

Riverside Energy Park

Environmental Statement Technical Appendices

APPENDIX:

B.2

PLANNING INSPECTORATE REFERENCE NUMBER:

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NAVIGATIONAL RISK ASSESSMENT

November 2018 | Revision 0 | APFP Regulation 5(2)(a)

Planning Act 2008 | Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

1 Executive Summary

- 1.1. This document comprises a Navigational Risk Assessment (NRA) which has been prepared on behalf of Cory Environmental Holdings Limited (trading as Cory Riverside Energy) (Cory or the Applicant) to support the application under the Planning Act (PA 2008) for powers to construct, operate and maintain an integrated Energy Park and associated Electrical Connection, to be known as Riverside Energy Park (REP or the Proposed Development). Cory is a leading recycling, energy recovery and resource management company. Cory consented, constructed and now operates the existing Riverside Resource Recovery Facility (RRRF) adjacent to the Proposed Development. RRRF is a key element of London's energy and resource management infrastructure.
- 1.2. Cory operates the existing Riverside Resource Recovery Facility situated at Norman Road in Belvedere which has been operating since 2011. The Proposed Development will maximise the use of Cory's existing energy and river infrastructure including its operational jetty, tugs and barges.
- 1.3. In line with the Port of London Authority's Thames Vision (2015), the Proposed Development would generate an increase in freight movements on the River Thames. A NRA, to consider the impacts of the project on the safety of navigation, has been developed as part of the Environmental Statement supporting the REP Development Consent Order application and in response to queries raised by stakeholders. Whilst the initial scoping report for the project proposed works in the river, this is no longer the case. Therefore, the Proposed Development would only utilise existing marine infrastructure.
- 1.4. This report details the project, methodologies, analysis and results of the NRA.
- 1.5. Through the use of existing infrastructure and no additional works in the river, the Proposed Development is not considered to create any physical obstruction to navigation vessels. However, REP would increase the number of tug and tow movements on the river. Between three possible NRA scenarios developed by the Cory Ligherage Team which assumes all waste delivered to REP is transported by river, this would result in one additional movement to Tilbury, and could result in one additional movement through Central London to Smugglers Wharf, or one additional movement to Barking Creek per day.
- 1.6. Analysis of existing river traffic identified a significant difference in background traffic across the study area which was inputted into the risk assessment. Cory tug and tows typically transit between three and eight knots depending on their laden/unladen state, tidal state and location.
- 1.7. Analysis of the Port of London Authority's incident data identified few incidents involving Cory tug and tows. 17 incidents were identified over eight years of data, which were mostly near misses and wash complaints. A single serious collision was recorded between a third party passenger boat and a Cory tug and tow, as a result of failures of the third party passenger boat.
- 1.8. A review of traffic projections up until 2030 suggested that an increase in vessel traffic would be likely over the course of the Proposed Development. Whilst this was assessed to be up to 20%, the Port of London Authority are committed to maintaining existing incident rates and therefore there should be no net change in risk.
- 1.9. A quantitative NRA was undertaken to measure the change in risk as a result of REP. The NRA identified that there was minimal impact upon navigational safety as a result of the additional REP traffic. Given the resultant risk scores from the NRA, no additional risk controls were proposed beyond those which are currently in effect on the river. This NRA has assumed continued use of day time tides only, any additional movements which would occur at night when the background traffic on the river is less, would have a lower impact on the risk profile.

- 1.10. In summary, this NRA has identified that the additional movements associated with REP would have a Negligible impact upon navigational safety on the River Thames with all hazards remaining at as Low as Reasonably Practicable or Low Risk levels with existing risk controls in place.

2 Introduction

- 2.1. Cory Environmental Holdings Limited (trading as Cory Riverside Energy) (Cory or the Applicant) is applying to the Secretary of State under the Planning Act 2008 (PA 2008) for powers to construct and operate an integrated Energy Park, to be known as Riverside Energy Park (REP).
- 2.2. The principal elements of REP comprise complementary energy generating development, with an electrical output of up to 96 megawatts (MWe), and an associated Electrical Connection (together referred to as the 'Proposed Development'). As the generating capacity of REP would be in excess of 50 MWe, it is classified as a Nationally Significant Infrastructure Project (NSIP) under Sections 14 and 15 of the PA 2008 and therefore requires a Development Consent Order (DCO) to authorise its construction and operation.
- 2.3. The REP site would be located adjacent to an existing Energy Recovery Facility (ERF) operated by Cory (referred to as Riverside Resource Recovery Facility (RRRF)) situated at Norman Road in Belvedere, within the London Borough of Bexley (LBB). The underground Electrical Connection would run from the REP site and terminate at the Littlebrook substation in Dartford.
- 2.4. Marico has been commissioned by the Applicant to prepare a Navigational Risk Assessment (NRA) (herein 'this report') to assess impacts of REP on the safety of navigation in the River Thames.
- 2.5. In line with the Port of London Authority's (PLA) Thames Vision (2015), the Proposed Development would necessitate an increase in freight movements on the river. This report has been developed as part of the Environmental Statement supporting the REP DCO application and in response to queries raised by stakeholders. Whilst the initial scoping report for the project considered works in the river, this is no longer the case and therefore the use of existing infrastructure is assumed with no additional obstruction to marine navigation.
- 2.6. This report details the project, methodologies, analysis and results of the NRA.

Overview of REP

- 2.7. REP would be constructed on land immediately adjacent to Cory's existing RRRF, within the London Borough of Bexley. It would comprise an integrated range of technologies including: waste energy recovery, waste anaerobic digestion, solar panels and battery storage. The main elements of REP are as follows:
 - Energy Recovery Facility (ERF): to provide thermal treatment of Commercial and Industrial (C&I) residual waste (post-recycling) with the potential for treatment of municipal solid waste (MSW);
 - Anaerobic Digestion facility: to process food and green waste. Outputs from the Anaerobic Digestion facility would be transferred off-site for use in the agricultural sector as fertiliser or as an alternative, where appropriate, used as a fuel in the ERF to generate electricity;
 - Solar Photovoltaic Installation: to generate electricity. Installed across a wide extent of the roof of the Main REP Building;
 - Battery Storage: to store and supply additional power to the local distribution network at times of peak electrical demand. This facility would be integrated into the Main REP building;
 - On Site Combined Heat and Power Connection ('CHP'): to provide an opportunity for local district heating for nearby residential developments and businesses. REP would be CHP Enabled with necessary infrastructure included within the REP site; and

- An electricity connection to the existing Littlebrook substation, in Dartford.
- 2.8. The Proposed Development would not include any additional works in the river or changes to the existing Middleton Jetty. The Proposed Development would increase the throughput at the jetty by up to a maximum of 805,920 tonnes per annum (likely throughput increase of 655,000 tonnes per annum) in addition to the existing transportation of 663,000 tonnes per annum to supply RRRF. The maximum combined throughput of waste for REP and the existing facility would therefore be 1,468,000 tonnes per annum, for which there is sufficient throughput capacity. Whilst Cory already have permission to operate the jetty 24 hours a day, existing operations occur during day time tides.
- 2.9. This increase would necessitate an increase in Cory freight operations on the river to transport the additional material generated by REP. **Section 3** describes how this would impact upon marine operations on the Thames.
- 2.10. In addition, Cory are exploring the feasibility of delivery of materials by river during the REP construction period. However, the increase in vessel movements resulting from the import of construction materials would be significantly less than the vessel movements associated with REP operations. Therefore, the assessment of movements during operations is considered adequate for identifying navigational risk and the assessment of movements during REP construction is not deemed necessary.
- 2.11. Construction is anticipated to commence in 2021, lasting three years. REP is expected to be operational in 2024.

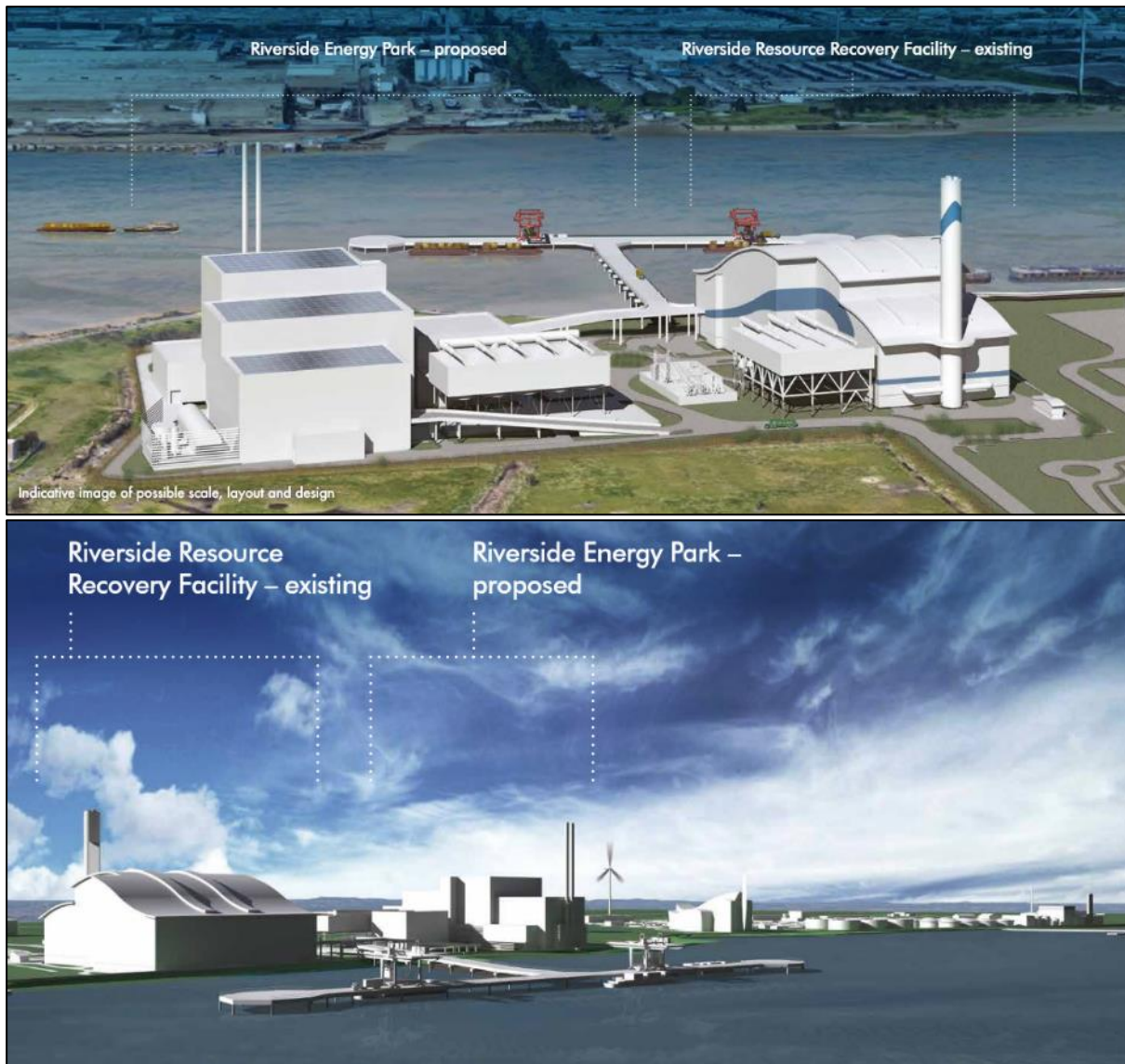


Figure 1: Indicative images of possible scale, layout and design.

Purpose of NRA

- 2.12. As the generating capacity of REP would be in excess of 50 MWe, it is classified as a Nationally Significant Infrastructure Project (NSIP) under Sections 14 and 15 of the PA 2008 and therefore requires a Development Consent Order (DCO) to authorise its construction and operation. The DCO application is accompanied by an Environmental Statement (ES).
- 2.13. Cory requested the Planning Inspectorate to prepare a Scoping Opinion under the Environmental Impact Assessment (EIA) Regulations to understand the scope of the information that should be contained in the ES.
- 2.14. The Planning Inspectorate in January 2018 provided a “Scoping Opinion: Proposed Riverside Energy Park” which describes the “scope, and level of detail, of the level of information to be provided in the environmental statement” in accordance with Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. The report recommends that a NRA is appended to the ES supporting the DCO application as described in the Transport section of the aspect based scoping tables which identified “the potential for impacts on the level

of service and level of safety for vessels on the River Thames during both construction and operation. No information has been provided as to how these impacts will be assessed, although it is noted that a Navigational Risk Assessment will be appended to the ES. The ES should set out the methodology used to undertake this assessment and to identify significant effects.”

- 2.15. The following scoping consultation responses define the scope of the NRA (noting that since this consultation was carried out the Applicant has removed the river works from the scope of Proposed Development):
- The Marine Management Organisation (MMO) advises that “impacts to navigation and other users of the sea are considered in the ES and a navigational risk assessment produced to inform final assessments.”;
 - The Maritime and Coastguard Agency (MCA) stated that they “would expect a full Navigation Risk Assessment to be carried out as part of the Environmental Statement, covering the construction, operation and decommissioning of the associated works in the marine environment, detailing the expected impact on the safety of navigation and appropriate supporting risk mitigation measures”; and
 - The PLA consider that “it is essential that a Navigational Risk Assessment (NRA) is completed as part of the Environmental Statement, and that this covers impacts during both the construction and operation stages of the Proposed Development, particularly to assess any potential risks / impacts for vessels that currently use the safeguarded Middleton Jetty”.

Scope and Methodology of NRA

- 2.16. This NRA seeks to assess the impact of the Proposed Development on the safety of navigation on the River Thames. The methodology of this assessment is described below:
- a. Describe the increase in freight movements as a result of the Proposed Development
 - b. Undertake an assessment of the baseline navigational safety of the Thames through data analysis and consultation
 - c. Develop a future case NRA Scenario that accounts for the general increases in vessel traffic and impacts of other planned or proposed projects
 - d. Develop a passage risk model for the project
 - e. Feed the model results, consultation feedback and analysis into the PLA’s standard risk assessment methodology
 - f. Identify and assess appropriate risk controls
 - g. Provide conclusions and recommendations.

Study Area

- 2.17. The study area of this assessment is defined below in **Figure 2**. It comprises the spatial extent of current and future Cory operations, upstream from Smugglers Way (Wandsworth) to downstream limits at Tilbury. Barking is marked in this figure, however this is not an existing waste transfer station and represents an indicative location which could potentially be used north of the river at some point in the future.

Assessment Criteria

2.18. This assessment has utilised the PLA’s vessel type classification of their incident database (see **Table 1**). All analysis and assessment has considered each of these vessel types in terms of navigational incidents; namely collisions, contacts and groundings.

Table 1: Vessel Types.

No.	Vessel Types	Vessel Type Details
1	Commercial Shipping	Large sea-going commercial vessels e.g. dredgers, tankers, cargo vessels, cruise ships etc.
2	Inland Passenger	Small passenger vessels including Traditional Class 5 sightseeing, passenger ferries, high speed passenger RIBs etc.
3	Inland Non-Passenger	Workboats, tugs and tows, port tenders etc.
4	Recreational	All recreational (powered and unpowered), including yachts, pleasure craft, canoes, rowers, kayaks etc.



Figure 2: Study area and location of existing and possible activity sites for REP.

3 Cory Operations

3.1. Cory is one of the UK's leading resource management, recycling, and energy recovery companies. Cory operate one of the largest Energy from Waste facilities in the United Kingdom, located on the banks of the River Thames in London, utilising river-based infrastructure, transporting London's waste on a fleet of barges and turning it into reliable, low carbon/renewable energy.

Cory Fleet

3.2. **Table 2** and **Table 3** summarises the current Cory tug and barge fleet.

Table 2: Cory Tug Fleet

Name	Length (metres)	Breadth (metres)	Gross tonnage	MMSI
Regain	25.95	8.98	125.65	235053647
Recovery	22.65	8.00	86.69	235078634
Resource	22.65	8.00	86.69	235078638
Reclaim	22.65	8.00	86.69	235078639
Redoubt	22.65	8.00	86.69	235078641
Merit (e.g. Down River Tug)	22.98	6.12	82.66	235053642

Table 3: Cory Barge Fleet

Class	Number of Barges in Fleet	Length (metres)	Breadth (metres)	Draught (metres)	GRT	Container Capacity (Operational / Maximum)
Cringle	24	33.5	7.48	3	250	19/20
Northumberland	6	49.7	7.9	3.02	347	29/30
Walbrook	5	42.3	7.9	3	302	25/26
WRWA	12	45.72	7.9	3.02	305	29/30
ASH	7	45	7.9			25/26

Existing Operations

3.3. **Table 4** shows an average weekday and Saturday (shown in brackets) activity on the river which is representative of current operations. These movements are tidal, using the day-time tide, and no movements take place on Sundays. Typical timings are as follows:

- Monday – Friday:
 - Tilbury Tugs: 0600 to 1800
 - London Tugs: 0600 to 2100
- Saturday:
 - Tilbury Tugs: 0700 to 1500
 - London Tugs: 0600 to 1700

- Sunday as required.

3.4. Activity outside of these hours does occur, particularly on Saturday.

3.5. It should be noted that there is considerable variation in activities based on waste supply at different Waste Transfer Station (WTS) sites. Each day two tugs serve the upper Waste Transfer Stations sites of Smugglers Way and Cringle Dock, one tug serves the Walbrook Wharf and Northumberland Wharf WTS sites and a third tug services Port of Tilbury.

Table 4: Baseline outline logistics plan (Saturdays in brackets).

Station	No. of barges per tide	No. of tugs per tide	Inbound journeys	Outbound journeys
Smugglers	2	2	2	2
Cringle	4			
Walbrook	1 (0)	1 (0)	1 (0)	1 (0)
Northumberland	1 (0)			
RRRF Ash/Jetty	1/2 (1)	1	1	1
TOTALS	9/10 (7)	4 (3)	4 (3)	4 (3)

3.6. **Appendix A** shows analysis of Cory movements from the Automatic Identification System (AIS) data collected as part of this study. Identifying the routes taken and major sites/layby moorings serviced.

Proposed REP Operations

3.7. The specific operational characteristics of REP are not known at this time and therefore for the purposes of the NRA, three NRA Scenarios (one representative and two indicative) have been developed by Cory as to how the REP facility may be serviced by different existing riparian Waste Transfer Station (WTS) sites and/or indicative potential WTS locations in the future.

3.8. For the purposes of this assessment the number of barges required to service each site, and therefore the associated vessel movements, was calculated on the precautionary assumption that all waste is delivered to REP via the river and not by road. This ensures that the NRA covered the greatest potential impact on navigation safety on the Thames.

3.9. In developing the three scenarios, the Cory Lighterage Team took into account the current operations, fleet characteristics and constraints on the river, such as PLA regulations, to ensure the scenarios were realistic.

3.10. The scenarios are described below and are assessed throughout the NRA.

Representative NRA Scenario 1 – Maximising Smugglers Way

3.11. Representative NRA Scenario 1 maximises the waste transfer from Smugglers Way up to the consent limit of 732,000 tonnes, more than tripling the annual throughput. To achieve this, three tugs would be required to service Smugglers Way, an increase of one on a regular basis. An additional tug would also service Tilbury in this NRA Scenario.

Table 5: Representative NRA Scenario 1 outline logistics plan (Saturdays in brackets).

Station	No. of barges	No. of tugs	Inbound journeys	Outbound journeys
Smugglers	5	3	3	3
Cringle	4			
Walbrook	2 (1)	1	2 (1)	2 (1)
Northumberland	2 (1)			
Tilbury Ash	3/2 (2)	1	1	1
Tilbury Waste	1	0/1	1	1
RRRF jetty	N/A	1	0	0
TOTALS	16/17 (14)	6/7	7 (6)	7 (6)
ADDITIONAL	7	3	3	3

Indicative NRA Scenario 2 – Maximising Tilbury

- 3.12. Indicative NRA Scenario 2 transfers a larger proportion of waste to Tilbury, whilst doubling the transfer from Smugglers Wharf. In this Indicative NRA Scenario, one additional journey would be made to Smugglers Way and one additional journey made to Tilbury.

Table 6: Indicative NRA Scenario 2 outline logistics plan (Saturdays in brackets).

Station	No. of barges	No. of tugs	Inbound journeys	Outbound journeys
Smugglers	5 (4)	3	3	3
Cringle	4			
Walbrook	2/1	1	2	2
Northumberland	2			
Tilbury Ash	3/2 (2)	1	1	1
Tilbury Waste	3 (2)	1	1	1
RRRF jetty	N/A	1	0	0
TOTALS	17/19 (16)	7	7	7
ADDITIONAL	8/9	3	3	3

Indicative NRA Scenario 3 – Use of Barking Creek

- 3.13. Indicative NRA Scenario 3 introduces waste transfer from Barking Creek. This Indicative NRA Scenario would be similar to the existing model, however two additional movements up to Barking Creek (indicative location only – no existing WTS) and Tilbury would be required.

Table 7: Indicative NRA Scenario 3 outline logistics plan (Saturdays in brackets).

Station	No. of barges	No. of tugs	Inbound journeys	Outbound journeys
Smugglers	2	2	2	2
Cringle	4			
Walbrook	2/1 (2)	1	2	2
Northumberland	2			
Tilbury Ash	3/2 (2)	1	1	1
Tilbury Waste	3	1	1	1
Barking	3 (2)	1	1	1
RRRF jetty	N/A	1	0	0
TOTALS	17/19 (18)	7	7	7
ADDITIONAL	8/9	3	3	3

4 Baseline Navigation Safety on Thames

Management of the Safety of Navigation

- 4.1. This assessment includes all existing risk control measures operated by both the PLA and Cory, in particular:

Cory:

- Generic Passage Plans and Risk Assessments
- Safety Management System
- Towing Procedures
- Tug type and specification
- Emergency Procedures
- Boatmaster's License / Training
- Local Knowledge Endorsement

PLA:

- General Directions
- Byelaws
- Pilotage Directions
- Safety Management System
- Codes of Practice
- Reporting Vessel Classification and Requirements (e.g. Isophase Lights)

- 4.2. These are discussed as relates to the risk assessment in **Section 6**.

Existing Vessel Traffic

- 4.3. To understand the baseline profile of the River Thames, analysis was undertaken of AIS data from the following two sources taken between the 17th to 30th June 2018:

- Marico AIS system
- Marine Traffic Data Extract

- 4.4. The combination of these two data sources ensured full coverage between Putney and Tilbury for the sample two weeks.

- 4.5. **Figure 3** shows the exposure of activity by vessel type in each of the reaches of the study area. The key areas of activity are in the central reaches of Lambeth Reach to Lower Pool, which are more than ten times the levels across the rest of the river.

4.6. **Figure 4** expands **Figure 3** to show just the exposure of Cory vessels in transit. Cory are active across the river, with key peaks seen in locations where significant manoeuvring occurs, at Woolwich and Barking Reaches.

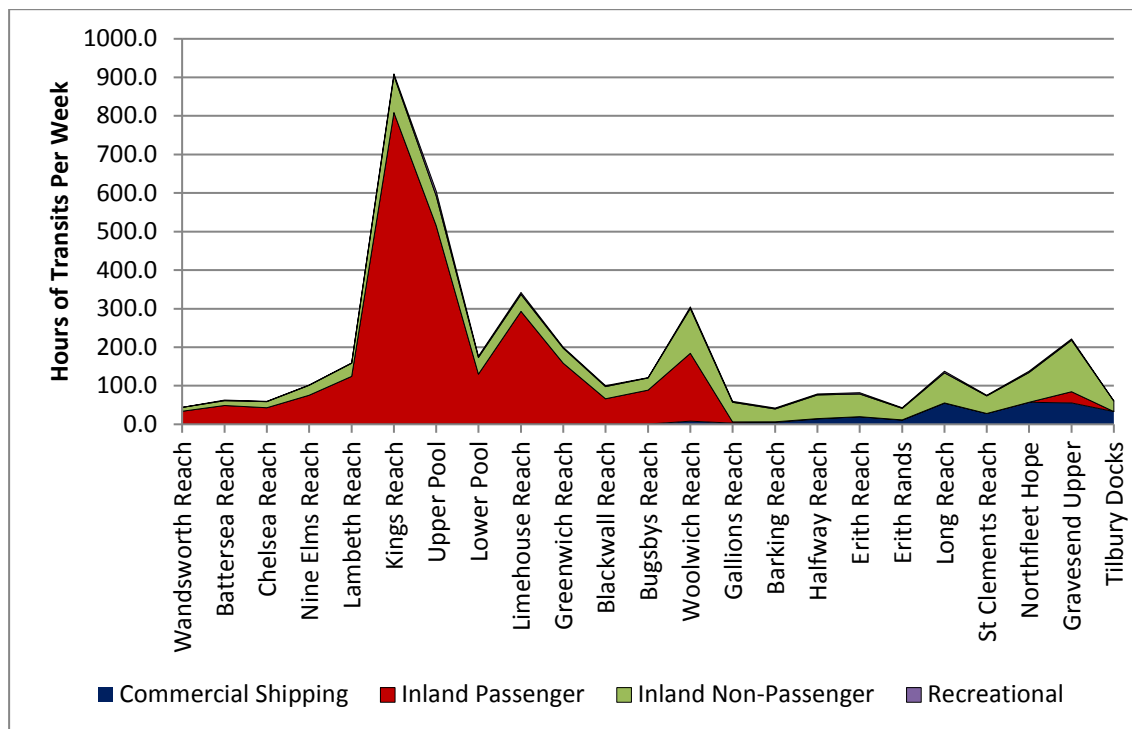


Figure 3: Exposure by Vessel Type by Reach (June 2018) (note only a small proportion of recreational craft transmit AIS and therefore are under-represented).

