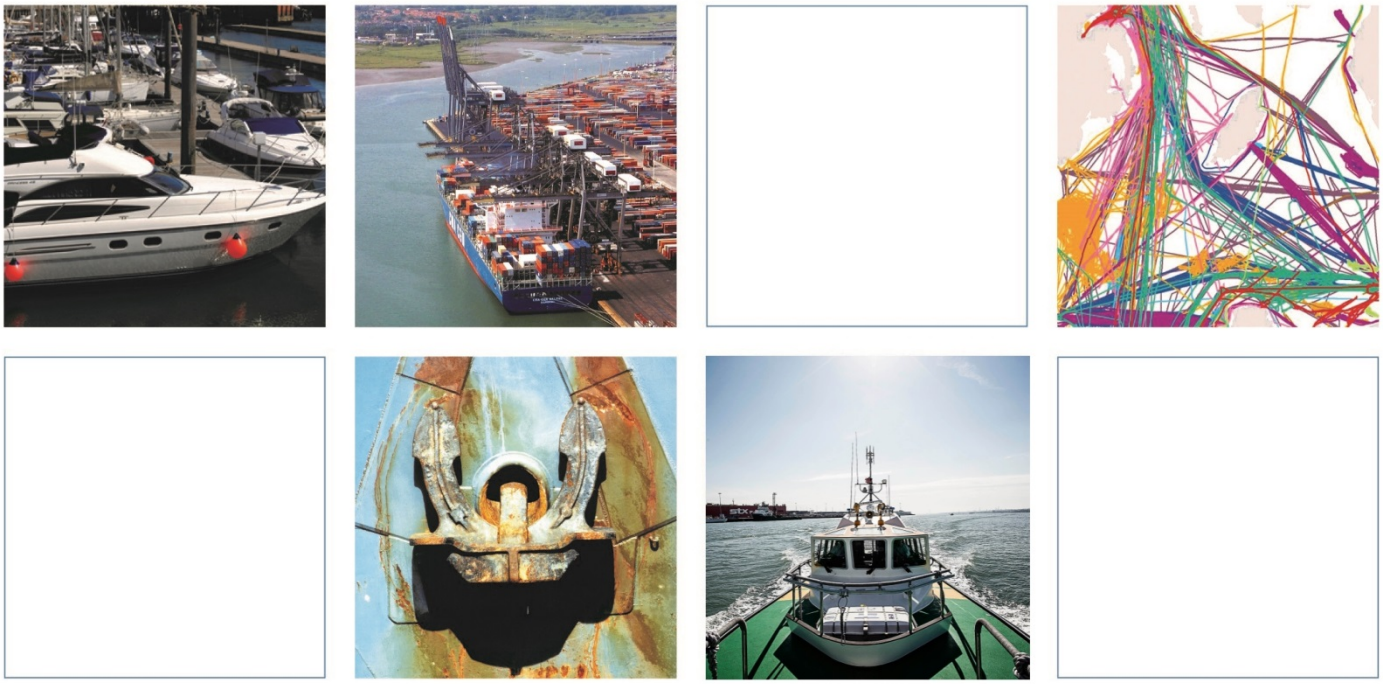
Peel Ports Group

Mersey Maintenance Dredge Protocol (MDP) Baseline Update

Water Framework Directive (WFD) Compliance Assessment

November 2021



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Document Information

Document History and Authorisation		
Title	Mersey Maintenance Dredge Protocol (MDP) Baseline Update	
	Water Framework Directive (WFD) Compliance Assessment	
Commissioned by	Peel Ports Group	
Issue date	November 2021	
Document ref	R.3749	
Project no	R/5010/1	
Date	**Version**	**Revision Details**
07/10/2021	1	Issued for client review
02/11/2021	2	Issued for client use
29/11/2021	3	Issued for consultation

Prepared (PM)	Approved (QM)	Authorised (PD)
Elena San Martin	Natalie Frost	Stephen Hull
	 Pp	

Suggested Citation

ABPmer, (2021). Mersey Maintenance Dredge Protocol (MDP) Baseline Update, Water Framework Directive (WFD) Compliance Assessment, ABPmer Report No. R.3749. A report produced by ABPmer for Peel Ports Group, November 2021.

Notice

ABPmer
Quayside Suite, Medina Chambers, Town Quay, Southampton, Hampshire SO14 2AQ
T: +44 (0) 2380 711844 W: http://www.abpmer.co.uk/

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1 Introduction

1.1 Project overview

ABPmer was commissioned by Peel Ports Group to update the Mersey Maintenance Dredge Protocol (MDP) Baseline Document, as well as prepare a Water Framework Directive (WFD) compliance assessment to determine whether maintenance dredging and disposal activities undertaken in the Mersey Estuary comply with the objectives of the WFD.

This report presents the WFD compliance assessment and is supported by a range of relevant environmental information which is included in the updated Mersey MDP Baseline Document (ABPmer, 2021). The Baseline Document also provides current and historical information on dredging activities in the Mersey, its approaches, and impounded dock systems. The Baseline Document should be read alongside this WFD compliance assessment. The assessment is based on the potential effects associated with the maximum total annual quantity of material that has been maintenance dredged from the Mersey and its approaches since 2002 as a worst case (i.e. 3.1 million hopper tonnes in 2007). In addition, the effects of other forms of dredging that do not involve the removal of sediment (i.e. WID and plough dredging) have also been assessed.

Figure 1 shows the location of the surrounding WFD water bodies. Figure 2 to Figure 8 show the location of the maintenance dredge areas and disposal sites within the study area.

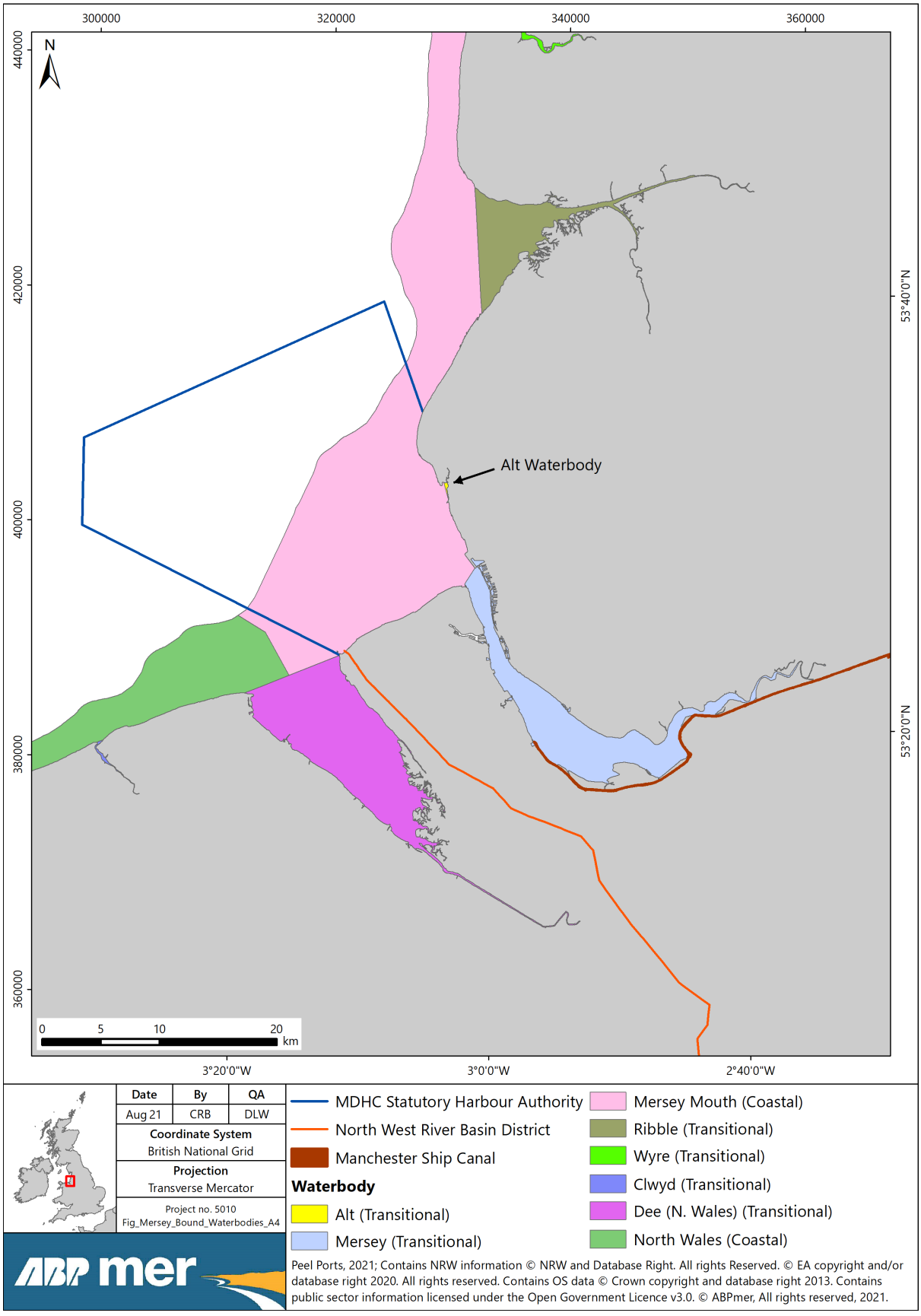


Figure 1. **Study area WFD water bodies**

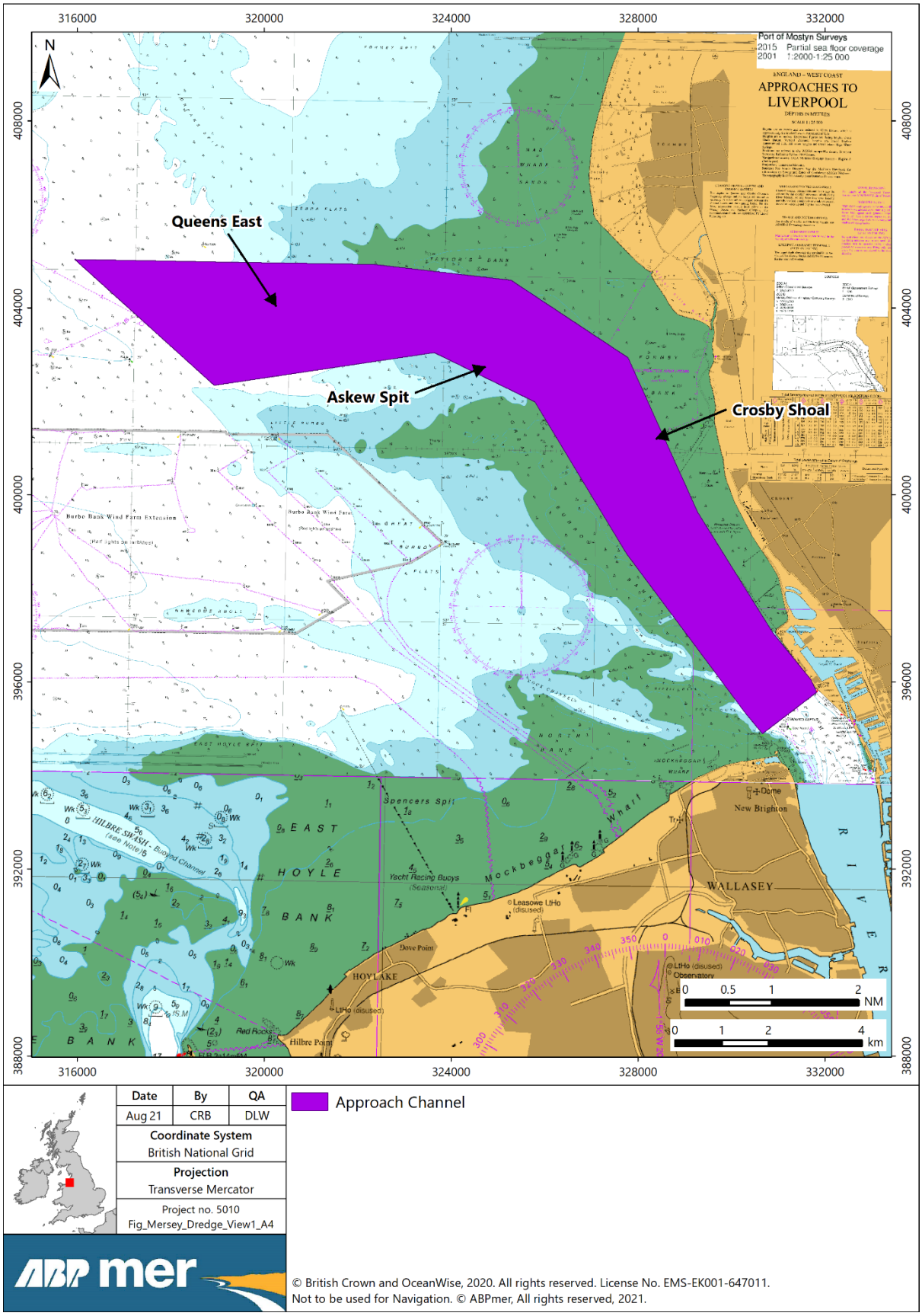
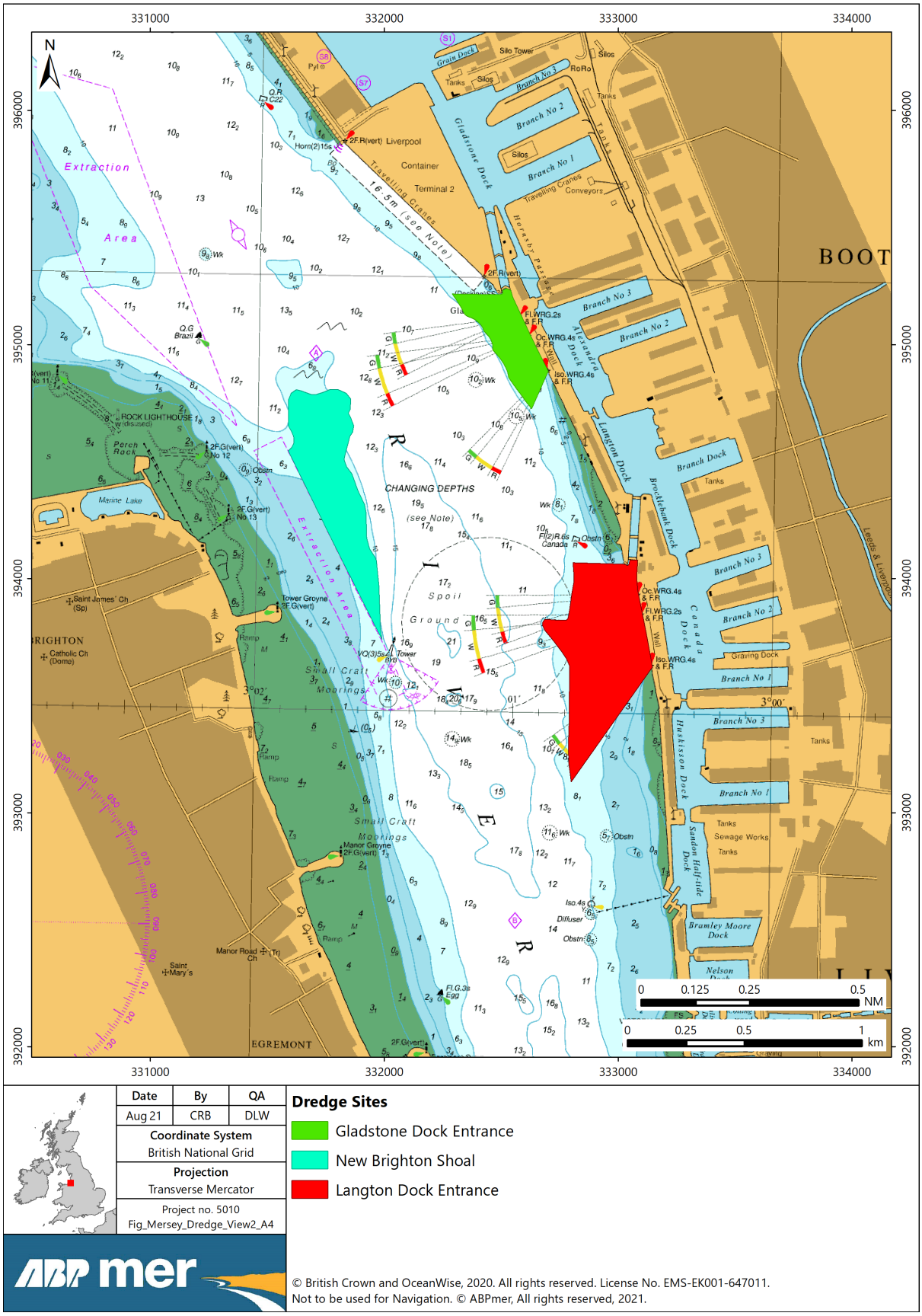


Figure 2. The Mersey Approach Channel dredge area



Date	By	QA
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Coordinate System
British National Grid

