction of the North Mole Extension

The overall steps in the construction process are |:

- i. Locally reduce the level of the seabed to design dredge level
 - a. Backhoe dredger
- ii. Excavate further to the design formation level for the concrete wall
 - a. Backhoe dredger
- iii. Dredger transit to spoil ground
 - a. Oxcars on ebb tide
 - b. Narrows Deep on flood tide
- iv. Place a regulating layer of stone to land the concrete units on
 - a. Diver operations to check levelling
- v. Bathymetric survey
 - a. Survey vessel
- vi. Place precast concrete foundation blocks Build up the precast concrete wall units, sealing the joints as they are placed to control subsequent wet concrete placement
 - a. Transport by sea
 - b. Lift from barge to North Mole Extension, placement by crane
 - c. Divers to verify positioning
- vii. Place any binding reinforcement and drop in pre-formed reinforcement cages
 - a. Long reach excavator from a barge
- viii. Fill concrete units with underwater mix concrete
 - a. Long reach excavator from a barge
- ix. Backfill around concrete wall externally to revetment founding level, internally to bed level.
 - a. Long reach excavator from a barge
- x. Construct revetment on outer face of concrete wall, and for an additional 25m along the line of the wall.

- a. Long reach excavator from a barge
- xi. Wave wall - units will be lifted into place by barge mounted crane
 - a. Long reach excavator from a barge
- xii. Blocking of Harbour Access by Construction Vessels
 - a. Access by RNLI rescue vessel
 - b. Access by marina users

Hazards associated with Construction of the North Mole Extension

- Introduction of invasive species
- Collision / grounding with marina structures
- Dropped objects
- Collision/ grounding during transit to spoil grounds
- Diving operations for stone layer levelling verification
- Survey operations in close proximity to existing North Mole structure
- Delivery of precast concrete blocks (by sea)
- Diving operations when mating precast concrete blocks
- Blocking of harbour entrance

2.5 Construction and Laying Out of The Marina

The Stakeholder Agreement states, “all floating pontoons will be delivered overland and offloaded into the West Harbour from the Middle Pier”.

At this point all the construction works are anticipated as being complete, including the North Mole Extension, therefore the incidence of wash / waves in the marina is seen as minimal and there is little perceived risk.

Traffic in and out of the ports of Grangemouth, Rosyth, Leith, Hound Point (VLCC Tankers) all pass to the north of Granton Marina.

Vessels approaching Leith pass to the south of Inchkeith through the Leith Channel and approach to the north of Leith Locks on a westerly heading (Figure 3), before turning south for the lock approach, vessels would not normally encroach on the area to the north of Granton which lies a mile to the west, although if a vessel was waiting for the lock on a flood tide then it may operate in that area, especially if other vessels are leaving Leith for sea. There is a chance that a dredger seeking to drop spoil at Narrows Deep will meet an incoming vessel in the Leith Channel but this would be controlled through Forth Ports VTS who monitor radar, AIS and also maintain control of the river through formal procedures for vessels that are moving within the area.

Figure 5 Outer Forth View

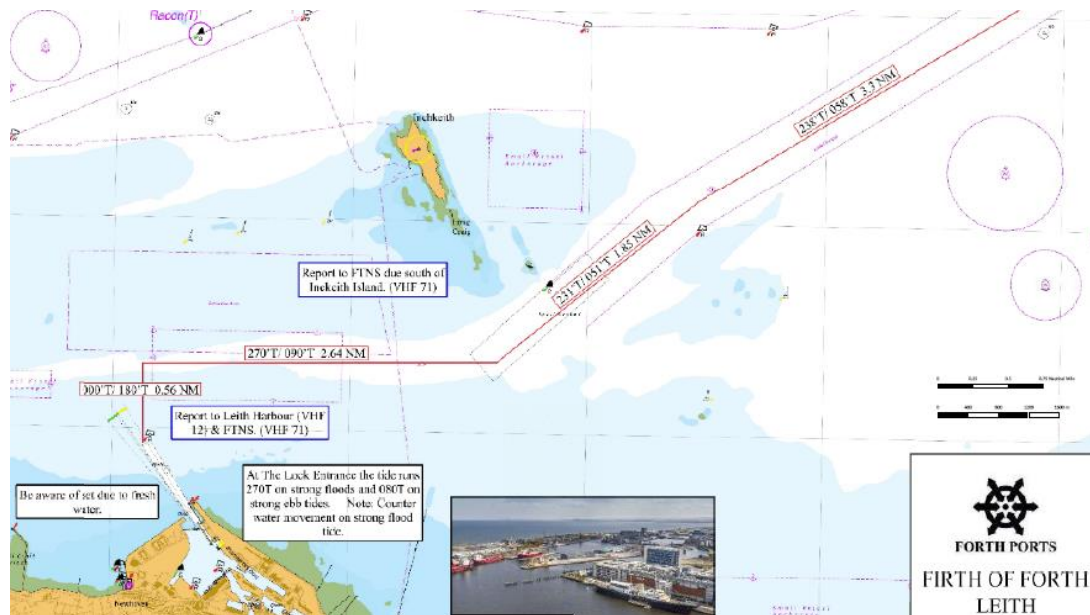


Figure 6 Approach to Leith

3.2 Dredge Spoil – Disposal Grounds

A backhoe dredger will be used, and dredged material will be disposed of at either Oxcars Main (FO044) OR Narrow Deep B (FO038) (as per the dredge licence), or if unsuitable for disposal at sea, either used within the wider marina masterplan area where possible or transported off site by road to an appropriately licenced disposal facility.

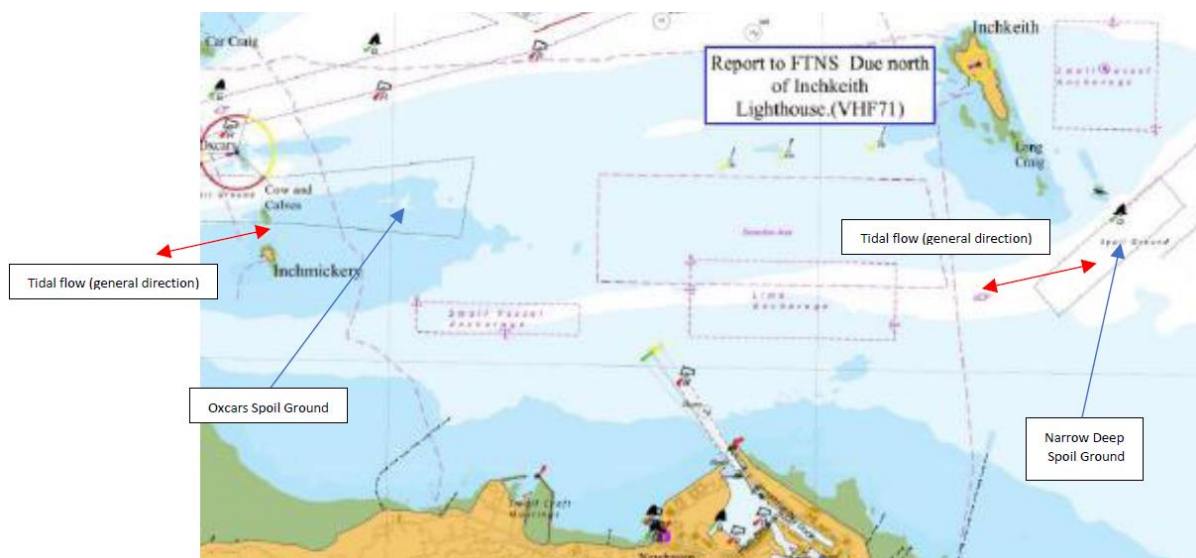


Figure 7 Spoil Grounds and Prevailing Tidal Set

The transit from Granton Marina to Oxcars transits the small vessel anchorage that sits 9 cables north of Granton Marina, the transit distance from Granton Marina to the edge of the

spoil ground at Oxcars, whilst remaining in the orange sector of the Oxcars Light (Fl2 WR 7s 16m 13/12M) is 1.7 to 2.1 miles.