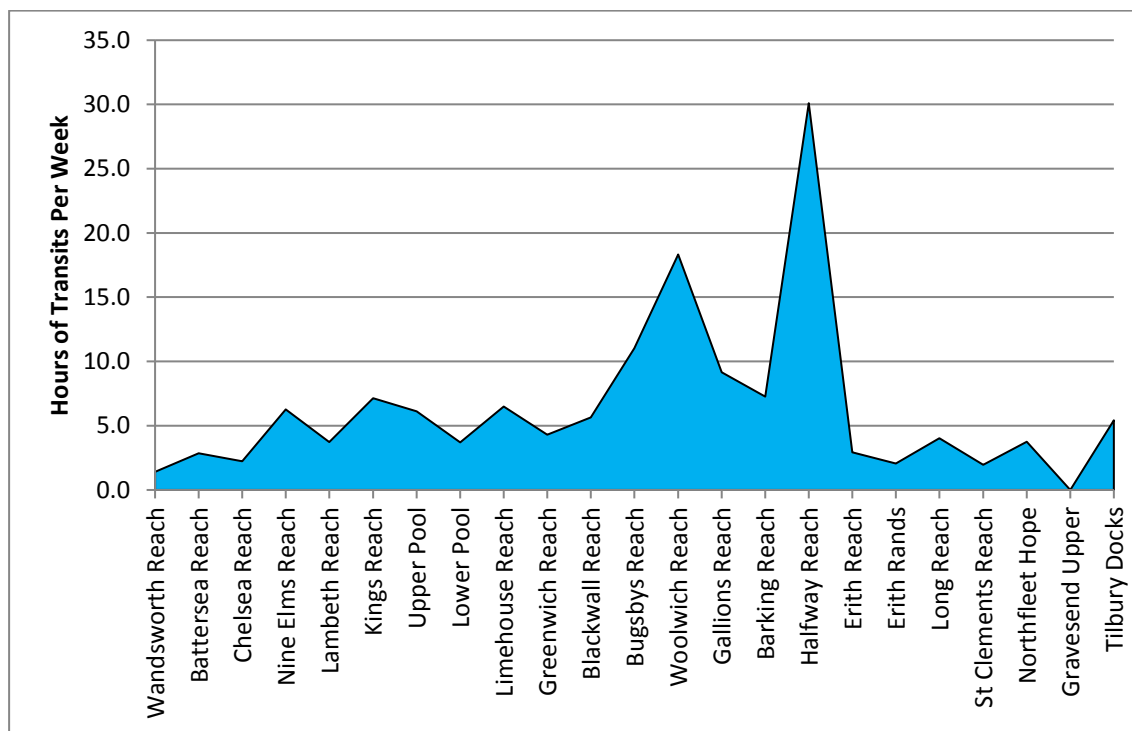


Figure 4: Cory exposure by reach.

- 4.7. **Figure 5** analyses the average speed of Cory vessels in the study area. Whilst the speeds range from five to eight knots, the average speed declines the further upstream the vessel is transiting. Localised reduction in speeds are seen at Bugsby and Halfway Reaches where manoeuvring on and off berths / moorings occurs.
- 4.8. The speeds presented in **Figure 5** are average speeds of both inbound and outbound transits. The actual speed of Cory tug and tow transits can vary from three knots, when they are laden and transiting downstream against the tide, to eight knots, when unladen and proceeding upstream with the tide.

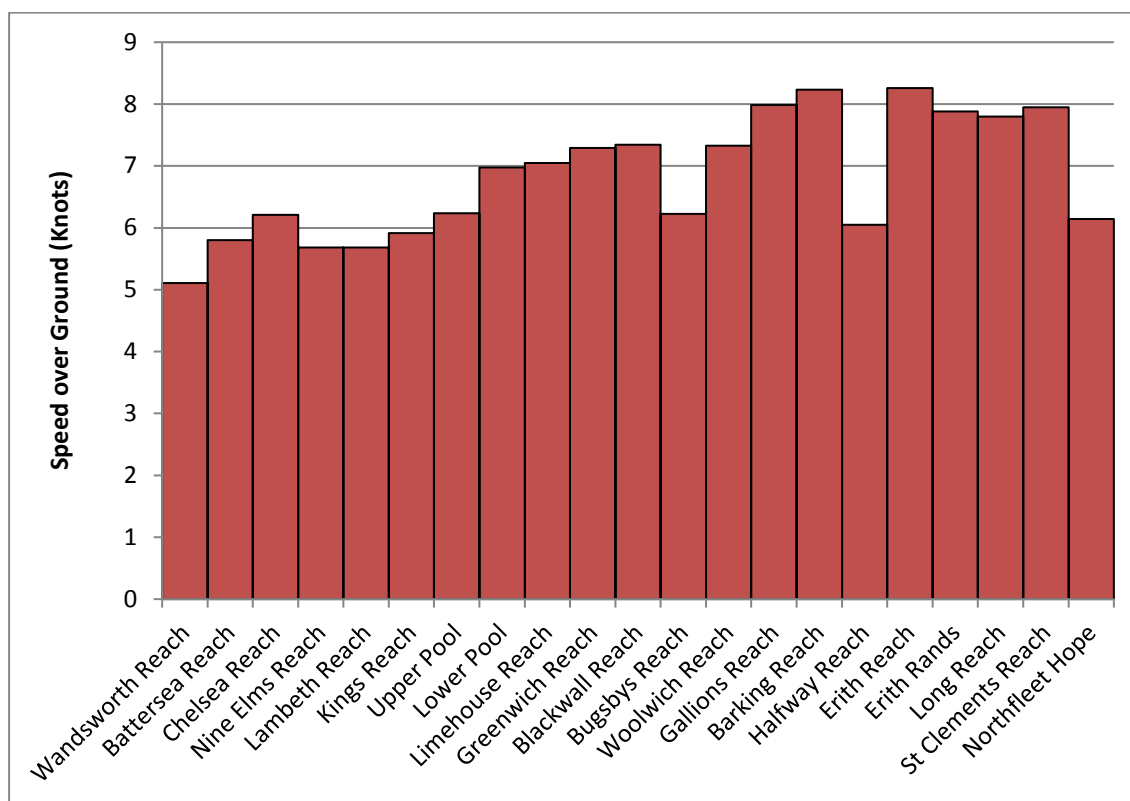


Figure 5: Average speed of Cory vessels by reach.

Historic Incidents

PLA Incidents

- 4.9. An analysis of the PLA’s incident database between 2010 and 2017 has been undertaken to understand the baseline risk. The study area contains 1,537 incidents, of which 370 are accidents (collisions, contacts and groundings). **Figure 6** shows accidents by reach per year in the dataset. For most of the study area, less than two accidents occur per year per reach, the exceptions being the central London reaches and the downstream reaches at Northfleet Hope and Tilbury.
- 4.10. **Figure 7** further differentiates this incident data by vessel type. Central London contains the most collisions and contacts, particularly of passenger vessels. The downstream incidents are mostly commercial shipping coming into contact with the berths.

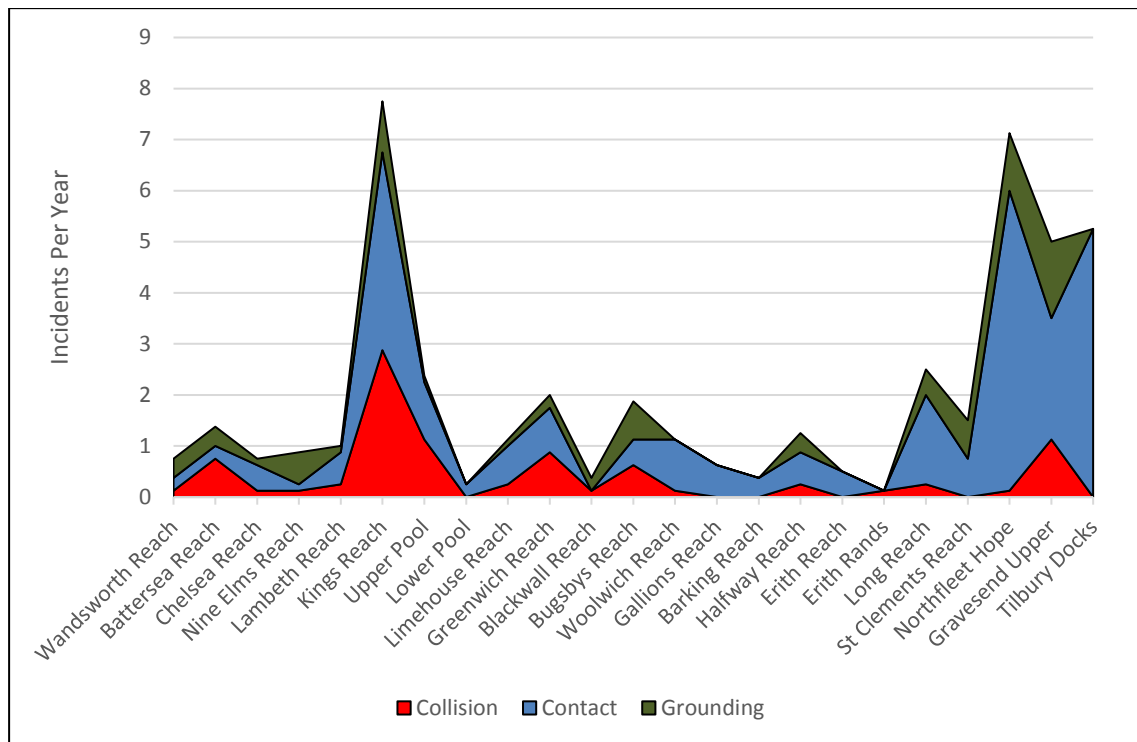


Figure 6: Incidents by Type per Reach.

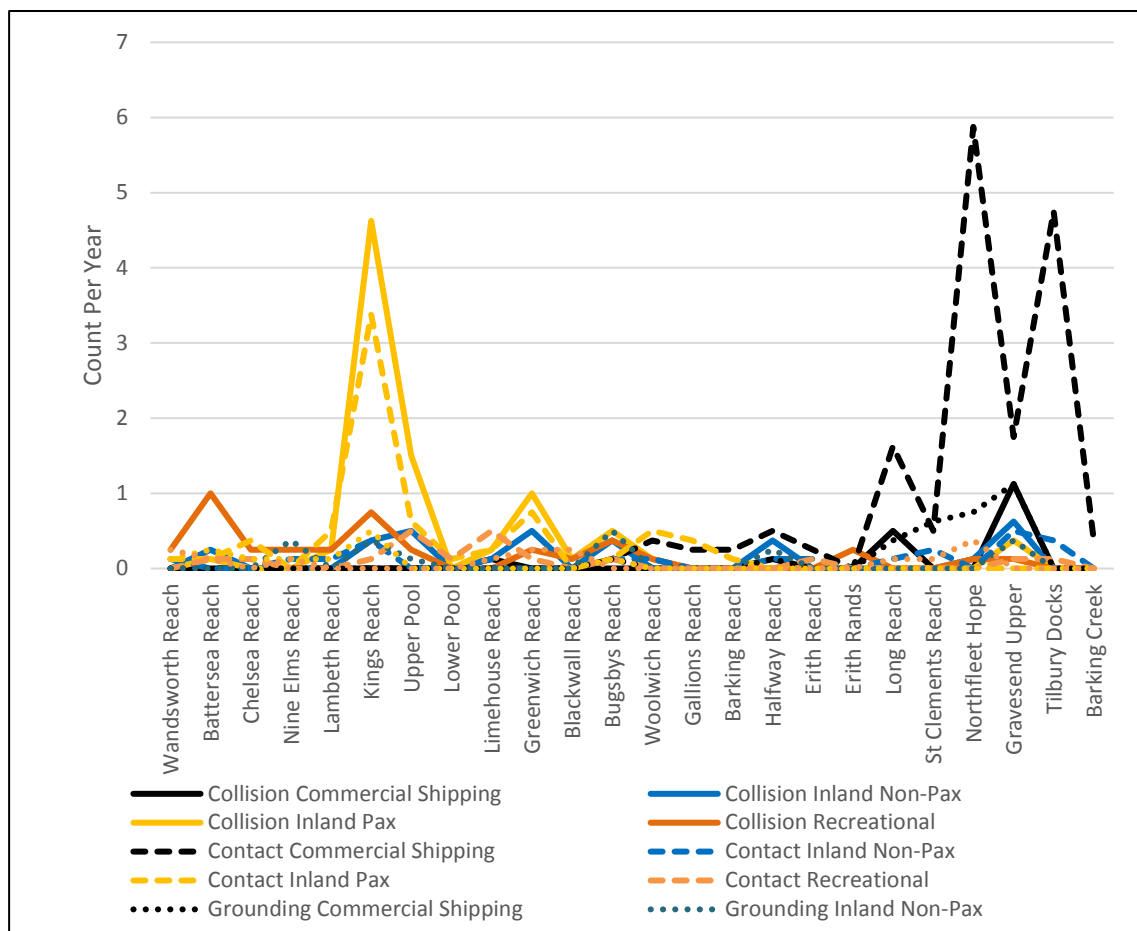


Figure 7: Incidents by Type, Vessel Type and Reach.

Incidents Involving Cory Tugs and Barges

- 4.11. A review of the PLA's incident database between 2010 and 2017 identified that Cory vessels had been involved in 17 incidents, a summary of which is shown in **Table 8**. Of these, the majority are near misses or wash complaints. Only a single serious incident is recorded, namely the 2014 collision between the Millennium Time (third party craft) and the Cory tug Redoubt, attributed to hydrodynamic effects and the loss of situational awareness of the Millennium Time skipper (see Marine Accident Investigation Branch report 12/2015).

Table 8: Summary of Incidents involving Cory Vessels/Barges (PLA Database 2010 to 2017).

Date	Type	Location	Description
09 March 2011	Wash\Draw-off	Upper Pool	N/A
13 February 2012	Breakout	Kings Reach	Breakout from Walbrook Wharf contacting Southwark Bridge.
16 June 2012	Wash\Draw-off	Limehouse Reach	Swamping and capsize of a 4 man scull.
10 August 2012	Wash\Draw-off	Limehouse Reach	Wash of a Thames Clipper resulted in one of the Cory's tow lines to part.
18 October 2012	Near Miss: Collision	Lambeth Reach	Thames Clipper steering failure resulted in near miss with Cory tug and tow.
09 February 2013	Near Miss: Collision	Wandsworth Reach	Multiple scullers impeding passage of Cory Tug and Tow.
17 May 2013	Wash\Draw-off	Limehouse Reach	Wash of a Thames Clipper resulted in one of the Cory's tow lines to part.
24 May 2013	Wash\Draw-off	Blackwall Reach	Wash of a Thames Clipper resulted in one of the Cory's tow lines to part.
26 September 2013	Near Miss: Collision	Upper Pool	Broken down recreational impedes passage of Cory and GPS tug and tows.
17 July 2014	Collision	Kings Reach	Collision between Millennium Time passenger vessel and Cory tug and tow resulting in major damage to passenger vessel and 9 injuries.
18 July 2014	Near Miss: Collision	Upper Pool	Near miss with overtaking passenger vessel at bridge arch.
23 April 2015	Contact	Tilbury Entrance Lock	Correction of misalignment of approach resulted in parting of tow rope and contact with fender piles at Tilbury Lock.

Date	Type	Location	Description
27 May 2016	Near Miss: Collision	Kings Reach	Near miss with Thames Clipper.
25 January 2017	Mechanical Failure	Kings Reach	Generator failure, successful switch to standby generator.
02 March 2017	Collision of Tug and Tow	Halfway Reach	Contact between tug and towed barge resulting in minor damage.
25 March 2017	Near Miss: Collision	Nine Elms Reach	Passage of Cory Tug and Tow impeded by rowers.
30 November 2017	Near Miss: Collision	Upper Pool	Near miss between Cory and GPS tug and tows.

5 Future Case Assessment

General Trends in Vessel Traffic on Thames

Commercial Shipping

- 5.1. In 2014, the Port of London handled approximately 45 million tonnes of cargo. The Thames Vision forecast an increase to between 56 and 93 million tonnes by 2035, with the goal set of between 60 and 80 million.

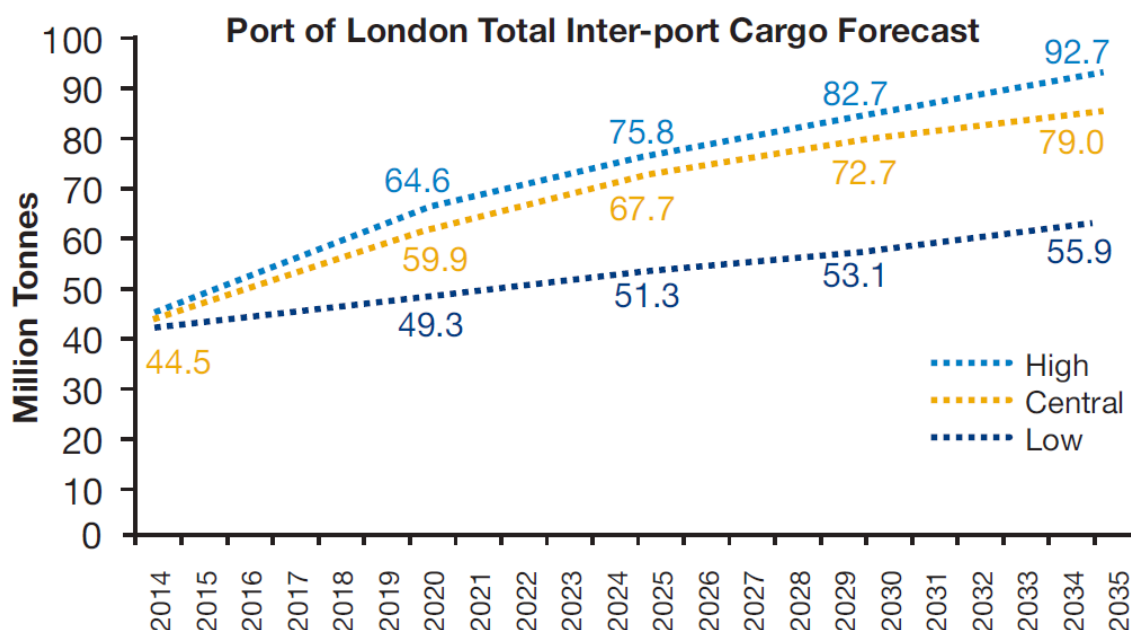


Figure 8: Port of London Inter-port cargo forecast (Stamford Research Group, 2015).

Passenger Demand

- 5.2. For passenger vessels, the Mayor’s River Action Plan sets a target to double the number of passenger journeys on the river to 12 million by 2020 (TfL, 2013). These additional passengers would come from River Bus, River Tour and charter services. It should therefore be noted that a doubling of passengers does not mean a doubling of vessels, as there is currently spare capacity on the existing network that could be better utilised or larger vessels could be employed. More historically, between 1999 and 2006 there was a 20% increase in the number of vessels registered to carry passengers on the Thames (Adams Hendry Consulting, 2007).
- 5.3. **Figure 9** shows recent trends in passenger numbers each year for selected operators. There has been a significant recent increase in total journey numbers, particularly through River Bus growth. Since the production of this graph, numbers have increased significantly reaching 10 million journeys in 2014/2015. Taken as a trend over the previous 10 years, the target of 12 million is achievable, although the rate of growth over the last 3 years has been far greater (**Figure 9**).

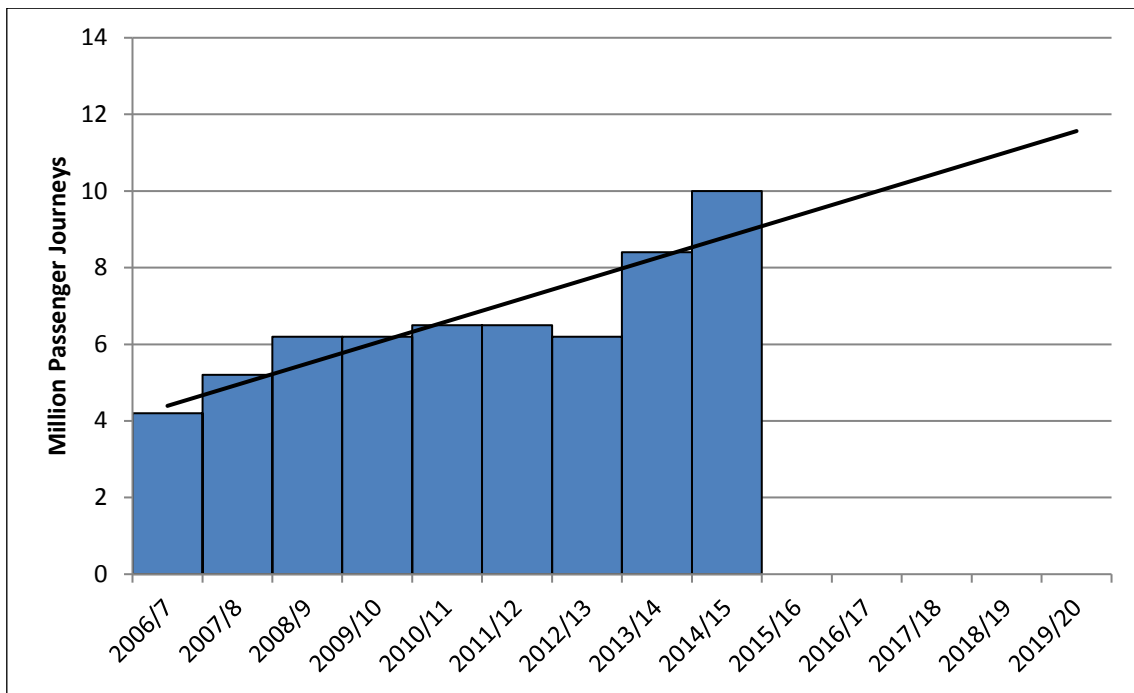


Figure 9: Forecast passenger journeys growth.

- 5.4. The Thames Vision set the goal of increasing the number of passenger journeys from 10 million in 2014 to 20 million by 2035.

Freight

- 5.5. In 2014, 5.5 million tonnes of cargo was carried on the river. If major projects are excluded, the actual long-term average of 2.15 million tonnes is carried on the river, forecast to increase to between 4.2 and 6.2 million tonnes by 2035. The Thames Vision set the goal of doubling the current tonnage to over 4 million by 2035. This Vision was set before REP was announced.

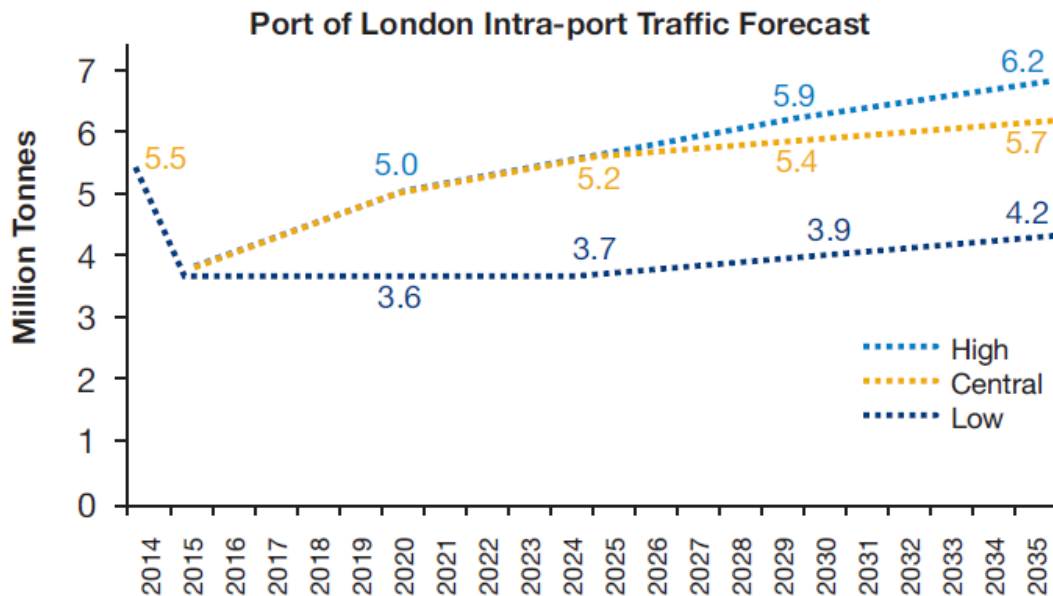


Figure 10: Port of London Intra-port Traffic Forecast (Stamford Research Group, 2015).

