Royal HaskoningDHV
Enhancing Society Together

Technical Note

HaskoningDHV UK Ltd.
Maritime & Waterways

To: James Barrie
From: RHDHV
Date: 19 August 2015
Copy:
Our reference: PB1586 - N018 - Rev B
Classification: Project related

Subject: Impact of Construction Activities on River Traffic

1.0 Introduction

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with the Consultees including the Port Authority and river operators as part of the Development Consent Order (DCO) application process. This process has raised a number of issues and concerns. One of these concerns relates to the potential impact on existing river traffic movements due to the construction activities associated with the development of the York Potash Harbour Facility.

The purpose of this document is to provide a preliminary assessment of the quantum of vessel movements associated with the construction activities and the impact that this may have on existing river movements. The first draft of this note will serve as a basis to begin discussions with the Harbour Master in order to obtain their input into the likely consequences of the construction activities and the mitigation measures that they deem appropriate to limit or minimise impact on River operations. This note will then be revised to incorporate the Harbour Masters comments and then distributed to the Consultees that have expressed concerns relating to the construction activities.

It should be noted that this is only the beginning of the process and will assist in future discussions and development with the Consultees as the form of construction and construction methodology is developed. Any required mitigation measures will be provided to the Principal Contractor as part of the pre-construction information which they will be contractually obliged to comply with.

2.0 Approach

Due to the development stage of the project, this note can only provide a relatively high level assessment of the potential construction activities and the related vessel working areas and movements to inform the impact assessment.

Consequently as the project is developed further there is the potential for changes in both the types and magnitude of the construction activities which would be reflected in the required working areas and actual vessel movements.

A suite of assumptions have been developed to a realistic worst case construction river traffic generation to be established and inform the impact assessment. The table below sets out these assumptions and provides a brief rationale.

Parameter	Note
Construction activities and material quantities are based on a development of PB1586/R004/Rev 0 Port Baseline Report.	PB1586/R004/Rev 0 formed the basis of the York Potash Harbour Facilities Order 201X – Environmental Statement and represents a reasonably conservative estimate of the required works.
Programme of works is based on a development of PB1586/R004/Rev 0 Port Baseline Report.	PB1586/R004/Rev 0 formed the basis of the York Potash Harbour Facilities Order 201X – Environmental Statement and represents a reasonably conservative estimate of the required works.
Environmental constraints that may introduce piling and dredging “windows” have not been considered.	The development of the Marine Export Terminal is not on the critical path of the York Potash Project and as such there is deemed to be sufficient programme scope to accommodate construction activity constraints. This would extend out the programme and reduce the number of concurrent activities resulting in less parallel construction vessel movements.
Open form of berth construction (piled suspended deck)	Initial assessment of open and closed forms of construction indicates that the open form will generate the greater number of vessel movements due to movements associated with precast deck construction being higher than for import of fill material and the additional volume of dredging.
Construction of the berth structures is typically undertaken by marine plant.	This maximises the working areas required in the river by excluding the option of undertaking the construction from the landside.
The Contractor establishes a construction compound / yard on the River upstream of Tees Dock at Cochranes Wharf.	An off-site compound will increase vessel movements (material transhipment and staff / labour movements) along the most trafficked lengths of the River. Identification of this compound does not infer any discussions with the owner of the site. It has been selected as an example of numerous potential sites on the River Tees.
Large order items such as piles and precast units will be imported by sea to the construction compound and then transhipped in smaller barges back to the site.	Vessel movements are maximised by assuming that materials are delivered by vessel to the compound and then transhipped to the site in smaller barges.
Materials handling equipment (ship loaders and conveyor modules) to be imported by sea to the site.	Equipment imported via the River instead of by road.
All dredged material will be taken to offshore disposal sites.	To maximise the estimate of disposal barge movements the potential for reuse of dredged material within the site is not considered.

3.0 River Related Construction Activities

The following section summarises the primary marine related construction activities along with assumed programme durations and basic parameters for vessels expected to undertake the works.

3.1 Dredging

Capital dredging of the berth pocket and a section of the approach channel will be required in order to accommodate the maximum design vessels proposed for the harbour facility. It is anticipated that this dredging will be undertaken in two phases, linked to the phased development of the quay.

The existing bed level in the area of the berth pocket varies between +0.9mCD and -11.6mCD. It is proposed that dredging to -16mCD would be undertaken to create the berth pocket.

At the Bran Sands site the current approach channel transitions from -14.1mCD to -10.4mCD. It is proposed that dredging to -14.1mCD would be undertaken along the full length of the new quay frontage.

The ground to be dredged typically comprises sedimentary silts overlying geological deposits of sands, gravels and clays above bedrock of mercia mudstone.

A summary of the anticipated capital dredged material quantities and types is provided in the table below. (This is an extract of Table 3-2 of the Environmental Statement.)

Material Type	Capital Dredge Volume (m^3)				Totals
	Silts	Sands & Gravels	Clays	Mercia Mudstone	
Phase 1	155,000	300,000	180,000	115,000	**750,000**
Phase 2	26,000	26,000	50,000	270,000	**372,000**
Total Phase 1 + 2	**181,000**	**326,000**	**230,000**	**385,000**	**1,122,000**

The anticipated programme for the dredging works is as follows:

- Phase 1:
  - Berth Area = 3 months
  - River Channel = 2 months
- Phase 2:
  - Berth Area = 3 months
  - River Channel = 3 months

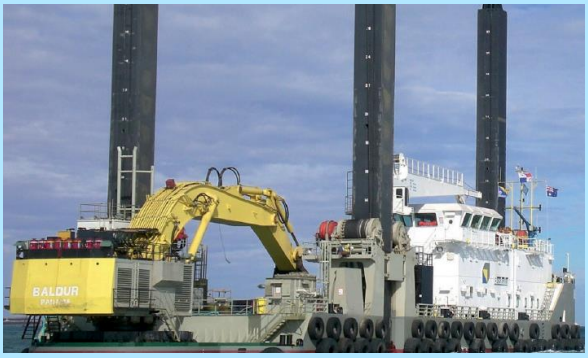
For both Phases 1 and 2 it is proposed that dredging of the silts would be undertaken using an enclosed grab due to elevated concentrations of contaminants present within the sediment. There are a number of options for the disposal of the contaminated silts, however, for the purposes of this note it is assumed that they are transported by barge to a treatment facility to be processed to reduce the levels of contaminate to safe levels for reuse or landfill.

Capital dredging of the sands, gravels and clays is likely to be undertaken by Trailing Suction Hopper Dredger (TSHD). The dredged material would be disposed of to offshore disposal sites by the dredger.

Capital dredging of the mercia mudstone is likely to be undertaken by a Backhoe Dredger. The dredge material would be loaded into hopper barges by the backhoe and taken to offshore disposal sites.

Enclosed Grab Dredger	
	44m Length 15m Beam 2.3m Draft

Trailing Suction Hopper Dredger	
	86m Length 14m Beam 6.3m Draft

Backhoe Dredger	
	73m Length 19m Beam 3.4m Draft

Hopper Barge	
	65m Length 12m Beam 3.7m Draft

3.2 Piling

Piling works would be undertaken to provide the foundation for the quay structure. The works would involve the driving or socketing of imported steel tubular piles (approx. 914mm diameter) into the underlying strata.

It is assumed that the piles will be imported by sea in a 5,000DWT coaster which will unload at the Contractors compound on the River Tees. As required by the construction sequence a group of the piles will then be transferred onto the pile support barge which will sail downstream to the site for installation.

The anticipated programme for the piling works is as follows:

- Phase 1 = 3 months
- Phase 2 = 3 months

Piling Barge	
	53m Length 21m Beam 2.6m Draft
Piling Support Barge	
	43m Length 18m Beam 1.5m Draft

Coaster	
	5,000DWT 93.45m LOA 15m beam] 6.27m draft

3.3 Deck Construction

The deck construction is expected to comprise of imported precast concrete beam and plank units which would be installed by floating crane. Insitu concrete pours would then be undertaken to stitch together the precast concrete elements and provide a deck topping.

It is assumed that the precast elements will be imported by sea in a 5,000DWT coaster which will unload at the Contractors compound on the River Tees. As required by the construction sequence a number of the precast elements will then be transferred onto a support barge which will sail downstream to the site for installation.

The anticipated programme for the deck construction works is as follows:

- Phase 1 = 7 months
- Phase 2 = 6 months

Crane Barge	
	60m Length 22m Beam 2.4m Draft

Support Barge	
	43m Length 18m Beam 1.5m Draft
Coaster	
	5,000DWT 93.45m LOA 15m beam] 6.27m draft

3.4 Topsides Installation

The topsides installation comprises elements such as fender units, bollards and crane rail systems.

It is assumed that the topsides elements will be imported by sea in up to 5,000DWT coaster vessels which will unload at the Contractors compound on the River. As required by the construction sequence a number of the topsides elements will then be transferred onto a support barge which will sail downstream to the site for installation.

The anticipated programme for the topsides installation works is as follows:

- Phase 1 = 3 months
- Phase 2 = 3 months

Crane Barge	
	60m Length 22m Beam 2.4m Draft
Support Barge	
	43m Length 18m Beam 1.5m Draft
Coaster	
	5,000DWT 93.45m LOA 15m beam] 6.27m draft

3.5 Materials Handling Equipment Installation

The materials handling equipment comprises elements such as the ship loaders and the conveyor modules.