Projection
Transverse Mercator

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Dredge Sites

- Gladstone Dock Entrance
- New Brighton Shoal
- Langton Dock Entrance

Figure 3. Dredge locations at the Mersey Mouth

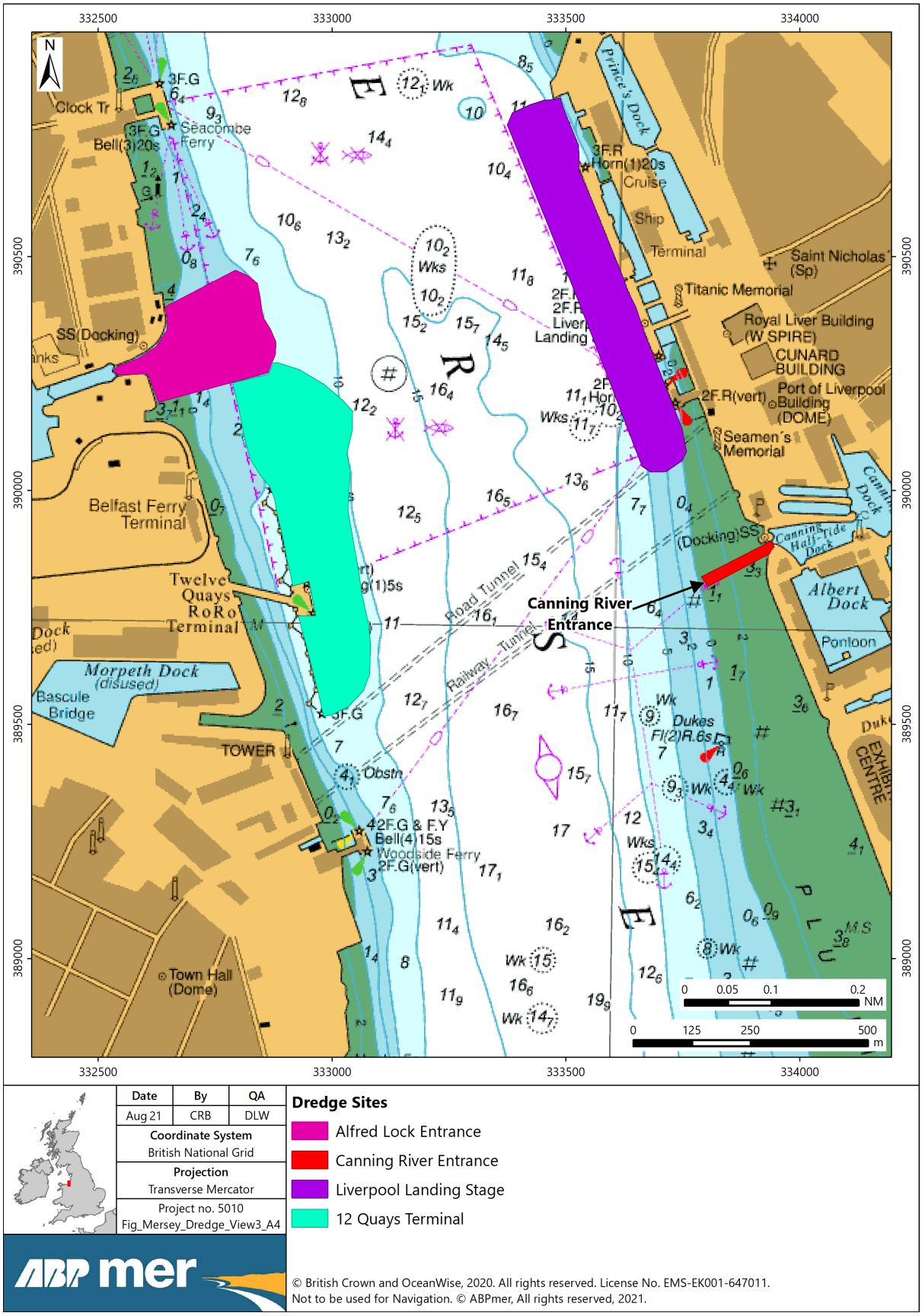

Figure 4. **Dredge locations adjacent to the Twelve Quays Terminal and Liverpool Landing Stage**

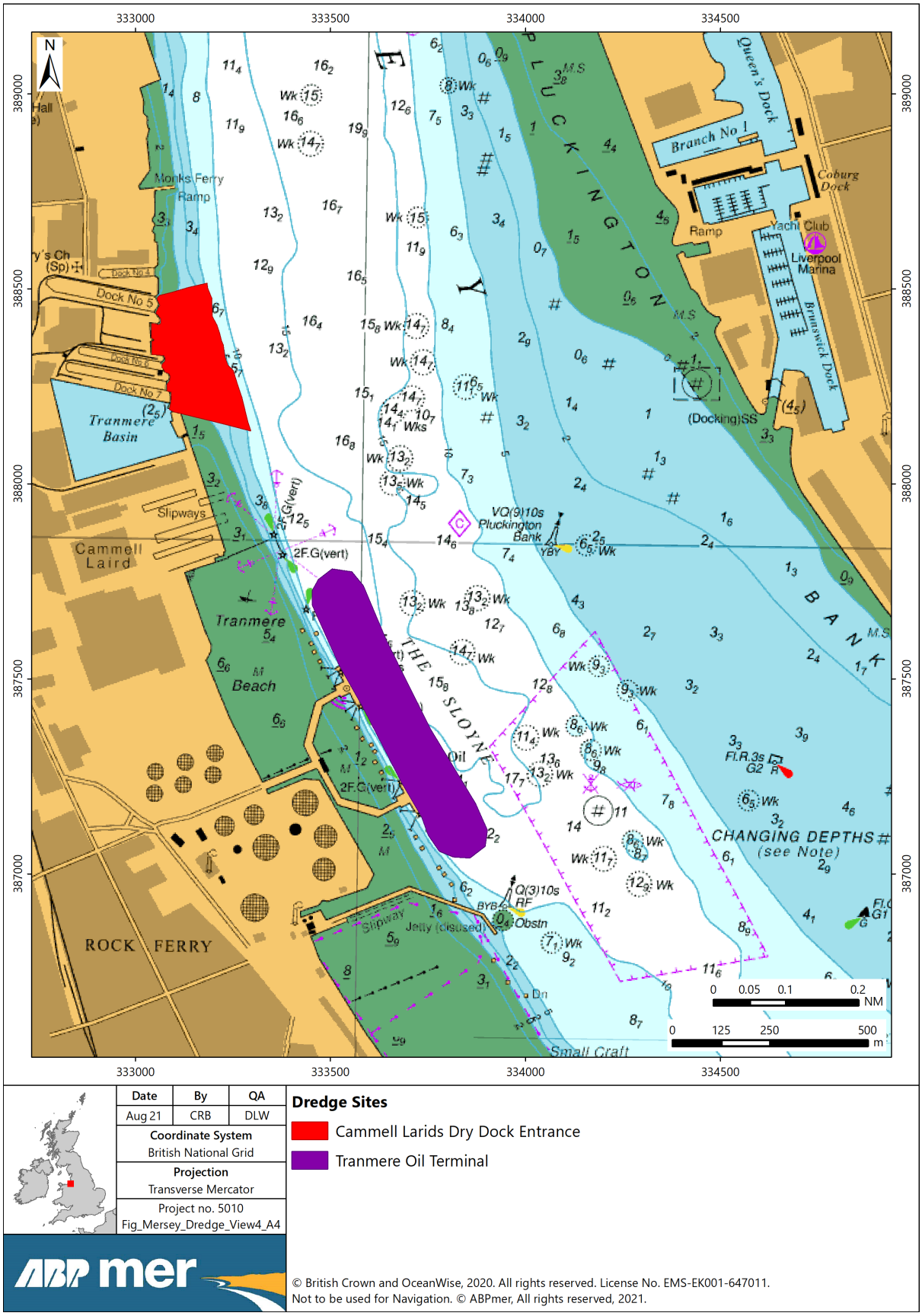

Figure 5. **Dredge locations adjacent to the Tranmere Oil Terminal**

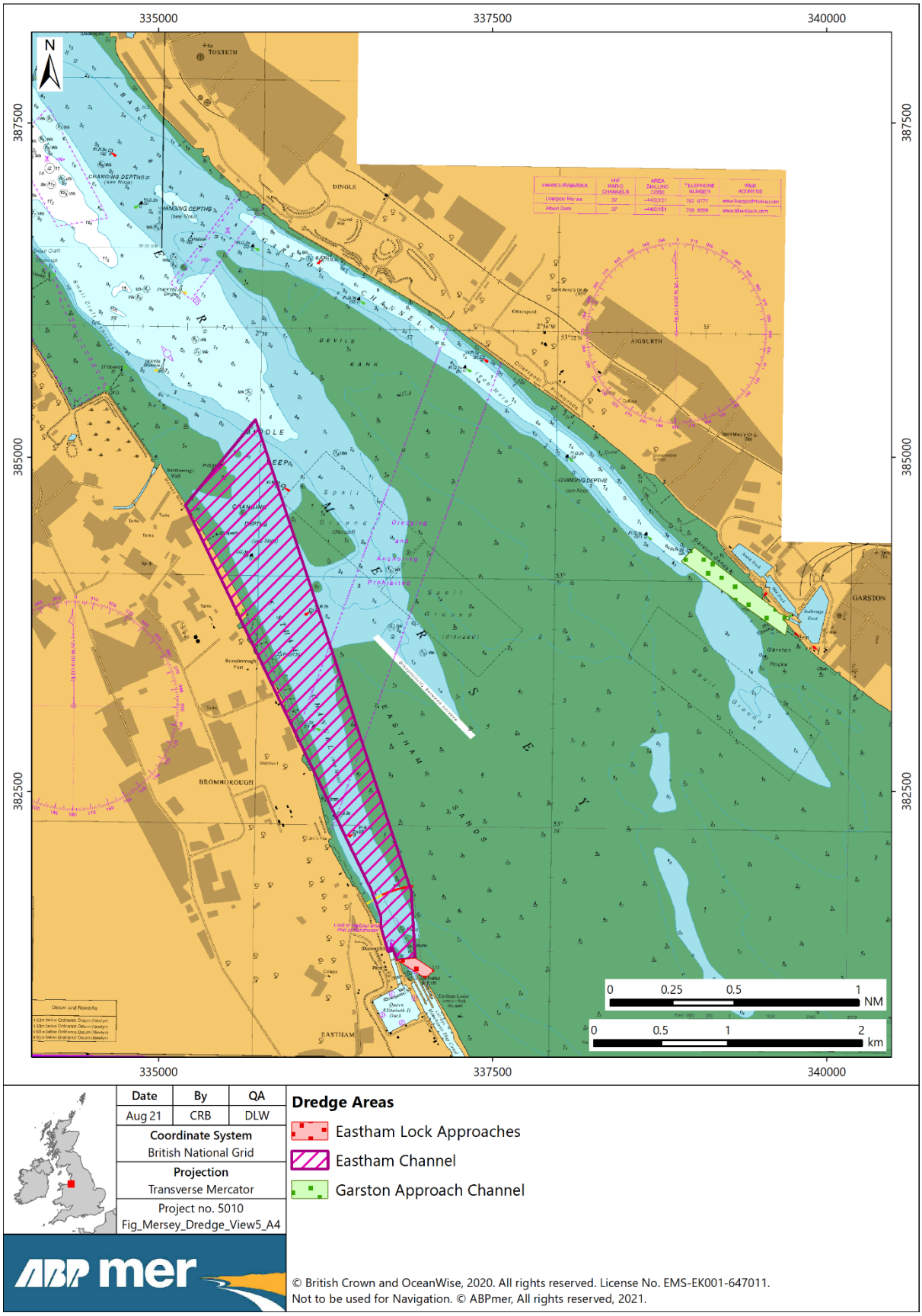

Figure 6. Dredge locations adjacent to the Manchester Ship Canal and Garston Docks

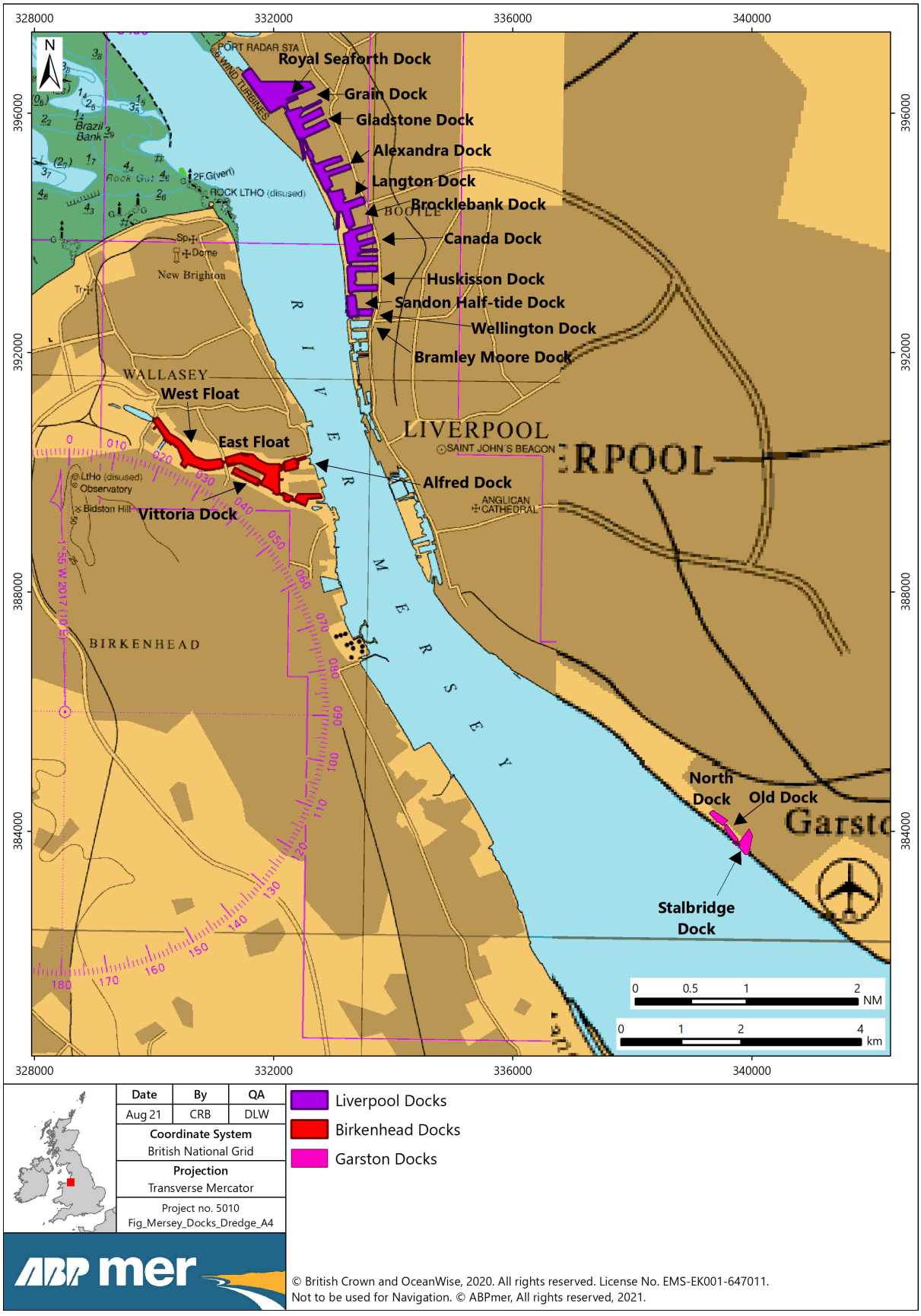

Figure 7. Dredge locations in the Liverpool and Birkenhead Dock areas

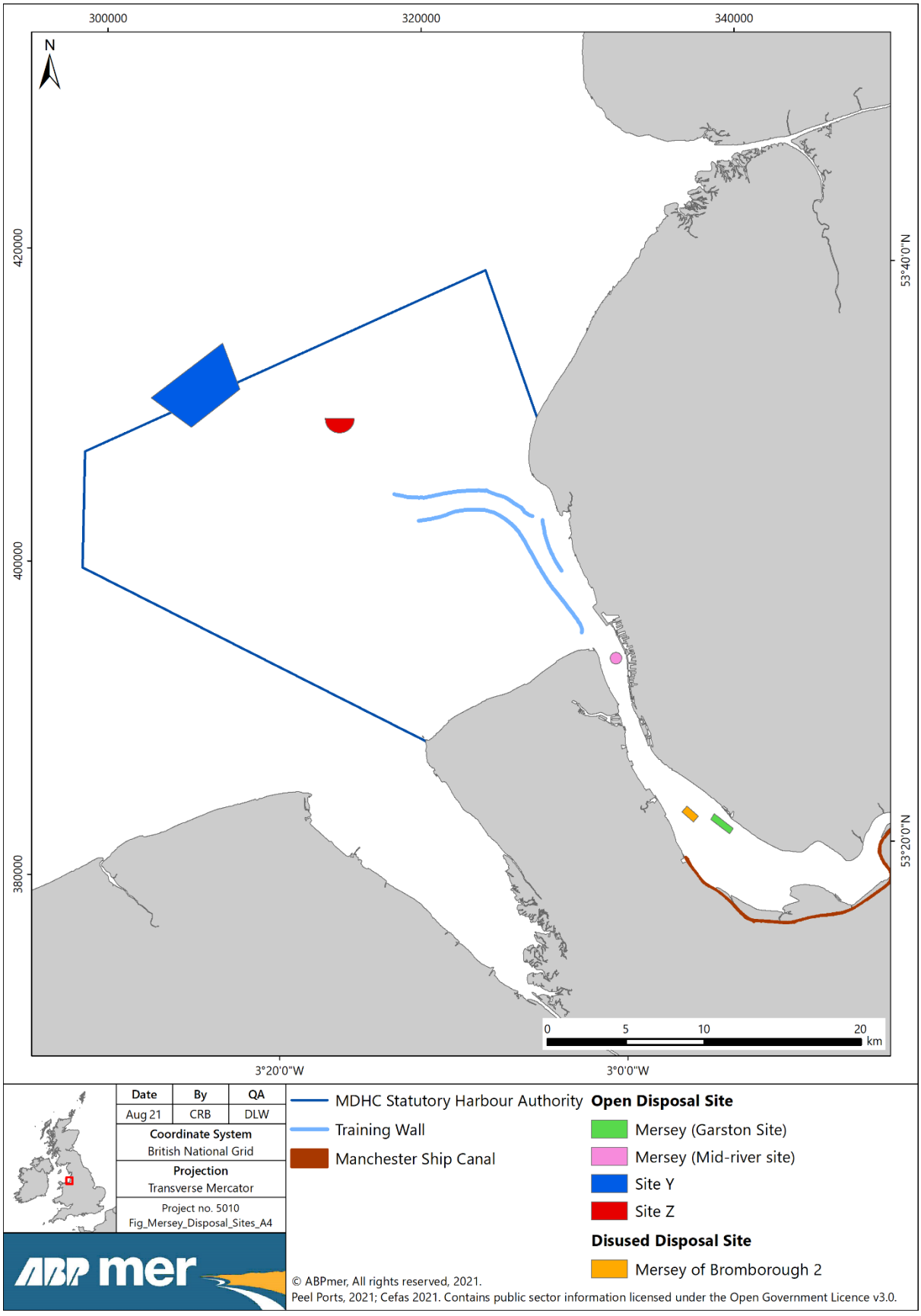

Figure 8. Dredge disposal locations within the study area

1.2 Water Framework Directive

The WFD (2000/60/EC) came into force in 2000 and establishes a framework for the management and protection of Europe's water resources. It is implemented in England and Wales through the Water Environment (WFD) (England and Wales) Regulations 2017 (the Water Framework Regulations)[1] (as amended). The overall objective of the WFD is to achieve good status (GS) in all inland, transitional, coastal and ground waters by 2021, unless alternative objectives are set and there are appropriate reasons for time limited derogation.