Cumulative Projects

- 5.6. The major infrastructure project active on the Thames between Putney and Tilbury during 2018 is the Tideway Tunnel. A significant amount of the construction activity and transportation of material has been conducted by river, with a peak of 12 project movements per day forecast for 2019. The Tideway schedule suggests that all works would be completed by 2023, and therefore no overlap is anticipated with REP (targeted to be operational in 2024).
- 5.7. The construction of the Rotherhithe-Canary Wharf cycle bridge is scheduled to occur sometime in the 2020s, this may necessitate temporary disruption of river traffic.
- 5.8. Similarly, the construction of the Silvertown Tunnel at North Greenwich could commence as early as 2019 and be opened by 2024. This would necessitate temporary disruption to all river traffic during the construction activities, including possible river closures, which may impact upon Cory operations.

Summary

- 5.9. The Thames Vision (2015) set out ambitious targets to increase the volume of commercial, passenger and recreational traffic on the river. The achievement of these targets would necessitate the following increases in cargo and passengers by 2025:
 - 42% increase in commercial tonnage;
 - 50% increase in passenger numbers; and
 - 50% increase in intra-port trade.
- 5.10. These increases relate to tonnage and not vessel numbers, as there is existing capacity on current vessels and at off-peak periods. A 50% increase in passenger numbers might necessitate only a 20% increase in vessel numbers, however the Vision does not make predictions on vessel traffic.
- 5.11. Furthermore, a key principle of the PLA's safety management system is that any increase in vessel traffic should not increase vessel risk. Therefore, a campaign of risk reduction has been enacted which should maintain or reduce the accident rate by 2025, irrespective of any increase in vessel numbers.

6 Navigational Risk Assessment

Introduction

- 6.1. Following consultation with the PLA, it was determined that a full time-domain model of vessel traffic was not required to assess the impacts of REP on navigation safety. A high-level passage risk model was therefore developed to provide quantitative analysis on the relative change in risk as a result of the Proposed Development.
- 6.2. The concept of this model is that each individual additional transit would occur using the existing Cory passage plans and navigation risk assessment and could be expected to have a similar risk. Cumulatively however, these additional transits could potentially increase the risk beyond acceptable thresholds. By mapping the increase in risk through the increase in activity, a judgement can be made on the acceptability of the modelled risk scores.
- 6.3. The model has a number of steps:
 - i. Base case risk model
 - a. Use historical incident data and vessel traffic exposure data to determine current incident rate per vessel types, per reach and per hazard
 - ii. Future case model
 - a. Uplift incident rate to account for 2025 future traffic
 - iii. Develop REP model
 - a. Develop model of additional exposure for each REP scenario
 - b. Uplift incident rate to account for additional Cory movements
 - iv. Input NRA models into PLA Risk Assessment Template

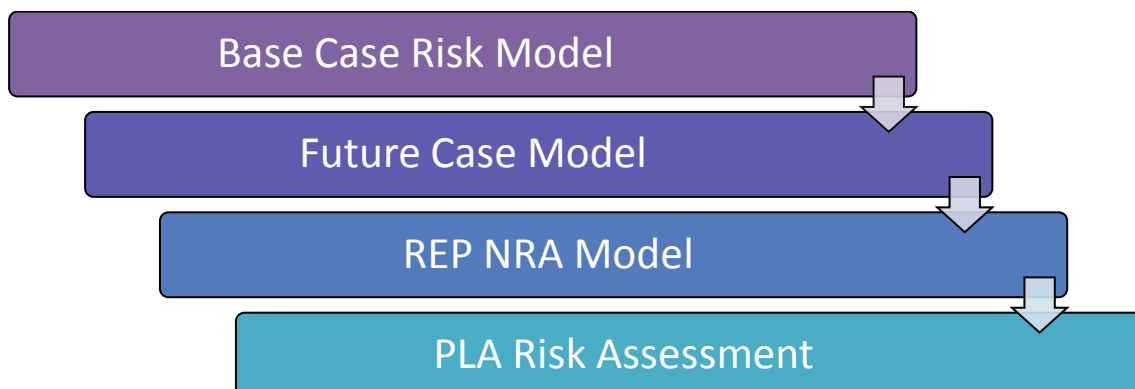


Figure 11: Development of Risk Models.

PLA Risk Assessment Methodology

Assessment of Risk

- 6.4. Risk is the product of the consequence and the likelihood of an unwanted event. The International Maritime Organisation (IMO) guidelines define a hazard as “something with the potential to cause harm, loss or injury”, the realisation of which results in an incident or accident.

The potential for a hazard to be realised can be combined with an estimated or known consequence of outcome. This combination is termed 'risk'. Risk is therefore a measure of the likelihood and consequence of a particular hazard occurring.

- 6.5. The likelihood of a hazard occurring is sometimes difficult to assess. Quantitative methods can be utilised to inform the likelihood of a particular hazard occurring. Records of incidents can be helpful in determining likelihood rates, however they are not, solely in themselves a measure of likelihood suitable for assessing the risk of a future developments where a change in the system being assessed has occurred (just because a hazard has not been recorded in accident records, it does not mean it is not likely to occur). Other methods of determining likelihood include data analysis, simulation or trials.
- 6.6. To assess frequency and, to a lesser extent, consequence, of a hazard occurring it is necessary to use a combination of historical incident (including near miss data) statistics, local stakeholder judgement, quantitative modelling and analysis, and professional judgement.
- 6.7. Using the PLA's risk assessment methodology, the risk assessment is scored by the combination of a "consequence" score and a "likelihood" score. Where consequence scores for people, property, business, environment, works / infrastructure, operations or publicity are scored differently, the level of consequence chosen was primarily driven by the damage to "people" category.
- 6.8. The combination of consequence and frequency of occurrence of a hazard is combined using a risk matrix (Table 9), which enables hazards to be ranked and a risk score assigned. The resulting scale can be divided into three general categories:
 - Acceptable
 - As Low as Reasonably Practicable (ALARP)
 - Intolerable

Table 9: PLA risk assessment matrix and frequency / consequence categories.

RISK ASSESSMENT MATRIX: RISK CRITERIA		FREQUENCY				
		Level 1	Level 2	Level 3	Level 4	Level 5
		Rare	Unlikely	Possible	Likely	Almost Certain
		One or more times greater than 100	One or more times 100 year	One or more times in 10 years	One or more times per year	Ten or more times per year
CONSEQUENCE	5 – Loss of vessel or severe damage to vessel / environment. Multiple fatalities International news coverage.	Moderate (5)	High (10)	Extreme (15)	Extreme (20)	Extreme (25)
	4 – Major damage to vessel / environment. Single Fatality. National news coverage.	Minor (4)	Moderate (8)	High (12)	Extreme (16)	Extreme (20)
	3 – Moderate damage to vessel / environment. Moderate / major injury Regional news coverage.	Minor (3)	Moderate (6)	Moderate (9)	High (12)	Extreme (15)
	2 - Minor or superficial damage to vessel / environment. Minor injuries and local news coverage.	Slight (2)	Minor (4)	Moderate (6)	Moderate (8)	High (10)
	1 - Insignificant or no damage to vessel / equipment / environment. No injuries.	Slight (1)	Slight (2)	Minor (3)	Minor (4)	Moderate (5)
ACTION KEY	Slight (1– 2)	No Action is required.				
	Minor (3– 4)	No additional controls are required, monitoring is required to ensure no changes in circumstances.				
	Moderate (5– 9)	Efforts should be made to reduce risk to ‘As low as reasonably practicable’ (ALARP), but activity may be undertaken.				
	High (10– 14)	Efforts should be made to reduce risk to ‘As low as reasonably practicable’ (ALARP). Activity can only be undertaken with further additional controls.				
	Extreme (15– 25)	Intolerable risk. Activity not authorised.				

Most Likely and Worst Credible

- 6.9. A hazard may have a range of outcomes, with the most likely or frequent outcome of a lower consequence than the worst credible and less infrequent outcome. The PLA’s risk assessment methodology allows for only a single input.
- 6.10. To overcome this, the following approach has been taken with each individual hazard. Based on an analysis of MAIB incident data, approximately one in every 40 incidents has a worst credible outcome.

6.11. Each hazard is therefore scored:

- Likelihood:
 - Most Likely – derived from incident data
 - Worst Credible – most likely divided by 40 (based on review of previous incidents)
 - PLA Input – average of the above
- Consequence:
 - Most Likely – derived from judgement and a review of previous incidents
 - Worst Credible – derived from judgement and a review of previous incidents
 - PLA Input – average of the above

6.12. Therefore, if a hazard has a most likely frequency score of 4 (once a year), it would have a worst credible frequency score of 2 (once in 100 years, and a 100 times less likely). The average of these would give a PLA input score of 3.

Risk reduction

6.13. The management of navigational risk on the River Thames is undertaken in line with the International Maritime Organisation Formal Safety Assessment methodology. Risk control measures aim to reduce the risk of a hazard, and can affect either the likelihood and / or the consequence of that hazard (for example buoyage reduces the likelihood of a vessel grounding, whereas lifejackets can be said to reduce the consequences of a grounding). It is possible to estimate or calculate the effectiveness a risk control measure has at reducing the risk of a hazard occurring and thereby determine risk control effectiveness. This is beneficial in determining the merits (either absolute or relative) of implementing a variety of risk control measures, which can also lead on to effective cost benefit analysis.

6.14. It can be difficult to determine the exact effectiveness of risk controls in a dynamic and changing system such as a port, and, as such, a significant degree of subjectivity is commonly used where quantitative methods are not available or are prohibitively expensive to determine risk effectiveness.

6.15. Fundamentally, the role of the PLA is to uphold navigational safety in the Thames. The implementation of a standardised risk framework applied across all hazards, no matter how subjective, remains a useful methodology, as the resulting scores can be used to judge the relative, and / or the absolute, merits of implementing additional risk controls.

Hazard Identification

6.16. The Assessment considers:

- 3 Hazard Types:
 - Collisions
 - Contacts
 - Groundings
- 24 Reaches

- From Wandsworth Reach to Tilbury Docks (including Barking Creek)
 - 4 Vessel Types:
 - Commercial Shipping
 - Inland Passenger
 - Inland Non-Passenger
 - Recreational
- 6.17. This creates 288 unique hazards.

Likelihood Scores

Development of Baseline

- 6.18. To understand the impact of REP on navigational safety, it is first necessary to establish a baseline level of safety. Analysis of the level of exposure and incident types by vessel type and location is undertaken in **Section 4**.

Development of REP NRA Models

- 6.19. **Section 3** provides the movement numbers predicted by Cory in the REP NRA Scenarios. To ensure that the risk analysis accurately represents the increase in vessel traffic as a result of REP, a comparison of the actual existing Cory traffic with a baseline model was undertaken.
- 6.20. Based on the vessel traffic analysis contained in **Section 4**, the actual hours of exposure by Cory tugs in each section of the river was calculated. In parallel, a model of transit time for each reach was developed by calculating distance and speed of transit, in combination with manoeuvring/berthing time where appropriate. The number of movements per reach using the current Cory operations given in **Section 3** was used to multiply the transit time per movement derived from the AIS data and therefore give a predicted Cory exposure by reach.
- 6.21. **Figure 12** shows a comparison of the actual and predicted exposure by reach for baseline Cory traffic. The results show very similar levels, suggesting that this same approach can be applied to the REP NRA Scenarios to provide an accurate prediction.

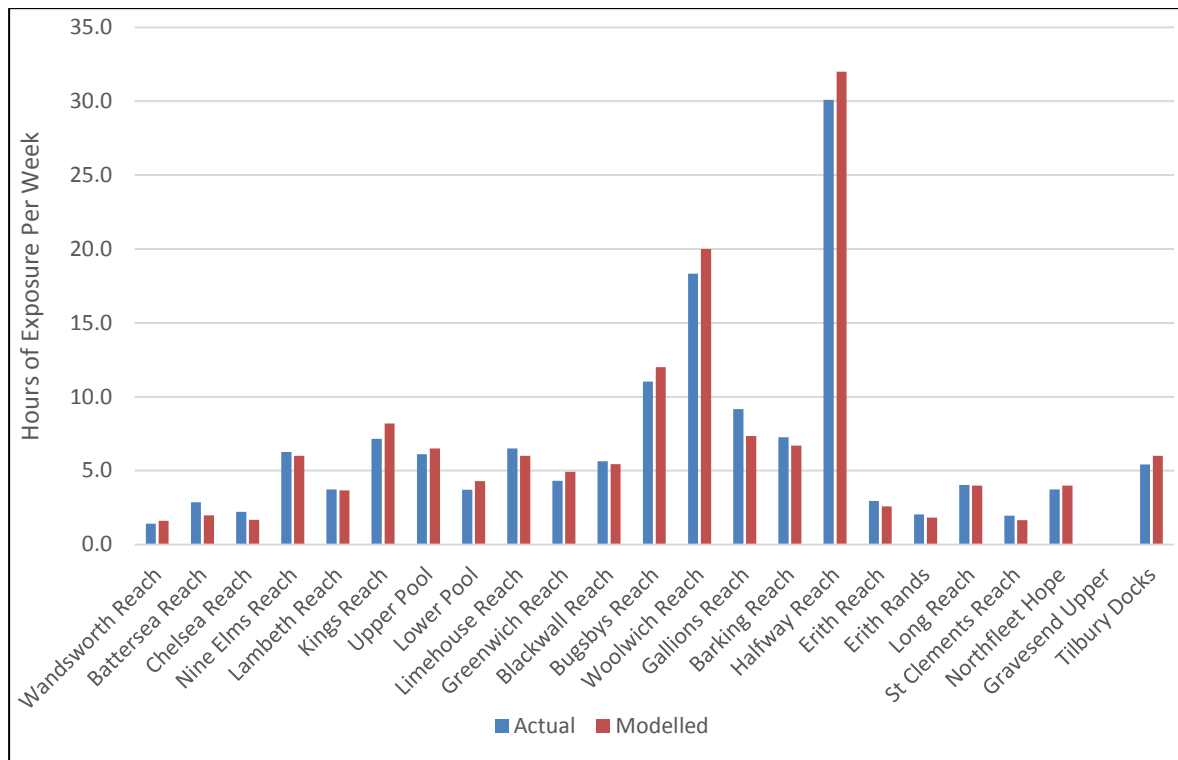


Figure 12: Comparison of baseline and modelled baseline.

- 6.22. Based on the movement numbers provided by Cory in **Section 3**, it is possible to determine the increase in exposure in each NRA Scenario. **Figure 13** compares the Cory exposure between the baseline and three modelled NRA Scenarios.
- 6.23. **Figure 14** presents the NRA Scenarios in terms of the percentage of additional traffic in relation to the baseline. The percentage increase in many parts of the river is negligible, particularly the busier central reaches where it is more than 95% accurate. The greatest relative increases are at Tilbury Docks and Barking Creek, both of which are relatively quiet in terms of movements, and therefore the impact of an additional movement is much more significant.

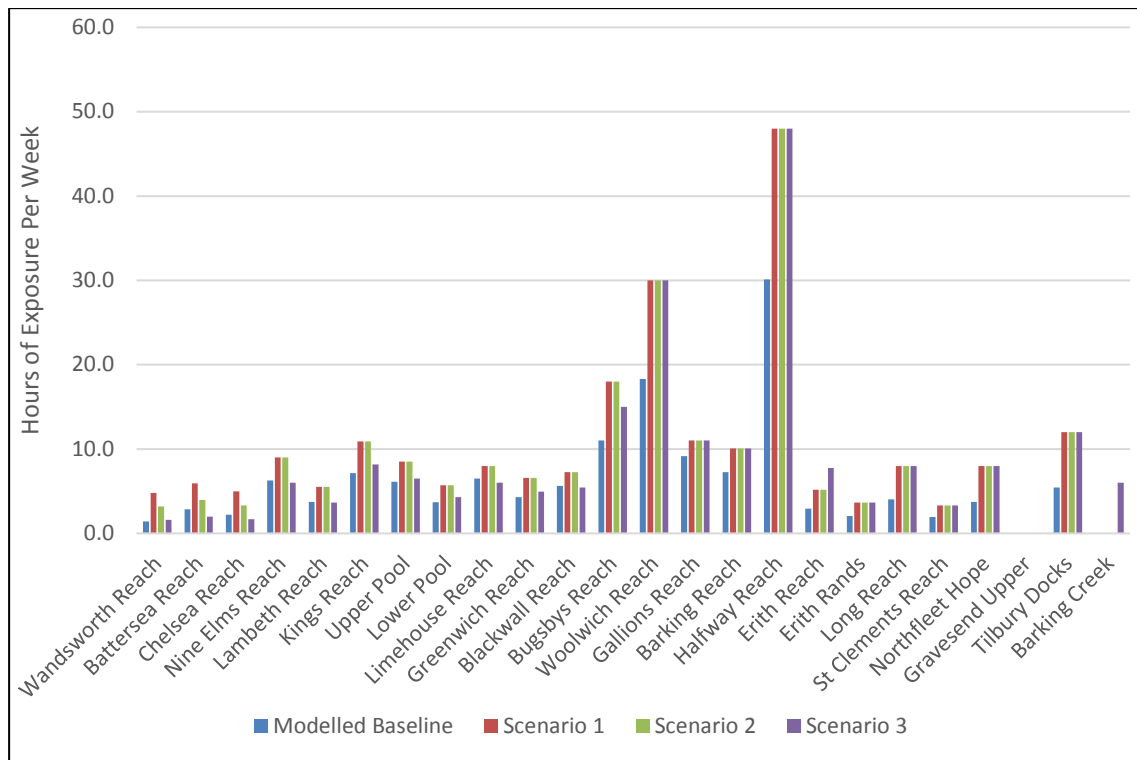


Figure 13: Development of REP Scenarios.

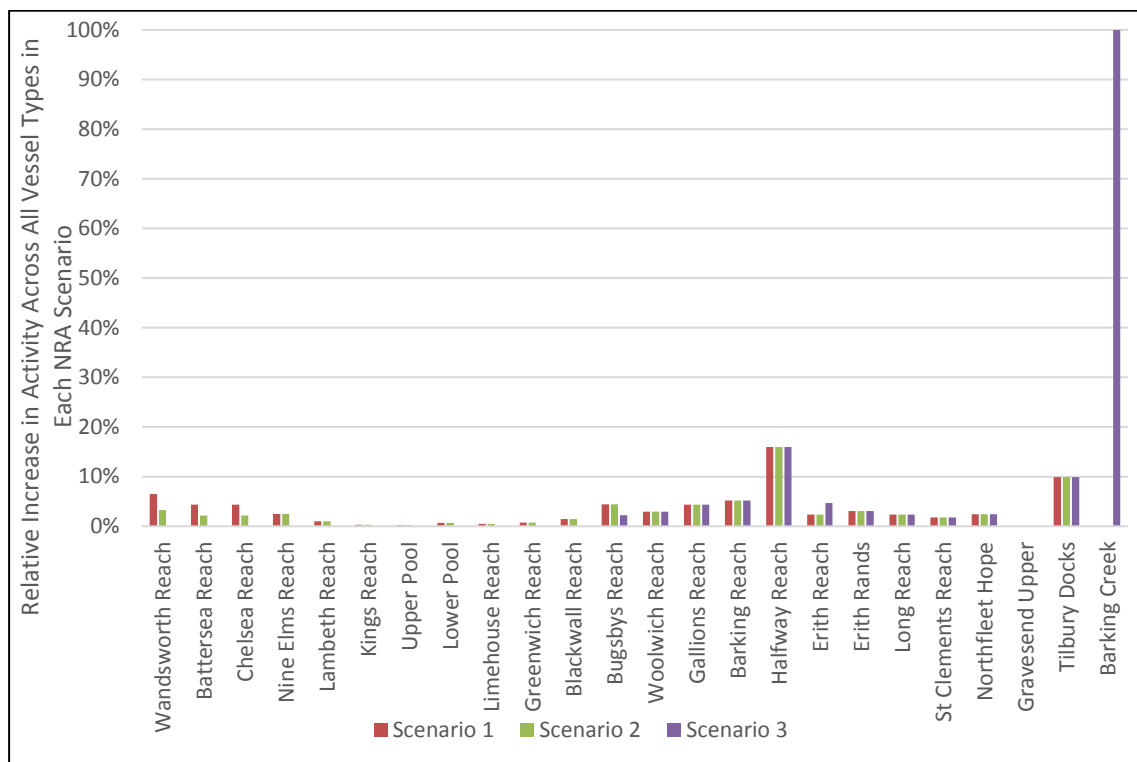


Figure 14: Relative change in all vessel traffic by NRA Scenario.

Risk Analysis

- 6.24. A baseline risk assessment was conducted using the following method:
- If no vessel traffic data is recorded in a reach, then a likelihood score of 0 was generated
 - If no previous incidents have been recorded, a 1 in 100 year likelihood is applied
 - Otherwise, multiply the vessel traffic data by the incident rate per hour of exposure
- 6.25. For the modelled REP Scenarios, the method is as follows:
- If no vessel traffic data is recorded in a reach, then a likelihood score of 0 was generated
 - If no previous incidents have been recorded, a 1 in 100 year likelihood is applied;
 - If the incident type is:
 - Collision:
 - Multiply the baseline exposure by the incident rate
 - Add the additional exposure associated with each NRA Scenario with the incident rate. This additional exposure is proportional of that type to the total exposure (to account for that not all additional collisions would involve a Cory vessel).
 - Contact or Grounding:
 - Multiply the baseline exposure by the incident rate
 - Add the additional exposure associated with each NRA Scenario with the incident rate.

Consequence Scores

- 6.26. Given the number of permutations of hazards, broad categorisations of hazard outcome have been developed by vessel type and incident type (see **Table 10**). The PLA's risk assessment methodology allows for the input of a single score, created by combining the most likely and worst credible outcomes.

Table 10: Consequence Classifications.

Incident	Vessel Type	Most Likely	Worst Credible	Average	Reason
Collision	Commercial Shipping	2	4	3	High potential energy and value of commercial vessels, potential for major damage, pollution and loss of life in a major incident. Some damage likely even in minor incidents.
	Inland Pax	1	5	3	High numbers of passengers aboard passenger boats could result in high fatalities. Most collisions have resulted in very minor damage.
	Inland Non-Pax	1	4	2.5	Lower numbers of passengers reduces potential consequence to other vessel types.
	Recreational	1	4	2.5	Small recreational craft would have negligible damage in minor collision, potential for a single fatality in worst credible.
Contact	Commercial Shipping	1	4	2.5	Contacting a berth is most likely incident and has lower potential consequence than a collision.
	Inland Pax	1	4	2.5	Potential for major damage and a fatality in a serious contact, most likely outcome is a hard coming alongside with a berth.
	Inland Non-Pax	1	4	2.5	Low damage and no injuries from a minor contact, but potential for a fatality in a worst credible.
	Recreational	1	4	2.5	Minor damage is most likely outcome, potential for a fatality in the worst credible.
Grounding	Commercial Shipping	2	4	3	Major damage and pollution possible in a serious grounding, most likely is minor damage and refloating on the next tide.
	Inland Pax	1	3	2	Soft grounding with no impact is the most likely with some damage or injuries possible in the worst credible.
	Inland Non-Pax	1	3	2	Soft grounding with no impact is the most likely with some damage or injuries possible in the worst credible.
	Recreational	1	3	2	Soft grounding with no impact is the most likely with some damage or injuries possible in the worst credible.

Risk Controls

Existing PLA Risk Controls

6.27. Navigation on the River Thames in Central London is managed by the PLA who have over the years implemented many risk control measures aimed at reducing and managing navigational risk. In total the PLA has 41 risk controls identified in the Port Wide Navigational Risk Register (see **Table 11** for control types). This NRA was therefore based on the following premises:

- Operations are to be planned to the extent necessary to ensure safety
- Operations are to be fully compliant with legislation, guidance and best practice

- All those involved in operations are to be competent persons
- All the necessary information is provided to undertake the project safely
- All equipment provided is fit for purpose
- All necessary resources are allocated to mitigate identified risks
- Operations are undertaken in accordance with up to date written procedures
- Any exceptions to safe practice are reported
- Incidents and near misses are investigated
- A planned response to emergencies is available

Table 11: PLA Risk Control Types.

Risk Control Types
PLA Procedures / Plans / Manuals
PLA Hardware
Training / Education
External Procedures
National / International Legislation
Codes of Practice / Guides
Liaison / Advice River Users
External Hardware
External Procedures / Hardware
PLA Legislation
PLA Policies
Other PLA Documents

Existing Cory Risk Controls

6.28. As demonstrated in **Section 4**, Cory’s vessels are safely operated and have a low incident rate. This is due to a safe system of working, which has been effective for many decades, that includes a number of risk controls:

- Generic Passage Plans and Risk Assessments
- Safety Management System
- Towing Procedures
- Tug type and specification
- Emergency Procedures

- Boatmaster’s License
- Local Knowledge Endorsement

6.29. These risk controls should be maintained for the duration of the Proposed Development.

Possible Additional Risk Controls

6.30. **Table 12** identifies possible additional risk controls which could be implemented to further control risk. Given the negligible impact on navigational safety of the project, no further risk controls have been identified as necessary.

Table 12: Possible Additional Risk Controls.

ID	Risk Control	Risk Control Details
1	Review of Passage Plan	Cory to review their generic passage plans to account for the changes associated with this project and submit to the PLA for review.