It is assumed that the ship loaders and conveyor modules will be imported by sea in specialist vessels which will unload at the site. It is anticipated that the ship loaders will be offloaded directly onto a complete section of the quay and the conveyor modules will either be offloaded via the completed section of quay or temporary facility (possibly the NWL Jetty).

The anticipated programme for the material handling equipment installation that will require marine based support is as follows:

- Phase 1 = 3 months
- Phase 2 = 3 months

Crane Barge	
	60m Length 22m Beam 2.4m Draft
Specialist Vessel	
	12,500DWT 161m Length 28m Beam

4.0 Primary Construction Locations

For each of the river related construction activities the following table summarises the primary associated river routes and working areas.

Construction Activity	Vessel	River Route / Location
Dredging	Enclosed (clamshell) dredger	Tees Bay to Site Berth Area River Channel
	Contaminated silts disposal barge	Site to Tees Bay Berth Area River Channel
	Trailing suction hopper dredger	Tees Bay to Site Berth Area River Channel
	Backhoe Dredger	Tees Bay to Site Berth Area River Channel
	Marl disposal barge	Site to Tees Bay Berth area River Channel
Piling	Piling Barge	Tees Bay to Site Berth Area
	Pile Delivery Vessel	Tees Bay to Compound
	Pile Materials Barge	Compound to Site Berth Area
Deck Construction	Crane Barge	Tees Bay to Site Berth Area
	Precast Delivery Vessel	Tees Bay to Compound
	Precast Elements Barge	Compound to Site Berth Area
Topsides Installation	Crane Barge	Tees Bay to Site Berth Area
	Fixtures Delivery Vessel	Tees Bay to Compound
	Fixtures Barge	Compound to Site Berth Area
Materials Handling Equipment Installation	Ship loader Delivery Vessel	Tees Bay to Site Berth Area
	Conveyor Module Delivery Vessel	Tees Bay to Site Berth Area

Notes:
Refer to drawing PB1586-SK3000 for details of river routes

5.0 Construction Traffic Movements

For each construction activity there are a number of different vessels involved with some vessels operating in working areas around the berth and others transporting materials up and down the River.

The anticipated working areas at the berth are identified in the following drawings:

- PB1586-SK3001 for details of Phase 1 Berth Construction Working Areas
- PB1586-SK3002 for details of Phase 2 Berth Construction Working Areas
- PB1586-SK3003 for details of Phase 1 Dredging Areas
- PB1586-SK3004 for details of Phase 2 Dredging Areas

The following tables present a preliminary estimate of the type of vessel and number of vessel movements related to each construction activity in both Phase 1 and Phase 2.

The vessel movements have been related to the programme in order to identify the distribution of vessel movements and establish potential peak periods of vessel movement in the River.

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Phase 1

Activity	Sub-Activity	Vessel Type	Construction Programme Month																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Totals
Dredging	Mobilise dredgers	Clamshell dredger			1		1													2
		TSH dredger				1	1													2
		Backhoe dredger					1	1												2
	Mobilise disposal barges	Hopper barge			2			2												4
	Dispose silt to processing	Hopper barge			120	120	86													326
	Dispose sands/gravels to offshore dumping site	TSH dredger				155	155													310
	Dispose marl to offshore dumping site	Hopper barge					111	111												222
Piling	Supply piles to compound	5,000DWT coaster				2		2												4
	Mobilise piling barge	Piling barge				1			1											2
	Supply piles to site	Piling support barge				4	8	8	6											26
Deck Construction	Supply precast units to compound	5,000DWT coaster				2		4		2										8
	Mobilise crane barge	Crane barge				1						1								2
	Supply precast units to site	Barge				2	4	8	8	10	10	8								50
Topsides Installation	Supply fixtures to compound	5,000DWT coaster							2		2									4
	Mobilise crane barge	Crane barge							1			1								2
	Supply fixtures to site	Barge							2	2	2	2								8
Materials Handling Equipment Installation	Supply conveyor modules to site	Specialist vessel											8	10	10					28
	Supply ship loaders to site	Specialist vessel													2					2
	Mobilise crane barge	Crane barge											1		2	2	1			6
Totals Per Month			**0**	**0**	**123**	**288**	**367**	**136**	**20**	**14**	**14**	**12**	**9**	**10**	**14**	**2**	**1**	**0**	**0**	**1010**

Activity	Sub-Activity	Vessel Type	Construction Programme Month																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Totals
Dredging	Mobilise dredgers	Clamshell dredger			2															2
		Backhoe dredger			1				1											2
	Mobilise disposal barges	Hopper barge			2				2											4
	Dispose silt to processing	Hopper barge			78															78
	Dispose sands/gravels to offshore dumping site	Hopper barge			118															22
	Dispose marl to offshore dumping site	Hopper barge				130	130	130	130											520
Piling	Supply piles to compound	5,000DWT coaster				2		2												4
	Mobilise piling barge	Piling barge				1			1											2
	Supply piles to site	Piling support barge				2	8	8	2											20
Deck Construction	Supply precast units to compound	5,000DWT coaster				2			2											4
	Mobilise crane barge	Crane barge				1						1								2
	Supply piles to site	Barge				2	4	8	8	10	10	2								44
Topsides Installation	Supply fixtures to compound	5,000DWT coaster								2										2
	Mobilise crane barge	Crane barge								1		1								2
	Supply fixtures to site	Barge								2	2	2								6
Materials Handling Equipment Installation	Supply conveyor modules to site	Specialist vessel										2								2
	Supply ship loaders to site	Specialist vessel											2							2
	Mobilise crane barge	Crane barge										1	2	2	1					6
Totals Per Month			**0**	**0**	**201**	**140**	**142**	**148**	**146**	**15**	**12**	**9**	**4**	**2**	**1**	**0**	**0**	**0**	**0**	**724**

6.0 Predicted Effects

6.1 Berth Construction Activities

As per drawings PB1586-SK3001 and PB1586-SK3002 the working area required for the berth construction activities is outside of the navigable river channel and as such represents no significant impact on existing river traffic movements. Some manoeuvring operations for set-ups may require marine based plant to infringe temporarily upon the navigable channel but these would be a short duration planned movements co-ordinated with the Harbour Master to prevent any obstruction to existing river traffic.

Vessel movements along the River associated with the berth construction activities, resulting from material deliveries and mobilisation / demobilisation of marine plant, are minimal. The estimate of construction vessel movements undertaken in the previous section shows a peak of 22 vessel movements in a month, equivalent to less than 1 vessel movement per day. The Harbour Master has confirmed that this number of vessel movements can be incorporated into the river traffic management system with no noticeable impact to existing river traffic.

6.2 Dredging Activities

The dredging activities comprise of creating the berth pocket (estimated 750,000m^3) and deepening of the navigable channel (estimated 350,000m^3).

Dredging operations associated with the berth pocket and will be undertaken outside of the navigable river channel and as such represent no significant impact on existing river traffic movements. Some manoeuvring operations for set-ups may require marine based plant to infringe temporarily upon the navigable channel but these would be short duration planned movements co-ordinated with the Harbour Master to prevent any obstruction to existing river traffic.

Dredging operations associated with deepening of the approach will be undertaken within the navigable river channel and therefore have the potential to impact the existing river traffic movements. A dredger and barges in the navigable channel would result in a restriction of the available channel width for 2 -3 months during each construction phase. The impact on existing river traffic is expected to be minimal as operations would be planned to maintain at least a single channel width at all times and dredging operations would be suspended as required to allow the passage of river traffic as deemed necessary by the Harbour Master.

Vessel movements along the River associated with the dredging activities, resulting from material disposal movements and mobilisation / demobilisation of marine plant, are minor. The estimate of construction vessel movements undertaken in the previous section shows a peak of 355 vessel movements in a month, equivalent to 12 vessel movements per day. As these vessel movements are not tidally restricted and there is a degree of flexibility in the timing of the movements the Harbour Master has confirmed that these vessel movements can be incorporated into the river traffic management system with no significant impact to existing river traffic.

It is noted that both capital and maintenance dredging activities have been undertaken on the river in the past with no significant impact on existing vessel traffic.

6.3 Total Vessel Movements

The table below represents the impact of construction activity related vessel movements on the overall vessel movements on the River.

Phase	Vessel Movements	
	Per Month	Per Day
Historical		
Past Movements (Peak Monthly Average 2003-2013)	1226	40.9
Phase 1		
Base Movements (Monthly Average for 2013)	888	29.6
Additional Tees Dock Movements (3.6Mtpa)	15	0.5
Peak Construction Related Vessel Movements	367	12.2
Total Peak Number of Vessel Arrivals	1270	42.3
Phase 2		
Base Movements (Monthly Average for 2013)	888	29.6
Additional Tees Dock Movements (3.6Mtpa)	15	0.5
Phase 1 YPL Movements (Monthly Average)	21	0.7
Peak Construction Related Vessel Movements	201	6.7
Total Number of Vessels	1125	37.5

Phase 1 represents a total number of vessel movements that is commensurate with peak numbers experienced on the River in the past 10 years.

The Phase 2 total vessel movements are less significant than the Phase 1 movements.

7.0 Management / Mitigation Measures

There are a number of management and mitigation measures that can be implemented in order to minimise the risks that the construction related activities will have a detrimental impact on the operation of the navigable channel.