The WFD divides rivers, lakes, lagoons, estuaries, coastal waters (out to one nautical mile from the low water mark), man-made docks and canals into a series of discrete surface water bodies. It sets ecological as well as chemical targets (objectives) for each surface water body. For a surface water body to be at overall GS, the water body must be achieving good ecological status (GES) and good chemical status (GCS). Ecological status is measured on a scale of high, good, moderate, poor or bad, while chemical status is measured as good or fail (i.e. failing to achieve good).

Each surface water body has a hydromorphological designation that describes how modified a water body is from its natural state. Water bodies are either undesignated (i.e. natural, unchanged), designated as a heavily modified water body (HMWB) or designated as an artificial water body (AWB). HMWBs are defined as bodies of water which, as a result of physical alteration by sustainable human use activities (such as flood protection and navigation) are substantially changed in character and cannot therefore meet GES. AWBs are artificially created through human activity. The default target for HMWBs and AWBs under the WFD is to achieve good ecological potential (GEP), a status recognising the importance of their human use while ensuring ecology is protected as far as possible.

The ecological status/potential of surface waters is classified using information on the biological (e.g. fish, benthic invertebrates, phytoplankton, angiosperms and macroalgae), physico-chemical (e.g. dissolved oxygen and salinity) and hydromorphological (e.g. hydrological regime) quality of the body of water, as well as several specific pollutants (e.g. copper and zinc). Compliance with chemical status objectives is assessed in relation to environmental quality standards (EQS) for a specified list of 'priority' and 'priority hazardous' substances. These substances were first established by the Priority Substances Directive (PSD) (2008/105/EC) which entered into force in 2009. The PSD sets objectives, amongst other things, for the reduction of these substances through the cessation of discharges or emissions.

As required by the WFD and PSD, a proposal to revise the list of priority (hazardous) substances was submitted in 2012. The PSD (and WFD) was amended in 2013[2] by identifying new priority substances, setting EQSs for those newly identified substances, revising the EQS for some existing substances in line with scientific progress and setting biota EQSs for some existing and newly identified priority substances. The Water Framework Regulations transpose the PSD into English law.

In addition to surface water bodies, the WFD also incorporates groundwater water bodies. Groundwaters are assessed against different criteria compared to surface water bodies since they do not support ecological communities (i.e. it is not appropriate to consider the ecological status of a groundwater). Therefore, groundwater water bodies are classified as good or poor quantitative status in terms of their quantity (groundwater levels and flow directions) and quality (pollutant concentrations and conductivity), along with chemical (groundwater) status.

[1] Modified by the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019 on 31 January 2020.

[2] OJEU (2013). Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

River Basin Management Plans (RBMPs) are a requirement of the WFD, setting out measures for each river basin district to maintain and improve quality in surface and groundwater water bodies where necessary. In 2009, the Environment Agency published the first cycle (2009 to 2015) of RBMPs for England and Wales, reporting the status and objectives of each individual water body. The Environment Agency subsequently published updated RBMPs for England as part of the second cycle (2015 to 2021), as well as providing interim water body classification results via the Environment Agency Catchment Data Explorer (http://environment.data.gov.uk/catchment-planning). Maintenance dredging activities undertaken to support the Mersey Estuary are located within the Mersey transitional, and Mersey Mouth coastal water bodies (see Figure 1) in the North West River Basin District which is reported in the North West RBMP (Environment Agency, 2016).

Consideration of WFD requirements is necessary for works which have the potential to cause deterioration in ecological, quantitative and/or chemical status of a water body or to compromise improvements which might otherwise lead to a water body meeting its WFD objectives. Therefore, it is necessary to consider the potential for the ongoing maintenance dredging works to impact WFD water bodies, specifically referring to the following environmental objectives of the WFD:

- Prevent deterioration in status of all surface water bodies (Article 4.1 (a)(i));
- Protect, enhance and restore all surface water bodies with the aim of achieving good surface water status by 2015 or later assuming grounds for time limited derogation (Article 4.1 (a)(ii));
- Protect and enhance all HMWBs/AWBs, with the aim of achieving GEP and GCS by 2015 or later assuming grounds for time limited derogation (Article 4.1 (a)(iii));
- Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances (Article 4.1 (a)(iv));
- Prevent or limit the input of pollutants into groundwater and prevent deterioration of the status of all groundwater water bodies (Article 4.1 (b)(i));
- Protect, enhance and restore all groundwater water bodies and ensure a balance between abstraction and recharge of groundwater (Article 4.1 (b)(ii));
- Ensure the achievement of objectives in other water bodies is not compromised (Article 4.8); and
- Ensure compliance with other community environmental legislation (Article 4.9).

The Environment Agency has published guidance ("Clearing the Waters for All") regarding how to assess the impact of activities in transitional and coastal waters for the WFD[3]. The guidance sets out the following three discrete stages to WFD compliance assessments:

- **Screening**: excludes any activities that do not need to go through the scoping or impact assessment stages (Section 2);
- **Scoping**: identifies the receptors that are potentially at risk from an activity and need impact assessment (Section 3); and
- **Impact Assessment**: considers the potential impacts of an activity, identifies ways to avoid or minimise impacts, and indicates if an activity may cause deterioration or jeopardise the water body achieving GS (Section 4).

[3] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters (Accessed August 2021).

2 Screening

2.1 Project description

The Mersey Estuary lies on the northwest coast of England and forms one of the largest estuaries in the UK. The estuary is tidal from the River Mersey at Howley Weir in Warrington to its mouth at Liverpool Bay (forming part of the Irish Sea; Figure 1). The conurbation on both sides of the Mersey is generally referred to as 'Merseyside' and includes the City of Liverpool and Widnes on the north (east) bank, and Wallasey, Birkenhead, Eastham, Ellesmere Port and Runcorn on the south (west) bank.

The Mersey Estuary has a long and established maritime heritage, with regular transport routes as far back as the Middle Ages. Liverpool saw the development of the world's first recorded commercial wet dock, known as the 'Old Dock'. Current port capacity in the Mersey Estuary comprises a suite of enclosed docks, riverside terminals and the Manchester Ship Canal. 'Liverpool Docks' is an interconnected dock system extending over 12 km and remains one of the biggest port estates in the UK. It is complimented by additional riverside berths, including the new Liverpool2 Terminal at Seaforth. Further upstream, at Garston, there are three more enclosed docks. Another sequence of enclosed interconnected docks on the Wirral Peninsula in Birkenhead provides further capacity, with riverside facilities at Twelve Quays (Birkenhead) and the Tranmere Oil Terminal.

The Manchester Ship Canal, which starts in the Mersey Estuary, is capable of taking ocean-going vessels. It provides an important inland transport link, offering access for shipping between the Mersey Estuary and Manchester. Together, the Port of Liverpool and Manchester Ship Canal offer a comprehensive range of port facilities, handling more than 41 million tonnes of cargo in 2019 (Port of Liverpool – 34.31 million tonnes; Manchester Ship Canal – 7.31 million tonnes; (Department for Transport, 2019)), with over 10,000 ship movements per year.

Sediment is constantly entering and departing the estuary, some of which settles in dredged channels, berthing pockets and in the enclosed dock system. Dredging is therefore required to remove recently deposited sediment. Most of the maintenance dredging occurs in the Outer Estuary in the approach channel and within the Manchester Ship Canal access channel in the Inner Estuary. The remainder of maintenance dredging occurs within the various enclosed dock systems, lock entrances and riverside berths.

2.2 Potentially affected water bodies

To determine which water bodies would potentially be affected by ongoing maintenance dredging and disposal activities, all surface and groundwater water bodies located within 5 km of the dredge areas and licenced marine disposal sites within and outside of the Mersey Estuary were recorded. On this basis, the following water bodies were screened in:

- Mersey transitional water body (ID: GB531206908100);
- Mersey Mouth coastal water body (ID: GB641211630001);
- Alt transitional water body (ID: GB531206908300);
- Dee (N. Wales) transitional water body (ID: GB531106708200);
- North Wales coastal water body (ID: GB641011650000);
- Ribble transitional water body (ID: GB531207112400);
- Wirral and Cheshire West Permo-Triassic Sandstone Aquafers groundwater body (ID: GB41101G202600);

- Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers (ID: 41201G101700);
- Manchester Ship Canal (ID: GB71210004);
- Leeds and Liverpool Canal, Wigan to Liverpool canal (ID: GB71210083); and
- The Birket including Arrowe Brook and Fender river (ID: GB112068060530).

The Dee (N.Wales) transitional water body (ID: GB531106708200), North Wales coastal water body (ID: GB641011650000), and Ribble transitional water body (GB531207112400) are within the study area; however, they have been screened out of this WFD assessment due to their boundary locations being more than 5 km from dredge areas and licensed marine disposal sites.

Numerous riverine (freshwater) water bodies drain into the transitional and coastal water bodies around the Mersey Estuary, while groundwater bodies lie beneath the terrestrial margins. These water bodies have also been screened out of this WFD assessment as maintenance dredging and disposal activities are unlikely to result in adverse effects (e.g. riverine water bodies are beyond the normal tidal limit (NTL) or behind a sluice/weir, and works are unlikely to result in saline intrusion for groundwaters).

Table 1 provides a summary of water body status (based on 2019 interim classifications) for the transitional and coastal water bodies screened into the WFD assessment. All three water bodies are currently failing to achieve GS as a result of moderate ecological potential and failing chemical status. In terms of chemical status, of those water bodies assessed, the priority hazardous substance Mercury and its compounds was reported as 'fail' for all three water bodies, as was Polybrominated diphenyl ethers (PBDEs). The overall, ecological and chemical status/potential is determined by the "one-out, all-out" principle, whereby the poorest individual parameter classification defines the assessment level. Therefore, if any parameter is assessed as less than good (e.g. moderate), then the status for that water body is reported at that level.

Table 1. Study area WFD water body summary table

Water Body Name	Mersey	Mersey Mouth	Alt
Water Body ID	GB531206908100	GB641211630001	GB531206908300
Water Body Type	Transitional	Coastal	Transitional
Water Body Area	79.637 km^2	420.516 km^2	0.263 km^2
Hydromorphological Designation	HMWB	HMWB	HMWB
Protected Area Designations	Nitrates Directive; Birds Directive.	Birds Directive; Shellfish Waters Directive; Habitats and Species Directive; Bathing Waters Directive.	Birds Directive; Habitats and Species Directive.
Overall Status	Moderate	Moderate	Moderate
Ecological Status/Potential	Moderate	Moderate	Moderate
Chemical Status	Fail	Fail	Fail
Parameters Not At Good Status	Mitigation Measures Assessment (moderate or less); Invertebrates (moderate); Phytoplankton (moderate); Dissolved Inorganic Nitrogen (moderate); Zinc (moderate); Dichlorvos (Priority) (fail); Polybrominated diphenyl ethers (PBDE) (fail); Benzo(g-h-i)perylene (fail); Heptachlor and cis-Heptachlor epoxide (fail); Mercury and Its Compounds (fail).	Mitigation Measures Assessment (moderate or less); Phytoplankton (moderate); Dissolved Inorganic Nitrogen (moderate); Polybrominated diphenyl ethers (PBDE) (fail); Benzo(g-h-i)perylene (fail); Mercury and Its Compounds (fail).	Expert Judgement (moderate); Mitigation Measures Assessment (moderate or less); Polybrominated diphenyl ethers (PBDE) (fail); Mercury and Its Compounds (fail);
Higher Sensitivity Habitats	Mussel beds, including blue and horse mussel (29.83 ha); Saltmarsh (898.57 ha); Subtidal kelp beds (85.10 ha)	Mussel beds, including blue and horse mussel (2.28 ha); Polychaete reef (0.25 ha);	N/A
Lower Sensitivity Habitats	Cobbles, gravel and shingle (1.69 ha); Intertidal soft sediment (5,057.78 ha); Rocky shore (11.71 ha); Subtidal rocky reef (198.09 ha); Subtidal soft sediments (380.54 ha).	Intertidal soft sediment (37,649.26 ha); Rocky shore (163.33 ha); Subtidal rocky reef (2,898.44 ha); Subtidal soft sediments (26,573.54 ha).	Intertidal soft sediment (55.50 ha).
Phytoplankton Status	Moderate	Moderate	N/A
History of Harmful Algae	Not Monitored	Not Monitored	Not Monitored

Source: Environment Agency (2021)

2.3 Protected areas

The WFD and Water Framework Regulations require that activities are also in compliance with other relevant retained EU legislation, such as the Habitats Directive (92/43/EEC as amended), Birds Directive (2009/147/EC), Ramsar Convention, Bathing Water Directive (2006/7/EC), Nitrates Directive (91/676/EEC), Urban Waste Water Treatment Directive (91/271/EEC) and the provisions of the Shellfish Waters Directive (2006/113/EC) (now repealed and integrated into the WFD).

2.3.1 Nature Conservation Designations

The Conservation of Habitats and Species Regulations 2017 (as amended) transpose the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) into English law. Article 3 of the Habitats Directive (92/43/EEC as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SAC) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive.

The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the Birds Directive (2009/147/EC), Special Protection Areas (SPA) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species. Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The nature conservation interests of the Mersey and surrounding area are of high importance with large sea expanses and adjacent coastlines having been designated as nationally and internationally protected sites. There are six internationally designated sites which overlap or are in the vicinity of maintenance dredge areas and/or disposal sites (Figure 9), including Special Protection Areas (SPAs), Ramsar Sites and Special Areas of Conservation (SACs); namely:

- Liverpool Bay/Bae Lerpwl SPA;
- Mersey Estuary SPA and Ramsar Site;
- Mersey Narrows and North Wirral Foreshore SPA;
- Ribble and Alt Estuaries SPA;
- Sefton Coast SAC; and
- The Dee Estuary/Aber Dyfrdwy SPA, SAC and Ramsar Site.

The dredge activities which occur in the outer Mersey area and approach channel, are in proximity to the Dee Estuary/Aber Dyfrdwy SPA, Ramsar Site and SAC, the Mersey Narrows and North Wirral Foreshore SPA, the Ribble and Alt Estuaries SPA and Ramsar Site and the Sefton Coast SAC, whilst overlapping the Liverpool Bay/Bae Lerpwl SPA.

The activities which occur within the inner Estuary/Mersey River overlap with the Mersey Estuary SPA and Ramsar Site, whilst the Alfred dock site partially overlaps with the Mersey Narrows and North Wirral Foreshore SPA at the southern extent of the SPA site.

2.3.2 Bathing Water Directive

The revised Bathing Water Directive (2006/7/EC) was adopted in 2006, updating the microbiological and physico-chemical standards set by the original Bathing Water Directive (76/160/EEC) and the process used to measure/monitor water quality at identified bathing waters. The revised Bathing Water Directive focuses on fewer microbiological indicators, whilst setting higher standards, compared to those of the Bathing Water Directive. Bathing waters under the revised Bathing Water Directive are classified as excellent, good, sufficient or poor according to the levels of certain types of bacteria (intestinal enterococci and *Escherichia coli*) in samples obtained during the bathing season (May to September).

The Bathing Water Directive was repealed at the end of 2014 and monitoring of bathing water quality has been reported against revised Bathing Water Directive indicators since 2015. The new classification system considers all samples obtained during the previous four years and, therefore, data has been collected for revised Bathing Water Directive indicators since 2012. The UK Government's target under the revised Bathing Water Directive is to achieve 'sufficient' for all bathing waters, as described under the Bathing Water Regulations 2013[4] (as amended) which transposes the revised Bathing Water Directive into UK law.