Due to the tidal flows that occur in the area around both Oxcars and Narrow Deep.

Chart 736 [11], close SW of Oxcars, tidal diamond E:

Time relative to HW Rosyth	Direction (to)	Spring Rate (kts)	Neap Rate (kts)
-6	077	0.9	0.5
-5	248	0.1	0.1
-4	260	0.9	0.4
-3	259	1.2	0.6
-2	254	1.0	0.5
-1	264	0.6	0.3
HW Rosyth	255	0.4	0.2
+1	280	0.1	0.1
+2	075	0.5	0.2
+3	082	1.0	0.5
+4	076	1.3	0.6
+5	080	0.9	0.5
+6	077	0.5	0.3

Table 2 Tidal Flows (Flood / Ebb) Oxcars

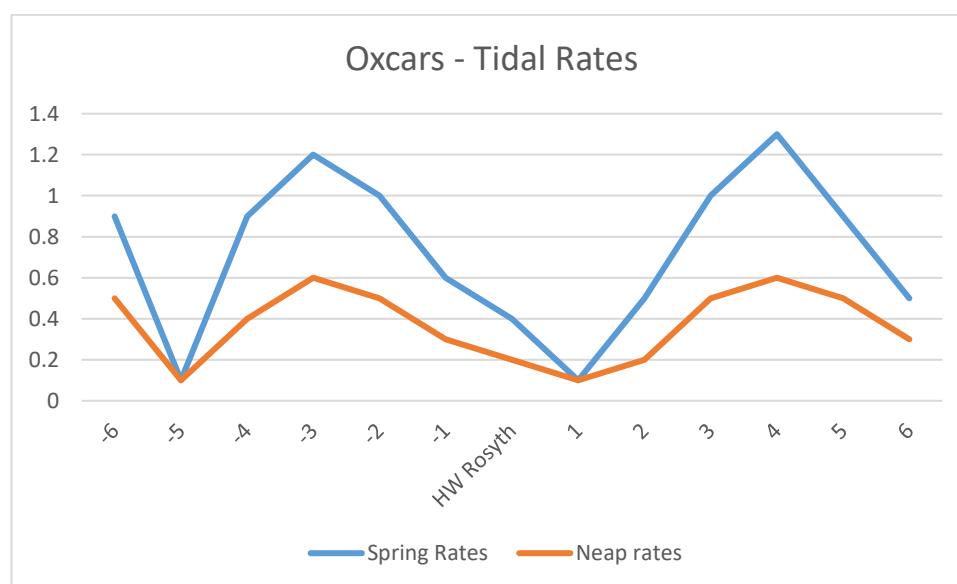


Figure 8 Oxcars Tidal Curve (Flood / Ebb)

The navigational hazards when operating at the spoil ground to the south of Oxcars are represented by Cow & Calves Shoal (drying height 4m) and the Isle of Inchmickery which is 11m above MHWS. Each of these navigational hazards lie to the SW of the spoil ground which

sits in the orange sector of the Oxcars light, therefore it would be prudent to avoid using this spoil ground at times of flood tide.

At Narrows Deep spoil ground, tidal diamond D [11] sits at the western end of the spoil ground, immediately south of Inchkeith.

Time relative to HW Rosyth	Direction (to)	Spring Rate (kts)	Neap Rate (kts)
-6	290	0.1	0.0
-5	272	0.4	0.2
-4	260	1.0	0.5
-3	264	0.7	0.3
-2	263	0.4	0.2
-1	250	0.2	0.1
HW Rosyth	225	0.1	0.0
+1	077	0.6	0.3
+2	080	0.8	0.4
+3	085	0.8	0.4
+4	092	0.5	0.2
+5	095	0.2	0.1
+6		0.0	0.0

Table 3 Tidal Flows (Flood / Ebb) Narrow Deep

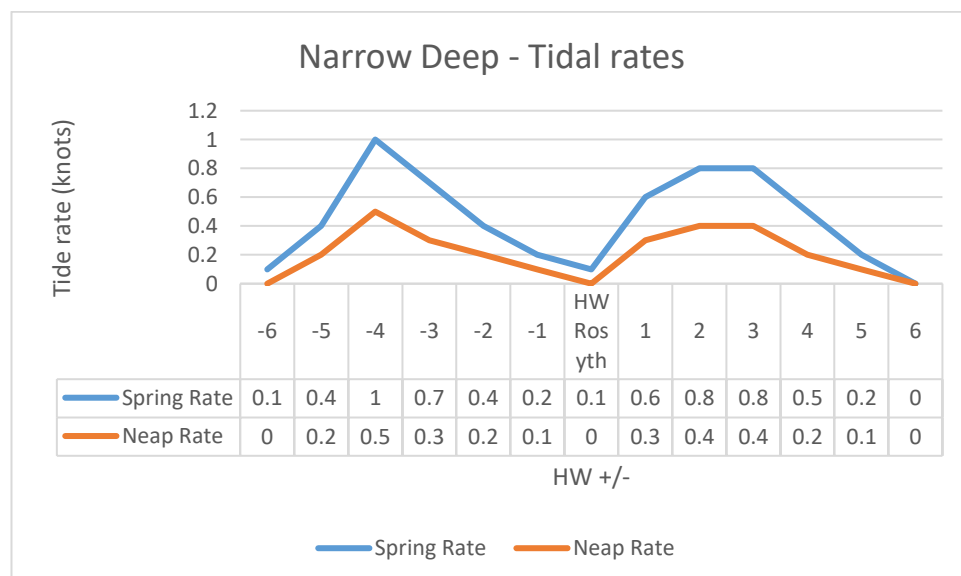


Figure 9 Narrow Deep Tidal Curve (Flood / Ebb)

The transit from Granton Marina to the Narrows Deep transits close to five specific areas of concern:

- Small vessel anchorage 9 cables north of Granton
- Lima anchorage north of Leith
- Approach to Leith locks
- Narrows Deep lies in the Leith Channel
- Vessels waiting for the locks at Leith

When a vessel is arriving at Leith, vessels under 150m in length inbound passing south of Inchkeith Island normally board their pilot at the position northeast of the Narrow Deep Buoy, this boarding location is 1 nautical mile east of the eastern extremity of Narrows Deep. Vessels may use the anchorage if no berth is available, however, the vessel may also be waiting for the locks and stem the tide in the immediate vicinity of the lock approach.

Approach speeds to the locks are unlikely to be at significant speeds and the risk associated with wash from the motion of the vessel is not perceived as high when operating vessels at Granton.

On a spring tide the lock can take large vessels up to 12.00m draft, and on a neap 10.80m, however the controlling depth alongside the berths in Leith is 10.2m and often significantly less. The approach channel is maintained at 6.00m and a UKC of 1.00m on a flood is required, applying the height of tide at flood and neap.