- Communication to be maintained with the Harbour Master throughout the development of the project to ensure that the decisions relating to forms and methods of construction are aligned with the safe operation of the river channel for existing vessel movements.
- Contractor(s) to hold preconstruction meetings with the Harbour Master to plan overall sequences of work and programmes.
- Contractor to hold daily meetings with Harbour Master to plan specific vessel movements and operations.
- Contractor to comply with Port byelaws, including:
    - All construction vessels entering the navigable channel to be in contact with the Harbour Master through VTS system.
    - All construction vessel movements within the navigable channel to be undertaken in accordance with the Harbour Masters traffic management system.
    - Pilotage on board construction vessels as determined by the Harbour Master.

- Contractor to stand down marine plant in certain circumstances as dictated by the Harbour Master (certain hazardous vessel movements in the River) and move out of the navigable channel.
- Harbour Master to issue Notices to Mariners as necessary to provide relevant information to other river users regarding construction activities.
- Contractor to provide adequate moorings for securing construction vessels outside of the navigable channel to minimise risk of construction vessels getting loose and drifting into the navigable channel.
- Contractor to employ dredging plant / systems of work that provide adequate flexibility for moving vessels to accommodate existing river traffic.

A Construction Phase Safety Assessment (CSA) has been undertaken in conjunction with the Harbour Master, Tees Bay Pilots, Foyboatmen and Svitzer with regard to construction activity risks to existing river traffic. The CSA is presented in Appendix B.

8.0 Conclusion

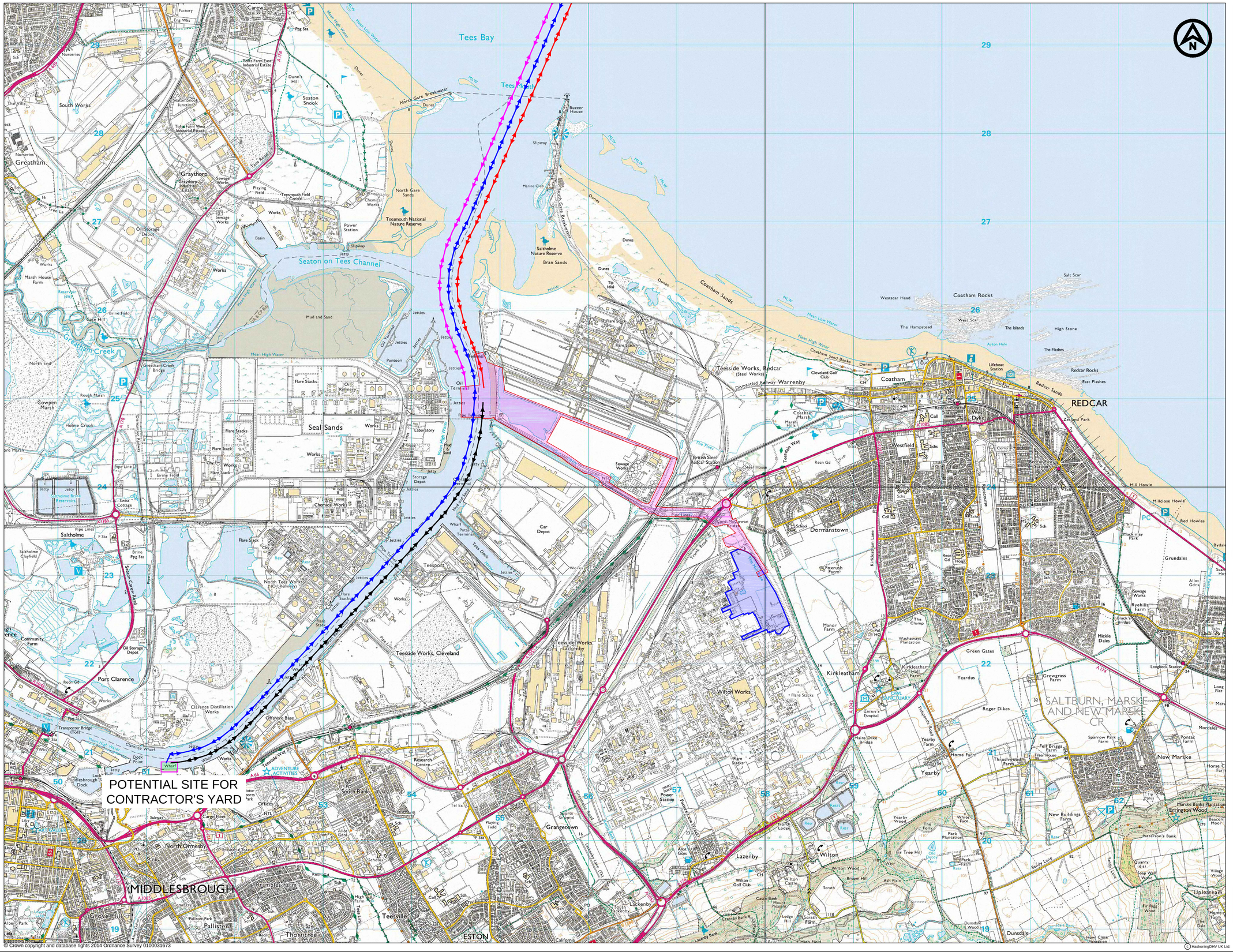
Following discussions held with the Harbour Master it is deemed that the risk of construction activities impacting the navigable channel can be sufficiently managed and mitigated to avoid any significant constraints or delays to existing river users.

- The majority of the construction activities (berth construction and berth pocket dredging) are undertaken outside of the navigable channel and as such do not represent a significant risk to existing river traffic.
- Dredging to deepen the navigable channel to be conducted in agreement with the Harbour Master to minimise any disruption to existing river traffic. Capital and maintenance dredging regimes have been successfully undertaken in the river previously.
- Peak vessel movements associated with construction activities are equivalent to approximately 12 movements per day. The Harbour Master has confirmed that there should be no significant issues accommodating this number of movements in to the river traffic management.

APPENDIX A

Drawings

DRG No. PB1586-SK3000



NOTES

LEGEND

- ORDER LIMITS
- MATERIALS HANDLING FACILITY
- VESSEL MOVEMENTS BETWEEN TEES BAY AND BRAN SANDS SITE
- VESSEL MOVEMENTS BETWEEN TEES BAY AND CONTRACTORS YARD
- BARGE / SMALL VESSEL MOVEMENTS BETWEEN CONTRACTORS YARD AND BRAN SANDS SITE
- BARGE / DREDGER MOVEMENTS BETWEEN BRAN SANDS SITE AND OFFSITE DISPOSAL AREAS

REV	DATE	DESCRIPTION	BY	CHK	APP
A	31/07/15	FOR DISCUSSION	IT	RWP	SCP

REVISIONS

YORKPOTASH
A Sirius Minerals Project

PROJECT

YORK POTASH

TITLE

PRIMARY CONSTRUCTION TRAFFIC ROUTES ON THE RIVER

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DATE	JUL' 15	CLIENT'S REF.	
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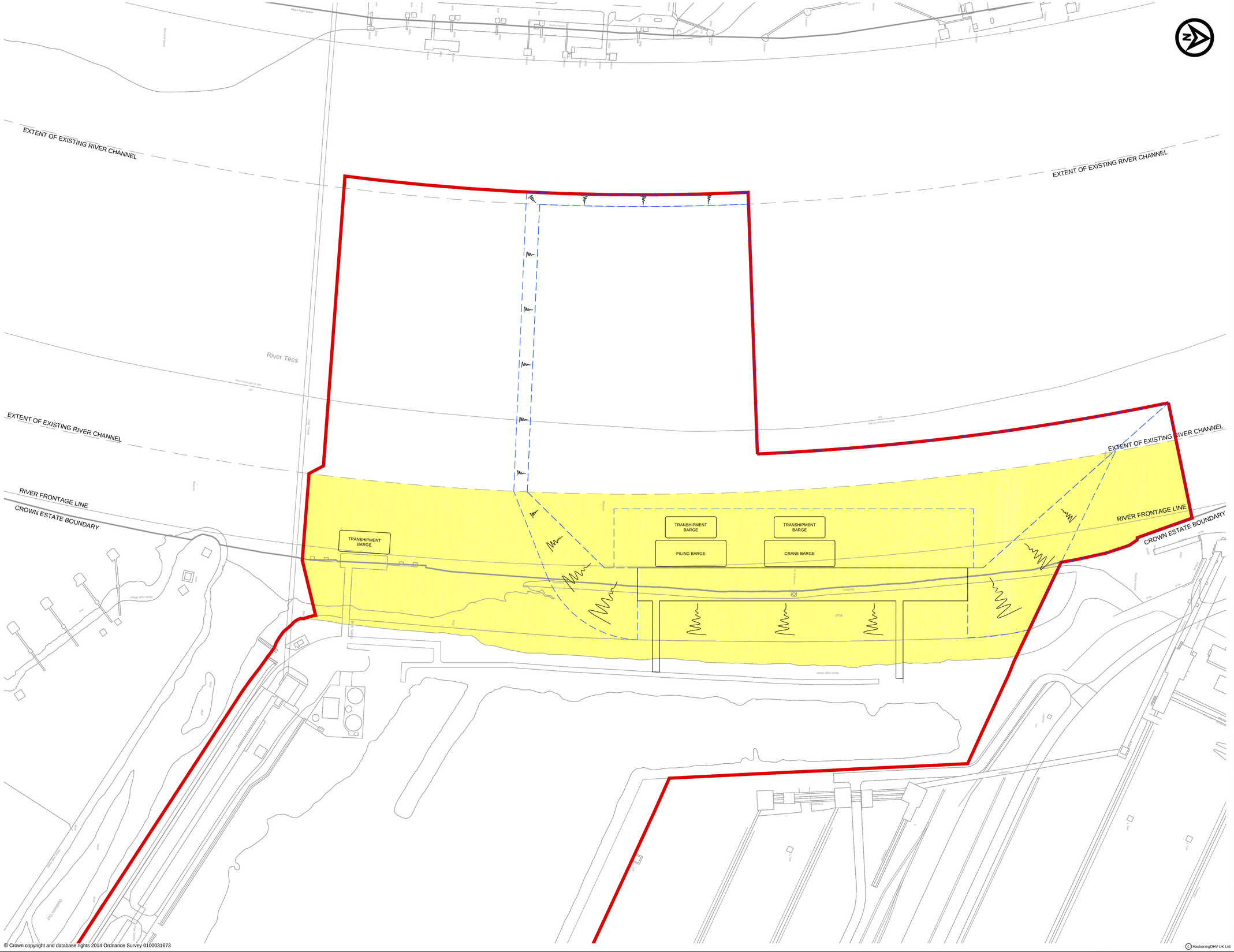
DRAWING No. PB1586-SK3000