Results

6.31. The results of the risk assessment are given below and are contained in full in **Appendix B**. All hazards identified fall below the PLA threshold of acceptability. Based on the acceptability levels identified in **Table 9**, the hazards fell into the following categories shown in **Table 13**.

Table 13: NRA Results.

Category	Baseline	Representative NRA Scenario 1	Indicative NRA Scenario 2	Indicative NRA Scenario 3
High Risk	0	0	0	0
Moderate	80	89	88	88
Minor	172	168	168	166
Slight	36	31	32	34

6.32. The highest risk scores relate to collisions and contacts of passenger vessels in the central reaches (e.g. Kings Reach) and contacts involving large commercial shipping in the lower district (Tilbury and Northfleet). The increase in risk scores as they relate to the REP Scenarios is negligible across the river, given the limited increase in activity as a result of each NRA Scenario compared to the background traffic.

6.33. This risk assessment has used the representative scenarios described in **Section 3** and assumes continued usage of day time tides only. Any movements which utilised night time tides would occur when there is less background traffic on the river and therefore would have lower risk scores than that assumed during this assessment.

Table 14: Top 20 Hazards (All Hazards Scored as Moderate in PLA Definitions).

Hazard Title	Baseline Risk	Representative NRA Scenario 1 Risk	Representative NRA Scenario 1 Increase	Indicative NRA Scenario 2 Risk	Indicative NRA Scenario 2 Increase	Indicative NRA Scenario 3 Risk	Indicative NRA Scenario 3 Increase
Collision of Inland Pax - Kings Reach	9.2	9.2	0.05	9.2	0.05	9.2	0.00
Contact of Commercial Shipping - Tilbury Docks	8.2	8.3	0.09	8.3	0.09	8.3	0.09
Contact of Inland Non-Pax - Northfleet Hope	8.1	8.2	0.05	8.2	0.05	8.2	0.05
Contact of Inland Non-Pax - Tilbury Docks	8.0	8.2	0.21	8.2	0.21	8.2	0.21
Contact of Inland Pax - Kings Reach	8.0	8.0	0.00	8.0	0.00	8.0	0.00
Contact of Commercial Shipping - Northfleet Hope	7.8	7.8	0.04	7.8	0.04	7.8	0.04
Collision of Inland Pax - Upper Pool	7.6	7.6	0.04	7.6	0.04	7.6	0.00
Collision of Inland Pax - Greenwich Reach	7.4	7.5	0.12	7.5	0.12	7.4	0.00
Contact of Inland Non-Pax - Gravesend Upper	7.3	7.3	0.00	7.3	0.00	7.3	0.00
Grounding of Commercial Shipping - Northfleet Hope	7.2	7.2	0.05	7.2	0.05	7.2	0.05
Grounding of Commercial Shipping - Gravesend Upper	7.0	7.0	0.00	7.0	0.00	7.0	0.00
Collision of Inland Pax - Bugsbys Reach	6.9	7.5	0.61	7.5	0.61	7.2	0.34
Collision of Inland Pax - Battersea Reach	6.9	7.5	0.59	7.2	0.33	6.9	0.00
Contact of Recreational - Northfleet Hope	6.8	6.9	0.09	6.9	0.09	6.9	0.09
Contact of Inland Non-Pax - Long Reach	6.8	6.9	0.05	6.9	0.05	6.9	0.05
Collision of Commercial Shipping - Gravesend Upper	6.7	6.7	0.00	6.7	0.00	6.7	0.00
Collision of Inland Non-Pax - Gravesend Upper	6.5	6.5	0.00	6.5	0.00	6.5	0.00
Grounding of Commercial Shipping - St Clements Reach	6.5	6.5	0.04	6.5	0.04	6.5	0.04
Contact of Commercial Shipping - Long Reach	6.4	6.4	0.04	6.4	0.04	6.4	0.04
Contact of Commercial Shipping - Gravesend Upper	6.4	6.4	0.00	6.4	0.00	6.4	0.00

7 Conclusions and Recommendations

Conclusions

- 7.1. This assessment has reached the following conclusions:
- 1 The Proposed Development would see no additional works in the river and would therefore not physically impact the navigation of vessels.
 - 2 Under the assessed scenarios that all waste is transported by river, REP would increase the number of tug and tow movements. Between the three NRA Scenarios this would result in one additional movement to Tilbury and could result in one additional movement through Central London to Smugglers Wharf or one additional movement to Barking Creek per day and any associated movements of ash to Tilbury.
 - 3 Analysis of existing traffic identified a significant difference in background traffic across the study area which was inputted into the risk assessment.
 - 4 Cory tug and tows typically transit between three and eight knots depending on their laden/unladen state, tidal state and location.
 - 5 Analysis of the PLA's incident data identified few incidents involving Cory tug and tows. 17 were identified over eight years of data, mostly near misses and wash complaints. A single serious collision was recorded between a passenger boat and a Cory tug and tow, following an error of the third party passenger vessel.
 - 6 A review of traffic projections up until 2030 suggested that an increase in vessel traffic would be likely over the course of the project. Whilst this was assessed to be up to 20%, the PLA are committed to maintaining existing incident rates and therefore there should be no net change in risk.
 - 7 An NRA was undertaken to measure the change in risk as a result of the Proposed Development. The NRA identified that there was minimal impact upon navigational safety as a result of the additional REP traffic. This NRA has assumed continued use of day time tides and therefore any additional movements at night would have a lower impact.
 - 8 Given the resultant risk scores from the NRA, no additional risk controls were proposed beyond which are currently in effect on the river.

Recommendations

- 7.2. The following recommendations were made:
- 1 Cory to submit revised passage plans to the PLA for review, which should also include a passage through Barking Creek (if this option is pursued).

Summary

- 7.3. In summary, this NRA has identified that the additional movements associated with the REP would have a Negligible impact upon navigational safety on the River Thames with all hazards remaining inside ALARP with existing risk controls in place.

8 References

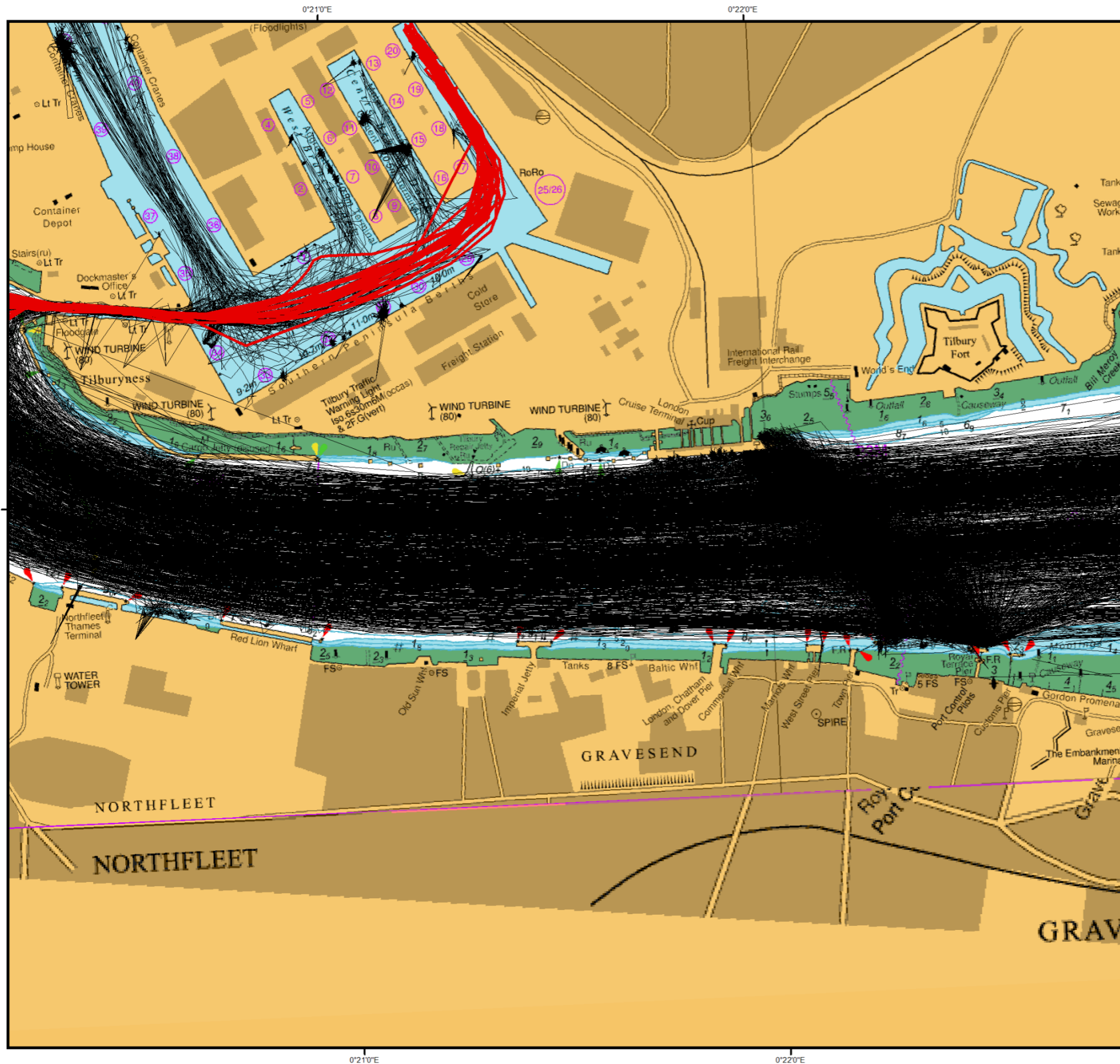
Adams Hendry Consulting Ltd (2007). Assessment of Boatyard Facilities on the River Thames.

Marine Accident Investigation Branch (2015). Report on the investigation of the collision between the passenger vessel Millennium Time and the motor tug Redoubt with 3 barges in tow on the Kings Reach, River Thames, London 17 July 2014.

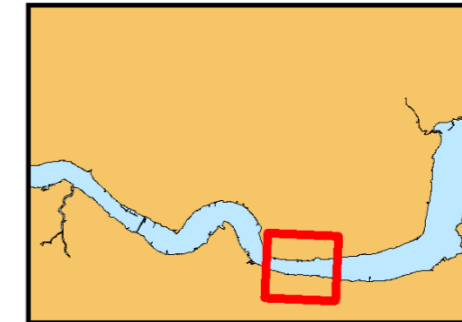
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Appendix A Cory Passage Analysis



Cory REP NRA, Gravesend Upper.



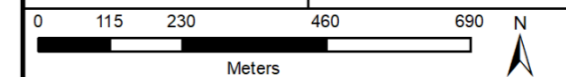
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- Corys
- All other Vessels

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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
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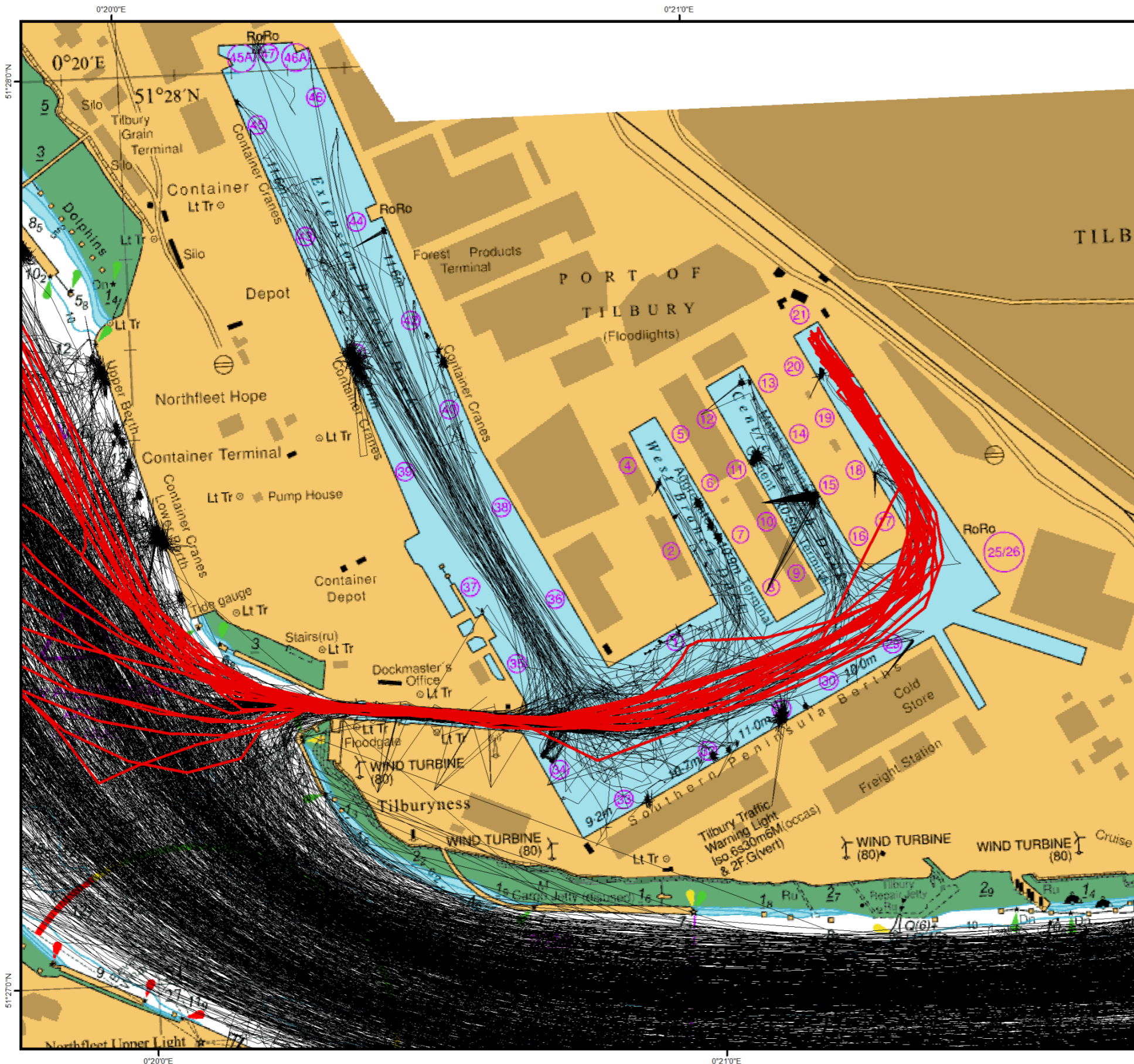
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Figure Reference: 18UK1404_CoryREP_Gravesend_v1



Cory REP NRA, Tilbury Docks.

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- Corys
- All other Vessels

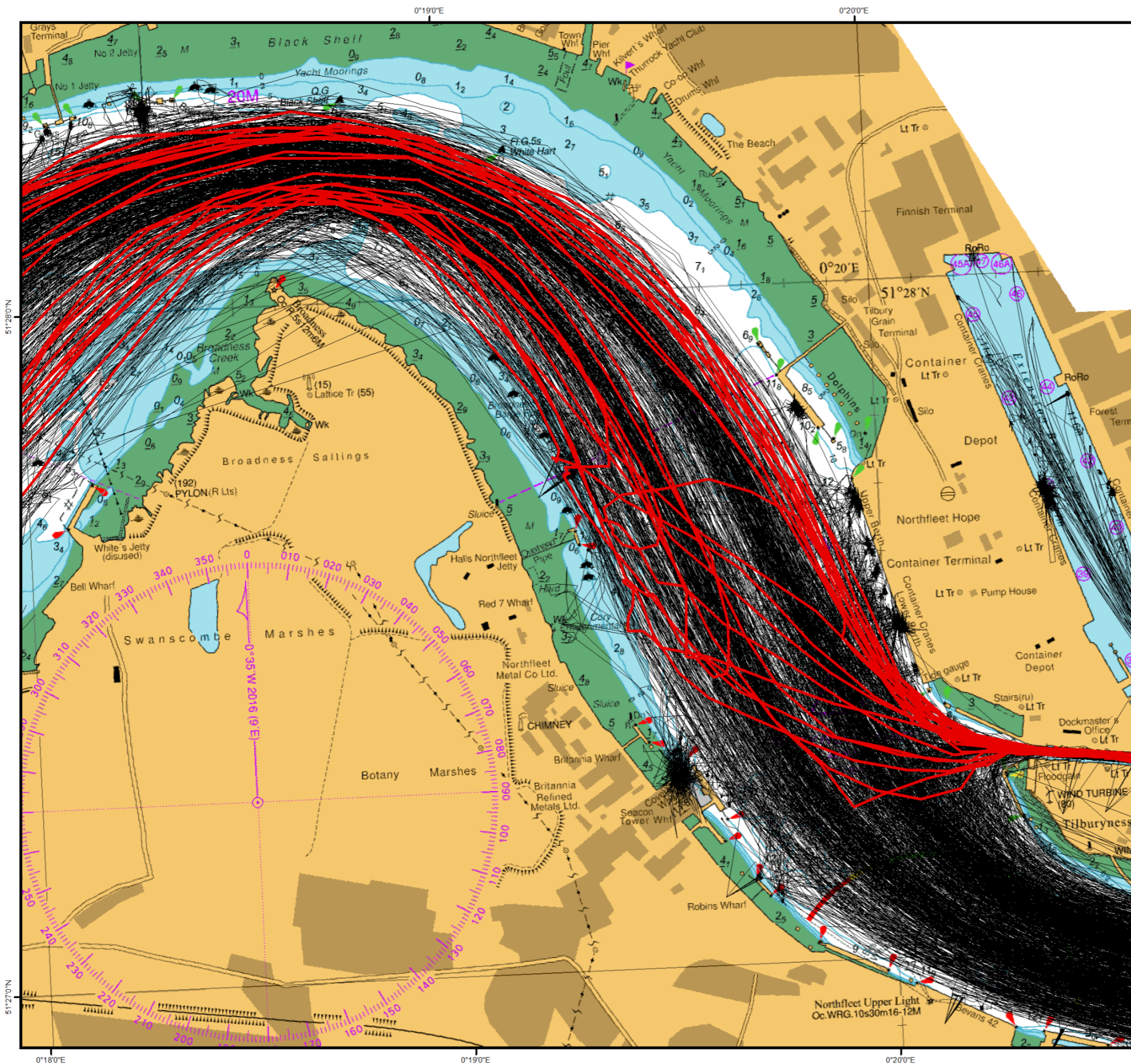
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Figure Reference: 18UK1404_CoryREP_TilburyDocks_v1



Cory REP NRA, Northfleet Hope.

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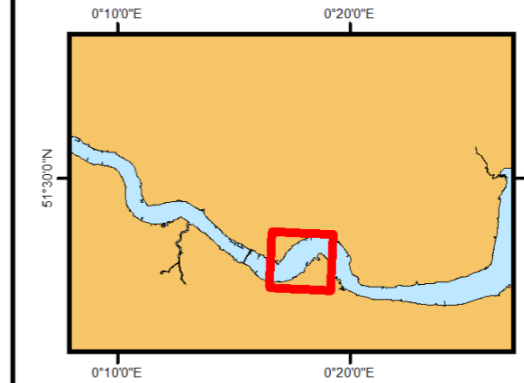
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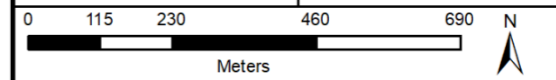
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- Corys
- All other Vessels

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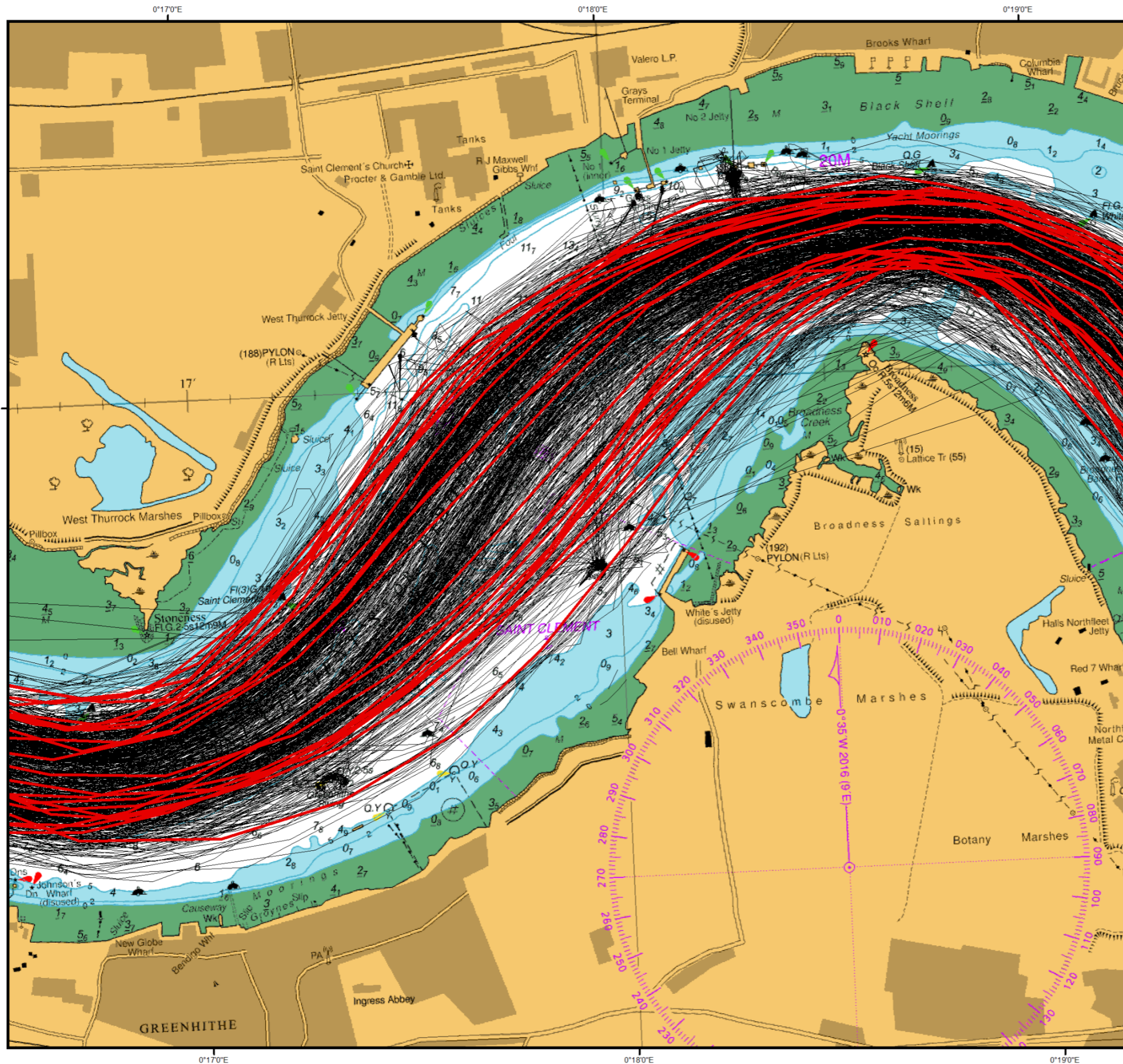
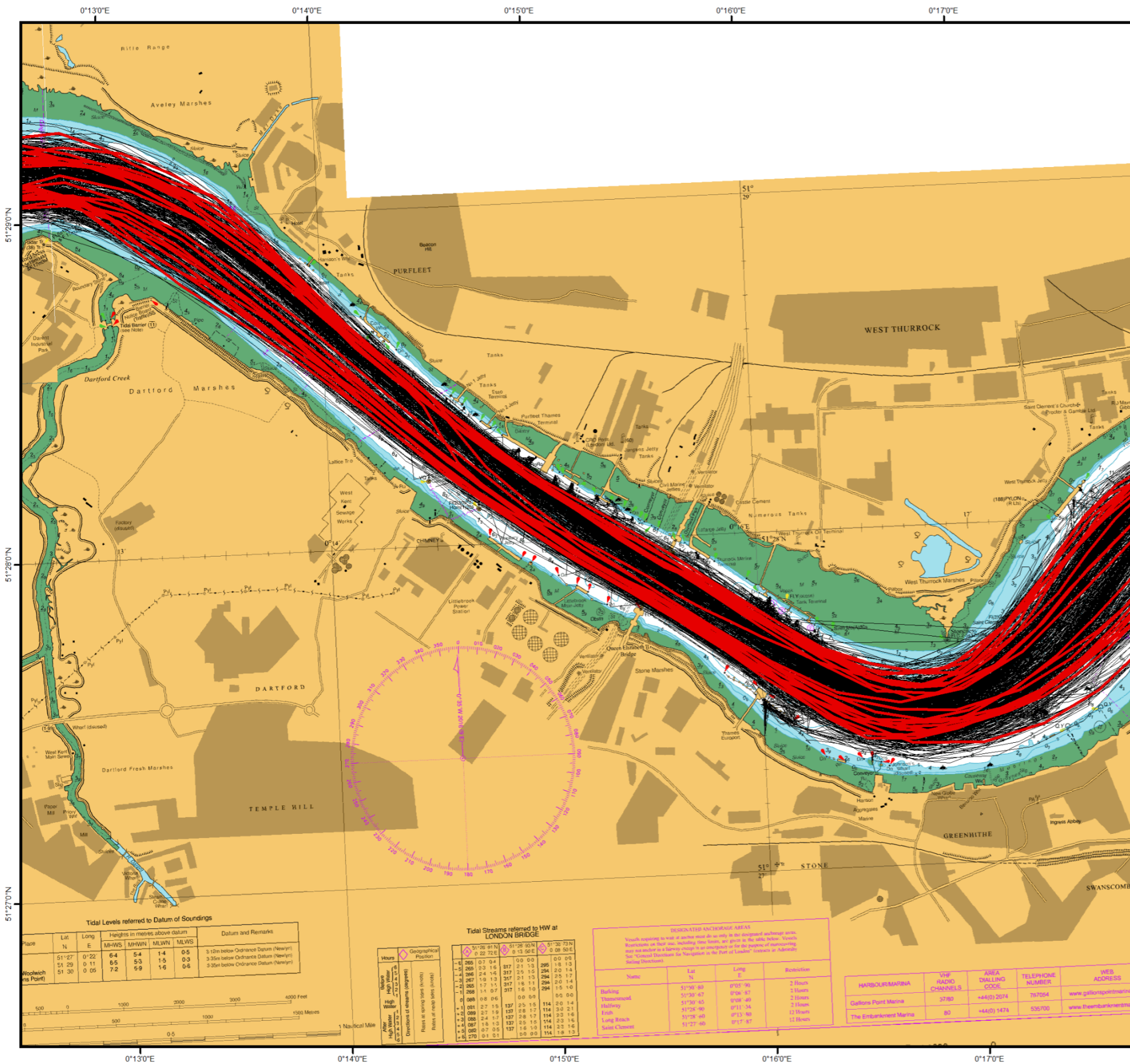


Figure Reference: 18UK1404_CoryREP_StClements_v1



Cory REP NRA, Long Reach.