3.3 Vessel Operations

At the SNP conference 2022, a motion was brought forward on news of the proposed reopening of the ferry link between Rosyth and Zeebrugge [6]. This could be restarted in 2023 and if so, would result in large vessels transiting the River Forth twice daily, inwards and outwards. As identified earlier, the route that these vessels follow transiting the Forth takes them in excess of 2 nautical miles from Granton Marina and the wash / wave s created by their movement is not seen as a concern.

4. HISTORIC INCIDENTS

4.1 Dredger Incidents

4.1.1 Man Crushed to Death at Rosyth [7]

On February 28, 2019, the master of the UK Dredging-owned dredger *Cherry Sand* was crushed between his vessel and the jetty after he fell while attempting to step ashore to assist berthing the vessel in Rosyth.

The investigation by the Marine Accident Investigation Board resulted in recommendations for avoiding a repetition of the incident, Safety Issues raised:

- *The method used for self-mooring Cherry Sand was inherently hazardous, and crew routinely stepped ashore/on board when the vessel was not tight alongside.*
- *Linesmen were not used, and no measures had been taken to avoid having to place a crewmember ashore while the vessel was unmoored.*
- *UK Dredging's safety management system audits had not identified that Cherry Sand's operational practices, and the general safety culture on board, were below the expected level.*
- *Of the occupational accidents investigated by the MAIB over the past five years, more than 40 per cent of the mariners who lost their lives were over 50 years old. Over the same period, the four persons who lost their lives while attempting to step on/off during mooring operations were between the age of 58 and 72. HSE guidance warns that older workers may experience more slips, trips, and falls compared to younger workers, and recovery following an injury may take longer.*

The Recommendations made:

- *A recommendation has been made to the Maritime and Coastguard Agency to amend the Code of Safe Working Practices for Seafarers to provide guidance on mooring and unmooring operations, and when it is permissible for vessels to self-moor.*
- *A recommendation has also been made to Associated British Ports (ABP) aimed at ensuring a common approach to safety and the application of company procedures across the UK Dredging fleet.*

4.1.2 Flooding and Foundering of Grab Hopper Dredger [8]

The 50-year-old grab hopper dredger, *Abigail H*, had been working in the Port of Heysham, clearing debris from the cooling water inlets of the local power station. During the evening of 1 November and in the early hours of the following morning, the vessel developed a leak which allowed water to flood into the engine room. The cause of the vessel flooding was water leaking into the engine room. It is considered most likely that this was due to

perforation of the hull plating beneath the bilge suction pipework on the starboard side of the stern gland. In the absence of the general manager, the Port of Heysham's safety management and emergency response procedures had limited effectiveness. The limited communication between the port and the emergency services in the early stages of this accident led to confusion and, if circumstances had deteriorated, could have reduced the effectiveness of the response.

Safety issues directly contributing to the accident which have resulted in recommendations

- Localised wastage and pitting of plating beneath bilge suctions is not uncommon, and it is good practice to keep bilges dry and to inspect these areas regularly to warn of any problems
- Although the rate of leakage was not great, sea inlet valves, pumps and generators were underwater by the time the flood was discovered. Appropriate means of alerting the crew to flooding are required.
- Bilge alarms in engine rooms, and other substantial compartments that could threaten the vessel's buoyancy and stability if flooded, should be a mandatory requirement regardless of engine room manning. These, and other emergency alarms should be capable of operating when the vessel's normal power supplies are shut down and be able to wake sleeping crew in sufficient time for them to react appropriately.

Other safety issues identified during the investigation also leading to recommendations

- A properly structured assessment of risks to crew sleeping on board a vessel that has been shut down overnight is required. This should include practical means of attracting the attention of sleeping crew to dangerous situations in time for them to take appropriate action.

4.1.3 Carbon Monoxide Poisoning - Panurgic II Dredger

On 14 October 2007 the hopper/dredger Panurgic II was dredging at Flixborough Wharf on the River Trent, when water was observed entering her accommodation space.

The skipper started the bilge pump for that space and manoeuvred the vessel onto a mud bank at the end of the berth to ensure she was safe. The crew then placed a portable, petrol driven, pump into the accommodation space, which was located below the main deck of the vessel, the vessel took the bottom and trimmed by the head as the tide ebbed. This resulted in water flowing forward from the accommodation space into an adjacent confined space. The pumps in the accommodation space lost suction and the two crew members decided to move the portable, petrol driven, pump into the adjacent confined space, sometime later the pump lost suction and one of the crew members went into the space to investigate, followed by his colleague. They were overcome by fumes from the pump but personnel returning to the vessel found them before a fatality occurred and they were rescued.

The Chief Inspector of Marine Accidents has written to the owner of Panurgic II commending him on the actions he took to ensure the vessel's safety after the hull was breached and in giving prompt first aid to the injured crewman. The Chief Inspector also stressed the importance of undertaking risk assessments for on board operations to help in ensuring that they are conducted in a safe manner, referring to the operational guidance contained in the Code of Safe Working Practices for Merchant Seamen.

The owner has scrapped the petrol driven pump and replaced it with a diesel pump capable of obtaining suction from the deck.

4.1.4 Vessels at Anchor

Anchorage are notoriously tricky and dangerous areas to transit a power-driven vessel. Incidents have occurred in anchorages where vessels have collided due to anchored vessels dragging their anchors due to environmental forces acting on the vessel, causing the anchor to be pulled along the seabed. The reason for this is often that inadequate chain is laid on the seabed, the holding force being overcome by the environmental forces on the hull of the vessel. Other incidents have occurred because vessels transit anchorages and are in a blow on location, namely where the prevailing environmental forces cause the transiting vessel to drift towards vessels at anchor, even a slight miscalculation can result in a collision occurring. Vessels at anchor generally sit head to the prevailing environment, where the location is subject to tidal changes, the vessel will swing with the tide as the direction changes. Further, when the tide eases down and the wind becomes the dominant environmental force, the vessel may sit head to wind for a period.

At 0246 on 1 March 2018 [10], the UK registered general cargo vessel Celtic Spirit dragged its anchor in heavy weather on the River Humber, England. The vessel subsequently collided with the research and survey vessel Atlantic Explorer and the general cargo vessel Celtic Warrior, which were also at anchor. All three vessels sustained shell plate damage, but there were no injuries and no pollution.

The MAIB investigation identified that:


- Celtic Spirit dragged its anchor because insufficient anchor cable had been deployed for the tidal range and environmental conditions experienced
- It was not immediately identified that Celtic Spirit was dragging its anchor because the anchor position monitoring was inadequate.
- Celtic Spirit's bridge watchkeeper did not alert Vessel Traffic Services or nearby vessels that his own ship was dragging anchor.
- Celtic Spirit was unable to manoeuvre in sufficient time to remedy the situation because its engine was not on immediate readiness, and
- class conditions relating to engine readiness while operating with only one anchor were not followed or understood.

- Lack of company guidance meant that there was an inconsistent approach to engine readiness on board sister vessels in the same fleet.
- Atlantic Explorer and Celtic Warrior were unable to weigh their anchors in the time available.