REVISION A

DRG No. PB1586-SK3001



NOTES

LEGEND

- ORDER LIMITS
- CROWN ESTATES LANDOWNERSHIP BOUNDARY
- WORKING AREA FOR MARINE PLANT ASSOCIATED WITH CONSTRUCTION OF THE PHASE 1 QUAY

REV	DATE	DESCRIPTION	BY	CHK	APP
A	31/07/15	FOR DISCUSSION	IT	RWP	SCP

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PROJECT

YORK POTASH

TITLE

QUAY CONSTRUCTION
WORKING AREA FOR
MARINE PLANT PHASE 1

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REVISION A

DRG No. PB1586-SK3002

EXTENT OF EXISTING RIVER CHANNEL

EXTENT OF EXISTING RIVER CHANNEL

River Tees

EXTENT OF EXISTING RIVER CHANNEL

EXTENT OF EXISTING RIVER CHANNEL

RIVER FRONTAGE LINE

CROWN ESTATE BOUNDARY

RIVER FRONTAGE LINE

CROWN ESTATE BOUNDARY

PHASE 2 MARINE PLANT MOVEMENTS NOT TO IMPACT ONGOING OPERATIONS AT PHASE 1

TRANSHIPMENT BARGE

PILING BARGE

TRANSHIPMENT BARGE

CRANE BARGE

OPERATIONAL PHASE 1 QUAY

NOTES

LEGEND

- ORDER LIMITS
- CROWN ESTATES LANDOWNERSHIP BOUNDARY
- WORKING AREA FOR MARINE PLANT ASSOCIATED WITH CONSTRUCTION OF THE PHASE 2 QUAY
- QUAY STRUCTURE
- ROADS

REV	DATE	DESCRIPTION	BY	CHK	APP
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REVISIONS

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PROJECT

YORK POTASH

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QUAY CONSTRUCTION
WORKING AREA FOR
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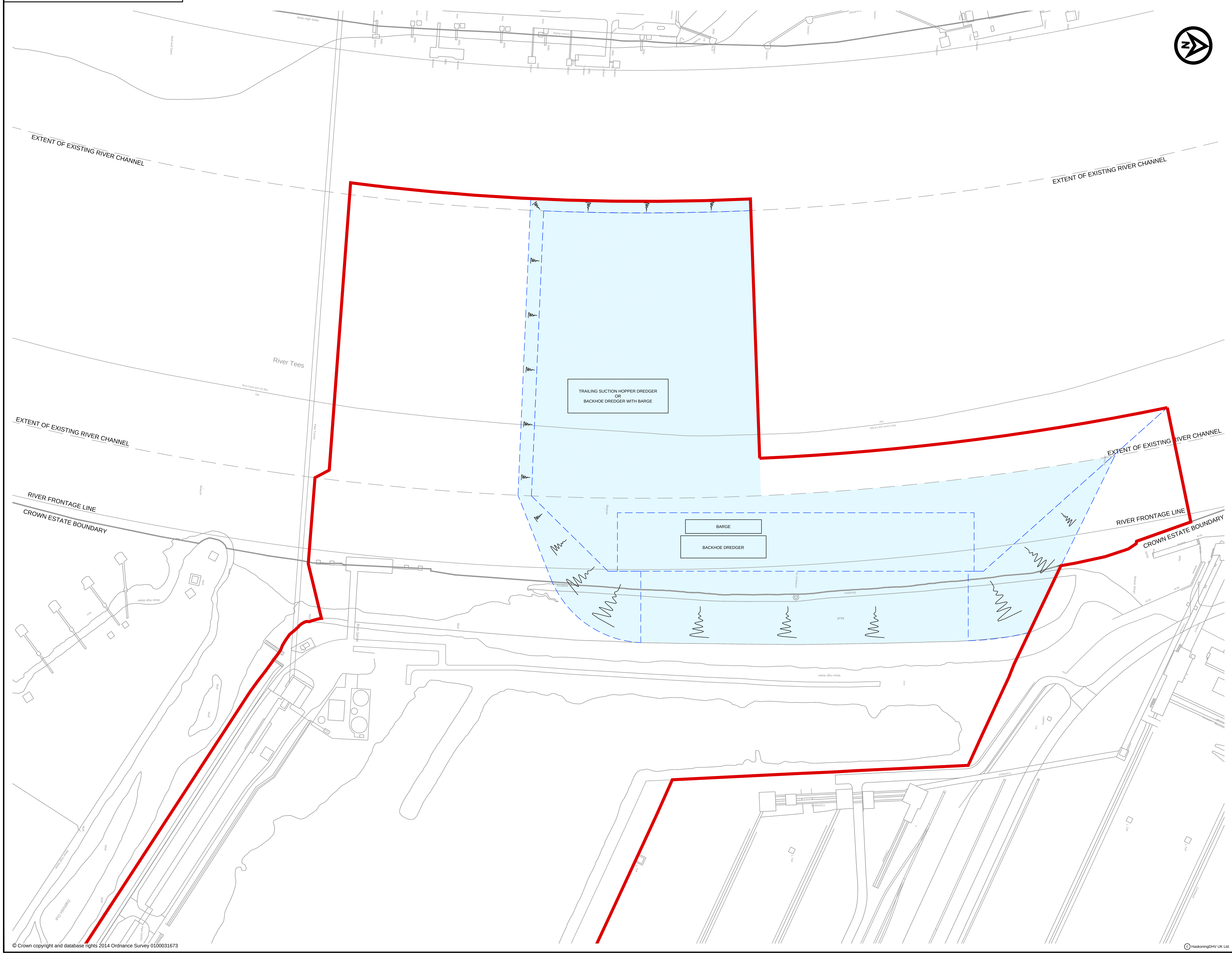
DRAWING No. PB1586-SK3002

REVISION A

DRG No. PB1586-SK3003



NOTES

LEGEND

ORDER LIMITS

CROWN ESTATES LANDOWNERSHIP BOUNDARY

WORKING AREA FOR MARINE PLANT ASSOCIATED WITH DREDGING IN PHASE 1

A	31/07/15	FOR DISCUSSION	IT	RWP	SCP
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

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PROJECT

YORK POTASH

TITLE

QUAY CONSTRUCTION
WORKING AREA FOR
DREDGING PLANT PHASE 1

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DATE	JUL' 15	CLIENT'S REF.			
SCALE AT A1	1:1500	AUTOCAD REF.	PB1586-SK3003		

DRAWING No. PB1586-SK3003

REVISION A

DRG No. PB1586-SK3004

EXTENT OF EXISTING RIVER CHANNEL

EXTENT OF EXISTING RIVER CHANNEL

River Tees

EXTENT OF EXISTING RIVER CHANNEL

EXTENT OF EXISTING RIVER CHANNEL

RIVER FRONTAGE LINE

CROWN ESTATE BOUNDARY

RIVER FRONTAGE LINE

CROWN ESTATE BOUNDARY

TRAILING SUCTION HOPPER DREDGER
OR
BACKHOE DREDGER WITH BARGE

BARGE

BACKHOE DREDGER

OPERATIONAL
PHASE 1 QUAY

NOTES

LEGEND

- ORDER LIMITS
- CROWN ESTATES LANDOWNERSHIP BOUNDARY
- WORKING AREA FOR MARINE PLANT ASSOCIATED WITH DREDGING IN PHASE 2
- QUAY STRUCTURE
- ROADS

REV	DATE	DESCRIPTION	BY	CHK	APP
A	31/07/15	FOR DISCUSSION	IT	RWP	SCP

REVISIONS

YORKPOTASH
A Sirius Minerals Project

PROJECT

YORK POTASH

TITLE

QUAY CONSTRUCTION
WORKING AREA FOR
DREDGING PLANT PHASE 2

Royal HaskoningDHV
Enhancing Society Together

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DRAWN	IT	CHECKED -	PASSED -
DATE	JUL' 15	CLIENT'S REF.	
SCALE AT A1	1:1500	AUTOCAD REF.	PB1586-SK3004

DRAWING No. PB1586-SK3004

REVISION A

APPENDIX B

Construction Phase Safety Assessment

Royal HaskoningDHV
Enhancing Society Together

Technical Note

HaskoningDHV UK Ltd.
Maritime & Waterways

To:	York Potash Ltd.
From:	RHDHVr
Date:	19 August 2015
Copy:	
Our reference:	PB1586 - N025 - Rev 1
Classification:	Project related

Subject: **Construction Phase Safety Assessment**

CSA Executive summary

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with the Consultees including river users and associated stakeholders as part of the Development Consent Order (DCO) application process. This process has raised a number of questions regarding the potential impact on river operations as a result of the construction process.