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- Corys
- All other Vessels

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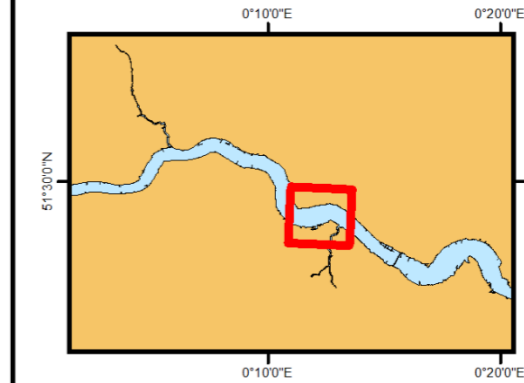
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Figure Reference: 18UK1404_CoryREP_LongReach_v1

Cory REP NRA, Erith Rands.



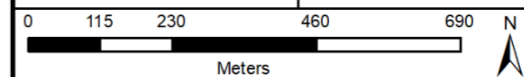
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The larger www Inwa Tills sets at inch

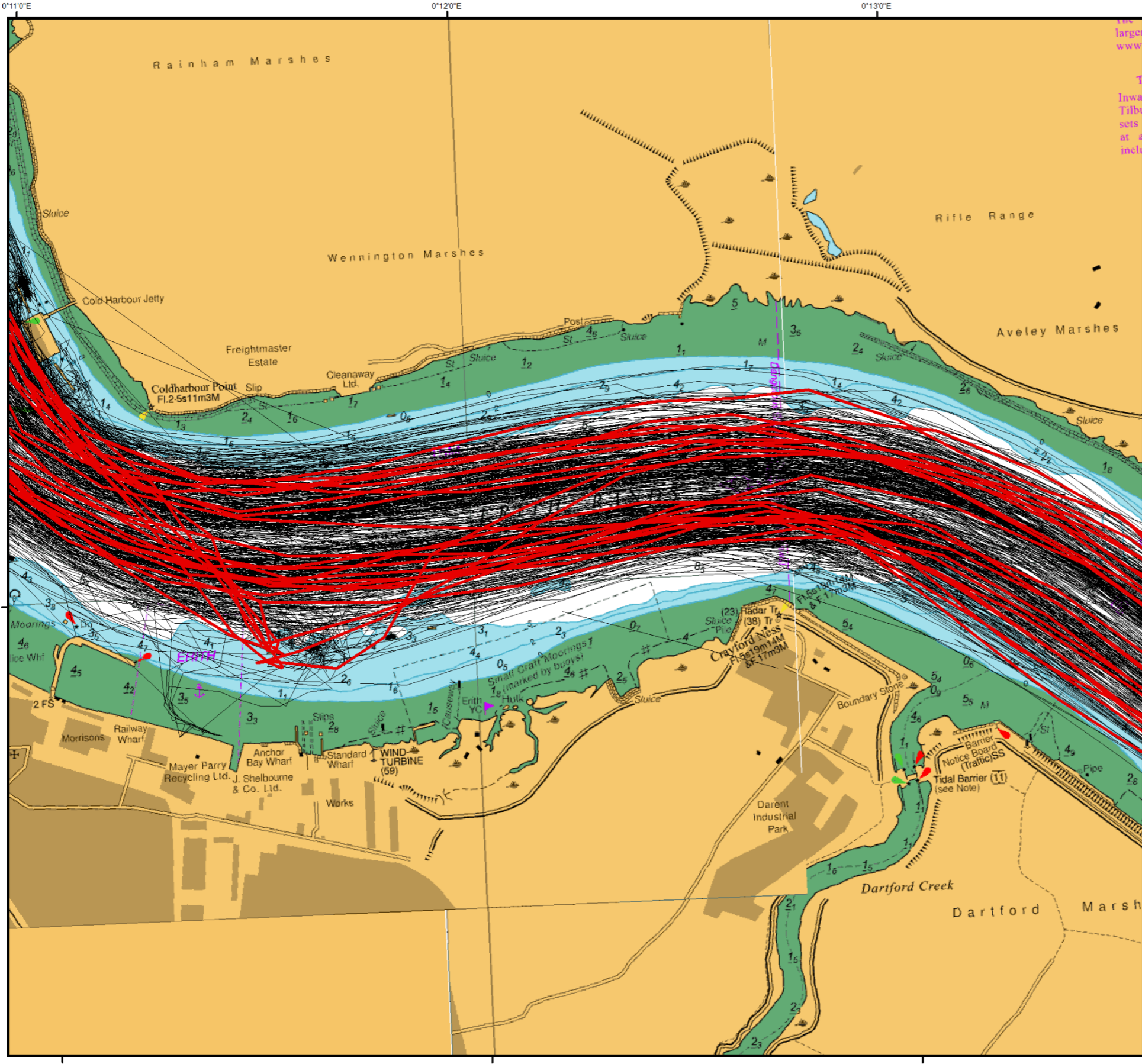
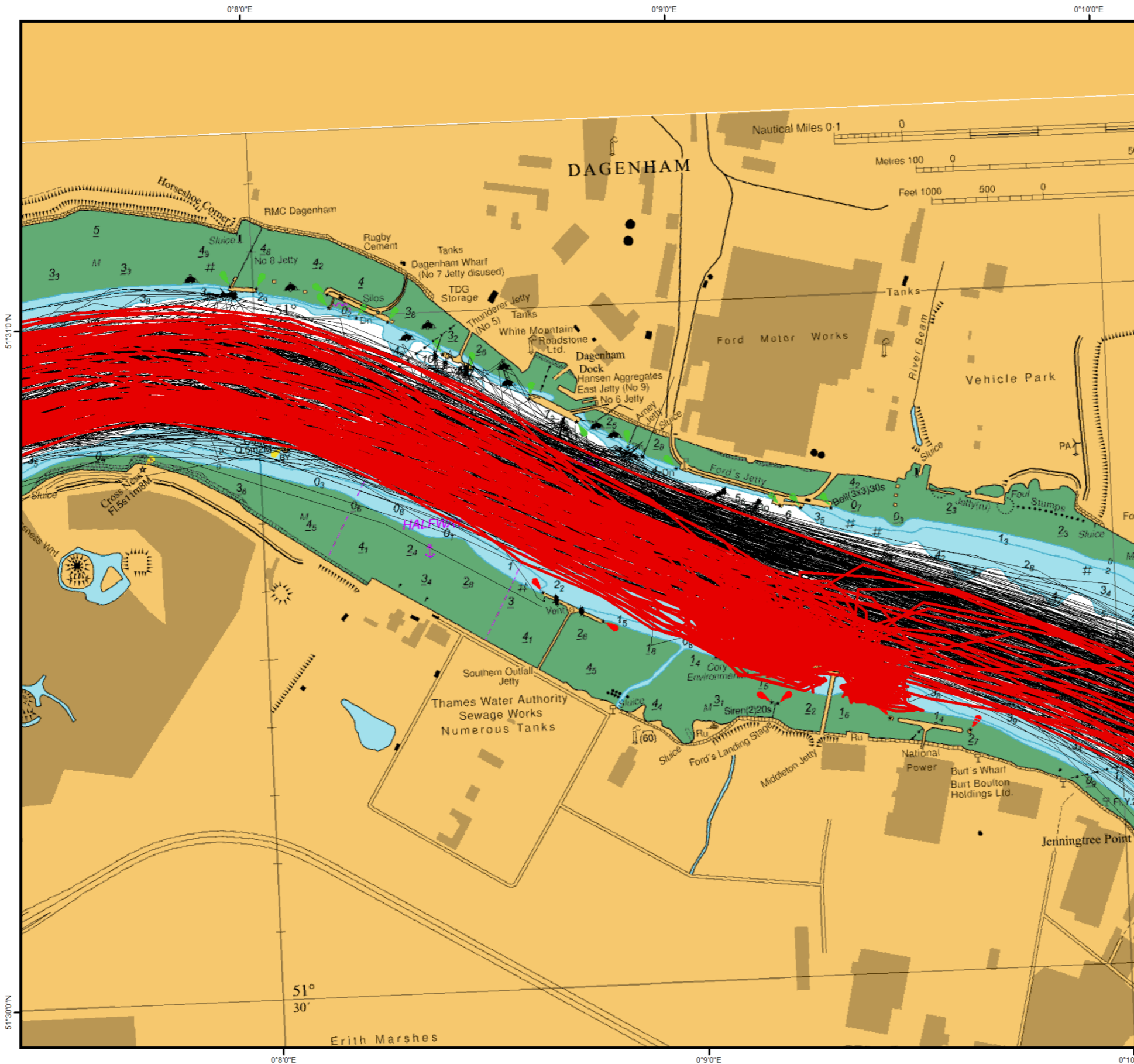


Figure Reference: 18UK1404_CoryREP_Erith_v1



Cory REP NRA, Halfway Reach.



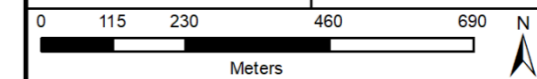
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
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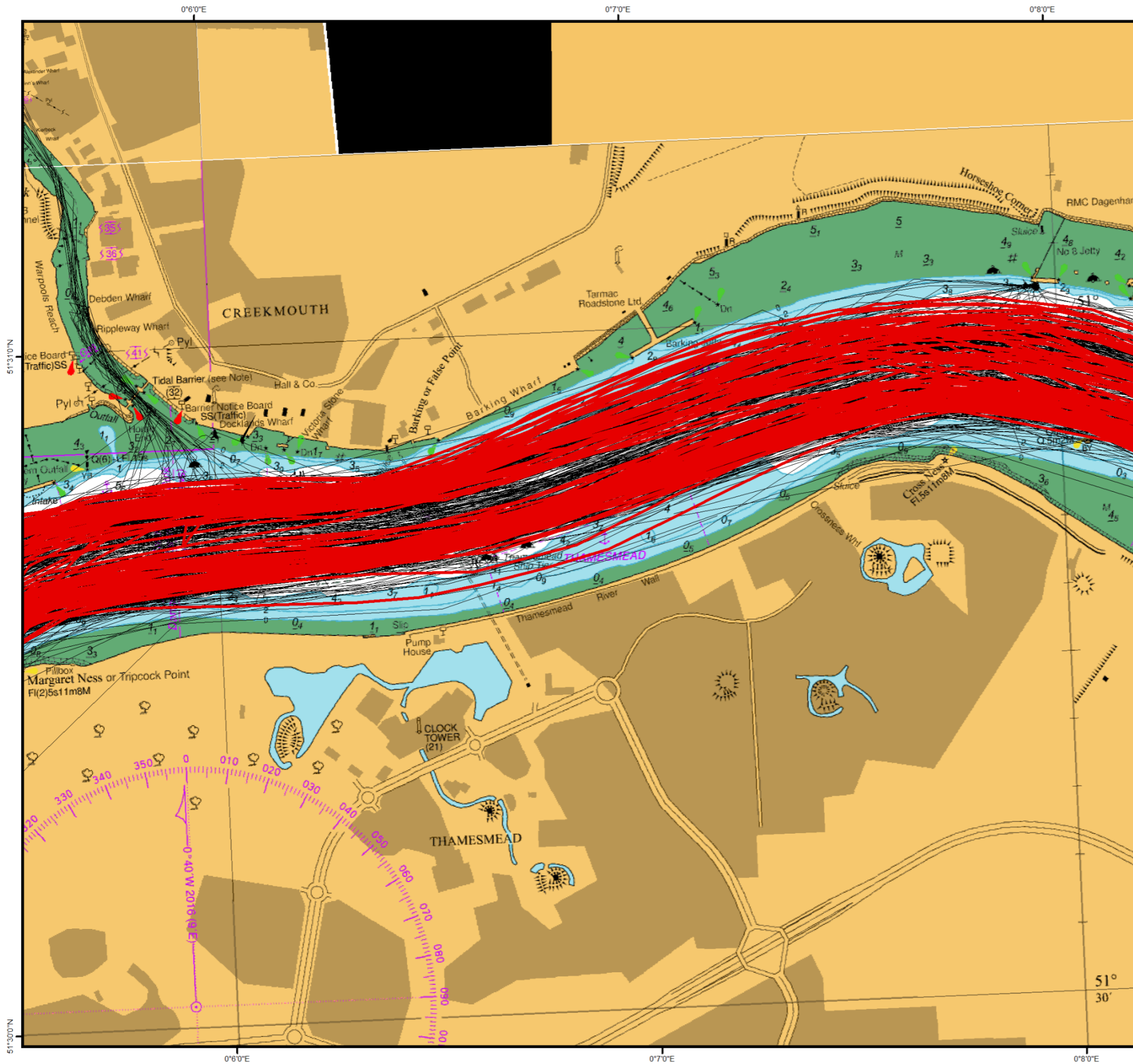
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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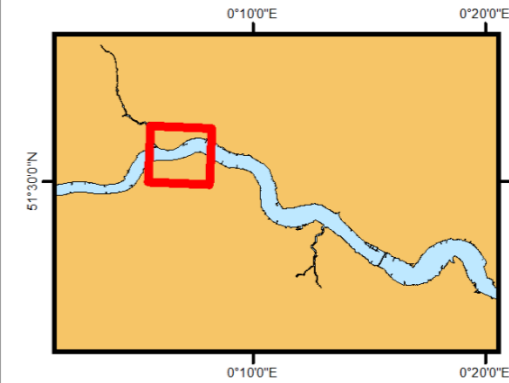
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Figure Reference: 18UK1404_CoryREP_HalfwayReach_v1



Cory REP NRA, Barking Reach.



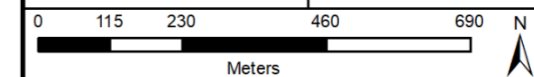
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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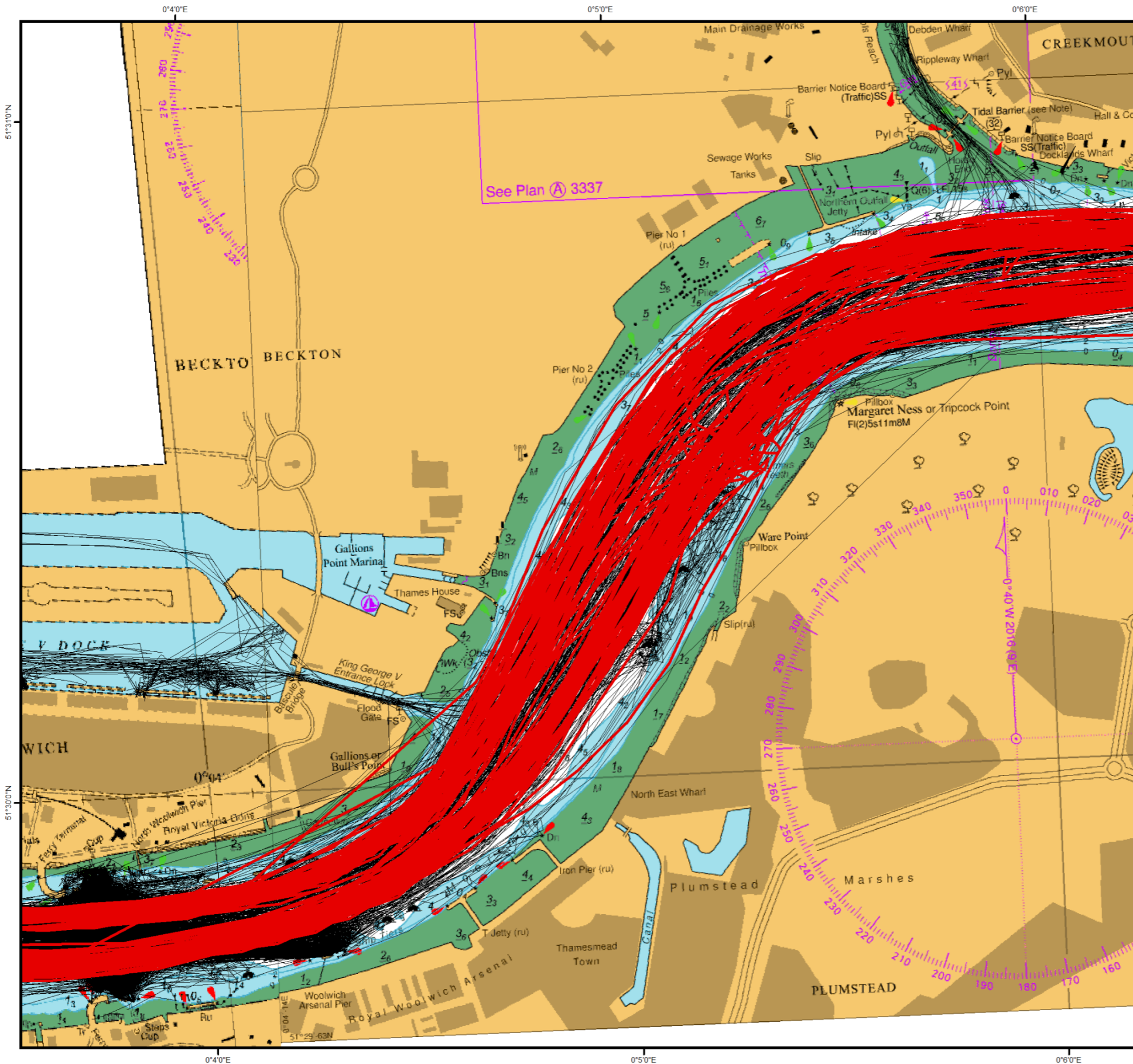
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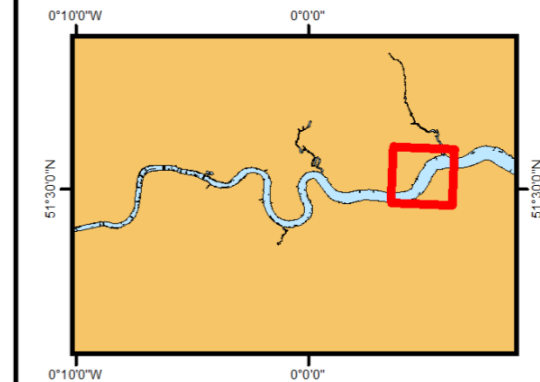
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Figure Reference: 18UK1404_CoryREP_BarkingReach_v1



Cory REP NRA, Gallions Reach.



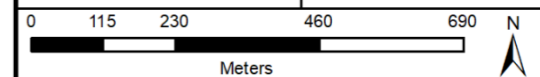
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
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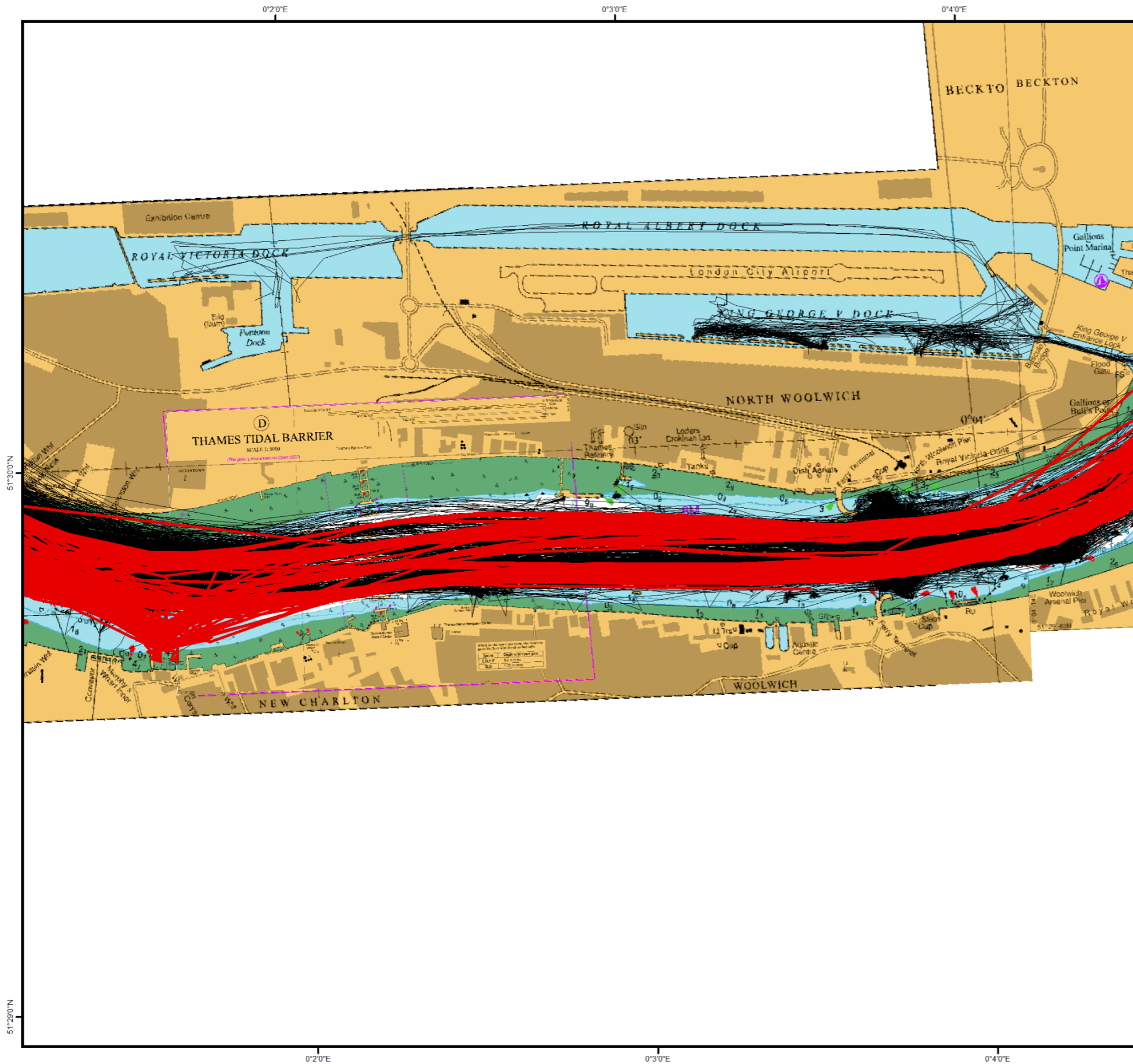
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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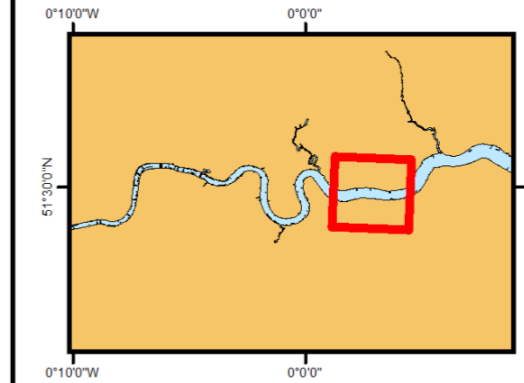
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Figure Reference: 18UK1404_CoryREP_GallionsReach_v1



Cory REP NRA, Woolwich Reach.



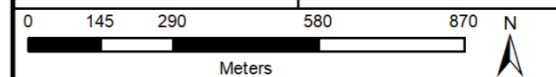
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:12,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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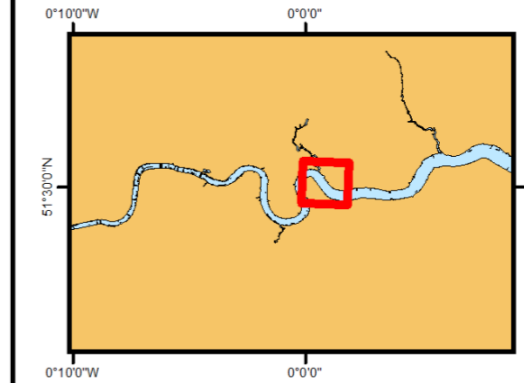


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Figure Reference: 18UK1404_CoryREP_WoolwichReach_v1

Cory REP NRA, Bugsbys Reach.