5. REFERENCES

- 1 Edinburgh Stakeholder Agreement Draft 011122 0.1
- 2 Edinburgh Marina CEMP_12052022
- 3 00009904 - Marine Construction Licence
- 4 00009904 - Annex One
- 5 Firth of Forth Passage Plans
- 6 <https://www.thenational.scot/comment/23033729.douglas-chapman-maritime-nation---new-link-europe/#comments-anchor>
- 7 <https://www.gov.uk/maib-reports/man-overboard-from-dredger-cherry-sand-with-loss-of-1-life>
- 8 <https://www.gov.uk/maib-reports/flooding-and-sinking-of-grab-hopper-dredger-abigail-h-while-alongside-at-the-port-of-heysham-england>
- 9 <https://www.gov.uk/maib-reports/flooding-and-subsequent-carbon-monoxide-poisoning-from-use-of-a-portable-petrol-driven-pump-on-dredger-panurgic-ii-river-trent-england-with-2-people-affected-by-fumes>
- 10 [https://assets.publishing.service.gov.uk/media/5bd8374540f0b6051e77b6c0/2018 - 18 - Celtic Spirit.pdf#:~:text=on%201%20March%202018%2C%20the%20UK%20registered%20general,with%20the%20research%20and%20survey%20vessel%20Atlantic%20Explorer](https://assets.publishing.service.gov.uk/media/5bd8374540f0b6051e77b6c0/2018_-_18_-_Celtic_Spirit.pdf#:~:text=on%201%20March%202018%2C%20the%20UK%20registered%20general,with%20the%20research%20and%20survey%20vessel%20Atlantic%20Explorer)
- 11 Admiralty Chart 736
- 12 Letter from EnviroCentre, addressed to Marine Scotland Licensing Operations Team, entitled Granton Harbour – Marine Licenses 06807/19/0 (Dredging) and 06806/19/0 (Construction) Request for a Screening Opinion, dated 06 May 2022

APPENDIX 1 – Risk Assessment – Construction of Western Harbour Wall

			South Lodge, Blackhall, Banchory, Kincardineshire, AB31 6PS enquiries@greenmaritime.co.uk							Granton Marina - Navigational Risk Assessment (Construction West Harbour Wall)							
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation					
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate		
1	Non Invasive Species	Contaminated ballast water, seawater intakes, sea chests, dirty hull	Construction	Commercial	People	2	4	8	12	Ballast Water Management required in Environmental Management Plan Implement appropriate management measures where known or suspected introduced marine organisms are detected during vessel inspections or during dredging operations. Remove any visible plant, fish, animal matter and mud from the vessel and hull cleaned prior to commencing operations, unless all equipment and vessels required are from within biogeographic regions where possible and have undergone the necessary inspections prior to arriving on site. Safely dispose of any plant and animal material removed from the vessel. Provide toolbox talks and posters to aid identification of non-native species.	Determine requirements based on last vessel location & ballast records Verification of compliance with BWM requirements of EMP Bridging documentation aligning SMS of involved companies	1	4	4	4		
					Environment	3	4	12				1	4	4			
					Reputation	3	3	9				1	3	3			
					Asset	3	3	9				1	4	4			
2	Collision	Jack up barge contacts existing structure (western harbour wall/ piles/ other vessels) during positioning Dredging operations underway during works at Western Harbour Wall	Construction	Jack up	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Notice to Mariners issued by Forth Ports Operational management plans and procedures developed by Granton Harbour Vessel assurance inspection and verification of competence of vessel operators Bridge operational procedures Passing traffic speed managed by VTS to reduce wash and wave generation through harbour entrance Limiting environment identified for continuing operations (may be adjusted for direction of environmental loading) Bridging documentation aligning SMS of involved companies	1	4	4	4		
					Environment	3	3	9				1	3	3			
					Reputation	2	3	6				1	3	3			
					Asset	3	4	12				1	4	4			
3	Punch through	Jack up barge leg punches through seabed and causes list/ immersion of deck edge, loss of waterplane are a and risk of capsize	Construction	Jack up	People	4	3	12	12	Typical geology of Granton Harbour is soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone	Site specific assessment for jack up positioning Pre-load of legs as per SSA Equipment checks and maintenance verified, Jack Up SOP Assurance inspection, testing of jacking system Operational integrity monitoring Bridging documentation aligning SMS of involved companies Seafastening verification of plant equipment and other heavy loads on jack up	1	3	3	3		
					Environment	3	2	6				1	2	2			
					Reputation	2	2	4				1	2	2			
					Asset	2	2	4				1	2	2			

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.



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**Granton Marina - Navigational Risk Assessment
(Construction West Harbour Wall)**

Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation			
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate
4	Dropping of Spud Legs	Positioning of the spud leg barge	Construction	River traffic/ anchored vessels	People	4	3	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses, maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures Assurance of vessel and competent crew/ passage plan Bridging documentation aligning SMS of involved companies	1	3	3	3
					Environment	3	2	6				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	
5	Collision / grounding at west harbour wall	Tug towing spud leg barge into position at HW	Construction	Tug & tow	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses, maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour / Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan/ vessel to avoid entering the red sector of the Oxcars light/ tidal conditions - flood tide to ensure vessel is in drift off location/ Marine Licence signed and retained on board the dredger Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	3	9				1	3	3	
					Reputation	2	3	6				1	3	3	
					Asset	3	4	12				1	4	4	
6	Grounding of hull at low water	Falling tide reduces to a level where the hull of the spud leg barge takes the ground	Construction	Spud leg barge	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses, maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Seabed assessment to verify no boulders Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	3	9				1	3	3	
					Reputation	2	2	4				1	2	2	
					Asset	3	2	6				1	2	2	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.



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**Granton Marina - Navigational Risk Assessment
(Construction West Harbour Wall)**

Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation			
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate
7	DROPS	Transfer of precast concrete foundation blocks to North Mole Extension	Construction	Barge & Crane utilisation	People	3	3	9	9	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses, maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour / Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan/ vessel to avoid entering the red sector of the Oxcars light/ tidal conditions - ebb tide to ensure vessel is in drift off location/ Marine Licence signed and retained on board the dredger Bridging documentation aligning SMS of involved companies	1	3	3	3
					Environment	3	2	6				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	
8	Drowning / personal injury	Transfer of personnel by bridge from shore to barge or by boat transfer (relief crews/ start & end of shift)	Construction	Jack up / spud leg barge	People	3	3	9	9	Verification of support structures to support bridge / gangway Suitable PPE worn by transferees, including lifejacket Proper tracking of personnel and advice to Forth Ports of number of personnel on jack up / spud leg barge LSA available at shore boarding point and at disembarkation point on Jack up / Spud Leg barge Monitoring of personnel crossing Launch of MOB boat from jack up / spud leg barge ERP in place and actioned		1	3	3	3
					Environment	3	2	6				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	


Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

APPENDIX 2 – Risk Assessment – Construction of North Mole Extension

**Granton Marina - Navigational Risk Assessment
(Construction North Mole Extension (NME))**

						Pre-Mitigation						Post-Mitigation			
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Likelihood	Severity	Rating	Highest Rate	Existing Controls	Additional Mitigation	Likelihood	Severity	Rating	Highest Rate
1	Non Invasive Species	Contaminated ballast water, seawater intakes, sea chests, dirty hull	Dredging	Commercial	People	2	4	8	12	Ballast Water Management required in Environmental Management Plan Implement appropriate management measures where known or suspected introduced marine organisms are detected during vessel inspections or during dredging operations. Remove any visible plant, fish, animal matter and mud from the vessel and hull cleaned prior to commencing operations, unless all equipment and vessels required are from within biogeographic regions where possible and have undergone the necessary inspections prior to arriving on site. Safely dispose of any plant and animal material removed from the vessel. Provide toolbox talks and posters to aid identification of non-native species.	Verification of compliance with BWM requirements of EMP Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	4	12				1	4	4	
					Reputation	3	3	9				1	3	3	
					Asset	3	3	9				1	4	4	
2	Collision	Barge moves and contacts exiting structure (north mole)	Dredging	Barge with Backhoe Dredger	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Mooring analysis verifies position keeping with anticipated loads from environment, environmental limits defined Vessel assurance inspection and verification of competence of vessel operators Compliance with Forth Ports Towage Guidelines Bridge Operational procedure, Bridge vessel control lights Passing traffic speed managed by VTS to reduce wash and wave generation Limiting environment identified for continuing operations (may be adjusted for direction of environmental loading) Adequate stability to ensure unit maintains upright profile and list is controlled on recovery of spoil Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	3	9				1	3	3	
					Reputation	3	3	9				1	3	3	
					Asset	3	4	12				1	4	4	
3	Dropped objects	Loss of spoil from Backhoe unit	Dredging	Barge with Backhoe Dredger	People	2	1	2	9	Operational integrity of the Backhoe unit verified through assurance Typical geology of Granton Harbour is soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone Operational verification of backhoe unit prior to deployment and recovery of spoil	Equipment checks and maintenance verified Operational integrity monitoring Clear seabed between spoil recovery position and barge hold Detailed Geotechnical Investigation is required to inform the detailed design of the seabed No significant boulders are anticipated Bridging documentation aligning SMS of involved companies	1	1	1	3
					Environment	3	3	9				1	3	3	
					Reputation	3	3	9				1	3	3	
					Asset	2	2	4				1	2	2	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

			South Lodge, Blackhall, Banchory, Kincardineshire, AB31 6PS enquiries@greenmaritime.co.uk								Granton Marina - Navigational Risk Assessment (Construction North Mole Extension (NME))									
					Pre-Mitigation										Post-Mitigation					
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Likelihood	Severity	Rating	Highest Rate	Existing Controls	Additional Mitigation	Likelihood	Severity	Rating	Highest Rate					
4	Collision/ Grounding	Transit from Granton Marina to Oxcars, encroachment on small vessel anchorage	Dredging	River traffic/ anchored vessels	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour/ Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan Bridging documentation aligning SMS of involved companies	1	4	4	4					
					Environment	4	4	16				1	4	4						
					Reputation	4	4	16				1	4	4						
					Asset	4	4	16				1	4	4						
5	Collision/ Grounding	Transit from Granton Marina to Oxcars, grounding at Oxcars, Cow & Calves, Inchmickery	Dredging	River traffic/ anchored vessels/ vessels waiting for access to Leith/ vessels departing Leith	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour / Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan/ vessel to avoid entering the red sector of the Oxcars light/ tidal conditions - flood tide to ensure vessel is in drift off location/ Marine Licence signed and retained on board the dredger Bridging documentation aligning SMS of involved companies	1	4	4	4					
					Environment	4	4	16				1	4	4						
					Reputation	4	4	16				1	4	4						
					Asset	4	4	16				1	4	4						
6	Collision/ Grounding	Transit from Granton Marina to Narrows Deep, encroachment on small vessel anchorage, Lima Anchorage and Leith Approach Channel	Dredging	Commercial	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour/ Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan Bridging documentation aligning SMS of involved companies	1	4	4	4					
					Environment	4	4	16				1	4	4						
					Reputation	4	4	16				1	4	4						
					Asset	4	4	16				1	4	4						

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

**Granton Marina - Navigational Risk Assessment
(Construction North Mole Extension (NME))**

						Pre-Mitigation						Post-Mitigation			
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Likelihood	Severity	Rating	Highest Rate	Existing Controls	Additional Mitigation	Likelihood	Severity	Rating	Highest Rate
7	Collision/ Grounding	Transit from Granton Marina to Narrows Deep, encroachment on small vessel anchorage, Lima Anchorage and Leith Approach Channel	Dredging	Commercial (all)	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour / Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan/ vessel to avoid entering the red sector of the Oxcars light/ tidal conditions - ebb tide to ensure vessel is in drift off location/ Marine Licence signed and retained on board the dredger Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	4	4	16				1	4	4	
					Reputation	4	4	16				1	4	4	
					Asset	4	4	16				1	4	4	
8	Diving Operations (verify levelling of stone layer)	Entrapment, DROPS	Construction	All	People	3	3	9	9	Compliance with Diving Regulations	Established exclusion zones for all traffic movements Use of permit to work process to manage diving operations Divers not deployed until levelling work completed No lifting operations when divers in area where there is potential for DROPS Emergency Response Plan in place for diver evacuation	1	3	3	3
					Environment	3	2	6				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	
9	Collision with north breakwater/ east breakwater	Survey Operations post levelling of stone regulating layer	Construction	Survey vessel	People	2	4	8	8	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Bridge Operational procedure, Bridge vessel control lights	1	4	4	4
					Environment	1	3	3				1	3	3	
					Reputation	2	3	6				1	3	3	
					Asset	2	3	6				1	3	3	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

**Granton Marina - Navigational Risk Assessment
(Construction North Mole Extension (NME))**

						Pre-Mitigation						Post-Mitigation			
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Likelihood	Severity	Rating	Highest Rate	Existing Controls	Additional Mitigation	Likelihood	Severity	Rating	Highest Rate
10	Collision	Delivery of precast concrete foundation blocks (by sea)	Operation	Tug & Barge	People	2	4	8	8	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Bridge Operational procedure, Bridge vessel control lights Compliance with Forth Ports Limited, Towage Guidelines, including completed method statement	1	4	4	4
					Environment	1	2	2				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	
11	DROPS	Transfer of precast concrete foundation blocks to North Mole Extension	Operation	Barge & Crane utilisation	People	2	3	6	6	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Mooring analysis completed for locating barge alongside crane barge Mooring analysis for the crane barge station keeping LOLER assessment of the crane and competent crane operator / banksman Lift plan with proper and safe slinging arrangements on foundation blocks, including release methodology at North Mole Extension Clear seabed, no lifting over obstructions or vulnerable seabed structures	1	3	3	3
					Environment	1	2	2				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	
12	Diving Operations (verify jointing of precast concrete foundation blocks)	Entrapment, DROPS	Construction	All	People	2	4	8	8	Compliance with Diving Regulations	Established exclusion zones for all traffic movements Use of permit to work process to manage diving operations Divers not deployed until levelling work completed No lifting operations when divers in area where there is potential for DROPS Emergency Response Plan in place for diver evacuation	1	4	4	4
					Environment	1	2	2				1	2	2	
					Reputation	2	4	8				1	4	4	
					Asset	2	2	4				1	2	2	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.