The closest designated bathing waters to the study area are Wallasey (>3 km from the approach channel), Moreton (>6 km), Meols (>9 km), West Kirby (>12 km), Formby (>9 km), Ainsdale (>8 km), and Southport (>13 km) (Figure 10). Water quality classifications for the period 2016 to 2019 are presented in Table 2.

Table 2. Bathing water quality classifications in study area (2016-2019)

Bathing Water	2016	2017	2018	2019
Wallasey	Excellent	Good	Good	Good
Moreton	Excellent	Excellent	Excellent	Excellent
Meols	Excellent	Excellent	Excellent	Excellent
West Kirby	Excellent	Excellent	Excellent	Excellent
Formby	Excellent	Excellent	Excellent	Excellent
Ainsdale	Good	Good	Good	Good
Southport	Good	Good	Good	Good

Source: Environment Agency's Bathing Water Quality (https://environment.data.gov.uk/bwq/profiles; Accessed August 2021)

[4] Replaced by The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019 on 31 January 2020.

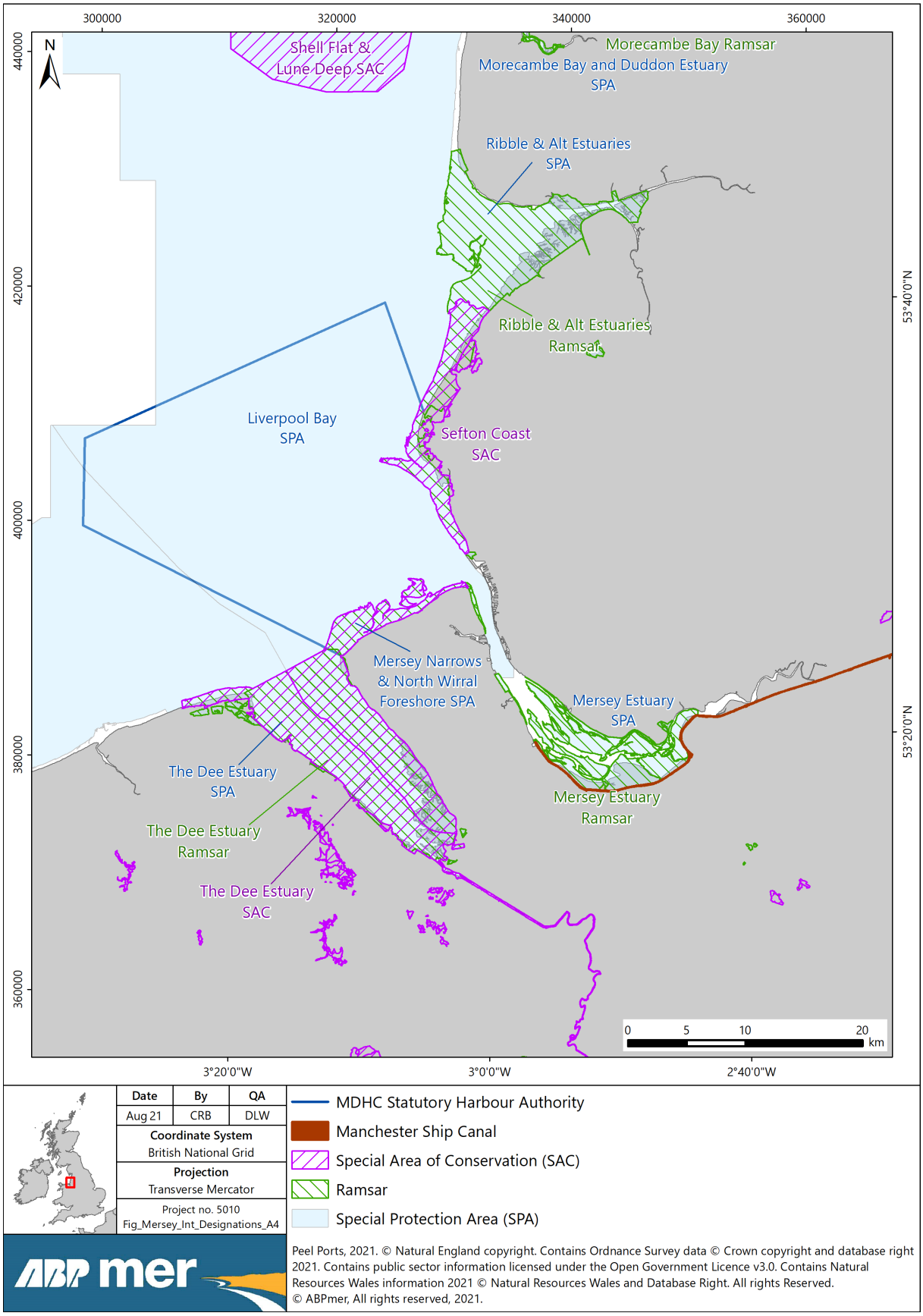

Figure 9. European and Ramsar designated sites within the study area

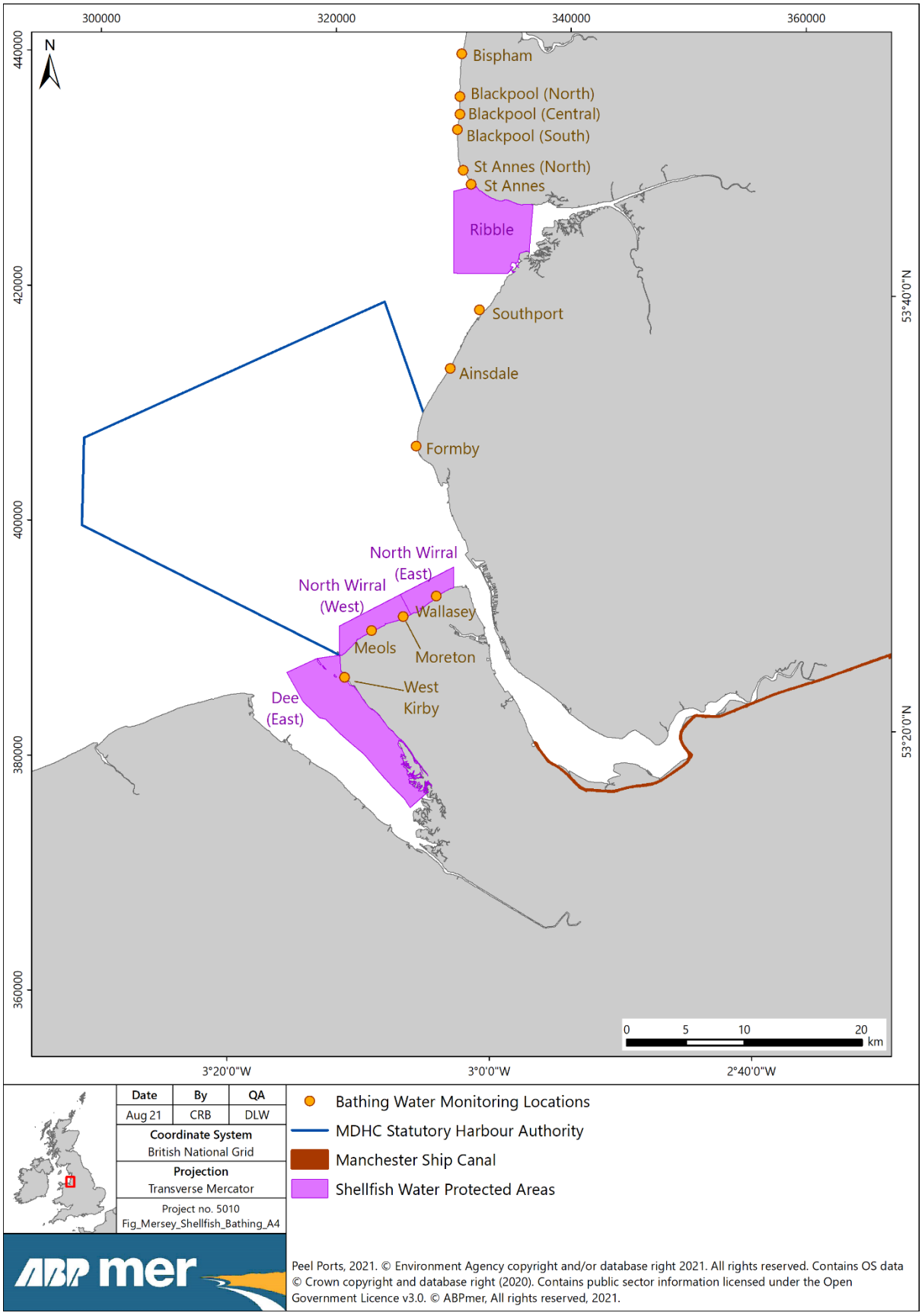

Figure 10. Designated Bathing Waters and Shellfish waters within the study area

2.3.3 Shellfish Waters Directive

The Shellfish Waters Directive (2006/113/EC) was repealed in December 2013 and subsumed within the WFD. However, the Shellfish Water Protected Areas (England and Wales) Directions 2016 require the Environment Agency (in England) to endeavour to observe a microbial standard in all 'Shellfish Water Protected Areas'. The microbial standard is 300 or fewer colony forming units of *E. coli* per 100 ml of shellfish flesh and intravalvular liquid. The Directions also requires the Environment Agency to assess compliance against this standard to monitor microbial pollution (75% of samples taken within any period of 12 months below the microbial standard and sampling/analysis in accordance with the Directions).

There are several Shellfish Water Protected Areas situated within or in the vicinity of maintenance dredging and disposal activities for the Mersey Estuary (Defra, 2016; see Figure 10). These are as follows:

- Dee (East);
- North Wirral (West);
- North Wirral (East); and
- Ribble.

The Mersey Approach Channel partially overlaps with the North Wirral (East) Shellfish Water Protected Area.

Table 3 presents details of classification zones located within the Dee, Liverpool Bay and Ribble bivalve mollusc production areas.

Table 3. Bivalve mollusc classification for 2020/2021

Production Area	Classification Zone	Species	Class
Dee	Caldy Blacks	*C. edule*	Class B (Long-term)
		Mytilus spp.	Class B (Long-term)
	Salisbury	*C. edule*	Seasonal A/B (Class A Season 1 August to 31 May, reverting to Class B at all other times)
		Mytilus spp.	Seasonal A/B (Class A Season 1 August to 31 May, reverting to Class B at all other times)
	Salisbury Middle	*C. edule*	Seasonal A/B (Class A Season 1 August to 31 May, reverting to Class B at all other times)
	Thurstaston	*C. edule*	Class B (Long-term)
		Mytilus spp.	Class B (Long-term)
	Thurstaston East	-	Prohibited
	West Kirby	*C. edule*	Class B (Long-term)
		Mytilus spp.	Class B (Long-term)
Liverpool Bay	Leasowe and New Brighton	*C. edule*	Seasonal B/C (Class B Season 1 October to 31 May, reverting to Class C at all other times)
	Mersey	-	Prohibited
Ribble	Ribble Walls North	*Mytilus spp.*	Class C
	Ribble Channel	-	Prohibited

Source: Food Standards Agency (https://www.food.gov.uk/business-guidance/shellfish-classification; Accessed September 2021)

The classification zones are designated for *Cerastoderma edule* (Common edible cockle) and/or *Mytilus* spp. (*Mytilus edulis* (blue mussel), *Mytilus galloprovincialis* (Mediterranean mussel) and hybrids). These zones were classified as Class B (Long-term; B-LT), Class C, Seasonal A/B or Seasonal B/C for 2020/21, with three zones designated as prohibited areas. The European Union (EU) legislation, retained post-Brexit, determining the classification of shellfish waters within the UK is EC Regulation 2019/627, namely Articles 53 (Class A), 54 (Class B) and 55 (Class C). The classification of shellfish waters determines the level of treatment required before molluscs can be placed on the market.

2.3.4 Nitrates Directive

The Nitrates Directive (91/676/EEC),which is implemented in England by the Nitrate Pollution Prevention Regulations 2008 (S.I. 2008/2349) (the 2008 Regulations)[5], aims to reduce water pollution from agricultural sources and to prevent such pollution occurring in the future (nitrogen is one of the nutrients that can affect plant growth). Under the Nitrates Directive, surface waters are identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water body.

Numerous Nitrate Vulnerable Zones (NVZs) surround the Mersey Estuary[6], with the following in the vicinity of dredge areas:

- Alt NVZ (S642);
- Clatter Brook NVZ (S631); and
- Ditton Brook (Halewood to Mersey Estuary) NVZ (S640).

2.3.5 Urban Waste Water Treatment Directive

The Urban Waste Water Treatment (England and Wales) Regulations 1994 (as amended) transpose the Urban Waste Water Treatment Directive (91/271/EEC) into English law. The Urban Waste Water Treatment Directive (91/271/EEC) aims to protect the environment from the adverse effects of the collection, treatment and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges.

In general, the Urban Waste Water Treatment Directive requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water. Sensitive areas under the Urban Waste Water Treatment Directive are water bodies affected by eutrophication due to elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The River Alt is recorded as a Eutrophic Sensitive Area (Rivers)[7].

[5] Certain provisions of the 2018 Regulations have been amended by the Nitrate Pollution Prevention (Amendment) and Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) (Amendment) Regulations 2013.

[6] https://environment.data.gov.uk/farmers (Accessed August 2021).

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/796751/sensitive-areas-map-manchester.pdf (Accessed August 2021).

2.4 Sediment quality

There are no formal quantitative EQS for the concentration of contaminants in sediments, although the WFD has introduced optional standards for a small number of priority (hazardous) substances. The Centre for Environment, Fisheries and Aquaculture Science (Cefas) has prepared a series of Guideline Action Levels to assist in the assessment of dredged material (and its suitability for disposal to sea). In general, contaminant levels in dredged material below Cefas Guideline Action Level 1 (AL1) are of no concern and are unlikely to influence the licensing decision. However, dredged material with contaminant levels above Cefas Guideline Action Level 2 (AL2) is generally considered unsuitable for disposal at sea.

Dredged material with contaminant levels between AL1 and AL2 may require further consideration before a decision can be made. The Cefas Guideline Action Levels should not be viewed as pass/fail thresholds. However, these guidelines provide an appropriate context for consideration of contaminant levels in sediments and are used as part of a 'weight of evidence' approach to assessing dredged material by the MMO as part of the marine licensing process and by MDHC when it undertakes any maintenance dredging under its own powers.

Over the last 20 years, sediment samples have been collected from various locations within the Mersey Estuary, docks and approaches to consider suitability of dredging and disposal activities. Sediment samples collected from across the study area show variable concentrations of chemical contaminants, both spatially and temporally. Contaminant concentrations in sediments within the Mersey Approach Channel and wider Liverpool Bay area have been shown to be relatively low, typically below AL1 or marginally exceeding AL1. This is to be expected given the predominantly sandy composition of dredged material in this area, with contaminants largely associated with finer material such as mud/silt. Similarly, contaminant concentrations in sediments within the River Mersey (The Narrows and Inner Estuary) have been shown to be relatively low, particularly in more recent samples.

In contrast, some contaminant concentrations in sediments within the enclosed dock systems of the Mersey (Liverpool, Birkenhead and Garston) have been shown to be elevated compared to the Mersey Approach Channel and Mersey River. This is to be expected given the historic and current industrial usage of these facilities and the restricted flow of water behind dock gates, preventing the natural dispersion of contaminants. Many of the samples tested have shown levels in excess of AL1, with occasional samples exceeding AL2 (less frequent in recent years). Notwithstanding these variable concentrations, marine licences have been issued for the disposal of dredged material at sea from all of the sampling locations (with a few exceptions).

Sediment quality data from samples collected by Peel Ports Group in 2016 cover the Mersey Approaches, Cammell Laird and Eastham Channel and are presented in Table 4 to Table 8. Figure 11 through Figure 14 show the location of the samples. This is not the full extent of sediment sampling and analysis that has been undertaken in the Mersey, but is the most recent and complete set of data that covers a large proportion of the study area.

Further details of historic sediment sampling within the Mersey is available in the Mersey MDP Baseline Document (ABPmer, 2021).