A Construction Phase Safety Assessment (CSA) has been undertaken in accordance with the Guide to Good Practice on Port Marine Operations. The purpose of the CSA was to consider the risks to river traffic movements associated with the construction phase of the York Potash Project. The following phases were undertaken in the development of the CSA:

- Quantification of working areas and vessel movements associated with the construction activities (PB1586-N018, August 2015).
- Identification of hazards to river traffic movements associated with construction activities.
- Assessment of risks with consideration to control measures to be adopted.
- Recommendations to be taken forward to minimise and control remaining risks.

The last three phases formed part of a risk assessment workshop with the Harbour Master and representatives from the Tees Bay Pilots, Foyboatmen (the organisation responsible for the mooring of vessels), Svitzer (the tug providers), York Potash Ltd (YPL) and Royal HaskoningDHV (RHDHV) held on 14th August 2015.

The workshop concluded that:

- The Harbour Master and operational services foresees no significant issues in dealing with YPL associated construction traffic (peaks equivalent to 12 vessel movements per day) alongside the existing river traffic.
- The working areas required for the majority of construction related activities are outside of the navigational channel and therefore pose very limited risk to existing river operations.
- Risks due to dredging equipment working in the navigable channel can be managed with minimal risk to existing river traffic and that both capital and maintenance dredging regimes have been undertaken successfully in the past.
- The Harbour Master confirmed that provided that identified management and mitigation measures were followed that there would not be significant impact to other users on the river due to the construction activities for the York Potash Project.

1.0 Introduction

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with the Consultees including river users and associated stakeholders as part of the Development Consent Order (DCO) application process. This process has raised a number of issues and concerns. These are concerns associated with marine constructability issues including the interface with existing operations and infrastructure within the river.

The purpose of this document is to consider risks associated with the marine construction related issues, including dredging. In order to assess the marine related construction working areas and vessel movements, York Potash Ltd. (YPL) has commissioned Royal HaskoningDHV (RHDHV) to prepare a technical note on the Impact of Construction Activities on River Traffic (PB1586-N018, August 2015). Due to the development stage of the project this technical note represents a relatively high level assessment but has been developed as a realistic worst case to inform the impact and risk assessment.

The CSA, as additionally required, has been carried out by RHDHV on behalf of YPL. The CSA in particular assesses the potential safety impacts on river users associated with the forecasted construction related vessel movements and activities.

This note is structured with the following headings:

- Abbreviations
- Methodology – discussion on the approach taken
- Conclusions
- Recommendations

1.1 Abbreviations

The following abbreviations are used in this report:

AIS	- Automatic Identification System
ALARP	- As Low As Reasonably Practicable
AtoN	- Aid to Navigation
CPA	- Closest Point of Approach
CSA	- Construction phase Safety Assessment
DWT	- Dead Weight Tonnes
ECDIS	- Electronic Chart Display and Information System
EIA	- Environmental Impact Assessment
GIS	- Geographical Information Systems
GPS	- Global Positioning System
GRT	- Gross Register Tonnage
FSA	- Formal Safety Assessment
HSE	- Health and Safety Executive
IMO	- International Maritime Organisation
ISPS	- International Ship and Port facility Security Code
LOA	- Length Overall
Mtpa	- mega ton per annum
nm	- Nautical Miles (1 nm = 1,852 metres)
NtM	- Notices to Mariners
PPU	- Portable Pilot Unit
RACON	- Radar Beacon
RAM	- Risk Assessment Matrix

RCM	- Risk Control Measures
SMCP	- Standard Marine Communication Phrases
SBV	- Standby Vessel
TSS	- Traffic Separation Scheme
VHF	- Very High Frequency
VTS	- Vessel Traffic Service

2.0 Methodology

2.1 Objective

The major objective of the CSA is early identification and risk assessment of safety hazards in order to provide essential input to project decisions. This CSA is dedicated for impact on the river traffic in particular. The CSA is a process for proactive and ongoing identification of hazards and is characterized by:

- Identification of safety hazards at the earliest practicable stage.
- Assessment of risks against standards of acceptability.
- Reduction of risks to an acceptable level.

The CSA study technique has been developed specifically to reflect the importance of HSE issues on the fundamental decisions that are made at this (relatively early) stage of the project. The CSA study is the first opportunity to assemble experienced engineering, construction and HSE staff together to address, in a short time frame, the HSE issues surrounding the construction phase.

2.2 CSA Standards and Risk Assessment process

The CSA is executed as a dynamic risk assessment, as required in Section 4.3 of the Guide to Good Practice on Port Marine Operations [Prepared in conjunction with the Port Marine Safety Code]. The method helps the individual to assess a situation which is constantly changing. The dynamic risk assessment method is used to evaluate the situation, tasks and persons at risk when carrying out any form of activity – whether routine or unusual. This process helps an individual to effectively assess a situation as it is unfolding. The person can continuously assess the circumstances and adjust his or her response to meet the risk presented moment by moment.

The CSA process and outcomes are recorded in Annex 1 of this Note. Over time, the CSA may lead to a review and revision of the planned activities. Review and update of the CSA may be required in case of major changes. Project managers can question staff about the safety and/or constructability implications of developments at any time. Routine team and/or meetings to discuss the effectiveness of performance shall be used for this purpose.

2.3 Approach

A workshop was held on 14th August 2015 in the Harbour Master's Office at Teesport in order to assess hazards, risks (i.e. impact) on the river traffic, due to construction activities. The workshop was attended by stakeholders in order to include local knowledge and experience in the CSA. The workshop is a meeting, employing a highly experienced multi-discipline team using a structured brainstorming technique, based on a tailor made checklist. During the workshop the data gathered and preliminary hazards identified are presented and discussed. Outcomes are fine-tuned, optimized and determined. The Workshop attendees are noted in Table 1.

Name	Position / Title	Organisation
Mr. James Barrie	Port Area Project Manager	York Potash Ltd.
Mr.Jerry Drewitt	Harbour Master	Teesport
Mr. Paul Brooks	Deputy Harbour Master	Teesport
Mr. Colin Pratt	Pilot…	Tees Bay Pilots

Mr. Ellis Appleton	Representative of Foyboatment	Foyboatmen
Mr. Stephen Brown	Representative of Svitzer	Svitzer
Mr. Tim Raby	Project Maritime lead	Royal HaskoningDHV [UK]
Mr. Steve Cross	Maritime construction specialist	Royal HaskoningDHV [UK]
Mr. Johan van Middelaar	CSA Process Lead	Royal HaskoningDHV [NL]
Mr. Jacco Valstar	Marine Navigation Specialist	Royal HaskoningDHV [NL]

Table 1 CSA Workshop participants

Prior to the workshop, an initial assessment and ranking of hazards was carried out in order to identify potential failure cases. This was based on RHDHV's maritime safety, construction safety, process & chemical and oil & gas experience, taking the baseline construction data into account.

The CSA further included the following activities:

- Step 1: Hazard identification.
- Step 2: Actions and Risk Control Measures.
- Step 3: Risk Assessment.
- Step 4: Conclusions and recommendations for decision-making.

Step 1: Hazard Identification
The identification of hazards is done by analysing the construction activities, including dredging. In each part of the process failure cases are identified per incident category. For each failure case the typical causes and potential consequences are identified. The following incident categories have been preselected and prepared with regard to construction activities:

1. Interfaces.
2. Preparations.
3. Staffing and time planning.
4. Transport of materials and Location of activities.
5. Construction activities.
6. Hoisting and lifting.
7. Occupational Health and Safety.
8. External threats.
9. Other.

Step 2: Actions and Risk Control Measures
The second step was identification of Actions and Risk Control Measures (RCM's) for those risks with the expected largest impact. The actions and RCM's are targeted to:

- Reduction of the probability of an incident.
- Reduction or mitigation of the consequences of an incident.
- Alleviate external circumstances in which an incident occurs.

Step 3: Risk Assessment
As per the Port Marine Safety Code, a Risk Assessment Matrix (RAM) was used to rank the hazards by applying the frequency and consequence categories shown below. The next step of the CSA consisted of qualitatively assessing the expected impact of each hazard based on expert opinion and (local)

incident statistics. The expected impact of a risk depends on both the probability of occurrence and the potential consequences and is generally summarized by the formula:

*Risk = Probability of occurrence * Consequence*

Since the risk is defined as the product of probability of occurrence and the consequences, the risk assessment focused on “non-frequent high impact” events as well as “frequent low impact” events.