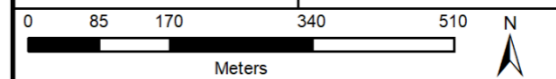
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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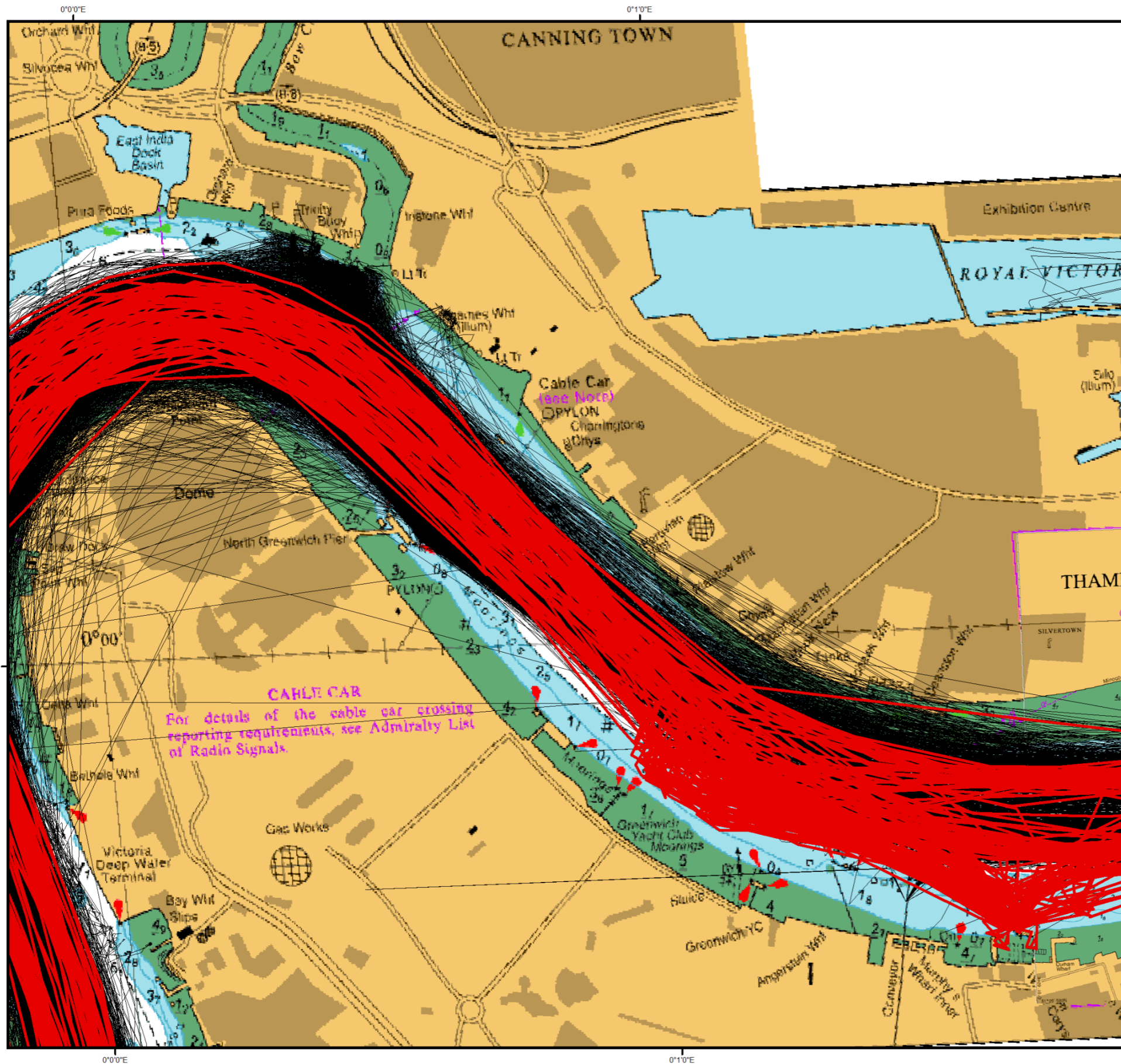
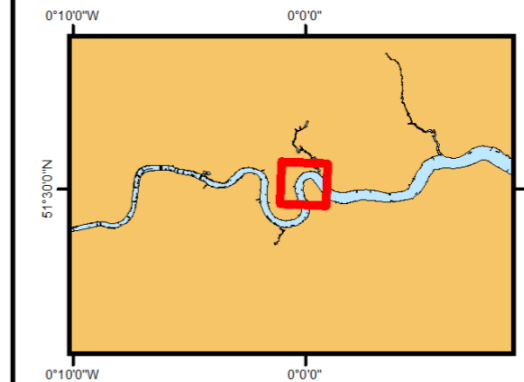


Figure Reference: 18UK1404_CoryREP_BugsbysReach_v1

Cory REP NRA, Blackwall Reach.



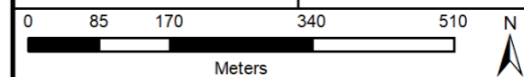
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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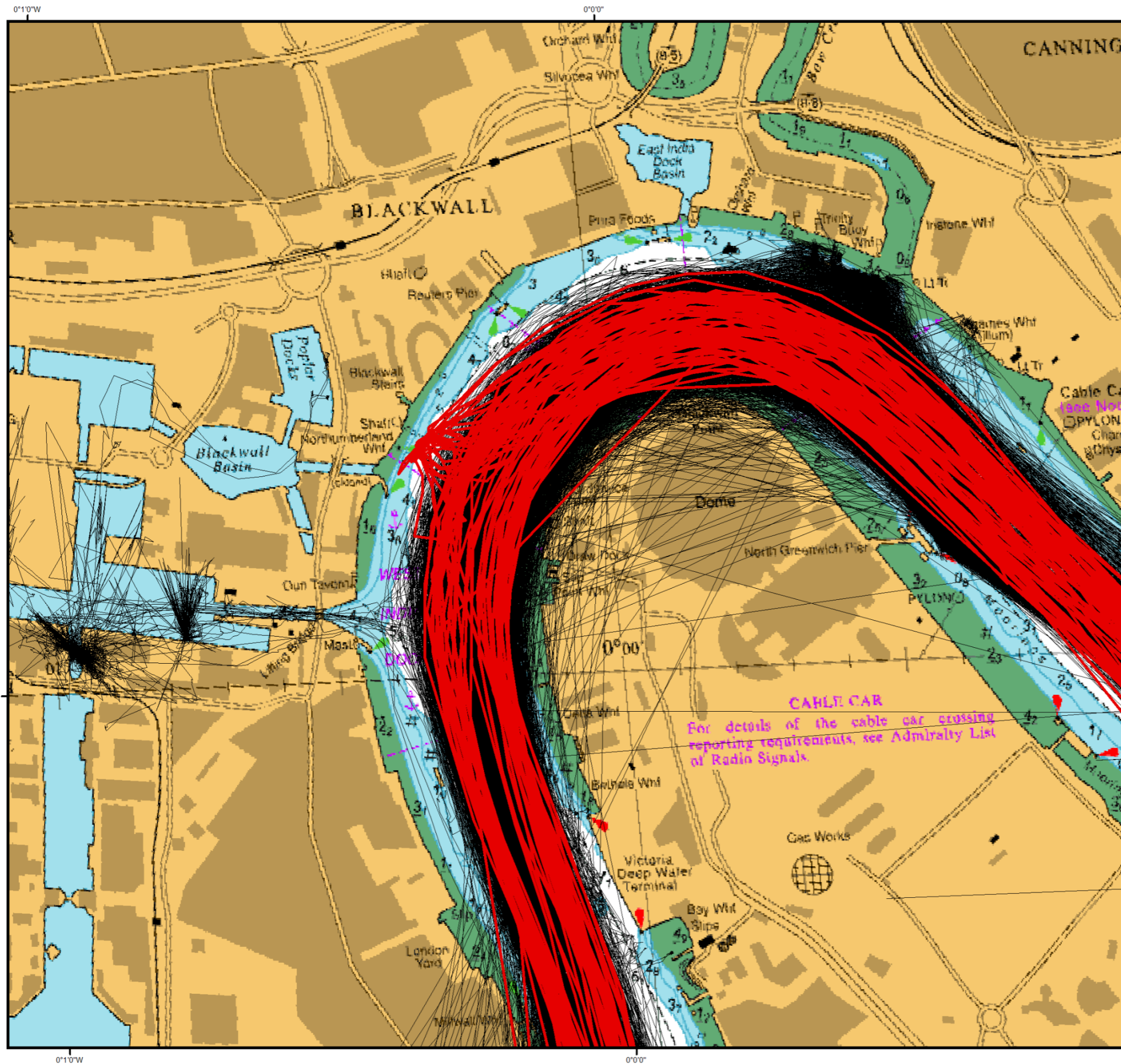
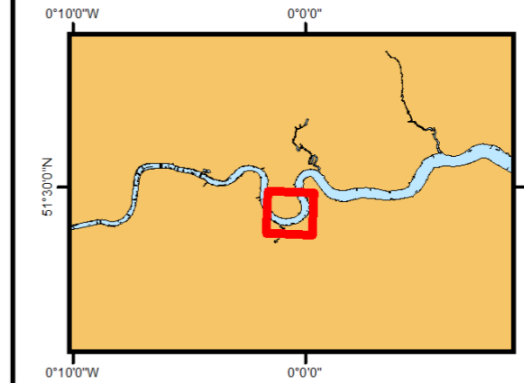


Figure Reference: 18UK1404_CoryREP_BlackwallReach_v1

Cory REP NRA, Greenwich Reach.



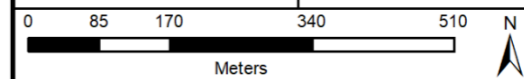
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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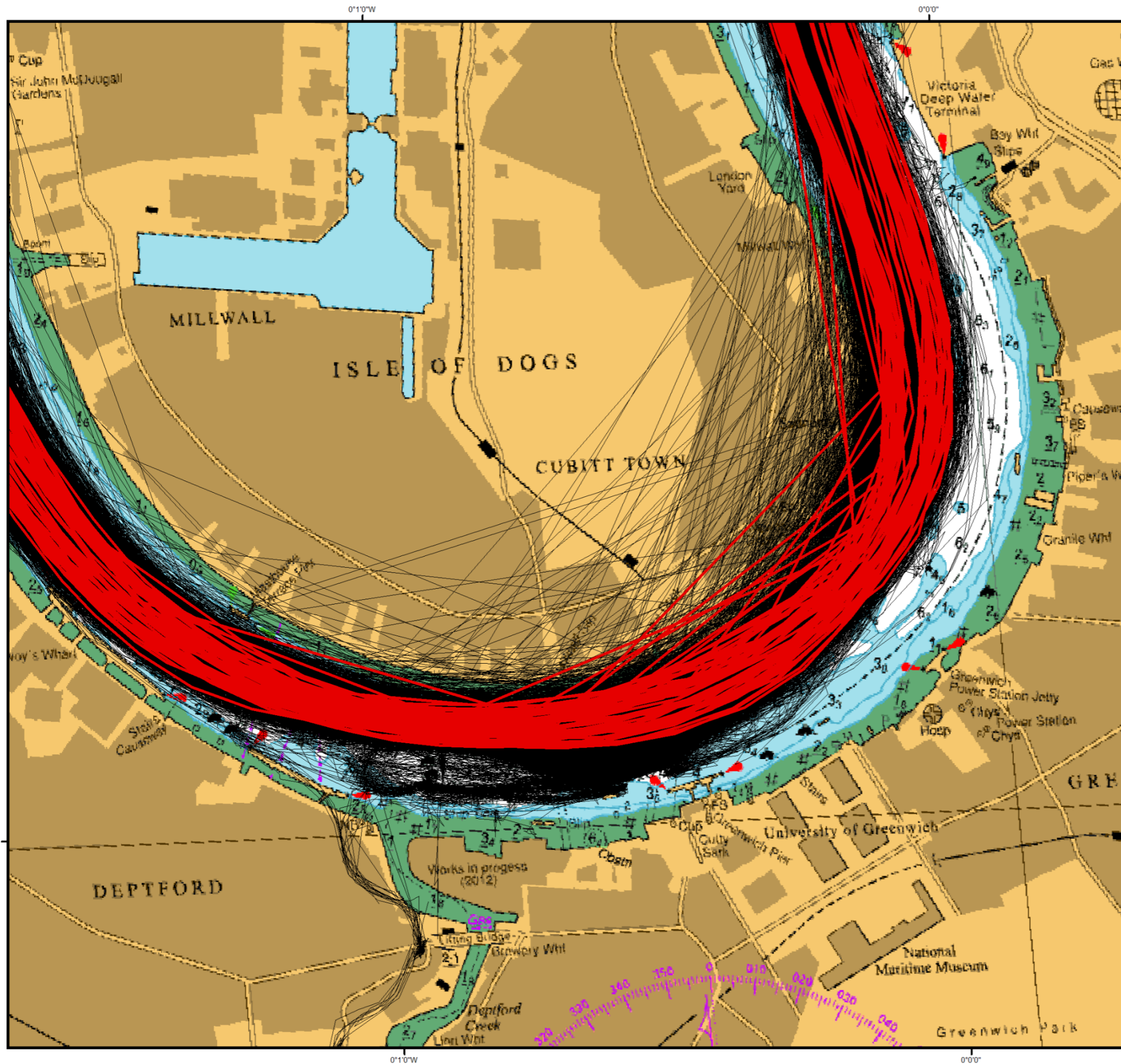
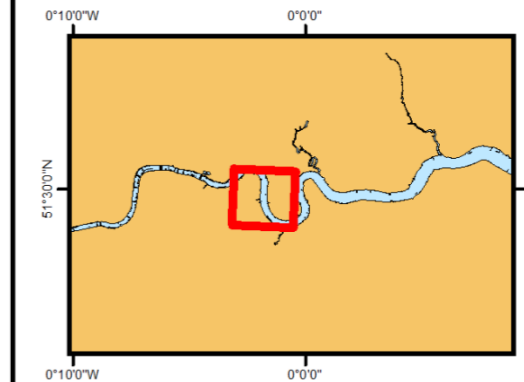


Figure Reference: 18UK1404_CoryREP_GreenwichReach_v1

Cory REP NRA, Limehouse Reach.



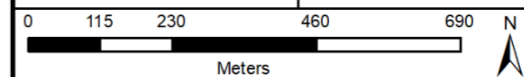
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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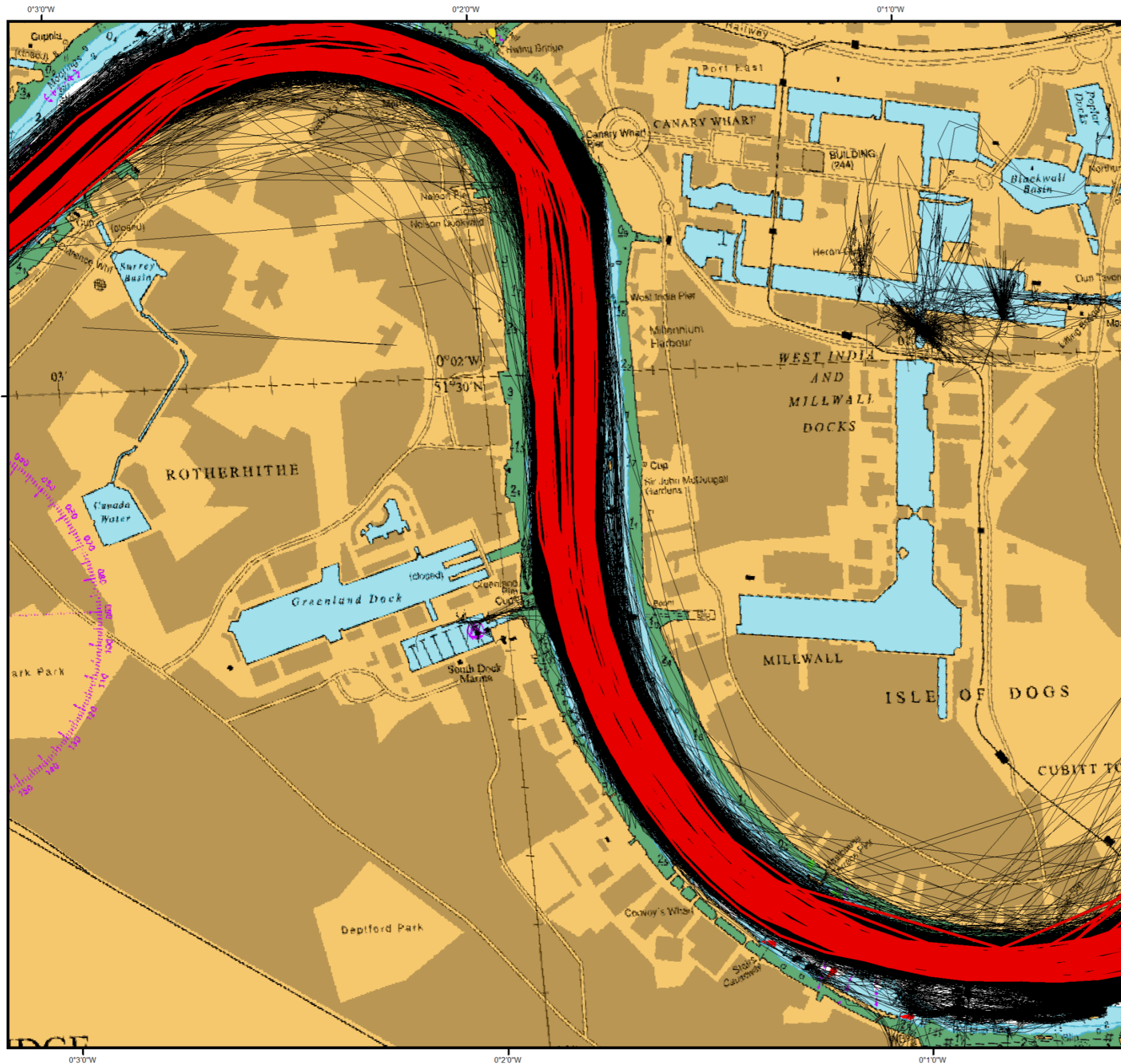
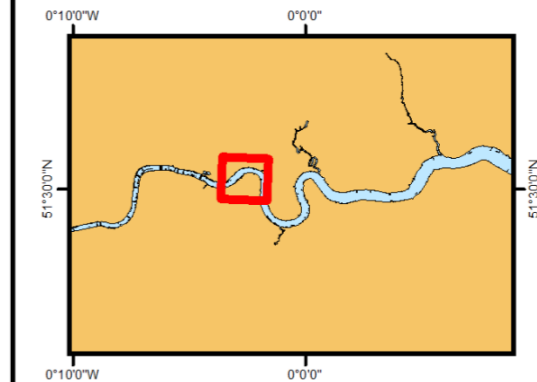


Figure Reference: 18UK1404_CoryREP_LimehouseReach_v1

Cory REP NRA, Lower Pool.



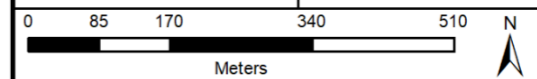
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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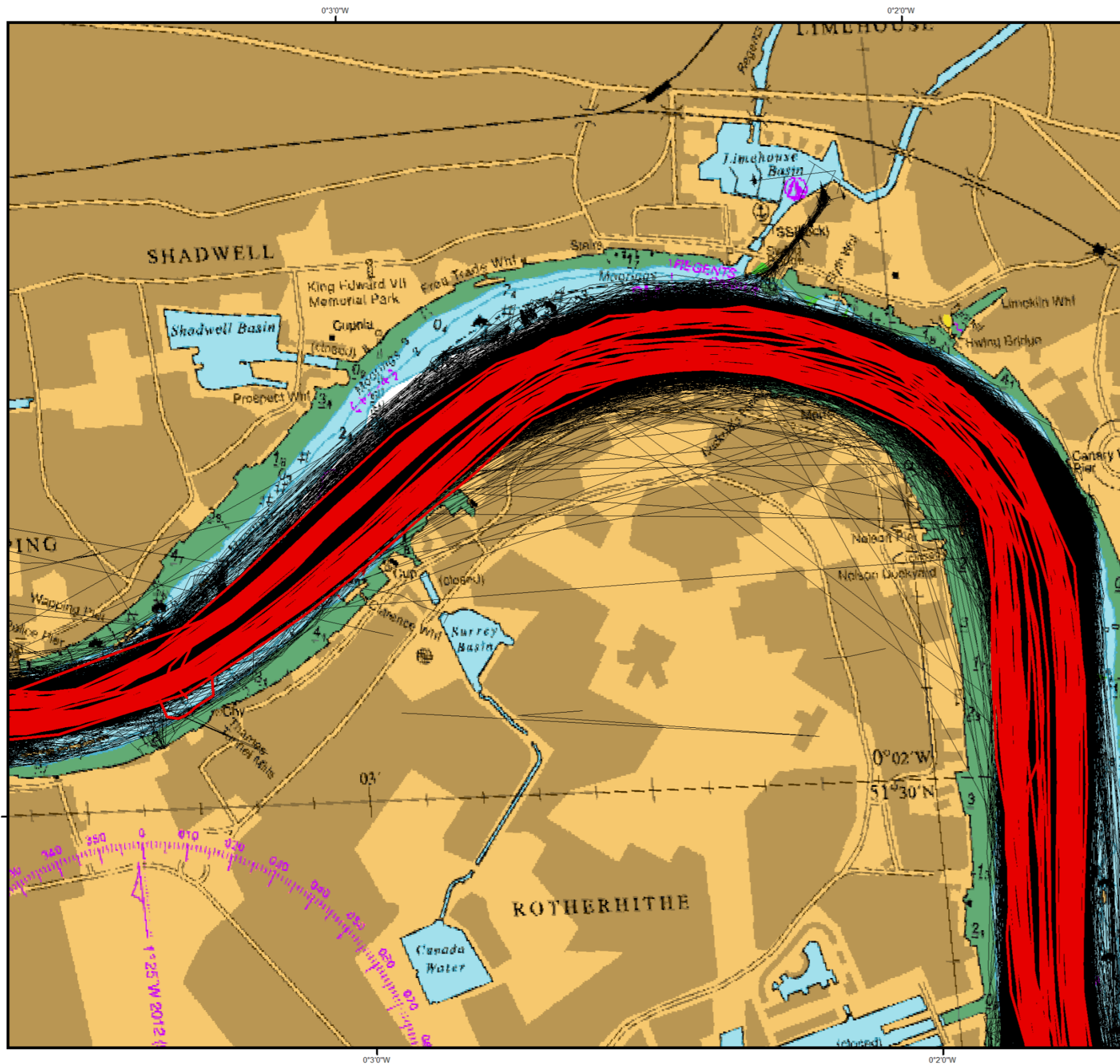
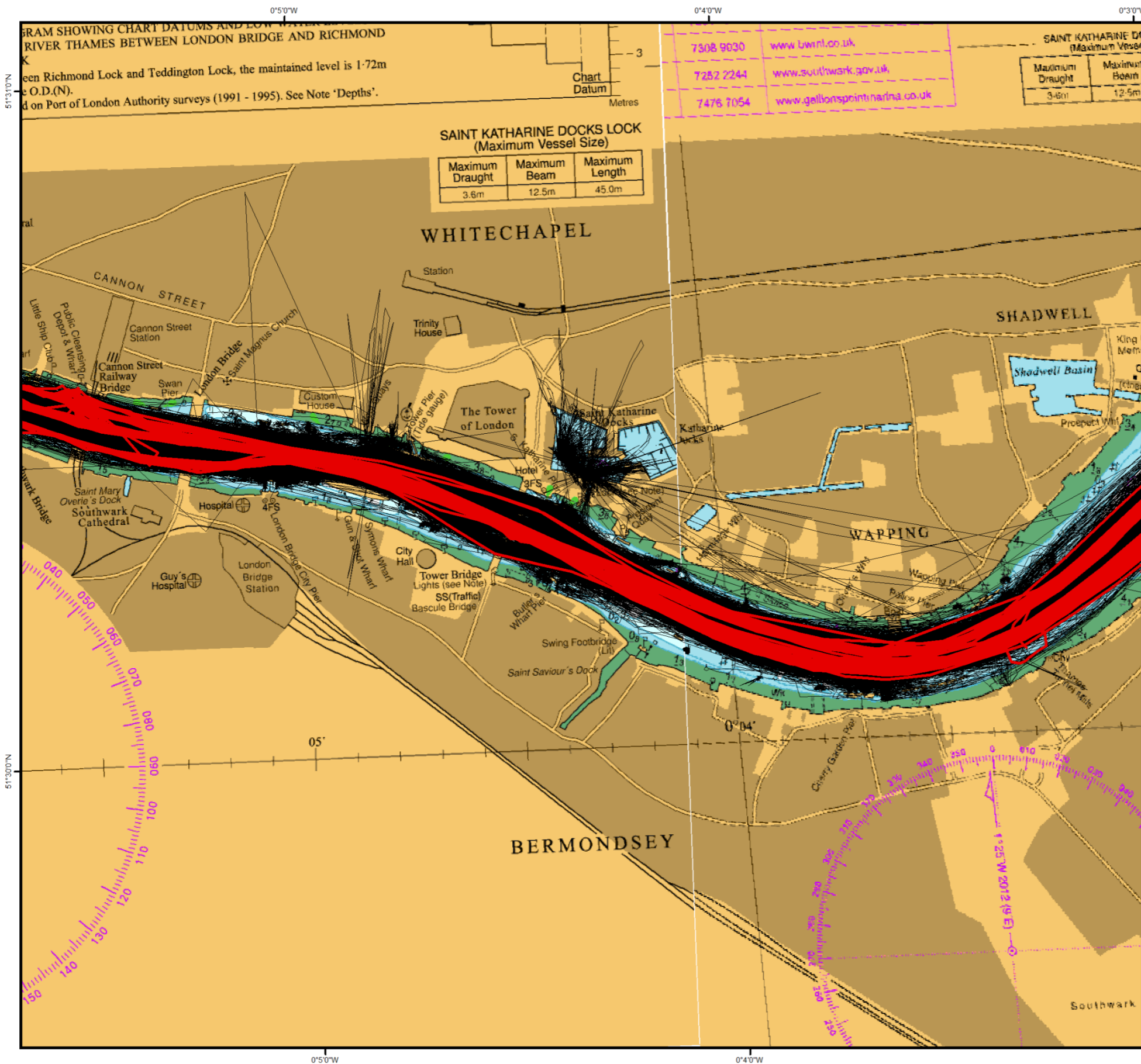


Figure Reference: 18UK1404_CoryREP_LowerPool_v1



Cory REP NRA, Upper Pool.