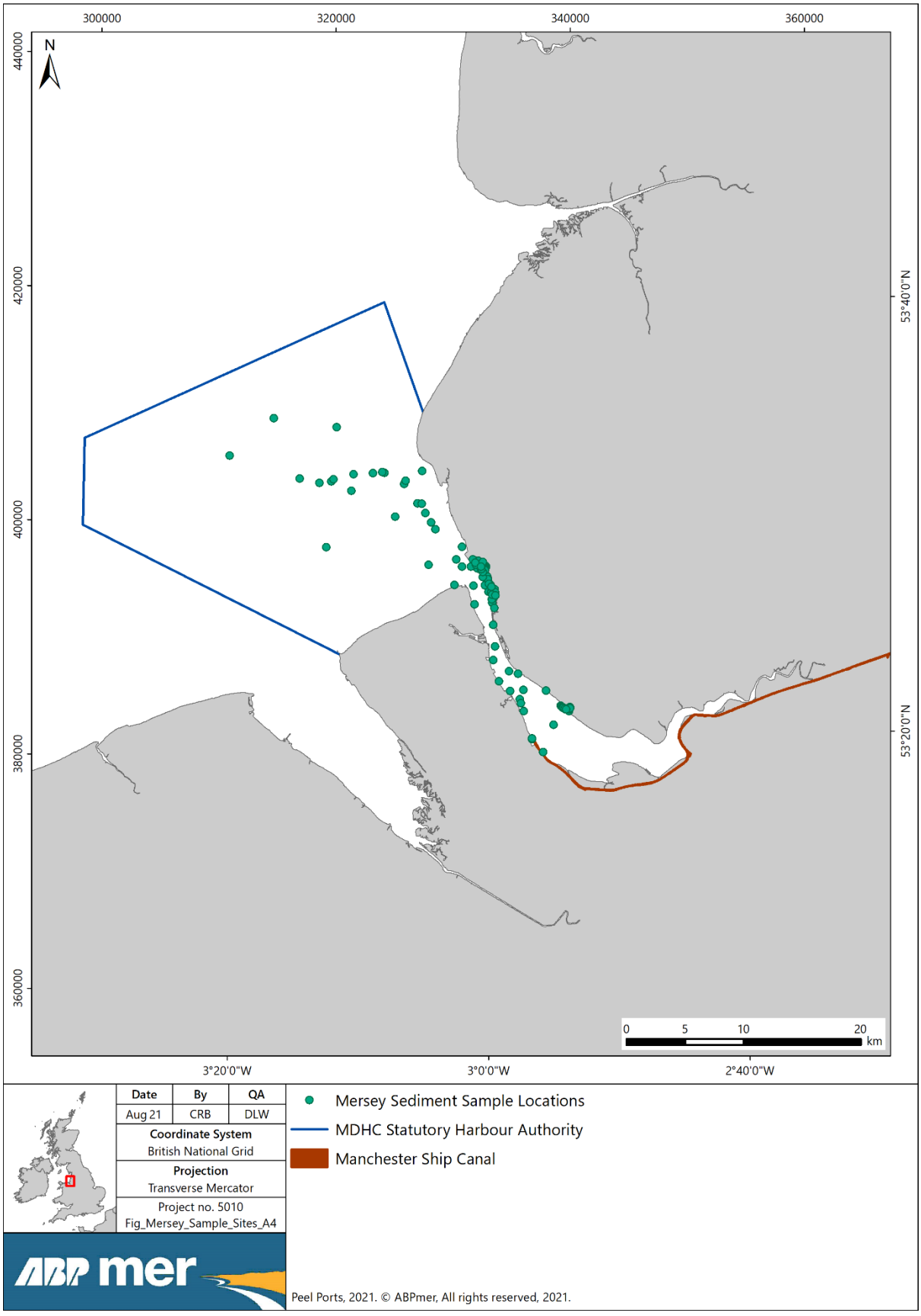

Figure 11. Sediment sample locations within the Mersey and Outer Mersey Estuary

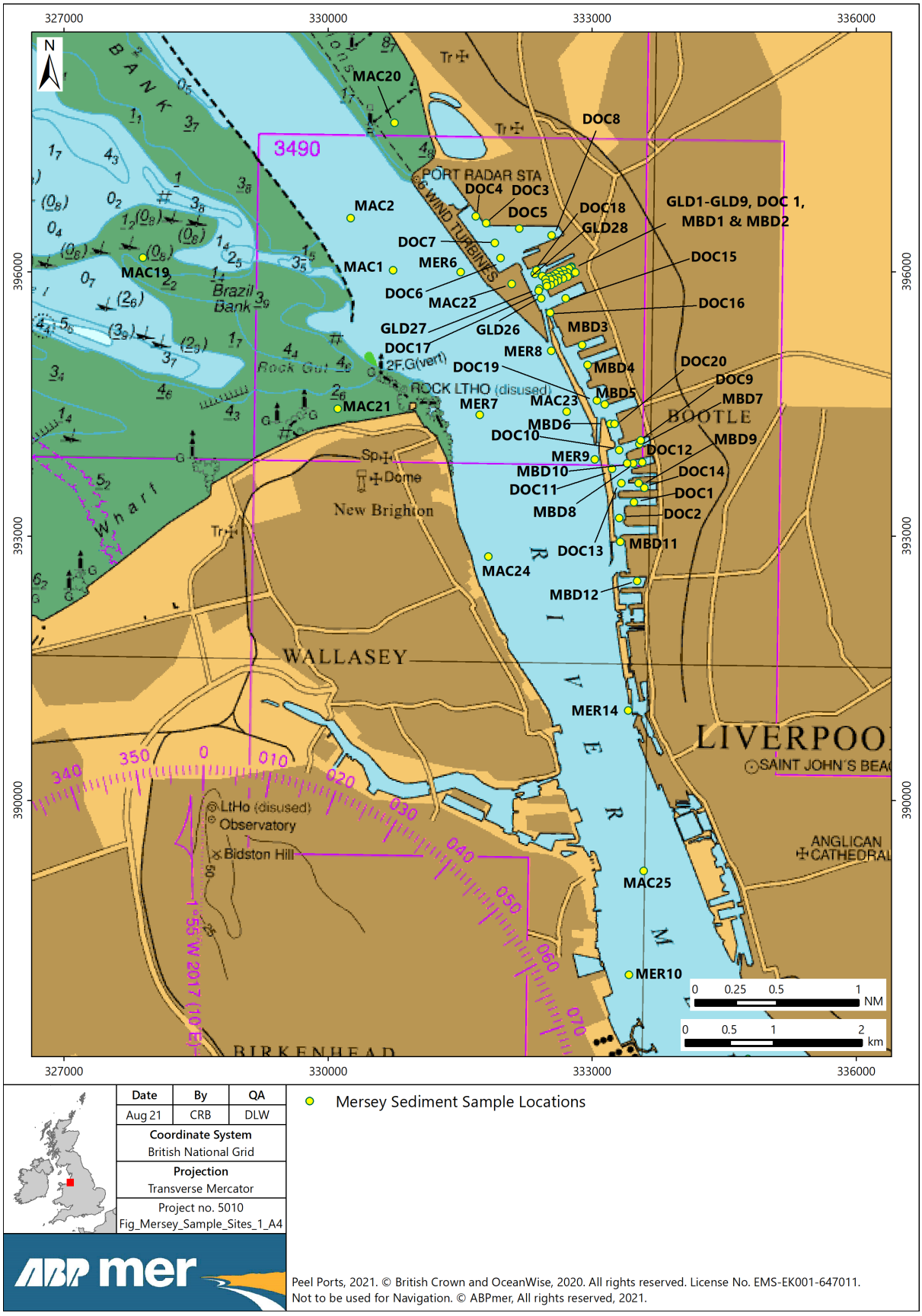

Figure 12. **Sediment samples taken within the vicinity of the Mersey and Birkenhead dock systems**

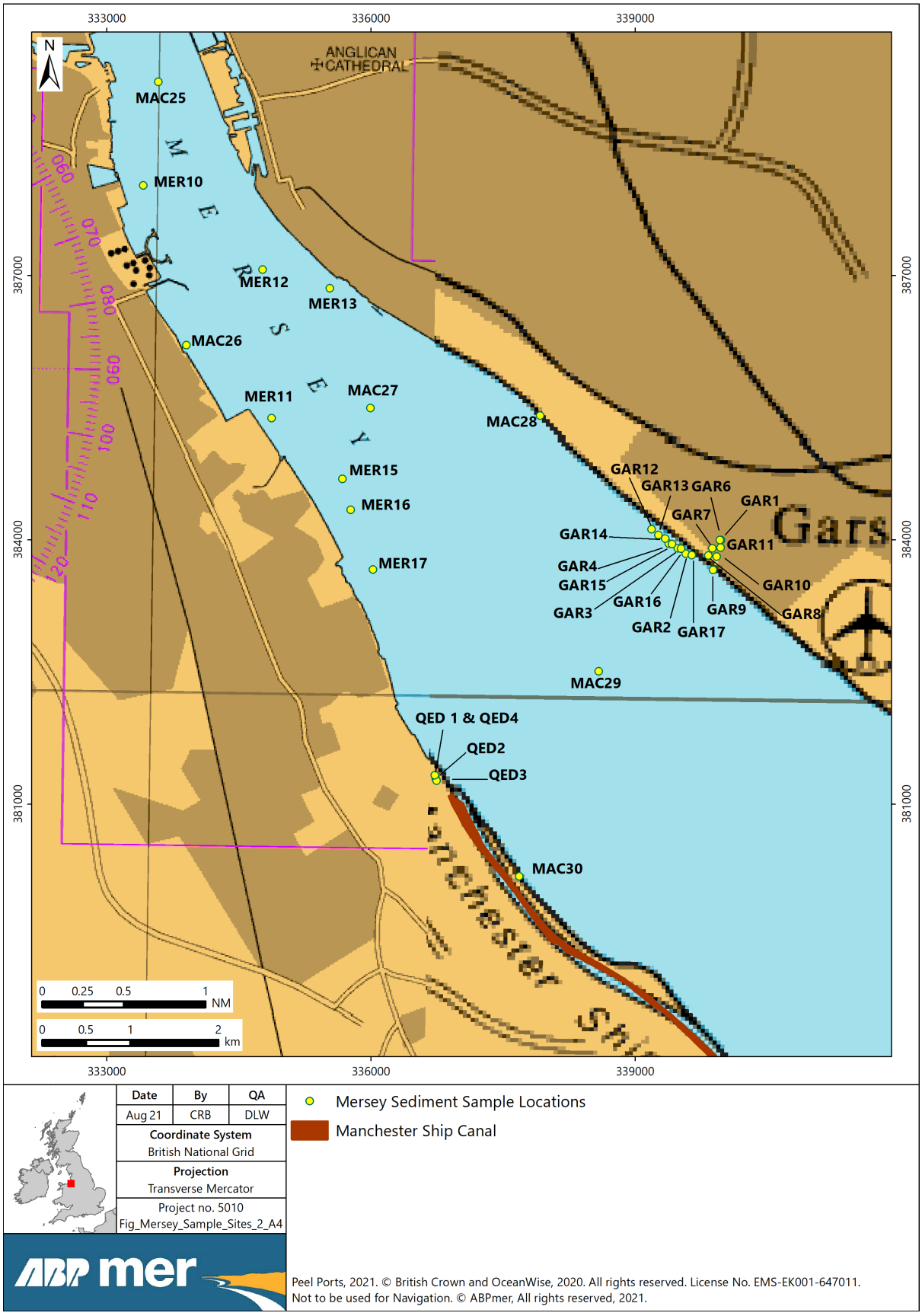

Figure 13. **Sediment samples taken from around the entrances to Garston and Manchester Ship Canal**

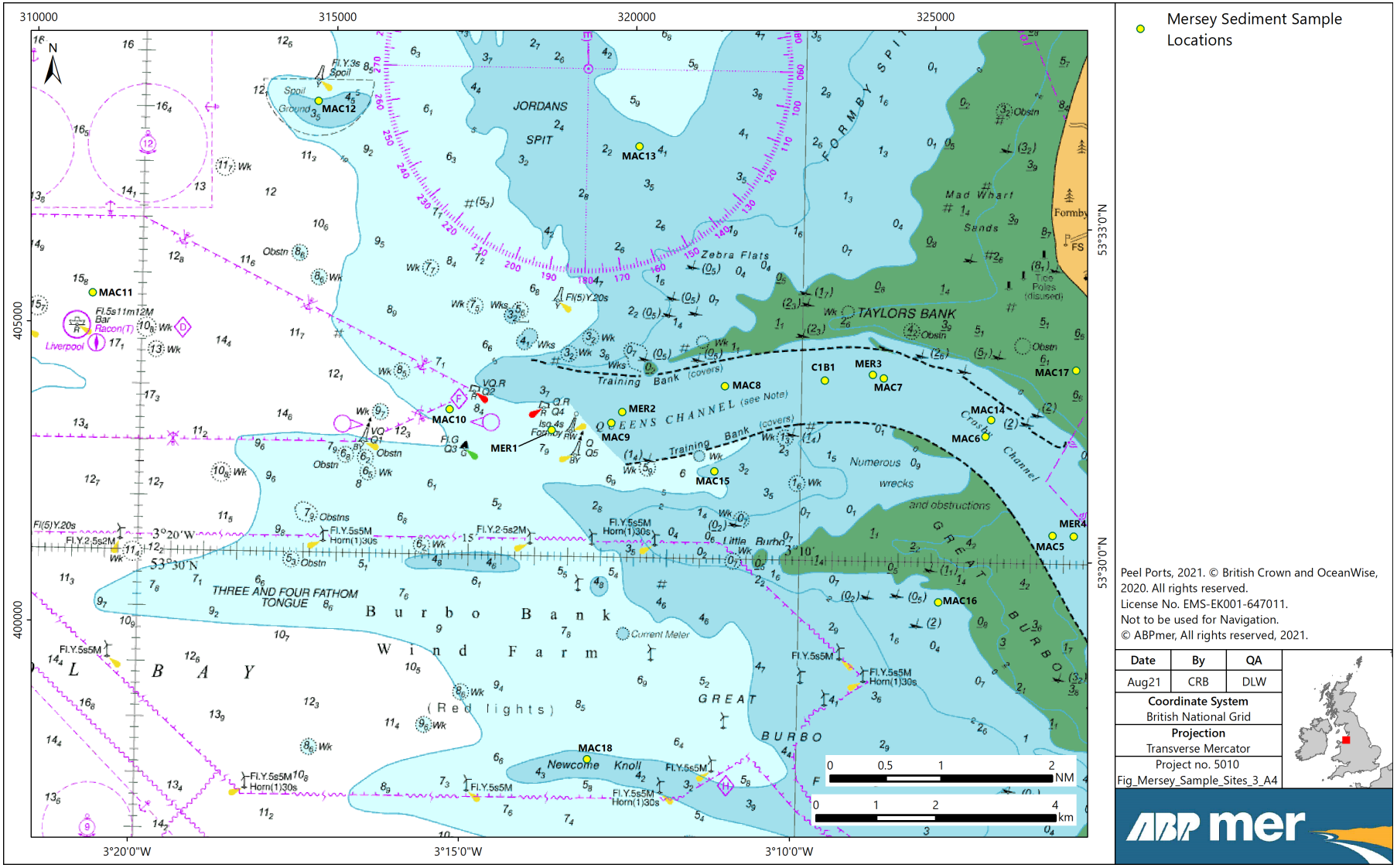

Figure 14. Sediment samples taken from the Outer Mersey Approach Channel

2.5 Water quality

Metal, organotin, PAH, and PBDE concentrations have been measured by the Environment Agency within the River Mersey located in the Narrows of the Mersey between Birkenhead Docks and Liverpool Docks and close to maintenance dredging operations at Alfred Lock Entrance, 12 Quays Terminal and Liverpool Landing Stage (Mersey Estuary at Seacombe Ferry, NW-88002822) (Table 9). Metal concentrations are generally available from 2016 to 2021 (with a lack of 2020 data noted), however arsenic concentrations are only available between 2004 and 2008. Benzene and Fluoranthene data are available from 2016 to 2021, alongside Tributyl tin (TBT) concentrations.

Metal concentrations reported over these periods were typically below respective annual average (AA) and/or maximum allowable concentration (MAC) environmental quality standards (EQS) as described under the WFD (Standards and Classification) Directions (England and Wales) 2015. There were multiple exceedances related to the AA EQS for Zinc in 2016 through to 2021 (excluding 2020). Whilst nearly all Benzene compounds were above their respective MAC except for Benzo(b)fluoranthene which remained below MAC for all yearly averages calculated between 2016 and 2021. TBT concentrations were above the AA EQS between 2015 and 2019; yet only exceed these standards on average by very small amounts. The Hexachlorobenzene and Hexachlorobutadiene concentrations were consistently below MAC standards.