In Figure 1 the RAM is depicted. On the top right the different frequencies/probabilities of occurrence are shown. The probability of occurrence of the various risks is categorised in 5 categories of expected frequency of occurrence. On the left side the consequence classification is shown with the classes. The consequences are grouped in the following categories;

- People (human injuries and casualties).
- Assets (financial and economic consequences).
- Environment (damage to natural habitat).
- Reputation (damage to image).

The combination of a consequence and a probability of occurrence results in a risk. The colours of the matrix indicate whether further action is required/ advised/ unnecessary.

						A	B	C	D	E
		Consequences				Frequency / Probability of occurence				
		People	Assets	Environment	Reputation	Improbable 1. Has occured in the world, but not in this country	Remote 2. Has occured in another facility/terminal in the country	Occasional 3. Has occured at this port/location/facility	Probable 4. Happens several times each year at this port/location/facility	Frequent 5. Happens several times per year at the same location/facility
5	Catastrophic	Multiple fatalities	Extensive damage	Massive effect	International impact	5	10	12,5	15	20
4	Severe	Single fatality or permanent disability	Major damage	Major effect	National impact	4	8	10	12	16
3	Critical	Major injury or health effects	Local Damage	Localised effect	Considerable impact	3	6	7,5	9	12
2	Marginal	Minor injury or health effects	Minor damage	Minor effect	Minor impact	2	4	5	6	8
1	Negligible	Slightly injured or health effecs	Slight damage	Slight effect	Slight impact	1	2	2,5	3	4

Figure 1 Risk Assessment Matrix

The colours in the prioritization matrix indicate the level of risk of the considered hazard:

- Green: Broadly Acceptable region (Low Risk): Generally regarded as insignificant and adequately controlled. None the less the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
- Orange: Tolerable Region (Medium Risk): The risks are as low as reasonably practicable (ALARP). The risks are tolerable however action would be beneficial. Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks

are properly assessed, appropriate control measures are in place, residual risks are ALARP and that risks are periodically reviewed to see if further controls are appropriate.

- Red: Unacceptable Region (High Risk). Generally regarded as unacceptable whatever the level of benefit associated with the activity.

Step 4: Conclusions and recommendations

Drawing up conclusions and recommendations is the final step in the CSA process. Following the workshop, the CSA was updated to final, incorporating the risk assessment and RCM's agreed during the workshop.

3.0 Conclusions

None of the CSA failure cases are assessed as ‘high risk’ with regard to river traffic. Several ‘medium risks’ have been assessed, however, all these risks are manageable taking actions and risk control measures into account.

The team concludes that medium risks are acceptable and no additional RCM’s are required, taking recommendations into account. However, these items will be kept under review as the project is developed so that any future opportunities to minimise these hazards and risks can be adopted. The low risk items are regarded as insignificant and adequately controlled. No additional RCM’s are required, taking recommendations (see next section) into account.

The size and volume of the conservatively estimated construction related vessel traffic is equivalent to approximately 12 movements per day. The Harbour Master has confirmed that these additional movements can be accommodated into the river traffic management system without any noticeable effect.

4.0 Recommendations

1. Concurrent operations are dedicated to construction activities only (no impact on river traffic); to be managed by main/principle contractor (to be assigned in Contract). Ensure preparation of:
   a) Overall project HSE Management Plan.
   b) Concurrent Operations plan (e.g. bridging document).
   c) Contractors to prepare own Construction HSE Plan(s).

2. Barges used to transport dredging and construction material shall be self-propelled (as far as is practicable) with use of towed barges minimised or eliminated. The reason is that self-propelled barges are more manoeuvrable and require less operational handling activities which make the barge activities quicker, more predictable and safer.

3. Communication requirements to be included into contract requirements (communication plan requirement to be in Contract).

4. Direct delivery to site to be considered in development of construction methodology where practical, (e.g. precast units) to further reduce number of construction vessel movements on the river. Consider intermediate stocks at site (e.g. sufficient materials for several days construction activities) either in laydown areas or on moored barges. This will allow additional flexibility in timings of construction vessel movements and minimise impacts on existing river traffic (i.e. construction vessel movements on the river could be made in off-peak times).

5. Contractor to provide the following as part of the construction planning:
   a) Safe locations for berthing and mooring of all vessels (e.g. barges), including sufficient locations for 'stand-by/empty' vessels (refer to point 4 above).
   b) Adequate mooring facilities, including methodology for ship-ship mooring (max number, side by side, etc.).

6. Planning of construction programme to consider environmental constraints for activities such as piling (and dredging). Fish and marine mammal movements (breeding season, etc.) may prevent some construction activities at certain times of the year. Generally the development of the marine terminal is not on the critical path for the overall York Potash Project development and therefore some flexibility exists to accommodate these issues.

7. Contractor to consider the following with regard to shipment of materials on the river:
   a) Shipping of materials (by barge) in off peak periods in order to create flexibility (and reduce peaks) in vessel movements on the river (for example at high tide).
   b) Additional barges and/or lay down areas to be made available for temporary storage to facilitate the above.

8. Include in contract documents that no handling/stowing activities may be undertaken on board of construction activity related vessels prior to berthing and adequate mooring systems being implemented.

9. Contractor to prepare in advance of operations where applicable:
   a) Dedicated hoisting plan(s) for (special) heavy lifting operations (e.g. lifting with 2 cranes) or exceptional transport.
   b) Programming and planning of heavy lifting with Harbour Master (e.g. to define adequate time slots within the river traffic management system for undertaking the works).

c) Define and agree exclusion zones with regard to (heavy) lifting/hoisting operations with the Harbour Master as applicable.

10. Take working above water and diving operations into consideration in communication with relevant contractors. Make sure working above water, man overboard scenario and diving operations are covered fully.

11. Contractor to align night activities with Teesport (incl. obligations and restriction with regard to lighting). Obligations and restrictions with regard to lighting to be included into contract requirements.

12. Contractor to align lighting of barges, and lighting of all construction vessels, with regard to safe operations and requirements of Teesport (e.g. lighting on deck). Obligations and restrictions with regard to lighting of vessels to be included in contract requirements.

13. Contractor to provide a permanent stand-by safety vessel to offer support for rescue / assistance over the full construction period.

14. All construction traffic will act as normal traffic and report their intentions in time and behave as such with rights and obligations equal to all other traffic. There are no additional delays foreseen by the operational management and support services. Any (manoeuvring) activities considered not safe will not be accepted.

Annex 1

Construction Phase Safety Assessment – Risk Assessment

Construction phase Safety Assessment (CSA), York Potash Ltd.
Version: REV 1 - For comments
Date August 14, 2015

CONSTRUCTION HAZARDS		HAZARD IDENTIFICATION			ACTIONS and RISK CONTROL	RISK ASSESSMENT						ACTIONS and RECOMMENDATIONS		
Incident Category		Failure Cases, Threats and Consequences			Actions and Risk Control Measures	Residual Risk Level						Discussion topics		
						Prob. (Pr.)	Consequence (C)				Risk (R)			
No.	Incident Category	Failure Case	Cause	Consequence	Mitigating Measures	Probability	People	Assets	Environment	Reputation	Residual Risk	No.	Actions and Recommendations	Action Owner
						A-E	1-5	1-5	1-5	1-5	R			
1	**Interfaces**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**
	Concurrent operations - on site	Concurrent operations due to construction activities: multiple activities on confined spaces with physical limitations (e.g. contractors working next to/on top of each other)	Dredging, piling, deck construction, transport/lay down of materials/equipment, hoisting and lifting	No impact on river traffic Personal injuries on site Dropped objects, damaged equipment	Project management Project planning Project HSE Management (covering all construction activities) Construction HSE Plan(s) of Contractors shall include: - All construction vessels to be in contact with the Harbour Master through VTS system - Construction vessel movements within the River to be undertaken within booked slots with the Harbour Master - For shipping movements in the navigable channel a pilot is to be on board the vessel, including dredgers.	B	1	1	1	1	2.0	1	Concurrent operations are dedicated to construction activities only (no impact on river traffic); to be managed by main/principle contractor (to be assigned in Contract). Ensure preparation of: - Overall project HSE Management Plan - Concurrent Operations plan (e.g. bridging document) - Contractors to prepare own Construction HSE Plan(s)	RHDHV
	Concurrent operations w.r.t. river traffic	Obstruction of (passing) vessels along the river due to (moving, fixed) vessels in working areas around the berth and others transporting materials up and down the River.	High number of (construction activity related) vessel movements Obstruction of waterway, e.g. by (limited manoeuvrable) dredging vessel Communication failure	Ship collision (e.g. with barges) Traffic Delays, waiting time Grounding	The majority of berth construction operations are expected to take place outside of the navigational channel. Vessel movements accommodated into river movements planning without adverse impact. Notice to Mariners (by Teesport). Contractor to stand down marine plant in certain circumstances as dictated by PM and/or Harbour Master (particularly hazardous vessel movements in the River, etc.) and brought to the side of the channel as necessary – NWL possibly used as a layby berth During the construction phase (seagoing) vessels navigating the River may be able to sail toward the centre of the channel maximising the distance to the construction activities to reduce the risk of collision. Speed restrictions as deemed necessary by the Harbour Master could be implemented for vessels passing the construction site. Tug standby to move backhoe as/when necessary; selection of dredging equipment with least impact (backhoe fixed (spud), self propelled, or anchored/mooring lines). The dredger could be relocated for a given period around high tide away from the main channel, thereby freeing up access to the larger vessel which require deeper water. Impact on vessel movement along the river: - Vessel movements associated with the berth construction (relatively low) - Vessel sizes are generally small (no tidal restrictions)	B	2	3	1	2	6.0	2	Basically, towed barges will not be used. Barges shall be self-propelled as much as possible; minimise use of non-self propelled barges, because barges being towed by tugs form an additional hazard.	RHDHV
		Incident (or delay) due to increase of vessel movements due to construction activities	Peak vessel movements estimated at 367 per month (12 movements per day)	Congestion Collisions (barge-passing vessel-dredging vessel, etc.) Impact on vessel movements along the river: - Traffic Delays - Ship collision - Grounding		C	1	2	1	1	5.0			
	Communication	Lack of communication with/to: - between contractors - Teesport - terminals/operators, located and operating at the river - community	Underestimation of impact of no communication	Disturbed relationship Financial claims No/Delayed/Withdrawal of permit(s) Delays	VHF channel 14 Own channel for contractors Alignment of concurrent operations Regular meetings with Teesport Project coordination meetings Periodic alignment meetings with PM, other contractors, Harbour Master to plan / inform progress and sequences of work	C	1	2	1	2	5.0	3	Make sure communication is in the contract (communication plan is part of contract) Align expectations of stakeholders; include stakeholder management in Contract	RHDHV
		Incident due to miscommunication: - passing vessel - construction vessel - inter construction vessel	Increase of communication (by VHF channel 14)		PtW system in place Assign main contractor w.r.t. communication	B	1	1	1	1	2.0			