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Granton Marina - Navigational Risk Assessment (Construction North Mole Extension (NME))


Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation			
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate
13	DROPS Crane collapse Barge location (carrying raw materials)	Binding reinforcement installation/ placement of underwater mix concrete/ backfill at concrete wall/ revetement of outer face/ wave wall unit installation	Construction	Barge & long reach excavator utilisation	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Mooring analysis completed for locating barge alongside crane barge Mooring analysis for the crane barge station keeping LOLER assessment of the crane and competent crane operator / banksman Lift plan with proper and safe slinging arrangements on foundation blocks, including release methodology at North Mole Extension Clear seabed, no lifting over obstructions or vulnerable seabed structures	1	4	4	4
					Environment	1	2	2				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	3	2	6				1	2	2	
14	Blocking of Harbour Entrance by Construction Vessels	Moored vessels and operations, backhoe dredger recovering spoil. Moored vessels, barge and long reach excavator with barge alongside	Dredging & Construction	All construction vessels	People	3	2	6	6	Any necessary temporary closure of the harbour (marina), Edinburgh Marina will attempt to give as much notice to harbour users as possible	Issue of Notice to Mariners by Forth Ports Stakeholder consultation and advice from project Management of schedule for works (avoiding times of high marina usage so far as possible) Operational Management Plan Vessels can be moved to accommodate access for a rib (RNLI)	1	2	2	2
					Environment	1	2	2				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	2	2	4				1	2	2	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

APPENDIX 3 – Risk Assessment – Repairs to North Mole Harbour Wall

			South Lodge, Blackhall, Banchory, Kincardineshire, AB31 6PS enquiries@greenmaritime.co.uk							Granton Marina - Navigational Risk Assessment (Repairs to North Mole)					
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation			
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate
1	Non Invasive Species	Contaminated ballast water, seawater intakes, sea chests, dirty hull	Dredging	Commercial	People	2	4	8	12	Ballast Water Management in Environmental Management Plan Implement appropriate management measures where known or suspected introduced marine organisms are detected during vessel inspections or during dredging operations. Remove any visible plant, fish, animal matter and mud from the vessel and hull cleaned prior to commencing operations, unless all equipment and vessels required are from within biogeographic regions where possible and have undergone the necessary inspections prior to arriving on site. Safely dispose of any plant and animal material removed from the vessel. Provide toolbox talks and posters to aid identification of non-native species.	Verification of compliance with BWM requirements of EMP Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	4	12				1	4	4	
					Reputation	3	3	9				1	3	3	
					Asset	3	3	9				1	4	4	
2	Collision/ Grounding	Barge moves and contacts existing structure (north mole)	Construction	Barge with Crane	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Mooring analysis verifies position keeping with anticipated loads from environment, environmental limits defined Vessel assurance inspection and verification of competence of vessel operators Bridge Operational procedure, Bridge vessel control lights Passing traffic speed managed by VTS to reduce wash and wave generation Limiting environment identified for continuing operations (may be adjusted for direction of environmental loading) Adequate stability to ensure unit maintains upright profile and list is controlled on recovery of spoil Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	3	3	9				1	3	3	
					Reputation	3	3	9				1	3	3	
					Asset	3	4	12				1	4	4	
3	Dropped objects	Loss of rock facing from crane grab	Construction	Barge with Crane	People	3	3	9	9	Operational integrity of the Backhoe unit verified through assurance Typical geology of Granton Harbour is soft alluvial silts overlying stiff glacial till which overlies bedrock comprising inter-bedded strata of sandstone and mudstone Operational verification of backhoe unit prior to deployment and recovery of spoil	Equipment checks and maintenance verified Operational integrity monitoring Clear seabed between spoil recovery position and barge hold Detailed Geotechnical Investigation is required to inform the detailed design of the seabed No significant boulders are anticipated Bridging documentation aligning SMS of involved companies	1	3	3	3
					Environment	3	1	3				1	1	1	
					Reputation	3	1	3				1	1	1	
					Asset	3	1	3				1	1	1	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.

		South Lodge, Blackhall, Banchory, Kincardineshire, AB31 6PS enquiries@greenmaritime.co.uk								Granton Marina - Navigational Risk Assessment (Repairs to North Mole)					
Hazard ID	Hazard Type	Cause	Phase	Traffic Type	Receptor	Pre-Mitigation				Existing Controls	Additional Mitigation	Post-Mitigation			
						Likelihood	Severity	Rating	Highest Rate			Likelihood	Severity	Rating	Highest Rate
4	Collision/ Grounding	Transit from Granton Marina to Narrows Deep, encroachment on small vessel anchorage, Lima Anchorage and Leith Approach Channel	Dredging	Barge with Crane	People	4	4	16	16	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	The vessel movements proximal including access the harbour berthing, unloading and egressing the harbour will be in accordance with existing operational management plans and procedures developed by Granton Harbour/ Issue of Notice to Mariners and Harbour Works Consent, implementation of temporary lights and marks, amendments to operational procedures/ assurance of vessel and competent crew/ passage plan Bridging documentation aligning SMS of involved companies	1	4	4	4
					Environment	4	4	16				1	4	4	
					Reputation	4	4	16				1	4	4	
					Asset	4	4	16				1	4	4	
5	DROPS Crane collapse Barge location (carrying raw materials)	Binding reinforcement installation/ placement of underwater mix concrete/ backfill at concrete wall/ revetment of outer face/ wave wall unit installation	Construction	Barge with Crane	People	3	4	12	12	Compliance with the Forth General Directions of Navigation Forth Ports Navigational Safety Management System 24 hour VTS monitoring & communications Promulgate effectively navigational, tidal, hydrographic and other relevant information to all port and river users Up to date hydrographic surveys to ensure safe and efficient navigation Provide the necessary aids to navigation within port limits, navigation buoys / beacons and lighthouses., maintained and operated in accordance with the requirements of the Northern Lighthouse Board	Mooring analysis completed for locating barge alongside crane barge Mooring analysis for the crane barge station keeping LOLER assessment of the crane and competent crane operator / banksman Lift plan with proper and safe slinging arrangements on foundation blocks, including release methodology at North Mole Extension Clear seabed, no lifting over obstructions or vulnerable seabed structures	1	4	4	4
					Environment	1	2	2				1	2	2	
					Reputation	2	2	4				1	2	2	
					Asset	3	2	6				1	2	2	

Note: Only risk combinations with a pre-mitigation rating of >3 are shown in the table.



South Lodge,
Blackhall,
Banchory,
Kincardineshire,
AB31 6PS

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APPENDIX 4 - Letter from EnviroCentre to Marine Scotland [Ref 12]

Marine Scotland Licensing Operations Team (MS-LOT)
Marine Scotland
By email

Our ref 776305/EC/002
Telephone 0141 341 5040
E-mail [REDACTED]

6 May 2022

Attn: Marine Scotland Licensing Operations Team (MS-LOT)

**Granton Harbour – Marine Licenses 06807/19/0 (Dredging) and 06806/19/0
(Construction)
Request for a Screening Opinion**

We write on behalf of our clients, PiP Asset Management, to formally request a screening opinion under The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 for the above-named project. The screening request relates to a temporal extension to the above noted marine licenses so capital dredging and construction works can continue through to July 2025.

As required by Part 2, Paragraph 10 of the above Regulations we have provided information relevant to this proposal (attached) which includes:

- (2) A request for a screening opinion under paragraph (1) must include –
 - a) a description of the location of the proposed works, including a plan sufficient to identify the area in which the works are proposed to be sited;
 - b) a description of the proposed works, including in particular—
 - (i) a list of all of the regulated activities which are proposed;
 - (ii) a description of the physical characteristics of the proposed works and, where relevant, works to be decommissioned; and
 - (iii) a description of the location of the proposed works, with particular regard to the environmental sensitivity of geographical areas likely to be affected;
 - c) a description of the aspects of the environment likely to be significantly affected by the proposed works; and
 - d) a description of any likely significant effects, to the extent of the information available on such effects, of the proposed works on the environment resulting from either, or both, of the following:—
 - (i) the expected residues and emissions and the production of waste, where relevant;
 - (ii) the use of natural resources, in particular soil, land, water and biodiversity.
- (3) A request for a screening opinion may, in addition to the information required in accordance with paragraph (2), also be accompanied by a description of any features

of the proposed works or proposed measures envisaged to avoid or prevent significant adverse effects on the environment.