Table 4. Trace metal and organotin concentrations from sediment samples collected from Mersey Approaches, Cammell Laird and Eastham Channel (2016)

Laboratory Sample N°.	Figure ID	Total Solids (%)	Trace Metals and Organotins (mg/kg dry weight)									
			As	Cd	Cr	Cu	Hg	Ni	Pb	Zn	DBT	TBT
Cefas Guideline AL1			**20**	**0.4**	**40**	**40**	**0.3**	**20**	**50**	**130**	**0.1**	**0.1**
Cefas Guideline AL2			**100**	**5**	**400**	**400**	**3**	**200**	**500**	**800**	**1**	**1**
Mersey Approaches A	MER1	69.87	7.32	0.12	15.17	6.48	0.12	9.27	18.1	63.5	<0.001	<0.001
Mersey Approaches B	MER2	60.70	12.05	0.49	27.31	18.72	0.51	14.72	35.37	158.49	<0.001	<0.001
Mersey Approaches C	MER3	71.64	7.63	0.19	13.42	7.25	0.75	8.64	17.72	83.89	<0.001	<0.001
Mersey Approaches D	MER4	61.56	9.43	0.31	23.04	14.12	0.32	13.98	33.71	125.33	<0.001	<0.001
Mersey Approaches E	MER5	67.66	8.74	0.48	20.59	10.62	0.24	12.24	24.78	114.57	<0.001	<0.001
Mersey Approaches F	MER6	58.56	12.58	0.34	36.68	18.69	0.32	21.81	42.96	149.84	<0.001	<0.001
River Mersey Jetties Cammell Laird A	-	56.55	9.66	0.22	27.97	16.99	0.12	18.46	38.38	107.43	<0.001	<0.001
River Mersey Jetties Cammell Laird C	MER7	72.73	6.64	0.14	14.59	7.35	0.25	10.96	15.85	67.09	<0.001	<0.001
River Mersey Jetties Cammell Laird D	MER8	70.49	7.63	0.22	18.53	10.88	0.21	10.96	22.8	97.84	<0.001	0.014
River Mersey Jetties Cammell Laird E	-	65.09	5.3	0.2	7.01	2.23	<0.037	5.01	10.01	33.21	<0.001	<0.001
River Mersey Jetties Cammell Laird F	MER9	72.69	7.67	0.31	17.58	8.99	0.22	9.91	22.29	118.08	<0.001	<0.001
River Mersey Jetties Cammell Laird G	-	64.63	9.8	0.42	26.03	18.35	0.52	13.14	36.98	152.54	<0.001	<0.001
River Mersey Jetties Cammell Laird H	MER10	81.02	16.2	0.02	6.54	1.43	<0.031	10.76	16.01	50.93	<0.001	<0.001
River Mersey Jetties Cammell Laird I	MER11	80.93	25.74	0.14	12.04	6.9	0.13	9.37	26.07	94.87	<0.001	<0.001
River Mersey Jetties Cammell Laird J	MER12	79.65	17.69	0.02	5.87	1.28	<0.028	5.01	15.57	51.67	<0.001	<0.001
River Mersey Jetties Cammell Laird K	-	80.98	10.53	0.04	4.84	1.76	<0.03	3.52	12.57	39.77	<0.001	<0.001
River Mersey Jetties Cammell Laird L	MER13	72.38	7.47	0.3	12.63	5.96	0.12	7.95	17.93	109.16	<0.001	<0.001
Eastham Channel A	MER14	79.84	8.1	0.04	6.53	1.67	<0.032	4.58	11	42.86	<0.001	<0.001
Eastham Channel B	MER15	80.07	9.27	0.03	7.13	1.5	<0.029	4.82	11.45	49.53	<0.001	<0.001
Eastham Channel C	MER16	29.15	17.92	0.32	70.54	32.47	0.27	45.63	86.21	265.88	<0.002	<0.002
Eastham Channel D	-	80.5	8.04	0.04	4.9	1.09	<0.023	3.35	9.01	32.51	<0.001	<0.001
Eastham Channel E	MER17	64.30	10.85	0.51	27.53	18.84	0.5	14.44	39.74	163.5	<0.001	<0.001
Eastham Channel F	-	80.28	5.03	0.09	6.16	3.82	<0.029	3.93	7.92	42.43	<0.001	<0.001
Eastham Channel G	-	74.36	7.61	0.23	17.85	9.28	0.21	8.1	21.28	83.12	<0.001	<0.001
Key	Below AL1											
	Above AL1, Below AL2											
	Above AL2											

Table 5. Total hydrocarbon content (THC) from sediment samples collected from Mersey Approaches, Cammell Laird and Eastham Channel (2016)

Laboratory Sample No.	Figure ID	THC (mg/kg dry weight)
	Cefas Guideline AL1	**100**
	Cefas Guideline AL2	**-**
Mersey Approaches A	MER1	56
Mersey Approaches B	MER2	462
Mersey Approaches C	MER3	66
Mersey Approaches D	MER4	224
Mersey Approaches E	MER5	118
Mersey Approaches F	MER6	179
River Mersey Jetties Cammell Laird A	-	27
River Mersey Jetties Cammell Laird C	MER7	64
River Mersey Jetties Cammell Laird D	MER8	113
River Mersey Jetties Cammell Laird E	-	7
River Mersey Jetties Cammell Laird F	MER9	63
River Mersey Jetties Cammell Laird G	-	343
River Mersey Jetties Cammell Laird H	MER10	4
River Mersey Jetties Cammell Laird I	MER11	128
River Mersey Jetties Cammell Laird J	MER12	33
River Mersey Jetties Cammell Laird K	-	17
River Mersey Jetties Cammell Laird L	MER13	57
Eastham Channel A	MER14	6
Eastham Channel B	MER15	10
Eastham Channel C	MER16	22
Eastham Channel D	-	4
Eastham Channel E	MER17	281
Eastham Channel F	-	5
Eastham Channel G	-	158
Key	Below AL1	
	Above AL1, Below AL2	

Table 6. Polychlorinated biphenyl (PCB) concentrations from sediment samples collected from Mersey Approaches, Cammell Laird and Eastham Channel (2016)

Laboratory Sample No.	Figure ID	PCBs (µg/kg dry weight)												
		#18	#28	#31	#44	#47	#49	#52	#66	#101	#105	#110	#118	#128
Cefas Guideline AL1		-	-	-	-	-	-	-	-	-	-	-	-	-
Cefas Guideline AL2		-	-	-	-	-	-	-	-	-	-	-	-	-
Mersey Approaches A	MER1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Mersey Approaches B	MER2	<0.2	0.866	0.774	<0.2	0.207	0.483	0.969	0.531	0.714	0.395	0.771	0.767	0.242
Mersey Approaches C	MER3	<0.2	0.441	0.372	<0.2	<0.2	0.242	0.325	<0.2	0.265	0.416	0.324	0.32	<0.2
Mersey Approaches D	MER4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Mersey Approaches E	MER5	<0.2	0.296	0.265	<0.2	<0.2	<0.2	0.271	<0.2	<0.2	0.302	0.25	0.274	<0.2
Mersey Approaches F	MER6	<0.2	0.528	0.451	<0.2	<0.2	0.236	0.439	0.284	0.415	0.211	0.442	0.482	<0.2
River Mersey Jetties Cammell Laird A	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird C	MER7	<0.2	0.232	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.211	<0.2
River Mersey Jetties Cammell Laird D	MER8	<0.2	0.355	0.305	<0.2	0.627	1.35	0.295	<0.2	0.219	0.349	0.289	0.343	<0.2
River Mersey Jetties Cammell Laird E	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird F	MER9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird G	-	0.272	0.804	0.575	0.325	<0.2	0.426	0.645	0.711	0.616	0.334	0.619	0.674	0.207
River Mersey Jetties Cammell Laird H	MER10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird I	MER11	<0.2	0.319	0.296	<0.2	<0.2	<0.2	0.263	<0.2	<0.2	<0.2	0.217	0.218	<0.2
River Mersey Jetties Cammell Laird J	MER12	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird K	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
River Mersey Jetties Cammell Laird L	MER13	<0.2	0.257	0.276	<0.2	<0.2	<0.2	0.242	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel A	MER14	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel B	MER15	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel C	MER16	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel D	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel E	MER17	<0.2	0.699	0.64	<0.2	<0.2	0.391	0.751	0.409	0.461	0.261	0.724	0.605	<0.2
Eastham Channel F	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Eastham Channel G	-	13.9	0.555	0.399	0.207	<0.2	0.275	0.522	0.343	0.304	0.255	0.339	0.51	<0.2

Laboratory Sample N°.	Figure ID	#138	#141	#149	#151	#153	#156	#158	#170	#180	#183	#187	#194	ΣICES 7 PCBs	Σ25 PCBs
Cefas Guideline AL1		-	-	-	-	-	-	-	-	-	-	-	-	10	20
Cefas Guideline AL2		-	-	-	-	-	-	-	-	-	-	-	-	-	200
Mersey Approaches A	MER1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Mersey Approaches B	MER2	0.904	0.226	0.95	0.287	1.03	<0.2	<0.2	0.472	0.825	<0.2	0.467	0.503	6.075	12.383
Mersey Approaches C	MER3	0.319	<0.2	0.258	<0.2	0.295	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.965	3.577
Mersey Approaches D	MER4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Mersey Approaches E	MER5	0.272	<0.2	0.233	<0.2	0.238	<0.2	<0.2	0.201	<0.2	<0.2	<0.2	<0.2	1.351	2.602
Mersey Approaches F	MER6	0.493	<0.2	0.382	<0.2	0.466	<0.2	<0.2	<0.2	0.269	<0.2	<0.2	<0.2	3.092	5.098
River Mersey Jetties Cammell Laird A	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird C	MER7	0.208	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.651	0.651
River Mersey Jetties Cammell Laird D	MER8	0.29	<0.2	0.289	<0.2	0.269	<0.2	<0.2	<0.2	<0.2	<0.2	0.417	<0.2	1.771	5.397
River Mersey Jetties Cammell Laird E	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird F	MER9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird G	-	0.719	<0.2	0.596	<0.2	0.722	<0.2	<0.2	0.879	0.441	<0.2	0.341	<0.2	4.621	9.906
River Mersey Jetties Cammell Laird H	MER10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird I	MER11	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8	1.313
River Mersey Jetties Cammell Laird J	MER12	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird K	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
River Mersey Jetties Cammell Laird L	MER13	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.499	0.775
Eastham Channel A	MER14	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Eastham Channel B	MER15	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Eastham Channel C	MER16	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Eastham Channel D	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Eastham Channel E	MER17	0.568	<0.2	0.54	<0.2	0.573	<0.2	<0.2	0.275	0.372	<0.2	<0.2	<0.2	4.029	7.269
Eastham Channel F	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Eastham Channel G	-	0.328	<0.2	0.514	<0.2	0.397	<0.2	<0.2	<0.2	0.205	<0.2	<0.2	<0.2	2.821	19.053
Key	Below AL1														
	Above AL1, Below AL2														
	Above AL2														

Table 7. Polybrominated diphenyl ether (PBDE) concentrations from sediment samples collected from Mersey Approaches, Cammell Laird and Eastham Channel (2016)

Laboratory Sample N°.	Figure ID	Polybrominated Diphenyl Ethers (PBDEs) (mg/kg dry weight)										
		BDE17	BDE28	BDE47	BDE66	BDE85	BDE99	BDE100	BDE138	BDE153	BDE154	BDE183
Cefas Guideline AL1		-	-	-	-	-	-	-	-	-	-	-
Cefas Guideline AL2		-	-	-	-	-	-	-	-	-	-	-
Mersey Approaches A	MER1	0.00006	0.00004	0.00015	<0.0002	<0.0002	0.00014	0.00003	<0.0002	0.00003	0.00004	0.00004
Mersey Approaches B	MER2	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00002
Mersey Approaches C	MER3	<0.0002	<0.0002	0.00005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mersey Approaches D	MER4	0.00003	0.00003	0.00009	<0.0002	<0.0002	0.00013	0.00003	<0.0002	0.00003	0.00002	0.00003
Mersey Approaches E	MER5	<0.0002	<0.0002	0.00004	<0.0002	<0.0002	0.00004	<0.0002	<0.0002	0.00003	0.00003	<0.0002
Mersey Approaches F	MER6	0.00003	<0.0002	0.00014	<0.0002	<0.0002	0.00017	0.00004	<0.0002	0.00004	0.00006	<0.0002
River Mersey Jetties Cammell Laird A	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird C	MER7	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird D	MER8	<0.0002	<0.0002	0.00005	<0.0002	<0.0002	0.00003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird E	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00006	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird F	MER9	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird G	-	0.00005	0.00003	0.00010	<0.0002	<0.0002	0.00010	0.00003	0.00005	<0.0002	0.00005	0.00007
River Mersey Jetties Cammell Laird H	MER10	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird I	MER11	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird J	MER12	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird K	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
River Mersey Jetties Cammell Laird L	MER13	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel A	MER14	<0.0002	<0.0002	0.00002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel B	MER15	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel C	MER16	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel D	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel E	MER17	0.00003	0.00002	0.00009	<0.0002	<0.0002	0.00011	<0.0002	<0.0002	0.00003	<0.0002	0.00004
Eastham Channel F	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Eastham Channel G	-	<0.0002	0.00002	0.00006	<0.0002	<0.0002	0.00004	0.00002	<0.0002	<0.0002	0.00003	0.00004

Table 8. Organochlorine pesticide (OCP) concentrations from sediment samples collected from Mersey Approaches, Cammell Laird and Eastham Channel (2016)

Laboratory Sample N°.	Figure ID	Organochlorine Pesticides (OCP) (µg/kg dry weight)	
		Dieldrin	DDT
	Cefas Guideline AL1	**5.0**	**1.0**
	Cefas Guideline AL2	**-**	**-**
Mersey Approaches A	MER1	0.3	0.5
Mersey Approaches B	MER2	<0.2	<0.2
Mersey Approaches C	MER3	<0.2	<0.2
Mersey Approaches D	MER4	0.2	0.2
Mersey Approaches E	MER5	<0.2	0.3
Mersey Approaches F	MER6	0.3	0.2
River Mersey Jetties Cammell Laird A	-	<0.2	0.4
River Mersey Jetties Cammell Laird C	MER7	<0.2	<0.2
River Mersey Jetties Cammell Laird D	MER8	<0.2	<0.2
River Mersey Jetties Cammell Laird E	-	<0.2	<0.2
River Mersey Jetties Cammell Laird F	MER9	<0.2	<0.2
River Mersey Jetties Cammell Laird G	-	0.3	10.4
River Mersey Jetties Cammell Laird H	MER10	<0.2	<0.2
River Mersey Jetties Cammell Laird I	MER11	0.2	1.1
River Mersey Jetties Cammell Laird J	MER12	<0.2	<0.2
River Mersey Jetties Cammell Laird K	-	<0.2	<0.2
River Mersey Jetties Cammell Laird L	MER13	<0.2	0.3
Eastham Channel A	MER14	<0.2	<0.2
Eastham Channel B	MER15	<0.2	<0.2
Eastham Channel C	MER16	<0.2	<0.2
Eastham Channel D	-	<0.2	<0.2
Eastham Channel E	MER17	0.3	0.6
Eastham Channel F	-	<0.2	<0.2
Eastham Channel G	-	0.3	4.9
Key	Below AL1		
	Above AL1		

Table 9. Concentration range, mean and number of water samples collected between 2004 and 2021 by the Environment Agency for metals and organotins from sampling point name: Mersey Estuary At Seacombe Ferry, NW-88002822

Parameter	Unit	EQS[1]	2004	2005	2006	2007	2008	
Arsenic	µg/l	25 (AA)	2.28 - 3.53 $\bar{x}$ = 2.858571 (*n* = 7)	1.6 – 4.84 $\bar{x}$ = 2.976 (*n* = 5)	2.09 – 4.61 $\bar{x}$ = 3.036667 (*n* = 5)	<1 – 4.8 $\bar{x}$ = 3.2175 (*n* = 5)	3.8 (*n* = 1)	
Cadmium	µg/l	0.2 (AA)						
Chromium (VI)	µg/l	0.6 (AA); 32 (MAC)					<0.5 (*n* = 1)	
Copper	µg/l	3.76 (AA)						
Lead	µg/l	1.3 (AA); 14 (MAC)						
Mercury	µg/l	0.07 (MAC)						
Nickel	µg/l	8.6 (AA); 34 (MAC)						
Zinc	µg/l	7.9 (AA)						
Benzo(a)pyrene	µg/l	0.00017 (AA) 0.0027 (MAC)						
Benzo(g,h,i)Perylene	µg/l	0.00082 (MAC)						
Benzo(b)Fluoranthene	µg/l	0.017 (MAC)						
Benzo(k)Fluoranthene	µg/l	0.0063 (AA) 0.017 (MAC)						
Fluoranthene	µg/l	0.12 (MAC)						
Tributyltin (TBT)	µg/l	0.0002 (AA) 0.0015 (MAC)						
Hexachlorobenzene	µg/l	0.05 (MAC)					<0.001 (*n* = 1)	
Hexachlorobutadiene	µg/l	0.6 (MAC)					<0.003 (*n* = 1)	
BDE 28	µg/l							
BDE 47	µg/l							
BDE 99	µg/l							
BDE 100	µg/l							
BDE 153	µg/l							
BDE 154	µg/l							