Version: REV 1 - For comments
Date August 14, 2015

CONSTRUCTION HAZARDS		HAZARD IDENTIFICATION			ACTIONS and RISK CONTROL	RISK ASSESSMENT						ACTIONS and RECOMMENDATIONS		
Incident Category		Failure Cases, Threats and Consequences			Actions and Risk Control Measures	Residual Risk Level						Discussion topics		
No.	Incident Category	Failure Case	Cause	Consequence	Mitigating Measures	Prob. (Pr.)	Consequence (C)				Risk (R)	No.	Actions and Recommendations	Action Owner
						Probability	People	Assets	Environment	Reputation	Residual Risk			
						A-E	1-5	1-5	1-5	1-5	R			
2	**Preparations**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**
	Demolition	NA				A	1	1	1	1	1.0			
	Prefabrication work	NA				A	1	1	1	1	1.0			
	Survey and diving operations (water-side)	Congestion due to ground survey Diving: NA	Presence of survey/dredging vessel Excessive wind/current Manoeuvring error Human failure or fatigue Communication failure	Collision ship with survey vessel Grounding Contact with object Restricted traffic due to diving activities	Survey planning NtM by Teesport w.r.t. survey activities	C	1	2	1	1	5.0			
3	**Staffing and Time planning**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**
	Staffing	No staff / no contractors available Strike Bankruptcy of contractor	Non availability of staff/contractor Peak season Contractual issues Commuting issues	No impact on river traffic No staff available Project delays Financial claims	Contractor pre-selection Use of qualified, reliable contractors Project staff planning Compound with proper infrastructure (road, ferry, etc.)	A	1	3	1	1	3.0			
	Time Pressure	Planning under pressure	Challenging planning	Time pressure Taking shortcuts	Project planning Continuous communication	B	1	2	1	1	4.0			
	Timing of Construction	Delay of construction activities leading to prolonged stand still (e.g. more than 5 days)	Deferment Not meeting lead time Transport issues Lack of staff/resources	Project delay Financial claims	Project manager to ensure staffing and planning Monitored and adjusted accordingly at all times	A	1	2	1	1	2.0			
	Seasonality	Adverse weather conditions	Adverse weather conditions	Project delay Financial claims	Project planning Daily weather forecast (1 week ahead) Restrictions w.r.t. adverse weather	B	1	2	1	1	4.0			
	Permits	No permits available (e.g. MMO, Works & Rivers licence)	Not applied for Non compliance	Project delay Financial claims	Permits applied for Staffing w.r.t. Licences to Operate	B	1	4	1	1	8.0			
4	**Transport of materials Location of activities**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**
	Transport of materials and equipment	No import or transport of materials or equipment	No/lacking transport equipment No/lacking infrastructure	Project delay Financial claims	Materials handling equipment (ship loaders and conveyor modules) to be imported by sea to the site. Equipment imported via the River instead of by road.	B	1	3	1	1	6.0	**4**	Consider direct delivery to site (when practical, e.g. precast units) and intermediate stocks at site (e.g. 1 or days stock)	RHDHV
	Dimensions of materials and equipment (handling, weight)	Constraints with delivery of materials behind the jetty, e.g. due to size, dimension or weight	Movement of barges (Heavy) Lifting Lift off	Personal injuries Transport accidents Delays, waiting time	Large order items such as piles and precast units will be imported by sea to the construction compound and then transhipped in smaller barges back to the site. Vessel movements are maximised by assuming that materials are delivered by vessel to the compound and then transhipped to the site in smaller barges.	A	2	3	1	1	3.0			
	Location of activities	Not sufficient working area's	No area's available	Project delay Financial claims	Construction of the berth structures is typically undertaken by marine plant. This maximises the working areas required in the river by excluding the option of undertaking the construction from the landside.	A	1	2	1	1	2.0			
	Construction compound	Not sufficient construction compounds or yards	No area's available	Project delay Financial claims	The Contractor establishes a construction compound / yard on the River upstream of Tees Dock at Cochranes Wharf. An off-site compound will increase vessel movements (material transhipment and staff / labour movements) along the most trafficked lengths of the River. Identification of this compound does not infer any discussions with the owner of the site. It has been selected as an example of numerous potential sites on the River Tees.	A	1	3	1	1	3.0			
	Lay-down area (compounds, sites)	Not sufficient lay down areas	No area's available	Project Delay Financial claims		A	1	2	1	1	2.0			

Royal HaskoningDHV	**Version:**	**REV 1 - For comments**															
	Date	**August 14, 2015**															
CONSTRUCTION HAZARDS		HAZARD IDENTIFICATION			ACTIONS and RISK CONTROL	RISK ASSESSMENT						ACTIONS and RECOMMENDATIONS					
Incident Category		**Failure Cases, Threats and Consequences**			**Actions and Risk Control Measures**	**Residual Risk Level**						**Discussion topics**					
No.	**Incident Category**	**Failure Case**	**Cause**	**Consequence**	**Mitigating Measures**	**Prob. (Pr.)**	**Consequence (C)**				**Risk (R)**	**No.**	**Actions and Recommendations**	**Action Owner**			
						Probability	**People**	**Assets**	**Environment**	**Reputation**	**Residual Risk**						
						A-E	**1-5**	**1-5**	**1-5**	**1-5**	**R**						
5	**Construction activities**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**			
	Dredging Phase 1: dredging in berth area; approx. 100,000 m3 to dredge in the navigable river channel	Incident due to dredging of the navigable river channel;	Barge movements to the disposal sites. See Vessels movements table: in month 4 peak of 165 calls per month (1+74+90), i.e. 330 additional moves per month (appr. 12 moves/day) Limited manoeuvrable dredging vessel Excessive wind/current Poor visibility Manoeuvring error Engine/rudder failure Human failure or fatigue (captain/pilot) Communication failure	Passing vessel running into dredger Impact on vessel movement along the river: - Vessel movements associated with the berth construction - Vessel sizes are generally small (no tidal restrictions) Ship-dredging vessel collision Grounding	Capital dredging of the sands, gravels and clays is likely to be undertaken by Trailing Suction Hopper Dredger (TSHD). The dredged material would be disposed of to offshore disposal sites by the dredger. Capital dredging of the mercia mudstone is likely to be undertaken by a Backhoe Dredger. The dredge material would be loaded into hopper barges by the backhoe and taken to offshore disposal sites. Vessel movements accommodated into river movements planning without adverse impact Notice to Mariners (by Teesport) During the construction phase vessels navigating the River may be able to sail toward the centre of the channel maximising the distance to the construction activities to reduce the risk of collision Speed restrictions as deemed necessary by the Harbour Master could be implemented for vessels passing the construction site Tug standby to move backhoe as/when necessary; selection of dredging equipment with least impact (backhoe fixed (spud), self propelled, or anchored/mooring lines). The dredger could be relocated for a given period around high tide away from the main channel, thereby freeing up access to the larger vessel which require deeper water Salvage equipment standby	B	1	2	1	1	4.0	5	Ensure: - location of berthing of all vessels (e.g. barges), including 'stand-by/empty' vessels - proper mooring facilities, incl. instructions ship-ship mooring (max number, side by side) - dredger does allow traffic to pass without significant delay	RHDHV			
	Dredging Phase 2: increase to 400,00m3 and generally involves removal mercia mudstone (rock)	Incident due to dredging of the navigable river channel;	Barge movements to the disposal sites See Vessels movements table: in month 3 peak of calls : 90 calls per month (i.e. 180 moves/month; 6 moves/day) Limited manoeuvrable dredging vessel Excessive wind/current Poor visibility Manoeuvring error Engine/rudder failure Human failure or fatigue (captain/pilot) Communication failure	Impact on vessel movement along the river: - Vessel movements associated with the berth construction are relatively low - Vessel sizes are generally small (no tidal restrictions) Ship-dredging vessel collision Grounding		B	1	2	1	2	4.0						
	Piling	Incident at piling works, undertaken to provide the foundation for the quay structure. The works would involve the driving or socketing of imported steel tubular piles (approx. 914mm diameter) into the underlying strata.	Equipment failure Human failure	Loss of life Dropped objects (on land, in water) Damage to assets	Piles will be imported by sea in a 5,000DWT coaster which will unload at the Contractors compound on the River Tees. As required by the construction sequence a group of the piles will then be transferred onto the pile support barge which will sail downstream to the site for installation. The majority of berth construction operations are expected to take place outside of the navigational channel.	B	1	2	1	1	4.0	6	Check planning of piling, as piling is maybe not possible in April/May due to environmental constraints (e.g. salmon, breeding season)	RHDHV			
	Deck construction	Incident at import of precast concrete beam and plank units, e.g. failure of floating crane. Insitu concrete pours undertaken to stitch together the precast concrete elements and provide a deck topping.	Open form of berth construction (piled suspended deck)	Initial assessment of open and closed forms of construction indicates that the open form will generate the greater number of vessel movements due to movements associated with precast deck construction being higher than for import of fill material and the additional volume of dredging	It is assumed that the precast elements will be imported by sea in a 5,000DWT coaster which will unload at the Contractors compound on the River Tees. As required by the construction sequence a number of the precast elements will then be transferred onto a support barge which will sail downstream to the site for installation. The majority of berth construction operations are expected to take place outside of the navigational channel.	A	1	2	1	1	2.0						
	Topsides installation	Incident at topsides installation (fender units, bollards or crane rail system)	Equipment failure Human failure	Loss of life Dropped objects (on land, in water) Damage to assets	It is assumed that the topsides elements will be imported by sea in up to 5,000DWT coaster vessels which will unload at the Contractors compound on the River. As required by the construction sequence a number of the topsides elements will then be transferred onto a support barge which will sail downstream to the site for installation.	B	2	2	1	1	4.0	7	Consider: - Shipping of materials (by barge materials) in off peak periods in order to create flexibility (and reduce peaks) in vessel movement at the river (for example at high tide) - Have some extra barges and/or lay down areas available for temporary storage	RHDHV			
	Materials Handling equipment installation	Incident with ship loaders or conveyor module	Equipment failure Human failure	Loss of life Dropped objects (on land, in water) Damage to assets	It is assumed that the ship loaders and conveyor modules will be imported by sea in specialist vessels which will unload at the site. It is anticipated that the ship loaders will be offloaded directly onto a complete section of the quay and the conveyor modules will either be offloaded via the completed section of quay or temporary facility (possibly the NWL Jetty).	B	2	2	1	1	4.0						
6	**Hoisting and Lifting**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**			