Legend

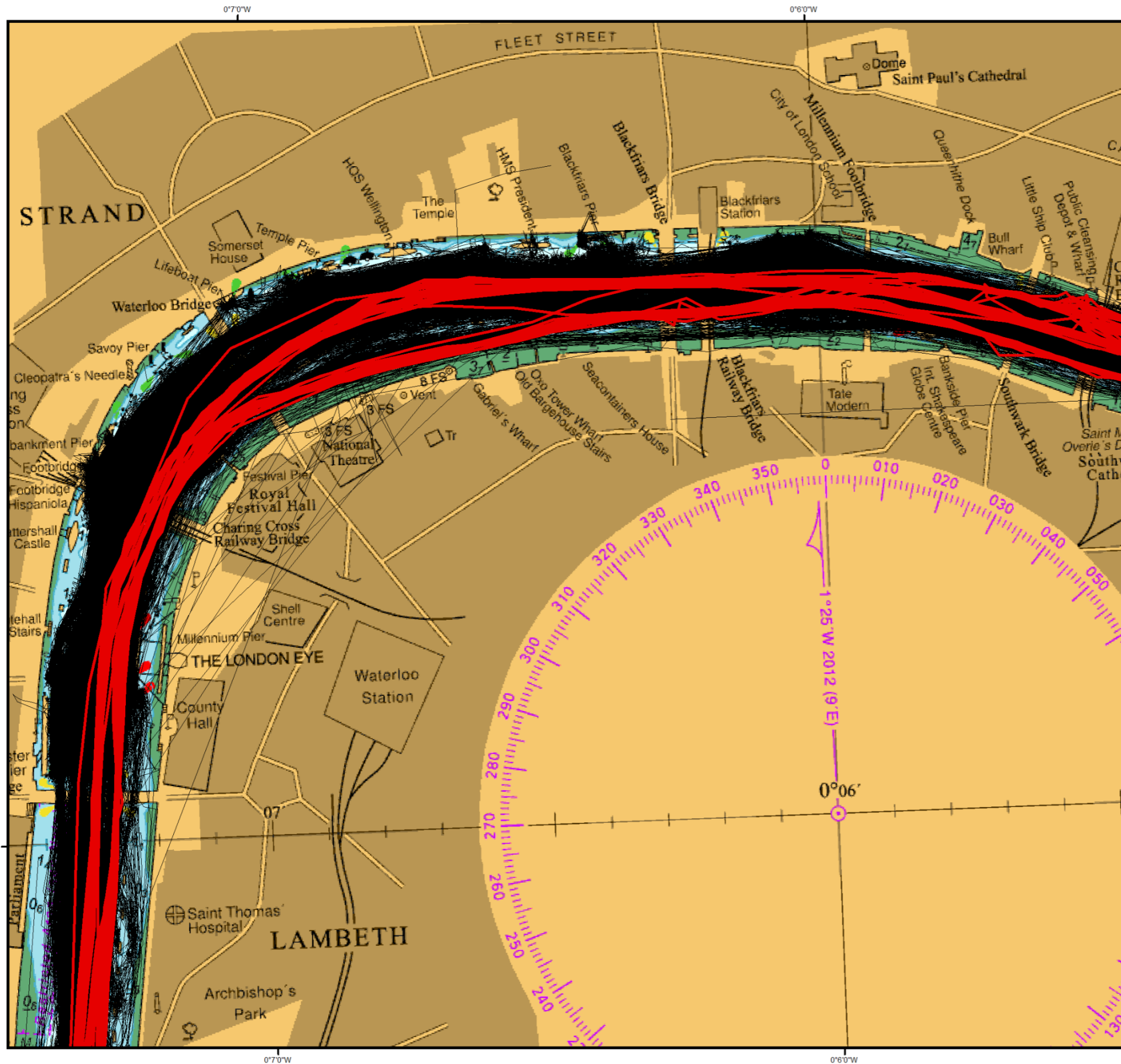
- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:10,000
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.		Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter

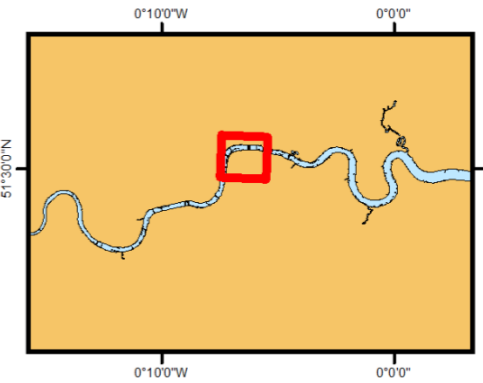
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Meters

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Figure Reference: 18UK1404_CoryREP_UpperPool_v1



Cory REP NRA, Kings Reach.



Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.		Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter

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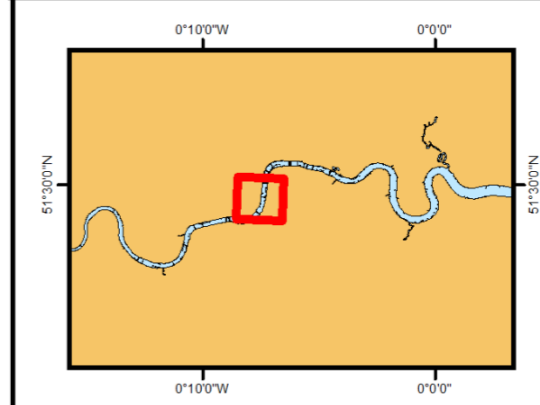
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Figure Reference: 18UK1404_CoryREP_KingsReach_v1

Cory REP NRA, Lambeth Reach.



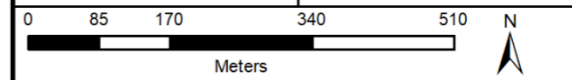
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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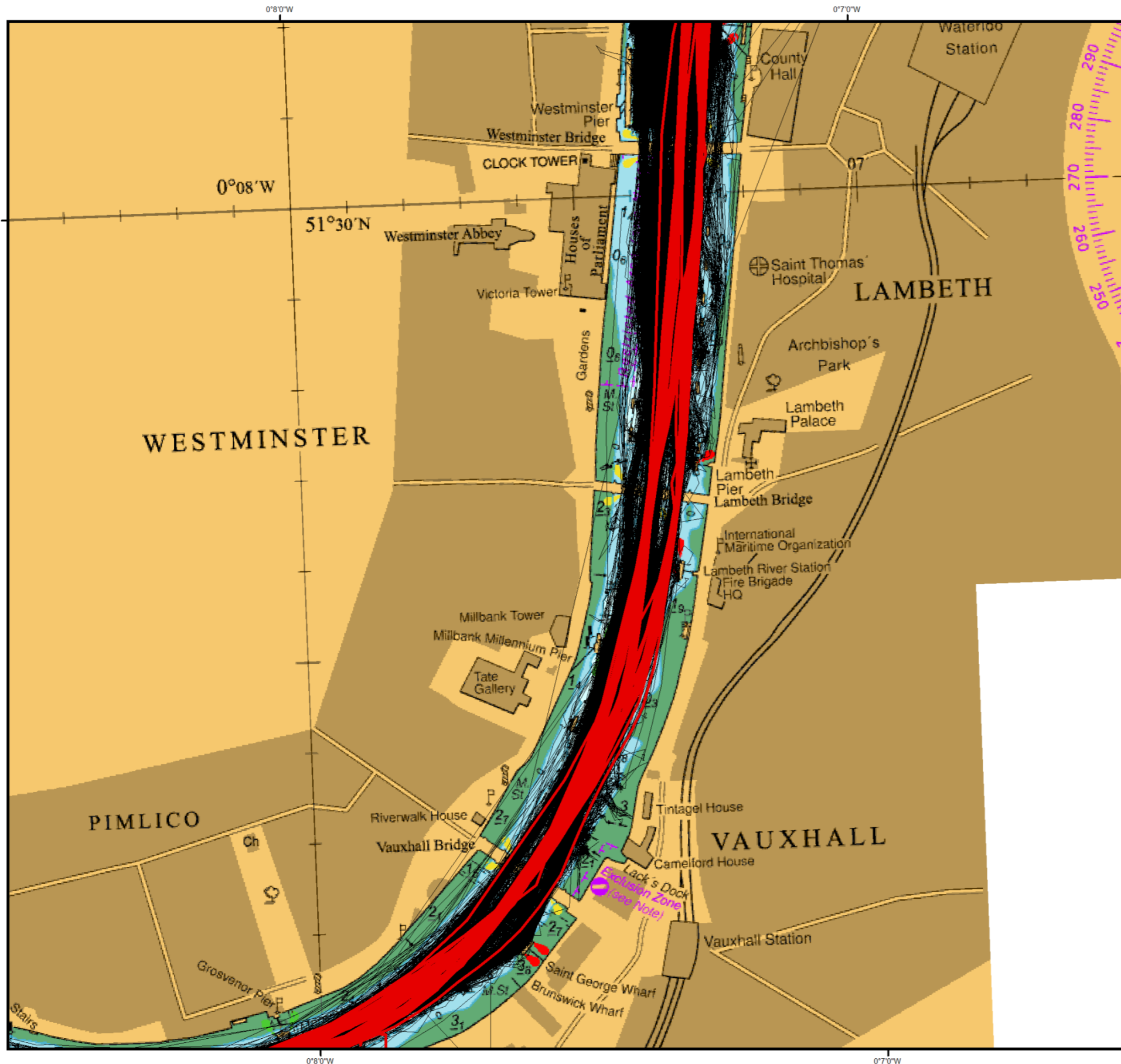
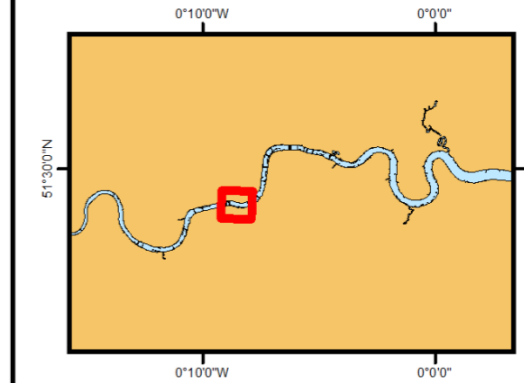


Figure Reference: 18UK1404_CoryREP_LambethReach_v1

**Cory REP NRA,
 Nine Elms Reach.**



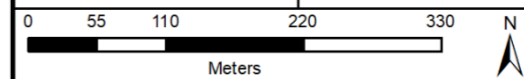
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:5,000
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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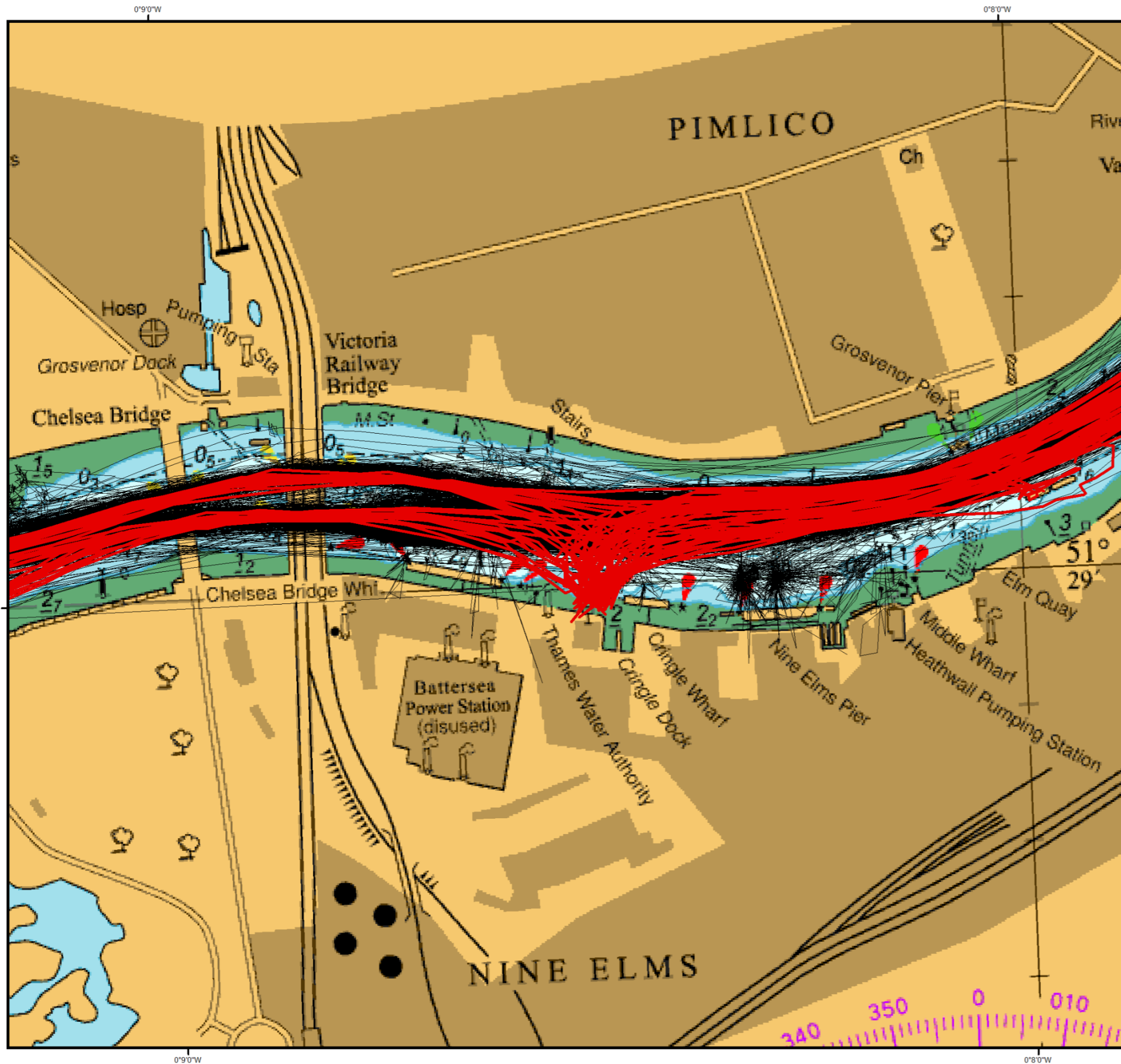
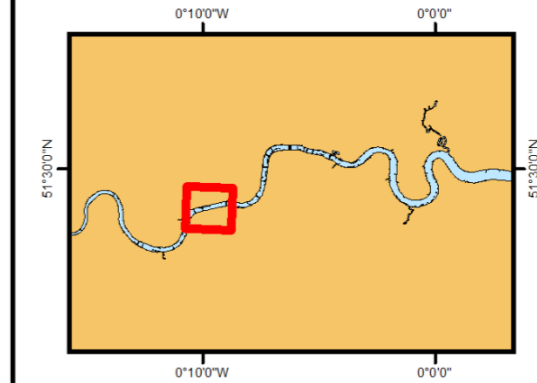


Figure Reference: 18UK1404_CoryREP_NineElms_v1

**Cory REP NRA,
 Chelsea Reach.**



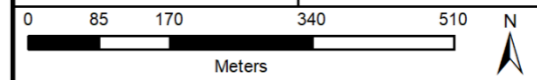
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
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Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
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Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.	Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter
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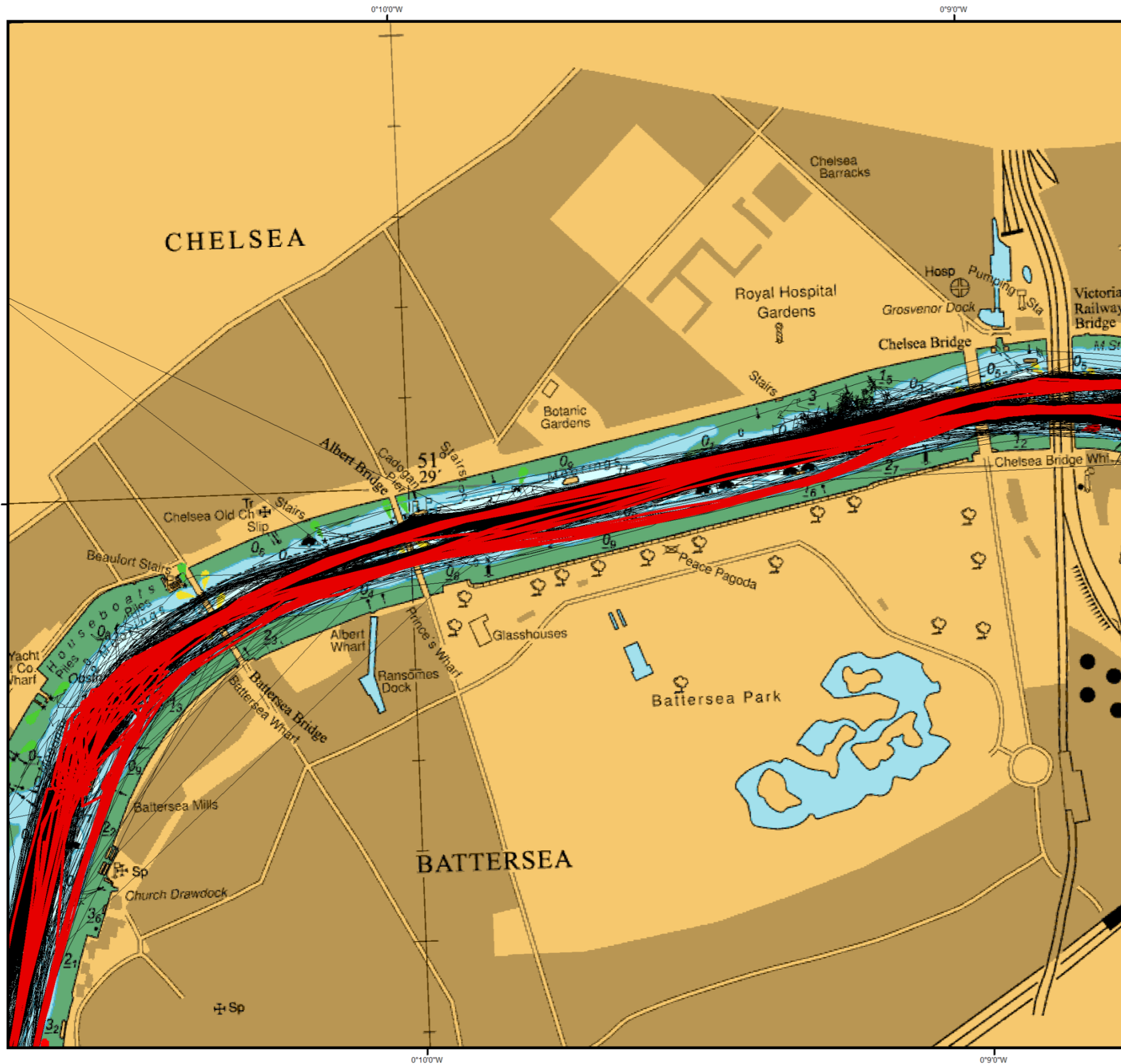
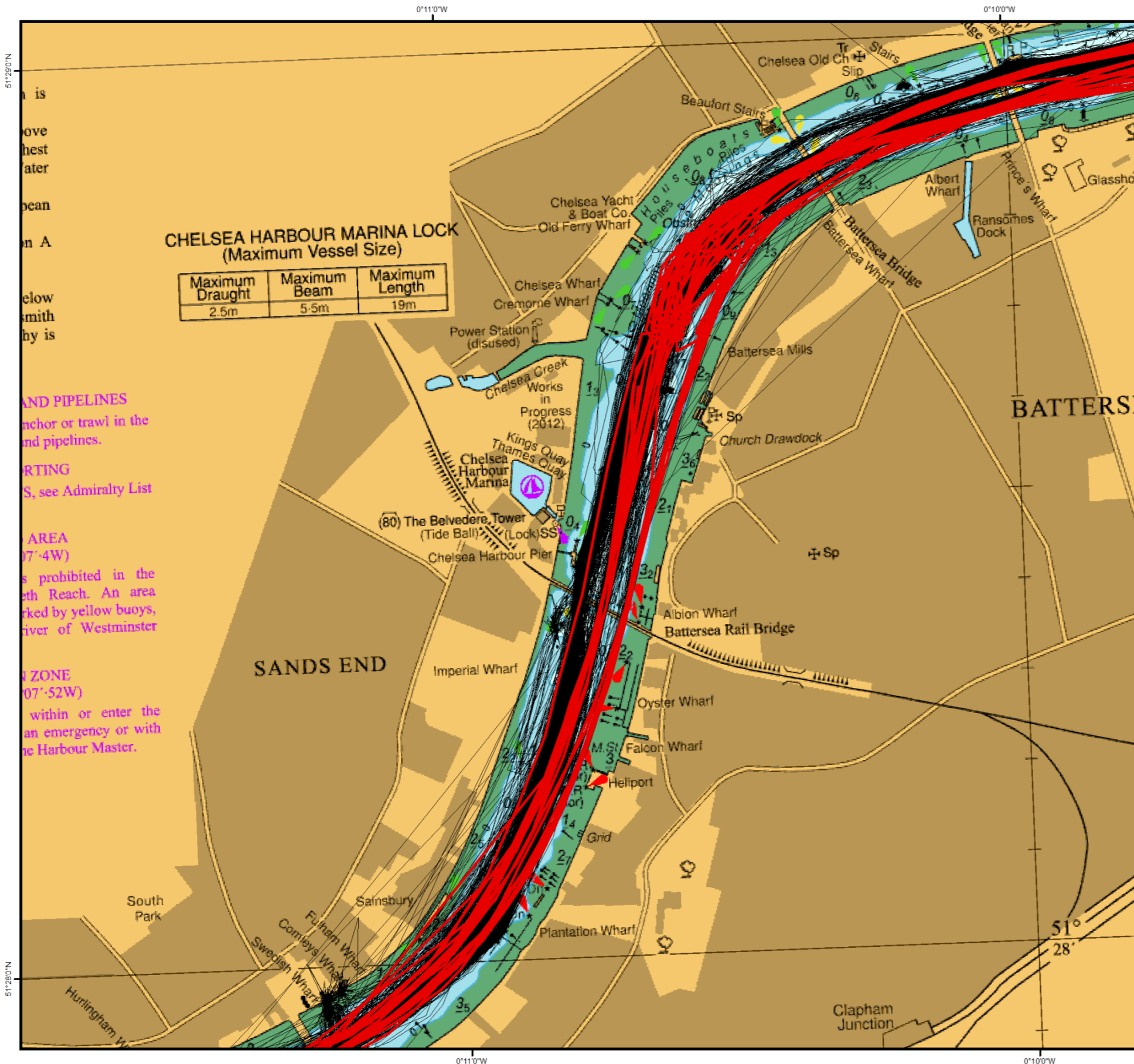


Figure Reference: 18UK1404_CoryREP_Chelsea_v1



Cory REP NRA, Battersea Reach.