Parameter	Unit	EQS[1]	2015	2016	2017	2018	2019	2021
Arsenic	µg/l	25 (AA)						
Cadmium	µg/l	0.2 (AA)		0.04 – 0.106) $\bar{x}$ = 0.071667 (*n* = 9)	0.0362 – 0.105) $\bar{x}$ = 0.058483 (*n* = 12)	0.0363 – 0.109) $\bar{x}$ = 0.063375 (*n* = 12)	<0.03 – 0.0646 $\bar{x}$ = 0.046333 (*n* = 3)	0.046 (*n* = 1)
Chromium (VI)	µg/l	0.6 (AA); 32 (MAC)		<0.5 (*n* = 9)	<0.5 (*n* = 12)	<0.5 (*n* = 4)	<0.03 – 0.0646 $\bar{x}$ = 0.046333 (*n* = 3)	
Copper	µg/l	3.76 (AA)		1.63 – 2.83 $\bar{x}$ = 2.255556 (*n* = 9)	1.9 – 3.97 $\bar{x}$ = 2.635833 (*n* = 12)	1.99 – 2.98 $\bar{x}$ = 2.5 (*n* = 6)	2.5 (*n* =1)	2 (*n* = 1)
Lead	µg/l	1.3 (AA); 14 (MAC)		0.052 – 0.148 $\bar{x}$ = 0.106778 (*n* = 9)	0.063 – 0.174 $\bar{x}$ = 0.120808 (*n* = 12)	0.0559 – 0.199 $\bar{x}$ = 0.105358 (*n* = 12	0.131 – 0.232 $\bar{x}$ = 0.181 (*n* = 3)	0.15 (*n* = 1)
Mercury	µg/l	0.07 (MAC)	<0.01 (*n* = 1)	<0.01 – 0.0341 $\bar{x}$ = 0.012192 (*n* = 12)	<0.01 (*n* = 12)	<0.01 (*n* = 12	<0.01 (*n* = 3)	
Nickel	µg/l	8.6 (AA); 34 (MAC)		1.11 – 1.71 $\bar{x}$ = 1.472222 (*n* = 9)	1.16 – 2.05 $\bar{x}$ = 1.609167 (*n* = 12)	0.8 – 2.09 $\bar{x}$ =1.479167 (*n* = 12	1.28 – 2.54 $\bar{x}$ = 1.873333 (*n* = 3)	1.6 (*n* = 1)
Zinc	µg/l	7.9 (AA)		8.57 – 15.3 $\bar{x}$ = 12.27778 (*n* = 9)	6.63 – 15.4 $\bar{x}$ = 11.44667 (*n* = 12)	8.64 – 15 $\bar{x}$ = 12.22333 (*n* = 6)	15.4 (*n* = 1)	12 (*n* = 1)
Benzo(a)pyrene	µg/l	0.00017 (AA) 0.0027 (MAC)		0.00024- 0.0181 $\bar{x}$ = 0.006489 (*n* = 11)	0.00097 – 0.0174 $\bar{x}$ = 0.006654 (*n* = 12)	0.00028 - <0.05 $\bar{x}$ = 0.012916 (*n* = 12)	0.00995 – 0.0154 $\bar{x}$ = 0.012283 (*n* = 3)	0.0084 (*n* = 1)
Benzo(g,h,i)Perylene	µg/l	0.00082 (MAC)		0.00039 – 0.0198 $\bar{x}$ = 0.006748 (*n* = 12)	0.00152 – 0.0218 $\bar{x}$ = 0.008155 (*n* = 12)	0.00061 – 0.05 $\bar{x}$ = 0.013807 (*n* = 12)	0.013 – 0.0183 $\bar{x}$ = 0.0148 (*n* = 3)	0.0097 (*n* = 1)
Benzo(b)Fluoranthene	µg/l	0.017 (MAC)		0.00036 – 0.0145 $\bar{x}$ = 0.004968 (*n* = 12)	0.00131 – 0.0141 $\bar{x}$ = 0.006374 (*n* = 11)	0.00058 – 0.05 $\bar{x}$ = 0.012305 (*n* = 12)	0.00885 – 0.013 $\bar{x}$ = 0.010483 (*n* = 3)	0.0069 (*n* = 1)
Benzo(k)Fluoranthene	µg/l	0.0063 (AA) 0.017 (MAC)		0.00016 – 0.00784 $\bar{x}$ =0.00268 (*n* = 12)	0.00061 – 0.00761 $\bar{x}$ = 0.00304 (*n* = 12)	0.00021 – <0.05 $\bar{x}$ = 0.00878 (*n* = 12)	0.00473 – 0.00675 $\bar{x}$ = 0.00545 (*n* = 3)	0.0034 (*n* = 1)
Fluoranthene	µg/l	0.12 (MAC)		0.00148 – 0.0138 $\bar{x}$ = 0.005751 (*n* = 12)	0.00155 – 0.0101 $\bar{x}$ = 0.006028 (*n* = 12)	0.0013 – <0.05 $\bar{x}$ = 0.010644 (*n* = 12)	0.00926 – 0.0186 $\bar{x}$ = 0.012887 (*n* = 3)	0.0066 (*n* = 1)
Tributyltin (TBT)	µg/l	0.0002 (AA) 0.0015 (MAC)		<0.0002 – 0.00021 $\bar{x}$ = 0.000201 (*n* = 9)	<0.0002 – 0.00026 $\bar{x}$ = 0.000212 (*n* = 12)	<0.0002 – 0.0004 $\bar{x}$ = 0.000231 (*n* = 12)	0.00023 – 0.0003 $\bar{x}$ = 0.000231 (*n* = 12)	<0.0002 (*n* = 1)
Hexachlorobenzene	µg/l	0.05 (MAC)	<0.001 (*n* = 10)	<0.0001 – <0.001 $\bar{x}$ = 0.0007 (*n* = 12)	<0.0001 – <0.001 $\bar{x}$ = 0.001073 (*n* = 11)	<0.001 (*n* = 4)		
Hexachlorobutadiene	µg/l	0.6 (MAC)	<0.003 (*n* = 10)	<0.0001 - <0.003 $\bar{x}$ = 0.002033 (*n* = 12)	0.00011 - < 0.005 $\bar{x}$ = 0.001077 (*n* = 12)	<0.001 (*n*= 4)		
BDE 28	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		
BDE 47	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		
BDE 99	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		
BDE 100	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		
BDE 153	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		
BDE 154	µg/l		<0.0006 (*n* = 6)	<0.0006 (*n* = 12)	<0.0006 (*n* = 12)	<0.0006 (*n* = 4)		

[1] As described under the WFD (Standards and Classification) Directions (England and Wales) 2015.;
EQS Environmental Quality Standard; AA – Annual Average; MAC – Maximum Allowable Concentration; $\bar{x}$ – Mean; *n* – number of samples;
Note: Range and mean values are likely to be conservative when using concentrations given as '<'.

Source: Environment Agency (2021)

3 Scoping

The "Clearing the Water for All" guidance provides a scoping template to record findings and consider potential risks for several key receptors, specifically:

- Hydromorphology;
- Biology (habitats);
- Biology (fish);
- Water quality;
- Protected areas; and
- Invasive non-native species (INNS).

Each receptor is considered in the following sections and summarised in a table. Potential risks that have been scoped into the assessment are highlighted in red and considered within the impact assessment stage, while those scoped out of the assessment are highlighted in green.

3.1 Hydromorphology

Hydromorphology is the physical characteristics of estuaries and coasts, including the size, shape and structure of the water body and the flow and quantity of water and sediment. Table 10 presents a summary of hydromorphological considerations and associated risk issues for maintenance dredging and disposal activities. As at least one hydromorphological consideration indicates that a risk could be associated with these ongoing works, this receptor has been scoped into the impact assessment (Section 0).

Table 10. Hydromorphology risk issues in the study area water bodies

Hydromorphology Considerations	Hydromorphology Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Consider if your activity could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status?	No (morphology status 'supports good'). Impact assessment not required.	No (hydromorphology not assessed). Impact assessment not required.	No (morphology status 'supports good'). Impact assessment not required.
Consider if your activity could significantly impact the hydromorphology of any water body?	Yes (potential changes in hydrodynamics and morphology). Requires impact assessment.	Yes (potential changes in hydrodynamics and morphology). Requires impact assessment.	No (indirect impacts to hydromorphology unlikely for this water body). Impact assessment not required.
Consider if your activity is in a water body that is heavily modified for the same use as your activity?	Yes (reason for hydromorphological designation is navigation ports and harbours). Requires impact assessment.	Yes (reason for hydromorphological designation is navigation ports and harbours). Requires impact assessment	No (reason for hydromorphological designation is flood protection). Impact assessment not required.

3.2 Biology (habitats)

It is necessary to consider the impact of the physical footprint of an activity on nearby marine and coastal habitats. This specifically refers to habitats of higher sensitivity (e.g. intertidal seagrass, maerl and saltmarsh) and lower sensitivity (e.g. cobbles, gravel and shingle, subtidal rock reef and intertidal soft sediments like sand and mud). Table 11 presents a summary of biology (habitats) considerations and associated risk issues for maintenance dredging and disposal activities. As the biology (habitats) considerations indicate that a risk could be associated with these ongoing works, this receptor has been scoped into the assessment (Section 0).

Table 11. Biology (habitats) risk issues in the study area water bodies

Biology (Habitats) Considerations	Biology (Habitats) Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Is the footprint of the activity 0.5 km^2 or larger?	Yes (dredge area >0.5 km^2). Requires impact assessment.	Yes (dredge area >0.5 km^2). Requires impact assessment.	No (dredge areas not within water body). Impact assessment not required.
Is the footprint of the activity 1% or more of the water body's area?	Yes (footprint >1% water body area). Requires impact assessment.	Yes (footprint >1% water body area). Requires impact assessment.	No (dredge areas not within water body). Impact assessment not required.
Is the footprint of the activity within 500 m of any higher sensitivity habitat?	Yes (mussel beds, subtidal kelp beds, saltmarsh, <500 m of the Mersey). Requires impact assessment.	No (higher sensitivity habitats >2 km away from dredge activities). Impact assessment not required.	No (dredge areas not within water body). Impact assessment not required.
Is the footprint of the activity 1% or more of any lower sensitivity habitat?	No (footprint <1% lower sensitivity habitat). Impact assessment not required.	No (footprint <1% lower sensitivity habitat). Impact assessment not required.	No (dredge areas not within water body). Impact assessment not required.

3.3 Biology (fish)

Activities occurring within an estuary could impact on normal fish behaviour such as movement, migration or spawning. Table 12 presents a summary of biology (fish) considerations and associated risk issues for maintenance dredging and disposal activities. As the biology (fish) considerations indicate that a risk could be associated with these ongoing works, this receptor has been scoped into the assessment (Section 0).

Table 12. Biology (fish) risk issues in the study area water bodies

Biology (Fish) Considerations	Biology (Fish) Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Consider if your activity is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary?	Yes. Guidance suggests "Continue with questions".	Yes. Guidance suggests "Continue with questions".	Yes. Guidance suggests "Continue with questions".
Consider if your activity could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)?	Yes (potential changes in noise levels and suspended sediment concentrations). Impact assessment required.	No (biological quality element 'fish' not assessed for coastal water bodies; maintenance dredging and disposal unlikely to affect migratory fish). Impact assessment not required.	No (dredge areas not within water body). Impact assessment not required.
Consider if your activity could cause entrainment or impingement of fish?	No (entrainment risk considered minimal). Impact assessment not required.	No (entrainment risk considered minimal). Impact assessment not required.	No (dredge areas not within water body). Impact assessment not required.

3.4 Water quality

Consideration should be made regarding whether phytoplankton status and harmful algae could be affected by the proposed works, as well as identifying the potential risks of using, releasing or disturbing chemicals. Table 13 presents a summary of water quality considerations and associated risk issues for maintenance dredging and disposal activities. As at least one water quality consideration indicates that a risk could be associated with these ongoing works, this receptor has been scoped into the impact assessment (Section 0).

Table 13. Water quality risk issues in the study area water bodies

Water Quality Considerations	Water Quality Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Consider if your activity could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)?	Yes. Requires impact assessment.	Yes. Requires impact assessment.	No (dredge and disposal areas not within water body). Impact assessment not required.
Consider if your activity is in a water body with a phytoplankton status of moderate, poor or bad?	Yes (phytoplankton status is currently moderate). Requires impact assessment.	Yes (phytoplankton status is currently moderate). Requires impact assessment.	No (phytoplankton status is currently not assessed). Impact assessment not required.
Consider if your activity is in a water body with a history of harmful algae?	No (history of harmful algae not monitored). Impact assessment not required.	No (history of harmful algae not monitored). Impact assessment not required.	No (history of harmful algae not monitored). Impact assessment not required.
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if the chemicals are on the Environmental Quality Standards Directive (EQSD) list?	Yes (potential for contaminants in sediments to be disturbed during works). Requires impact assessment.	Yes (potential for contaminants in sediments to be disturbed during works). Requires impact assessment.	No (dredge and disposal areas not within water body). Impact assessment not required.
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if it disturbs sediment with contaminants above Cefas Action Level 1?			
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if the chemicals released are on the Environmental Quality Standards Directive (EQSD) list?	No (not applicable). Impact assessment not required.	No (not applicable). Impact assessment not required.	No (not applicable). Impact assessment not required.

3.5 Protected areas

Consideration should be made regarding whether WFD protected areas are at risk from your activity, including SACs and SPAs (Natura 2000 sites), as well as bathing waters, shellfish waters and nutrient sensitive areas. Table 14 presents a summary of protected area considerations and associated risk issues for maintenance dredging and disposal activities. As the protected areas considerations indicate that a risk could be associated with these ongoing works, this receptor has been scoped into the impact assessment (Section 0).

Table 14. Protected area risk issues in the study area water bodies

Protected Area Considerations	Protected Area Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Consider if your activity is within 2 km of any WFD protected area?	Yes (overlap with nature conservation designated sites and Shellfish Water Protected Areas). Impact assessment required.	Yes (overlap with nature conservation designated sites and Shellfish Water Protected Areas). Impact assessment required.	No (dredge areas not within water body). Impact assessment not required.

3.6 Invasive non-native species (INNS)

Consideration should be made regarding whether there is a risk the activity could introduce or spread INNS. Risks of introducing or spreading INNS include materials or equipment that have come from, had use in or travelled through other water bodies, as well as activities that help spread existing INNS, either within the immediate water body or other water bodies. Table 15 presents a summary of INNS considerations and associated risk issues for maintenance dredging and disposal activities. As the INNS considerations indicate that a risk could be associated with these ongoing works, this receptor has been scoped into the impact assessment (Section 0).

Table 15. Invasive non-native species (INNS) risk issues in the study area water bodies

INNS Considerations	INNS Risk Issue(s)		
	Mersey	Mersey Mouth	Alt
Consider if your activity could introduce or spread INNS?	Yes (potential for introduction or spread of INNS). Requires impact assessment.	Yes (potential for introduction or spread of INNS). Requires impact assessment.	Yes (potential for introduction or spread of INNS). Requires impact assessment.

4 Impact Assessment

An impact assessment should be conducted for each receptor identified during the scoping stage as being at risk from an activity. The following receptors have been scoped into the impact assessment:

- Hydromorphology;
- Biology (habitats);
- Biology (fish);
- Water quality;
- Protected areas; and
- Invasive non-native species (INNS).

Each of these WFD parameters has been evaluated in order to determine whether the proposed activities might cause deterioration in the status of the relevant water body (defined as a non-temporary effect on status at water body level), or an effect that prevents the water body from meeting its WFD objectives.

4.1 Hydromorphology

Maintenance dredging within the Mersey (to the currently permitted depths under the marine licences held by stakeholders in the area) and disposal at sea have been undertaken to support the port infrastructure present in the study area for many years. It is important to note that dredge campaigns are only completed as necessary to ensure safe navigation based on pre-dredge surveys and monitoring. Some maintenance dredging activities within the Mersey can be carried out by Mersey Docks and Harbour Company Limited (MDHC), part of the Peel Ports Group, under its own powers and do not require a marine licence. MDHC follows the same approach and principles as the MMO does in determining dredge licence applications (i.e. taking account of existing permitted depths, volumes/quantities and dredge and disposal methods etc. as well as contamination concentrations relative to the relevant Action Levels) when it undertakes any maintenance dredging under its own powers.

The Alt transitional water body is outside of dredge and disposal areas and is thus considered unlikely to be impacted by changes brought about from maintenance dredging in the Mersey transitional water body and Mersey Mouth transitional water body.

The dredge footprint within the approach channel, dock systems and berths on both banks of the Mersey results in localised changes to seabed bathymetry. These cause a change in the local geometry, which in turn marginally increase the Mersey's tidal volume. However, there is no change in tidal prism as all the dredge areas are subtidal. The scale of these changes is considered to be negligible and will not modify the way the tide propagates through the Mersey, in terms of the shape of the tidal curve, water levels and tidal range. Changes to flows following maintenance dredging will also be negligible in magnitude and extent, confined to the close proximity of the dredge, and will not result in a change in the hydrodynamic working of the estuary.

Overall, maintenance dredging is considered unlikely to result in any significant changes in hydromorphology or associated coastal and flood protection. The works are, therefore, not expected to lead to a deterioration of the assessed hydromorphological elements within the Mersey transitional water body or the Mersey Mouth transitional water body, nor prevent these waterbodies from meeting their WFD objectives.

4.2 Biology (habitats)

Subtidal kelp beds, coastal saltmarsh, and mussel beds (higher sensitivity habitats) are located within 500 m of the dredge and disposal sites. To the south of the Eastham and Garston Approach Channels there are swathes of saltmarsh located on the southern bank, and thinner saltmarsh areas located on the northern bank. Areas of mussel beds are located either side of the Garston approach channel, with kelp beds in the vicinity of the 12 Quays terminal and the Liverpool Impounded Dock system. More mussel beds are located in the vicinity of the New Brighton Shoal on the western bank of the Mersey Estuary[8].

Impacts arising from the resuspension of sediment are expected to be negligible and well within the natural variability of the system and, therefore, will have no impact on subtidal kelp beds, coastal saltmarsh, and mussel beds in the wider area.

There is also extensive coastal saltmarsh within the Alt transitional water body, (and discrete patches in the Mersey Mouth coastal water body); however, these are not located within the dredge areas and, therefore, would be limited to indirect disturbance through suspension of sediments and smothering. It is considered unlikely that maintenance dredging would result in significant impacts to these higher sensitivity habitats in the context of naturally high suspended sediment concentrations within and outside of the Mersey Estuary.

It should also be noted that maintenance dredging within the Mersey (to the currently permitted depths under Marine Licences L/2015/00294/1, L/2018/00334/1, L/2021/00101/1 and L/2015/00351/1) and disposal at sea have been undertaken to support maintenance dredging in the Mersey Estuary and associated dock systems for many years.

In conclusion, these ongoing works are not expected to lead to a deterioration of the assessed biological (habitats) elements within the Mersey transitional water body or downstream Mersey Mouth water body, nor prevent these water bodies from meeting their WFD objectives.

4.3 Biology (fish)

The main impact pathway in which fish may be affected by maintenance dredging is from elevated underwater noise levels. Elevated noise and vibration levels caused by the action of the dredger could potentially disturb fish by causing physiological damage and/or inducing adverse behavioural reactions and masking (Hawkins *et al*., 2015). Noise impacts on fish are restricted to behavioural changes through avoidance, which are limited to a localised area around the dredger for most species. As the dredger vessel is moving, fish are not physically constrained; they will be able to move away from the source of the noise and return once dredging activity has ceased. Furthermore, levels of underwater noise generated by dredgers (over the low frequencies to which fish are sensitive) are similar to vessels that are already regularly occurring in the Mersey.