- (4) The information referred to in paragraph (2) is to be compiled taking into account, where relevant—
- a) the selection criteria set out in schedule 3; and
 - b) the available results of any relevant assessment.

The information provided is drawn from a desk-based appraisal of the site in relation to its environmental setting.

If you have any questions related to the information provided, please do not hesitate to contact the undersigned.

Yours sincerely
for EnviroCentre Ltd

(issued electronically)

Emma Cormack
Principal Consultant

Campbell Stewart
Associate Director

Enc: Granton Harbour (Marine Licenses 06807/19/0 (Dredging) and MS-06806/19/0 (Construction))

CC: Gary Freckleton

GRANTON HARBOUR (MARINE LICENSES 06807/19/0 (DREDGING) AND MS-06806/19/0 (CONSTRUCTION))

Introduction

PiP Asset Management Ltd seek a formal Screening Opinion from Marine Scotland as the Consenting Authority under Part 2, Regulation 10(1) of the Marine EIA Regulations in respect of the temporal variation of both of the above noted marine licenses for Granton Harbour. The approximate Grid Reference for the site is 323710 677705 with the site boundary shown in Drawing No 776305-GIS001, Appendix A.

Site Location

Granton Harbour lies on the Firth of Forth, about 1.6km west of Newhaven and 4km north of Edinburgh City centre. The harbour sits within the Granton Harbour regeneration development area which fronts the Firth of Forth. It is approximately 9.5Ha in size, bounded to the north by the Western Breakwater, to the east by the Eastern Harbour and to the south by Granton Waterfront Development.

2018 Environmental Impact Assessment

An Environmental Impact Assessment Report (reference 8170, hereafter referred to as the EIAR) was prepared under the Marine EIA Regulations to accompany the marine licence applications for the construction and dredging/disposal activities associated with the development. The applications were submitted to Marine Scotland in October 2018.

The EIAR considered the environmental impact associated with developing the existing harbour into a marina, including land reclamation, construction of a quay wall, revetment, mole extension and associated dredging. The EIAR concluded there were no significant impacts associated with the development as long as the mitigation measures identified in Chapter 8 Schedule of Mitigation of the EIAR were adhered to.

Habitats Regulation Appraisal (HRA)

Due to the proximity of works to European designated sites, the marine license applications were accompanied by a HRA (refer to Edinburgh Marina, Technical Appendix 5-4: Habitat

Regulation Appraisal, Ref 8399, dated 28 September 2018) to determine the effect of the proposed development on the qualifying features of the following designated sites:

- Firth of Forth Special Protection Area (SPA);
- Firth of Tay and Eden Estuary Special Area of Conservation (SAC)
- Forth Islands SPA;
- Imperial Dock Lock, Leith SPA;
- Outer Firth of Forth and St Andrews Bay Complex proposed SPA (pSPA);
- Isle of May SAC;
- Berwickshire and North Northumberland Coast (SAC); and
- River Teith SAC.

The HRA Screening process could only rule out Likely Significant Effects (LSEs) of all the qualifying features of Firth of Tay and Eden Estuary SAC. Therefore, the effects on the qualifying features for the other seven sites were taken forward for further consideration in the next HRA stage, an Appropriate Assessment.

The Appropriate Assessment concluded that if mitigation measures outlined within the EIA Report (EIAR) are adhered to, along with the pollution prevention mitigation described in Chapter 13 of the HRA report, then there would be no significant effects on the integrity of the designated sites with regard to the conservation objectives for the sites' qualifying features.

Climate Change

Climate change has taken a prominent position within policy and legislation at a national level, with the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019¹ amending the Climate Change (Scotland) Act 2009². The 2019 Act sets a target date of 2045 for Scotland reaching net-zero emissions.

In addition, under Schedule 4(4), the Marine EIA Regulations require:

“A description of the factors specified in Regulation 5(3) likely to be significant affected by the works... (Including) climate (for example greenhouse gas emissions, impacts relevant to adaption)”

Note: Climate change was considered in the 2018 EIAR in Chapter 6.7. In summary it was concluded that the primary concern was in relation to flooding and that as this topic was scoped out of the EIA it did not constitute a significant environmental aspect.

Proposed Temporal Variation

Under the current Marine Scotland authorisation, capital dredging and construction activities at the port are licensed until July 2022.

¹ Climate Change (Emission Reduction Targets) (Scotland) Act 2019 (asp 15). Available at: <https://www.legislation.gov.uk/asp/2019/15/enacted>

² Climate Change (Scotland) Act 2009 (asp 12). Available at: <https://legislation.gov.uk/asp/2009/12/contents>

COVID restrictions in 2020/1 has significantly delayed the commencement of the works to the extent that work will not start within the period authorised by both licenses. As such it is proposed to extend the marine licenses by 3 years to July 2025 which should allow sufficient time to complete the works.

EIA Screening

Under the Marine EIA Regulations, proposals are screened to determine whether they fall within one of the types or scales of development which would require an EIA. In screening an application, consideration is given to whether the proposal would fall into any of the categories set out in Schedules 1 or 2 of the Regulations.

The EIA Regulations do not attempt to define 'significant effects' as each development must be dealt with in its own merits. Schedule 1 of the Regulations lists types and scales of development for which an EIA will always be required. Schedule 2 of the Regulations lists types and scales of development for which an EIA might be required, subject to assessment under Schedule 3.

Assessment in Relation to Schedule 1

The proposed alteration to the works is not of a type/scale listed in Schedule 1 of the Regulations; it is therefore necessary to assess the proposal in terms of Schedule 2

Assessment in Relation to Schedule 2

The proposed development was originally identified as being a Schedule 2 development as it fell under the following classes:

Paragraph 12 (a) - Marinas where the area of the enclosed water surface exceeds 1,000m².

Paragraph 1(e) - Reclamation of land from the sea (all works)

Paragraph 10(m) - Coastal work to combat erosion and maritime works capable of altering the coast through the construction for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works.

The Schedule 2 class in which the proposed temporal extension to the works could fall under are:

Paragraph 13 - Any change to or extension of works of a description mentioned in paragraphs 1 to 12 of Column 1 of this table where those works are already authorised, executed or in the process of being executed.

The applicable threshold and criteria in relation to this Paragraph are that the thresholds and criteria in the corresponding part of Column 2 of Schedule 2 applied to the works as changed or extended are met or exceeded and in such a case the change or extension may have significant adverse effects on the environment.

As the site is located in, what is considered to be an environmentally sensitive area, it is necessary to assess the proposed alterations to the site design against the criteria contained in Schedule 3 in order to establish whether the proposed change would be deemed a “significant effect” and thereby require an EIA to accompany any application to vary the marine construction license.

Assessment in Relation to Schedule 3

Schedule 3 of the Regulations provides selection criteria for the screening of Schedule 2 developments. It must be noted that there are no rigid thresholds providing a universal test of whether or not an EIA is required. The proposal must be considered on a case-by-case basis by virtue of factors such as its nature, size or location. The fundamental test to be applied in each case is whether that particular type of development proposed, and its specific impacts are likely, in that particular location, to result in significant effects on the environment.

The main concerns in relation to marine construction and dredging activities identified in the 2018 EIAR were:

- The Water Environment, in particular waves, sediment transport and water quality;
- Ecology in relation to Ornithology, Marine Mammals & Non-Native Species and Otter;
- Underwater Noise associated with piling operations; and
- Navigational resulting from the breakwater extension.