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	Date	**August 14, 2015**																
CONSTRUCTION HAZARDS		HAZARD IDENTIFICATION			ACTIONS and RISK CONTROL	RISK ASSESSMENT						ACTIONS and RECOMMENDATIONS						
Incident Category		**Failure Cases, Threats and Consequences**			**Actions and Risk Control Measures**	**Residual Risk Level**						**Discussion topics**						
No.	**Incident Category**	**Failure Case**	**Cause**	**Consequence**	**Mitigating Measures**	**Prob. (Pr.)**	**Consequence (C)**				**Risk (R)**	**No.**	**Actions and Recommendations**	**Action Owner**				
						Probability	**People**	**Assets**	**Environment**	**Reputation**	**Residual Risk**							
						A-E	**1-5**	**1-5**	**1-5**	**1-5**	**R**							
	Dropped objects	Dropped object due to hoisting incident, for example due to wind, waves or passing traffic (wash) Loss of cargo on deck (e.g. piles from a barge/coaster)	Equipment failure Human failure	Objects (e.g. piles) blocking river passage Loss of life Dropped objects (on land, in water) Obstruction of waterways Damage to assets	Basic hoisting activities are covered by existing procedures HSE plans Good seamanship (stowing)	B	2	2	1	1	4.0	8	Ensure in contract documents: no handling/stowing activities on board of construction activity related vessels, before moored/berthed	RHDHV				
	Heavy loads/ heavy lifting	Heavy lift incident due to wind, wash due to passing traffic	Adverse weather conditions Equipment failure Human failure	Loss of life Dropped objects (on land, in water) Obstruction of waterway Damage to assets	In case of heavy loads or exceptional transport, a dedicated transport/hoisting plan is to be prepared (incl criteria for adverse weather) Programming and planning of heavy lifting i.c.w. Harbour Master w.r.t. passing vessels (e.g. time slots for river traffic) Good Seamanship (stowing, handling)	B	2	2	1	1	4.0	9	Prepare when applicable: dedicated hoisting plan(s) for (special) heavy lifting operations, e.g. lifting with 2 cranes, or exceptional transport. Ensure programming and planning of heavy lifting with Harbour Master (e.g. define time slots for river traffic) Define exclusion zones w.r.t. (heavy) lifting/hoisting operations	RHDHV				
7	**Occupational Health and Safety**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**				
	Hazardous Chemicals	NA			Any hazards assessed in Contractors' HSE Construction plan, incl.: - Proper labelling and marking of hazardous chemicals - Use of PPE - Safety Data Sheets available and understood	A	1	1	1	1	1.0							
	Working Above Water	Working/falling overboard	Time pressure (taking risks) Weather conditions Loss of balance Horse play	Man overboard, drowning SAR, delays	Hazards managed by Contractors, a.o.: - Overboard work only allowed during daylight - Safety boat/MOB equipment	B	4	1	1	1	8.0	10	Take working above water and diving operations into consideration in communication with relevant contractors. Make sure working above water, man overboard scenario and diving operations are covered fully	RHDHV				
	Working on Elevation	NA			Hazards managed by Contractors, a.o: - Scaffolding - Working instructions	A	1	1	1	1	1.0							
	Working near hazardous areas	NA				A	1	1	1	1	1.0							
	Noise	NA				A	1	1	1	1	1.0							
	Work in Confined Spaces	NA			Hazards managed by Contractors, a.o.; - (Special) Permit to Work - Use of PPE	A	1	1	1	1	1.0							
	Diving operations	Basically not required, but maybe due in unexpected circumstances (e.g.. Additional survey, inspection, or rescue operations)	Unexpected circumstances (e.g.. additional surveys or inspection, or rescue operations)	Shipping slowing down Obstruction to passing traffic Delays	Hazards managed by diving contractor (diving plan), including: - Diving work only allowed during daylight - No fishing	B	1	2	1	1	4.0							
	Waste disposal	No possibility for disposal of dredged materials	No disposal options	Disposal of dredged material to offshore disposal sites.	Disposal of dredged materials with barges. For both Phases 1 and 2 it is proposed that dredging of the silts would be undertaken using enclosed grabs due to elevated concentrations of contaminants present within the sediment. There are a number of options for the disposal of the contaminated silts, however, for the purposes of this note it is assumed that they are transported by barge to a treatment facility to be processed to reduce the levels of contaminate to safe levels for reuse or landfill.	B	1	1	1	1	2.0							

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Incident Category		**Failure Cases, Threats and Consequences**			**Actions and Risk Control Measures**	**Residual Risk Level**						**Discussion topics**							
No.	**Incident Category**	**Failure Case**	**Cause**	**Consequence**	**Mitigating Measures**	**Prob. (Pr.)**	**Consequence (C)**				**Risk (R)**	**No.**	**Actions and Recommendations**	**Action Owner**					
						Probability	**People**	**Assets**	**Environment**	**Reputation**	**Residual Risk**								
						A-E	**1-5**	**1-5**	**1-5**	**1-5**	**R**								
8	**External threats**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**					
	Lighting	Insufficient working light during nightshifts	Too little lighting	Loss of life Damage to assets	Proper lighting Align night activities (incl lighting) with Teesport	B	2	2	1	1	4.0								
		Navigation lights not visible (for passing vessels) due to lighting of construction site (during night operations)	Too much lighting	Grounding Collision	Proper lighting Align night activities (incl lighting) with Teesport	B	3	3	1	1	6.0	11	Align night activities with Teesport (incl. obligations and restrictions w.r.t. lighting). Ensure obligations and restrictions w.r.t. lighting in Contracts	RHDHV					
		Insufficient lighting of barges (either in operation, or barges moored / standby)	Insufficient (navigation/work) lighting of barges	Loss of life Damage to assets	Proper lighting of barges Align night activities (incl lighting) with Teesport	B	3	2	1	1	6.0	12	Align lighting of barges, and lighting of all construction vessels, w.r.t. adequacy; Align requirements with Teesport (e.g. lighting on deck) Put obligations and restrictions in Contracts	RHDHV					
9	**Other**	**Failure Case**	**Cause**	**Consequence**	**Actions and Risk Control Measures**	**Pr.**	**P**	**A**	**E**	**R**	**Risk**	**No.**	**Actions and Recommendations**	**Action Owner**					
	Barge coming loose (unintended)	Barge coming loose (unintended) and drifting (unpowered) on river	Adverse weather Human failure Technical failure	Ship collision with unpowered barge	VTS Inform Teesport VHF channel 14 Salvage (tugs)	B	1	3	1	1	6.0								