Fish within the Mersey and surrounding water bodies are considered to be well adapted to living in an area with variable and often high suspended sediment loads. Any changes to suspended sediment concentrations (SSC) will be largely limited to the immediate vicinity of the maintenance dredge area. Changes in SSC beyond the immediate vicinity of the maintenance dredge areas will be temporary, short-lived and transient in nature. The resultant changes in dissolved oxygen (DO) will also be negligible and short-lived, with tidal exchange quickly replenishing the oxygen supply. It is considered that there is a low probability that levels will fall below the standards set by the WFD. The increase in

[8] https://magic.defra.gov.uk/magicmap.aspx (Accessed August 2021).

dissolved concentrations of contaminants from the redistribution of sediment-bound chemical contaminants during dredging is also expected to be low, representing only a small percentage of background concentrations and is unlikely to cause an exceedance of EQSs alone or in combination with background concentrations (see Section 4.4). Overall, fish are not considered to be sensitive to the magnitude of changes in water quality that are predicted during maintenance dredging, and the proposed dredging will, therefore, not result in significant displacement or a barrier to migratory fish.

Furthermore, fish, including migratory species, feed on a range of food items and, therefore, their sensitivity to a temporary change in the availability of a particular food resource is considered to be low. Their high mobility enables them to move freely to avoid areas of adverse conditions and to use other prey resources. Potential impacts on benthic ecology (including fish prey items) are also assessed as insignificant.

It is noted that there is potential for fish to become entrained during the use of TSHD. However, the scale and likelihood of such impacts is considered negligible.

In conclusion, the proposed works are not expected to lead to a deterioration of the assessed fish elements within the Mersey transitional water body, nor prevent this water body from meeting their WFD objectives.

4.4 Water quality

The Mersey transitional water body and Mersey Mouth coastal water body are both currently at moderate status for the biological quality element 'Phytoplankton'. However, impacts arising from resuspension of sediment are expected to be negligible and well within natural variability of the system and, therefore, will have no impact on phytoplankton in the wider area. Also, dredging activities do not introduce significant quantities of substances such as nutrients to the marine environment, which could result in harmful algal blooms.

The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere. Sand and coarser grained material will be re-deposited within close proximity to the dredge site whereas fine silts may remain in suspension for a period of days following dredging. Furthermore, any material that settles is very short-lived, most likely only occurring during slack water periods and being re-dispersed as tidal currents increase. In summary, these periods of deposition are transient and the scale of any exposure at any one time is considered to be within the existing natural variability of the system.

Based on sediment samples from 2016, contaminant concentrations in dredge material from the approach channel are generally low and considered suitable for disposal at sea (see Table 4, Table 5, Table 6, Table 7 and Table 8; reference should also be made to the recently updated Mersey MDP Baseline Document; ABPmer, 2021).

The Mersey transitional water body is currently failing chemical status due to the priority hazardous substances 'Dichlorvos', 'Polybrominated diphenyl ethers (PBDE)', 'Benzo(g-h-i)perylene', 'Heptachlor and cis-Heptachlor epoxide' and 'Mercury and its compounds'. The Mersey Mouth coastal water body is also failing for 'Polybrominated diphenyl ethers (PBDE)', 'Benzo(g-h-i)perylene', and 'Mercury and its compounds'.

As sediment is disturbed and re-distributed into the water column, any sediment-bound contaminants may be partitioned from the solid phase (i.e. bound to sediments or suspended matter), to the dissolved or aqueous phase (i.e. dissolved in pore water or overlying water) (Luoma, 1983). To determine the

maximum dissolved fraction of contaminants released into the water column, it is necessary to consider the relative potential for each contaminant to change from one phase to another (i.e. contaminant adsorbed to sediment surfaces to dissolved in the water), referred to as the partition coefficient. Partition coefficients describe the ratio between the freely dissolved concentration in water and another environmental phase (e.g. sediment-bound) at equilibrium. It should be noted that desorption rates of contaminants from suspended sediments into the water column are highly regulated by hydrodynamics, biogeochemical processes, and environmental conditions (redox, pH, salinity and temperature) (Eggleton and Thomas, 2004). Due to the variability in environmental conditions, a wide range of partition coefficients are reported in the literature.

There is potential for sediment-bound contaminants to be re-mobilised in the water column following an increase in SSC during the maintenance dredging within the study area. Sediment disturbance will be caused at the bed by abrasion pressure from the dredging equipment.

A Microsoft Excel Spreadsheet tool developed by APEM Ltd, referred to as SeDiChem, that was provided by the Environment Agency for a project on the Thames Estuary, has been used to support consideration of potential uplift in contaminant concentrations.

In order to apply this tool, a realistic typical scenario of the maintenance dredging operations must be used. Fundamental to the calculations produced by the tool is data on water quality to determine background concentrations. For the purposes of this assessment, Environment Agency monitoring data at Mersey Estuary at Seacombe Ferry (NW-88002822) in the River Mersey was used, located in the Narrows of the Mersey between Birkenhead Docks and Liverpool Docks and close to maintenance dredging operations at Alfred Lock Entrance, 12 Quays Terminal and Liverpool Landing Stage. There is also representative and relatively recent sediment sampling data close to this location (Table 4 to Table 8). Trailer Suction Hopper Dredging (TSHD), Water injection dredging (WID), Grab Hopper Dredging (GHD) and plough dredging are the principal methods used to maintain navigable depth in the Mersey and dock systems.

Table 16 provides a summary of the SeDiChem tool outputs, with empirical calculations based on a number of simple assumptions. This includes general site parameters (e.g. conservative net flow rate of 3,283,200 m^3/day based on an average for the Mersey Estuary of 38 m^3/second (Ridgeway *et al*., 2012)), maximum incremental SSC (379 mg/l based on average value for TSHD, WID, grab and plough dredging noted in the SSC uplift library within the SeDiChem tool), worst case partition coefficients from suggested literature, and sediment quality from samples collected within the proposed dredge area (maximum concentrations from samples MER1 to MER17). As noted above, maximum background water quality concentrations have been inputted based on Environment Agency monitoring data from the Mersey Estuary at Seacombe Ferry (NW-88002822) in the River Mersey (average for the five most recent year available, see Section 2.5).

Overall, the uplift in contaminant concentrations is anticipated to be minimal, and unlikely to present a significant issue at the water body level. Where contaminants are already reported to be failing within the water bodies (e.g. zinc, PBDEs, Benzo[g,h,i]perylene, and Mercury and its compounds), any disturbance of sediments during dredging activities will result in an uplift effectively causing a 'worse failure'. However, the scale of this deterioration is considered to be small and highly localised. As a percentage increase of EQS headroom (i.e. the capacity for the concentration to increase whilst still remaining below the environmental threshold), the increased concentration of mercury due to dredging is likely to be less than 1 %. The background dissolved concentrations for zinc and benzo[g,h,i]perylene are above the EQS, therefore no headroom is available according to the SeDiChem tool. However, as a percentage increase of background concentrations, the increase in concentration is calculated as < 1% for zinc (there is no sediment quality data for benzo[g,h,i]perylene to enable a calculation). Furthermore,

these calculations are based on a maximum sediment concentration and worst case partition coefficients.

The Environment Agency have recently identified PBDEs as presenting a widespread issue across transitional and coastal water bodies in England. Given the ubiquitous (widespread and persistent) PBDE failures, occasional and local maintenance dredging and disposal activities in the area are highly unlikely to be the sole or primary cause of such failures.

In conclusion, the ongoing maintenance dredging and disposal activities are not expected to lead to a deterioration of the assessed water quality elements within the Mersey transitional water body or the Mersey Mouth coastal water body, nor prevent these water bodies from meeting their WFD objectives.

Table 16 **Potential contaminant concentrations as a result of maintenance dredging in the Mersey transitional water body based on SeDiChem tool outputs**

Parameter	Max. Sediment Concentration (mg/kg)	Current WFD Status	Partition Coefficient (l/kg)	EQS (µg/l)	Dissolved Concentration (Background* and Dredging) (µg/l)	Concentration Increase due to Dredging (% of Background)	Concentration Increase as % of EQS Headroom
Arsenic	25.74	High	40	25 (dissolved)	3.439	13.506%	1.86%
Cadmium	0.51	Good	100	0.2 (dissolved)	0.065	5.381%	2.42%
Chromium	70.54	High	79	32 (dissolved)	0.999	122.058%	1.74%
Copper	32.47	High	3,162	3.76 (dissolved)	2.467	0.268%	0.51%
Lead	86.21	Good	35,481	14 (dissolved)	0.122	1.289%	0.01%
Mercury	0.75	Fail	6,310	0.07 (dissolved)	0.011	0.679%	0.13%
Nickel	45.63	Good	500	34 (dissolved)	1.607	3.657%	0.17%
Zinc	265.88	Moderate	12,589	8.8 (dissolved)	12.033	0.112%	No headroom
Benzo(a) pyrene	-	Good	9,120	0.027 (total)	-	-	-
Benzo(b) fluoranthene	-	Good	20,795	0.017 (total)	-	-	-
Benzo(g,h,i) perylene	-	Fail	20,369	0.00082 (total)	-	-	-
Benzo(k) fluoranthene	-	Good	19,859	0.017 (total)	-	-	-
Fluoranthene	-	Good	1,475	0.12 (total)	-	-	-
Tributyltin (TBT)	0.002	Good	53	0.0015 (total)	0.000	11.343%	1.95%

* Averaged for the five most recent years of data

4.5 Protected areas

The dredge and disposal areas directly overlap, or are in the vicinity of, the following international nature conservation designated sites (Figure 9):

- Dee Estuary SAC and Ramsar;
- Liverpool Bay SPA;
- Mersey Estuary SPA and Ramsar;
- Mersey Narrows and North Wirral Foreshore SPA and Ramsar;
- Ribble and Alt Estuaries SPA and Ramsar; and
- Sefton Coast SAC

The recently updated Mersey MDP Baseline Document (ABPmer, 2021) provides details about these designated sites which protect a range of habitats and species.

The habitats within the direct and indirect footprint of the maintenance dredge areas and disposal sites are routinely disturbed by this longstanding activity. Waterbirds in the Mersey and surrounding areas are accustomed to high levels of commercial and recreational vessel activity with the area already subject to regular vessels movements as a result of the associated port and shipping industries. Therefore, the slow movements of the vessels involved in maintenance dredging and disposal are unlikely to cause significant disturbance to most species. Any disturbance that does occur will generally be temporary, infrequent and only cause mild responses in a localised area in the direct vicinity of the dredger. Such responses include increased vigilance, flight responses and localised avoidance.

The potential effects resulting from an increase in SSC and the release of sediment bound contaminants are assessed as negligible. Localised changes in water quality as a result of the presence of increased contaminants within the water column will be temporary and unlikely to be harmful to waterbirds. In addition, the dredging activities are not predicted to have an adverse effect on the benthic and fish prey species of these birds. Furthermore, best practice pollution prevention guidelines will be followed in line with Marine Licence requirements to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout the dredging process.

The Mersey Approach Channel dredge area also partially overlaps with the North Wirral (East) Shellfish Water Protected Area. However, any changes to SSC will be temporary, lasting the period of the dredge works. Overall, the spatial and temporal magnitude of change in SSC is considered to be minor locally and negligible further afield. The potential changes to levels of chemical contaminants in the water and the potential redistribution of sediment-bound chemical contaminants are considered to be insignificant. Thus, in physical terms, the plumes resulting from dredging are expected to have a minimal and very localised effect on water and sediment quality. Overall, considering the highly localised effects of the maintenance dredging on the above nature conservation designated sites and Shellfish Water Protected Area, these will be also negligible in the context of natural variation of the Mersey.

In conclusion, the ongoing maintenance dredging and disposal activities are not expected to lead to a deterioration of the assessed protected area designations within the Mersey transitional water body or the Mersey Mouth coastal water body, nor prevent these water bodies from meeting their WFD objectives.

4.6 Invasive non-native species (INNS)

As with most activities which occur in the marine environment, there is a potential risk that maintenance dredging and disposal at sea could result in the introduction or spread of INNS. Non-native species have the potential to be transported into the local area on the hulls of the vessels and via ballast water if the vessels have operated in other water bodies. This risk is considered low as most dredge and disposal activities, including WID, in the Mersey and its approaches result in the movement of material within the same water body and/or marine system. The risk of introducing or transferring INNS is currently managed through the dredge contractor's conditions of contract which stipulate that all equipment needs to be checked, cleaned and dried before moving in to the dredge area. Overall, the risk is, therefore, considered to be minimal and, if necessary, can be managed through a risk-based Biosecurity Plan.

Consequently, the probability of the introduction and spread of INNS from dredging is considered low and it is not expected to lead to a deterioration in status of the Mersey transitional water body, Alt transitional water body, or the Mersey Mouth coastal water body, nor prevent these water bodies from meeting their WFD objectives.

5 Conclusion

Based upon the information presented within this WFD compliance assessment, it is concluded that maintenance dredging and disposal activities undertaken within the Mersey are not likely to have a permanent (i.e. non-temporary) effect on the status of WFD parameters that are significant at water body level. Therefore, deterioration to the current status of the Mersey transitional water body, Alt transitional water body, or the Mersey Mouth coastal water body is not predicted, nor will the maintenance dredge and disposal activities prevent these water bodies achieving their WFD status objectives.

6 References

ABPmer. (2021). Mersey Estuary Maintenance Dredge Protocol (MDP) and Water Framework Directive (WFD), Baseline Document Update, ABPmer Report No. R.3721. A report produced by ABPmer for Peel Ports Mersey, September 2021.

Defra. (2016). Water Framework Directive. List of Shellfish Water Protected Areas in England. March 2016. Available online at: https://www.gov.uk/government/publications/water-framework-directive-shellfish-protected-areas (Accessed September 2021).

Department for Transport. (2019). UK port freight annual statistics: interactive dashboard. Available online at: http://maps.dft.gov.uk/port-freight-statistics/interactive-dashboard (Accessed August 2021).

Eggleton, J., and Thomas, K. V. (2004) A review of factors affecting the release and bioavailability of contaminants during sediment disturbance events. Available from: https://www.researchgate.net/publication/8510428_A_Review_of_Factors_Affecting_the_Release_and_Bioavailability_of_Contaminants_during_Sediment_Disturbance_Events (Accessed September 2021).

Environment Agency. (2016). North West River Basin District: River basin management plan. Available online at: https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan (Accessed September 2021).

Environment Agency (2021). Catchment Data Explorer. Available online at: https://environment.data.gov.uk/catchment-planning) (Accessed September 2021).

Food Standards Agency. (2021). Shellfish Classifications England and Wales 2020-21. Designated bivalve mollusc production areas in England and Wales 2020/21. Effective from 1 September 2020 – 31 August 2021. Updated: 2 July 2021. Available online at: https://www.food.gov.uk/business-guidance/shellfish-classification (Accessed September 2021).

Hawkins, A. D., Pembroke, A., and Popper, A. (2015). Information gaps in understanding the effects of noise on fishes and invertebrates. Reviews in Fish Biology and Fisheries, 25, pp. 39–64.

Luoma, S. N. (1983) Bioavailability of trace metals to aquatic organisms – A review. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0048969783800047 (Accessed September 2021)

Ridgeway, J., Bee, E., Breward, N., Cave, M., Chenery, S., Gowing, C., Harrison, I., Hodgkinson, E., Humphreys, B., Ingham, M., Jarrow, A., Jwnkins, G., Kim, A., Lister, R.T., Milodowski, A., Pearson, S., Rowlands, K., Spiro, B., Strutt, M., Turner, P. and Vane, C. (2012) The Mersey estuary: sediment geochemistry. British Geological Survey Research Report RR/10/02, Keyworth.

Websites

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/796751/sensitive-areas-map-manchester.pdf

https://environment.data.gov.uk/bwq/profiles

https://environment.data.gov.uk/farmers

https://magic.defra.gov.uk/magicmap.aspx

https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

7 Abbreviations/Acronyms

AA	Annual Average
AL1	Cefas Guideline Action Level 1
AL2	Cefas Guideline Action Level 2
AWB	Artificial Water Body
Cefas	Centre for Environment, Fisheries and Aquaculture Science
DBT	Dibutyltin
DDT	Dichlorodiphenyltrichloroethane
Defra	Department for Environment, Food and Rural Affairs
DO	Dissolved Oxygen
EA	Environment Agency
EC	European Commission
EEC	European Economic Community
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive
EU	European Union
GCS	Good Chemical Status
GEP	Good Ecological Potential
GES	Good Ecological Status
GHD	Grab Hopper Dredging
GS	Good Status
HMWB	Heavily Modified Water Body
ID	Identity
INNS	Invasive Non-Native Species
LT	Long-term
MAC	Maximum Allowable Concentration
MDHC	Mersey Docks and Harbour Company Limited
MDP	Maintenance Dredge Protocol
NRA	Natural Resources Wales
NTL	Normal Tidal Limit
NVZ	Nitrate Vulnerable Zone
OCP	Organochlorine Pesticides
OJEU	Official Journal of the European Union
PAH	Polycyclic Aromatic Hydrocarbon
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PSD	Priority Substances Directive
Ramsar	Wetlands of international importance designated under the Ramsar Convention
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SeDiChem	Sediment Chemistry Data
SI	Statutory Instruments
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
TBT	Tributyltin
THC	Total Hydrocarbon Content
TSHD	Trailing Suction Hopper Dredging

UK	United Kingdom
WFD	Water Framework Directive
WID	Water Injection Dredging

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Contact Us

ABPmer

Quayside Suite,
Medina Chambers
Town Quay, Southampton
SO14 2AQ

T +44 (0) 23 8071 1840
F +44 (0) 23 8071 1841
E enquiries@abpmer.co.uk

www.abpmer.co.uk