The 2018 EIAR considered the above and defined appropriate mitigation measures to limit any impact as summarised in the Schedule of Mitigation and Dredging Environmental Management Plan dated November 2019 (Document Reference Number 8794) and the Construction Environmental Management Plan dated March 2022 (Document Reference Number 9879). We are therefore of the opinion that the temporal extension to the dredging license to July 2025 will not have a significant impact on the outcomes of the 2018 EIAR and associated HRA AA conclusions.

Assessment in Relation to Climate Change

As noted above, climate change was considered in the 2018 EIAR, in line with best practice guidance, and summarised in Chapter 6.7. The 2018 EIAR concluded that due to the nature of the proposed development, it would not result in any significant impact upon climate. It was outlined that development vulnerability to climate change would primarily relate to flood risk, which was scoped out of the EIA, given the water compatible nature of the development, and the consideration that the proposed works are unlikely to alter the flood risk. It is noted that climate projections for sea level rise have been updated since completion of the 2018 EIAR, with the publication of the UKCP18 projections. However, given flood risk was scoped out, this has no material impact on the assessment and conclusions.

We are therefore of the opinion that the temporal extension of the capital dredge and marine construction licenses to July 2025 will not alter the 2018 EIAR conclusions in relation to climate change.

Assessment of Cumulative Impacts

The 2018 EIAR considered the cumulative effects of the development which all related to the dredging and disposal of dredged material. At the time of writing in 2018, data supplied by Marine Scotland indicated that just under 1.25 million tonnes (wet) of dredged material were disposed of within the licensed sites in the Firth of Forth in 2017. In comparison to this, the proposed material for disposal from Granton Harbour is 86,980m³, which assuming a bulk density of 1.8, would equate to 156,564 tonnes (wet) dredged material.

Information provided by Marine Scotland in 2022, as outlined in Table 1 below, indicates that a total of 349,545 tonnes (wet) were deposited at the licensed marine disposal sites in 2021.

Table 1: Dredge Volumes

Site ID	2020 Licensed Capacity	2021 Deposited volumes
FO038 – Narrow Deep and Narrow Deep B	No set capacity	180,073 tonnes
FO041, FO042, FO043 – Oxcars Main, Ext A and Ext B	No set capacity	169,472.2 tonnes
FO044 – Bo’Ness	No set capacity	0

Given the small-scale dredge and disposal volumes going to sea, no set annual licensed capacity, and the similar chemical composition of other dredge operations within the Firth of Forth, the dredge and disposal operations associated with Granton Harbour are unlikely to have any cumulative effects either by volume or chemical composition as per the original 2018 EIAR.

Assessment of New Sediment Accumulation

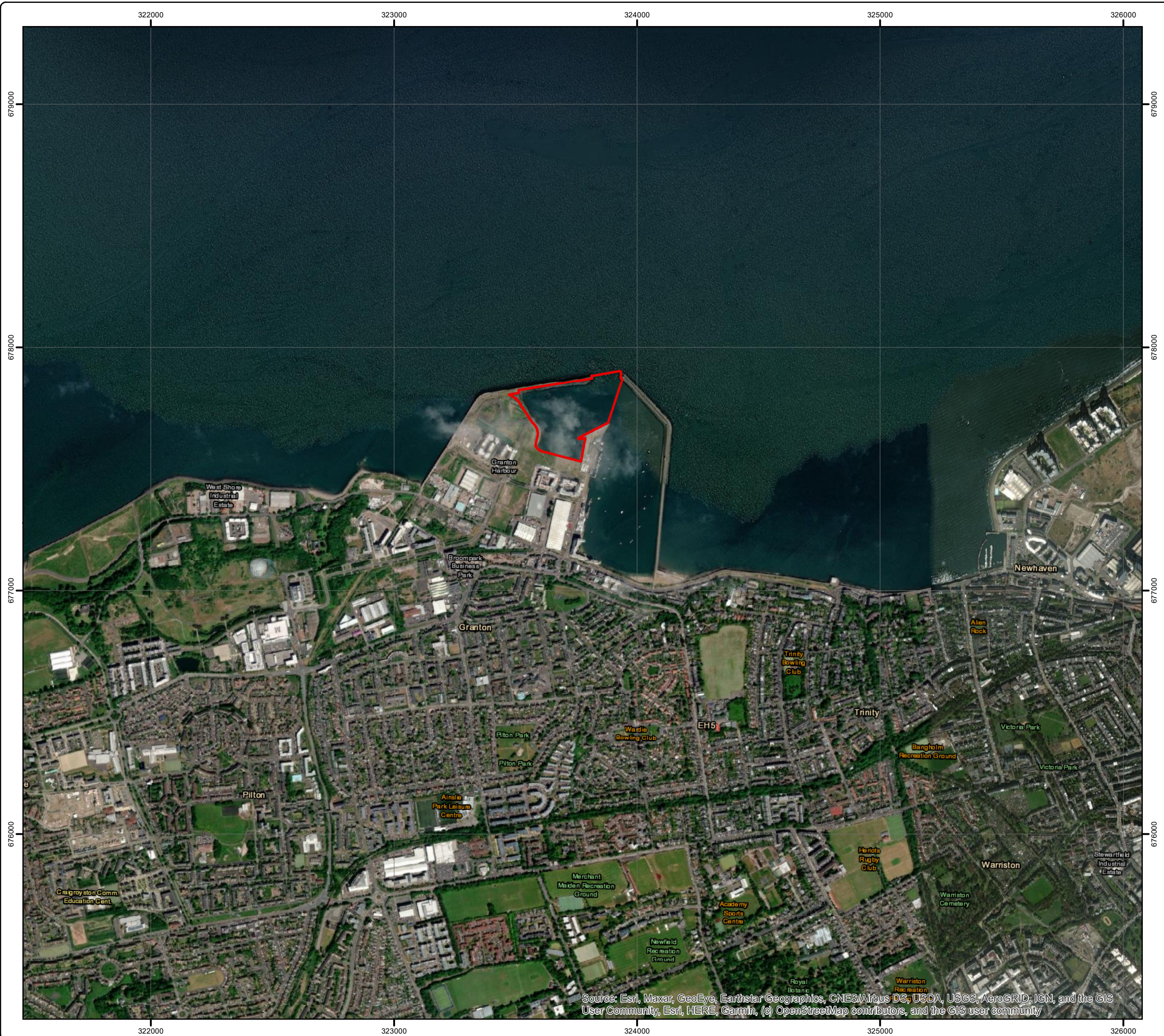
A new bathymetric survey was undertaken in the harbour in April 2022 to assess the changes in sediment volume since the original EIAR submission was submitted in 2018. The calculations indicate that there has been an increase of 9,983m³ within the harbour area.

Further discussion with the client has indicated that this material will be dredged and brought to land for reuse in the wider site development along with the material previously agreed to be brought to land for treatment and disposal.

Conclusions

In conclusion, we are of the opinion that the temporal extension to the Marine License to July 2025 will have no significant impacts on the site or surrounding area and its notable environmental features.

A DRAWINGS




Legend

Site Boundary

Do not scale this map

Client		
Edinburgh Marina Granton Harbour Ltd		
Project		
Edinburgh Marina		
Title		
Site Location Plan		
Status		
FINAL		
Drawing No.	Revision	
776305-GIS001		
Scale	A3	Date
1:15,000		5 May 2022
Drawn	Checked	Approved
GV	EC	CCAS



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