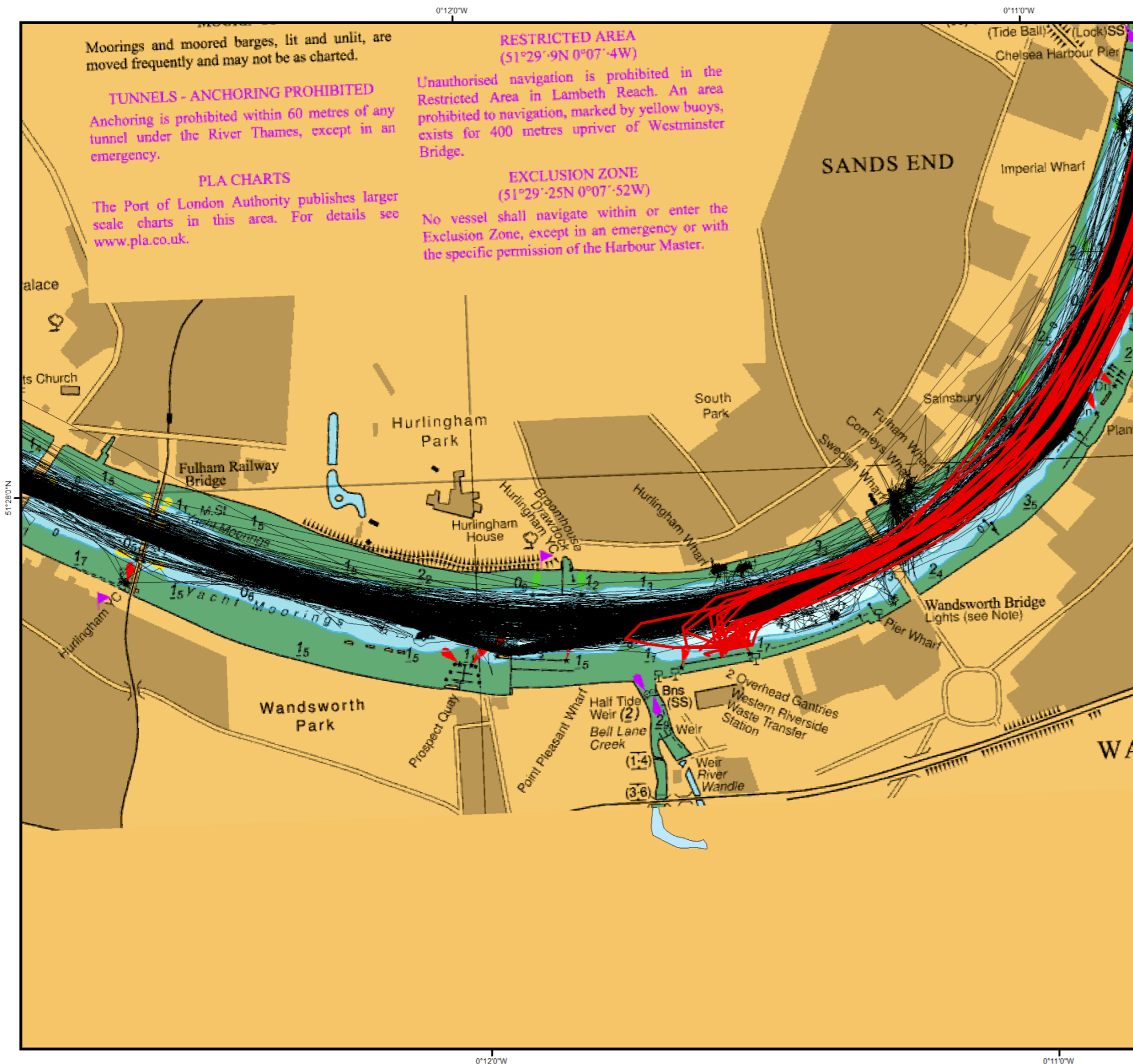
Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.		Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter

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Figure Reference: 18UK1404_CoryREP_Battersea_v1



Cory REP NRA, Wandsworth Reach.

Legend

- Corys
- All other Vessels

Project No. 18UK1404	Date 09/10/2018	Issue Number 001
Author Andrew Rawson	Checked by Ed Rogers	Scale at A3 1:7,500
Data Source AIS Source - Marico Marine and MarineTraffic, 15th to 30th June 2018.		Coordinate System: WGS 1984 UTM Zone 30N Projection: Transverse Mercator Datum: WGS 1984 Units: Meter

0 85 170 340 510 Meters

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Figure Reference: 18UK1404_CoryREP_Wandsworth_v1

Appendix B Risk Assessment

Hazard ID	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Area	Baseline Risk - with existing risk controls in place				Scenario 1			Scenario 2			Scenario 3		
								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
1	Collision	Collision of Commercial Shipping	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C2	Minor injuries	L2	Pilot error	Battersea Raech	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C7	Minor or superficial damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C21	Insignificant impact on the environment	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C27	Minor local adverse publicity	L10	Action of the tidal stream	Lambeth Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Kings Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			WORST CREDIBLE				Upper Pool	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C3	Major injuries			Lower Pool	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C9	Major damage to vessel			Limehouse Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C23	Limited impact on the environment with short-term or long-term effects (Tier 2)			Greenwich Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C29	National adverse publicity			Blackwall Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Bugsbys Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Woolwich Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Gallions Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Barking Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Halfway Reach	1.4	3.0	4.1 Minor	5.3 Moderate	1.2	5.3 Moderate	1.2	5.3 Moderate	1.2				
							Erith Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Erith Rands	1.2	3.0	3.5 Minor	3.9 Minor	0.3	3.9 Minor	0.3	3.9 Minor	0.3				
							Long Reach	1.7	3.0	5.2 Moderate	5.4 Moderate	0.3	5.4 Moderate	0.3	5.4 Moderate	0.3				
							St Clements Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
				Northfleet Hope	1.4	3.0	4.3 Minor	4.6 Moderate	0.3	4.6 Moderate	0.3	4.6 Moderate	0.3							
				Gravesend Upper	2.2	3.0	6.7 Moderate	6.7 Moderate	0.0	6.7 Moderate	0.0	6.7 Moderate	0.0							
				Tilbury Docks	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							
				Barking Creek	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							

Hazard ID	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Area	Baseline Risk - with existing risk controls in place				Scenario 1			Scenario 2			Scenario 3		
								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
2	Collision	Collision of Inland Non-Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5											
								1.2	2.5	3.0 Minor	3.3 Minor	0.3	3.2 Minor	0.2	3.0 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	1.8	2.5	4.6 Moderate	4.9 Moderate	0.3	4.7 Moderate	0.2	4.6 Moderate	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.2	2.5	3.1 Minor	3.3 Minor	0.2	3.2 Minor	0.1	3.1 Minor	0.0				
			C21	Insignificant impact on the environment	L8	Congestion	Nine Elms Reach	1.2	2.5	3.1 Minor	3.2 Minor	0.1	3.2 Minor	0.1	3.1 Minor	0.0				
			C26	No adverse publicity	L9	Adverse weather conditions / reduced visibility	Lambeth Reach	1.5	2.5	3.7 Minor	3.8 Minor	0.1	3.8 Minor	0.1	3.7 Minor	0.0				
					L10	Action of the tidal stream	Kings Reach	2.3	2.5	5.6 Moderate	5.7 Moderate	0.0	5.7 Moderate	0.0	5.6 Moderate	0.0				
			WORST CREDIBLE				Upper Pool	1.8	2.5	4.6 Moderate	4.6 Moderate	0.0	4.6 Moderate	0.0	4.6 Moderate	0.0				
			C4	Major injuries or single fatality			Lower Pool	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
			C9	Major damage to vessel			Limehouse Reach	1.3	2.5	3.1 Minor	3.2 Minor	0.0	3.2 Minor	0.0	3.1 Minor	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	2.0	2.5	5.0 Moderate	5.0 Moderate	0.0	5.0 Moderate	0.0	5.0 Moderate	0.0				
			C28	Regional adverse publicity			Blackwall Reach	1.3	2.5	3.3 Minor	3.4 Minor	0.1	3.4 Minor	0.1	3.3 Minor	0.0				
							Bugsbys Reach	2.0	2.5	4.9 Moderate	5.1 Moderate	0.2	5.1 Moderate	0.2	5.0 Moderate	0.1				
							Woolwich Reach	1.4	2.5	3.6 Minor	3.7 Minor	0.1	3.7 Minor	0.1	3.7 Minor	0.1				
							Gallions Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Barking Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Halfway Reach	2.0	2.5	5.0 Moderate	5.3 Moderate	0.3	5.3 Moderate	0.3	5.3 Moderate	0.3				
							Erith Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Erith Rands	1.6	2.5	4.0 Minor	4.1 Minor	0.1	4.1 Minor	0.1	4.1 Minor	0.1				
							Long Reach	1.9	2.5	4.7 Moderate	4.7 Moderate	0.1	4.7 Moderate	0.1	4.7 Moderate	0.1				
				St Clements Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							
				Northfleet Hope	1.6	2.5	4.0 Minor	4.0 Minor	0.1	4.0 Minor	0.1	4.0 Minor	0.1							
				Gravesend Upper	2.6	2.5	6.5 Moderate	6.5 Moderate	0.0	6.5 Moderate	0.0	6.5 Moderate	0.0							
				Tilbury Docks	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							
				Barking Creek	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
3	Collision	Collision of Inland Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	3.0											
								1.6	3.0	4.8 Moderate	5.7 Moderate	0.8	5.3 Moderate	0.5	4.8 Moderate	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	2.3	3.0	6.9 Moderate	7.5 Moderate	0.6	7.2 Moderate	0.3	6.9 Moderate	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.5	3.0	4.6 Moderate	5.2 Moderate	0.6	4.9 Moderate	0.3	4.6 Moderate	0.0				
			C21	Insignificant impact on the environment	L8	Congestion	Nine Elms Reach	1.6	3.0	4.7 Moderate	5.1 Moderate	0.4	5.1 Moderate	0.4	4.7 Moderate	0.0				
			C28	Regional adverse publicity	L9	Adverse weather conditions / reduced visibility	Lambeth Reach	1.9	3.0	5.8 Moderate	5.9 Moderate	0.2	5.9 Moderate	0.2	5.8 Moderate	0.0				
					L10	Action of the tidal stream	Kings Reach	3.1	3.0	9.2 Moderate	9.2 Moderate	0.0	9.2 Moderate	0.0	9.2 Moderate	0.0				
			WORST CREDIBLE				Upper Pool	2.5	3.0	7.6 Moderate	7.6 Moderate	0.0	7.6 Moderate	0.0	7.6 Moderate	0.0				
			C5	Major injuries or multiple fatalities			Lower Pool	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
			C10	Loss of vessel or severe damage to vessel			Limehouse Reach	2.0	3.0	5.9 Moderate	6.0 Moderate	0.1	6.0 Moderate	0.1	5.9 Moderate	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	2.5	3.0	7.4 Moderate	7.5 Moderate	0.1	7.5 Moderate	0.1	7.4 Moderate	0.0				
			C30	International adverse publicity			Blackwall Reach	1.5	3.0	4.5 Moderate	4.8 Moderate	0.2	4.8 Moderate	0.2	4.5 Moderate	0.0				
							Bugsbys Reach	2.3	3.0	6.9 Moderate	7.5 Moderate	0.6	7.5 Moderate	0.6	7.2 Moderate	0.3				
							Woolwich Reach	1.5	3.0	4.5 Minor	4.9 Moderate	0.4	4.9 Moderate	0.4	4.9 Moderate	0.4				
							Gallions Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Barking Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Halfway Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Erith Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Erith Rands	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Long Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
				St Clements Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							
				Northfleet Hope	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							
				Gravesend Upper	1.8	3.0	5.4 Moderate	5.4 Moderate	0.0	5.4 Moderate	0.0	5.4 Moderate	0.0							
				Tilbury Docks	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							
				Barking Creek	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
4	Collision	Collision of Recreational	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5											
								1.0	2.5	2.5 Minor	2.8 Minor	0.3	2.6 Minor	0.1	2.5 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	2.1	2.5	5.2 Moderate	5.7 Moderate	0.5	5.5 Moderate	0.3	5.2 Moderate	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.2	2.5	2.9 Minor	3.4 Minor	0.5	3.2 Minor	0.3	2.9 Minor	0.0				
			C21	Insignificant impact on the environment	L8	Congestion	Nine Elms Reach	1.0	2.5	2.5 Minor	2.8 Minor	0.3	2.8 Minor	0.3	2.5 Minor	0.0				
			C27	Minor local adverse publicity	L9	Adverse weather conditions / reduced visibility	Lambeth Reach	1.2	2.5	3.0 Minor	3.1 Minor	0.1	3.1 Minor	0.1	3.0 Minor	0.0				
					L10	Action of the tidal stream	Kings Reach	2.1	2.5	5.3 Moderate	5.3 Moderate	0.0	5.3 Moderate	0.0	5.3 Moderate	0.0				
			WORST CREDIBLE				Upper Pool	2.2	2.5	5.5 Moderate	5.6 Moderate	0.0	5.6 Moderate	0.0	5.5 Moderate	0.0				
			C4	Major injuries or single fatality			Lower Pool	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
			C10	Loss of vessel or severe damage to vessel			Limehouse Reach	1.2	2.5	3.1 Minor	3.2 Minor	0.1	3.2 Minor	0.1	3.1 Minor	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	1.8	2.5	4.4 Minor	4.5 Moderate	0.1	4.5 Moderate	0.1	4.4 Minor	0.0				
			C28	Regional adverse publicity			Blackwall Reach	1.1	2.5	2.7 Minor	2.9 Minor	0.2	2.9 Minor	0.2	2.7 Minor	0.0				
							Bugsbys Reach	1.5	2.5	3.8 Minor	4.3 Minor	0.5	4.3 Minor	0.5	4.1 Minor	0.3				
							Woolwich Reach	1.0	2.5	2.5 Minor	2.6 Minor	0.1	2.6 Minor	0.1	2.6 Minor	0.1				
							Gallions Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Barking Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Halfway Reach	1.5	2.5	3.7 Minor	4.9 Moderate	1.2	4.9 Moderate	1.2	4.9 Moderate	1.2				
							Erith Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Erith Rands	1.3	2.5	3.2 Minor	3.6 Minor	0.4	3.6 Minor	0.4	3.6 Minor	0.4				
							Long Reach	1.4	2.5	3.5 Minor	3.8 Minor	0.3	3.8 Minor	0.3	3.8 Minor	0.3				
				St Clements Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							
				Northfleet Hope	1.1	2.5	2.6 Minor	2.9 Minor	0.3	2.9 Minor	0.3	2.9 Minor	0.3							
				Gravesend Upper	1.8	2.5	4.5 Minor	4.5 Minor	0.0	4.5 Minor	0.0	4.5 Minor	0.0							
				Tilbury Docks	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							
				Barking Creek	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
5	Collision	Contact of Commercial Shipping	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C1	No injuries	L2	Pilot error	Battersea Raech	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C7	Minor or superficial damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C17	Minor damage to works / barges alongside works / infrastructure	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C21	Insignificant impact on the environment	L10	Action of the tidal stream	Lambeth Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C26	No adverse publicity			Kings Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
							Upper Pool	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			WORST CREDIBLE				Lower Pool	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C3	Major injuries			Limehouse Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C9	Major damage to vessel			Greenwich Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C19	Major damage to works / barges alongside works / infrastructure			Blackwall Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C23	Limited impact on the environment with short-term or long-term effects (Tier 2)			Bugsbys Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C28	Regional adverse publicity			Woolwich Reach	1.2	2.5	2.9	Minor	3.5	Minor	0.5	3.5	Minor	0.5	3.5	Minor	0.5
							Gallions Reach	1.2	2.5	3.0	Minor	3.5	Minor	0.5	3.5	Minor	0.5	3.5	Minor	0.5
							Barking Reach	1.3	2.5	3.1	Minor	3.5	Minor	0.3	3.5	Minor	0.3	3.5	Minor	0.3
							Halfway Reach	1.8	2.5	4.4	Minor	4.9	Moderate	0.5	4.9	Moderate	0.5	4.9	Moderate	0.5
							Erith Reach	1.8	2.5	4.4	Minor	4.5	Minor	0.1	4.5	Minor	0.1	4.5	Moderate	0.1
							Erith Rands	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
							Long Reach	2.6	2.5	6.4	Moderate	6.4	Moderate	0.0	6.4	Moderate	0.0	6.4	Moderate	0.0
							St Clements Reach	2.2	2.5	5.4	Moderate	5.4	Moderate	0.0	5.4	Moderate	0.0	5.4	Moderate	0.0
				Northfleet Hope	3.1	2.5	7.8	Moderate	7.8	Moderate	0.0	7.8	Moderate	0.0	7.8	Moderate	0.0			
				Gravesend Upper	2.5	2.5	6.4	Moderate	6.4	Moderate	0.0	6.4	Moderate	0.0	6.4	Moderate	0.0			
				Tilbury Docks	3.3	2.5	8.2	Moderate	8.3	Moderate	0.1	8.3	Moderate	0.1	8.3	Moderate	0.1			
				Barking Creek	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0			

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
6	Collision	Contact of Inland Non-Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5											
								1.5	2.5	3.8 Minor	4.1 Minor	0.3	4.0 Minor	0.2	3.8 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	1.4	2.5	3.4 Minor	3.7 Minor	0.3	3.5 Minor	0.2	3.4 Minor	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.8	2.5	4.6 Moderate	4.8 Moderate	0.2	4.7 Moderate	0.1	4.6 Moderate	0.0				
			C16	Insignificant or no damage to works / barges alongside works / infrastructure	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.2	2.5	3.1 Minor	3.2 Minor	0.1	3.2 Minor	0.1	3.1 Minor	0.0				
			C21	Insignificant impact on the environment	L10	Action of the tidal stream	Lambeth Reach	1.9	2.5	4.7 Moderate	4.7 Moderate	0.1	4.7 Moderate	0.1	4.7 Moderate	0.0				
			C26	No adverse publicity			Kings Reach	2.4	2.5	6.0 Moderate	6.0 Moderate	0.0	6.0 Moderate	0.0	6.0 Moderate	0.0				
							Upper Pool	1.8	2.5	4.6 Moderate	4.6 Moderate	0.0	4.6 Moderate	0.0	4.6 Moderate	0.0				
			WORST CREDIBLE				Lower Pool	1.5	2.5	3.8 Minor	3.8 Minor	0.0	3.8 Minor	0.0	3.8 Minor	0.0				
			C4	Major injuries or single fatality			Limehouse Reach	1.7	2.5	4.3 Minor	4.4 Minor	0.0	4.4 Minor	0.0	4.3 Minor	0.0				
			C8	Moderate damage to vessel			Greenwich Reach	2.0	2.5	5.0 Moderate	5.0 Moderate	0.0	5.0 Moderate	0.0	5.0 Moderate	0.0				
			C18	Moderate damage to works / barges alongside works / infrastructure			Blackwall Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Bugsbys Reach	1.9	2.5	4.7 Moderate	4.9 Moderate	0.2	4.9 Moderate	0.2	4.8 Moderate	0.1				
			C28	Regional adverse publicity			Woolwich Reach	2.3	2.5	5.9 Moderate	5.9 Moderate	0.1	5.9 Moderate	0.1	5.9 Moderate	0.1				
							Gallions Reach	2.4	2.5	6.0 Moderate	6.1 Moderate	0.1	6.1 Moderate	0.1	6.1 Moderate	0.1				
							Barking Reach	2.1	2.5	5.2 Moderate	5.4 Moderate	0.1	5.4 Moderate	0.1	5.4 Moderate	0.1				
							Halfway Reach	2.4	2.5	6.0 Moderate	6.2 Moderate	0.3	6.2 Moderate	0.3	6.2 Moderate	0.3				
							Erith Reach	2.2	2.5	5.6 Moderate	5.6 Moderate	0.0	5.6 Moderate	0.0	5.7 Moderate	0.1				
							Erith Rands	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Long Reach	2.7	2.5	6.8 Moderate	6.9 Moderate	0.1	6.9 Moderate	0.1	6.9 Moderate	0.1				
				St Clements Reach	2.4	2.5	5.9 Moderate	6.0 Moderate	0.0	6.0 Moderate	0.0	6.0 Moderate	0.0							
				Northfleet Hope	3.3	2.5	8.1 Moderate	8.2 Moderate	0.1	8.2 Moderate	0.1	8.2 Moderate	0.1							
				Gravesend Upper	2.9	2.5	7.3 Moderate	7.3 Moderate	0.0	7.3 Moderate	0.0	7.3 Moderate	0.0							
				Tilbury Docks	3.2	2.5	8.0 Moderate	8.2 Moderate	0.2	8.2 Moderate	0.2	8.2 Moderate	0.2							
				Barking Creek	2.4	2.5	6.0 Moderate	6.0 Moderate	0.0	6.0 Moderate	0.0	7.3 Moderate	1.3							

Hazard ID	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Area	Baseline Risk - with existing risk controls in place				Scenario 1			Scenario 2			Scenario 3		
								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
7	Collision	Contact of Inland Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5											
								1.9	2.5	4.8	Moderate	4.9	Moderate	0.1	4.8	Moderate	0.0	4.8	Moderate	0.0
			C1	No injuries	L2	Pilot error	Battersea Raech	1.8	2.5	4.5	Moderate	4.6	Moderate	0.1	4.6	Moderate	0.0	4.5	Moderate	0.0
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	2.1	2.5	5.3	Moderate	5.4	Moderate	0.1	5.4	Moderate	0.0	5.3	Moderate	0.0
			C16	Insignificant or no damage to works / barges alongside works / infrastructure	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.6	2.5	3.9	Minor	4.0	Minor	0.0	4.0	Minor	0.0	3.9	Minor	0.0
			C21	Insignificant impact on the environment	L10	Action of the tidal stream	Lambeth Reach	2.3	2.5	5.8	Moderate	5.8	Moderate	0.0	5.8	Moderate	0.0	5.8	Moderate	0.0
			C26	No adverse publicity			Kings Reach	3.2	2.5	8.0	Moderate	8.0	Moderate	0.0	8.0	Moderate	0.0	8.0	Moderate	0.0
							Upper Pool	2.5	2.5	6.3	Moderate	6.3	Moderate	0.0	6.3	Moderate	0.0	6.3	Moderate	0.0
			WORST CREDIBLE				Lower Pool	1.9	2.5	4.7	Moderate	4.7	Moderate	0.0	4.7	Moderate	0.0	4.7	Moderate	0.0
			C5	Major injuries or multiple fatalities			Limehouse Reach	2.4	2.5	6.1	Moderate	6.1	Moderate	0.0	6.1	Moderate	0.0	6.1	Moderate	0.0
			C9	Major damage to vessel			Greenwich Reach	2.5	2.5	6.2	Moderate	6.2	Moderate	0.0	6.2	Moderate	0.0	6.2	Moderate	0.0
			C18	Moderate damage to works / barges alongside works / infrastructure			Blackwall Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Bugsbys Reach	2.2	2.5	5.5	Moderate	5.6	Moderate	0.0	5.6	Moderate	0.0	5.5	Moderate	0.0
			C30	International adverse publicity			Woolwich Reach	2.4	2.5	6.0	Moderate	6.0	Moderate	0.0	6.0	Moderate	0.0	6.0	Moderate	0.0
							Gallions Reach	1.0	2.5	2.5	Minor	3.2	Minor	0.7	3.2	Minor	0.7	3.2	Minor	0.7
							Barking Reach	1.0	2.5	2.5	Minor	2.7	Minor	0.2	2.7	Minor	0.2	2.7	Minor	0.2
							Halfway Reach	1.0	2.5	2.5	Minor	3.8	Minor	1.3	3.8	Minor	1.3	3.8	Minor	1.3
							Erith Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
							Erith Rands	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0
							Long Reach	1.0	2.5	2.5	Minor	3.1	Minor	0.6	3.1	Minor	0.6	3.1	Minor	0.6
				St Clements Reach	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0			
				Northfleet Hope	1.0	2.5	2.5	Minor	4.3	Minor	1.8	4.3	Minor	1.8	4.3	Minor	1.8			
				Gravesend Upper	2.1	2.5	5.3	Moderate	5.3	Moderate	0.0	5.3	Moderate	0.0	5.3	Moderate	0.0			
				Tilbury Docks	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0			
				Barking Creek	1.0	2.5	2.5	Minor	2.5	Minor	0.0	2.5	Minor	0.0	2.5	Minor	0.0			

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
8	Collision	Contact of Recreational	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.5											
								1.2	2.5	2.9 Minor	3.3 Minor	0.3	3.1 Minor	0.2	2.9 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	1.6	2.5	4.0 Minor	4.1 Minor	0.1	4.1 Minor	0.0	4.0 Minor	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.8	2.5	4.4 Minor	4.5 Moderate	0.1	4.5 Minor	0.1	4.4 Minor	0.0				
			C16	Insignificant or no damage to works / barges alongside works / infrastructure	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.0	2.5	2.5 Minor	2.6 Minor	0.1	2.6 Minor	0.1	2.5 Minor	0.0				
			C21	Insignificant impact on the environment	L10	Action of the tidal stream	Lambeth Reach	1.6	2.5	4.0 Minor	4.0 Minor	0.1	4.0 Minor	0.1	4.0 Minor	0.0				
			C26	No adverse publicity			Kings Reach	2.2	2.5	5.6 Moderate	5.6 Moderate	0.0	5.6 Moderate	0.0	5.6 Moderate	0.0				
							Upper Pool	2.2	2.5	5.5 Moderate	5.5 Moderate	0.0	5.5 Moderate	0.0	5.5 Moderate	0.0				
			WORST CREDIBLE				Lower Pool	1.3	2.5	3.3 Minor	3.3 Minor	0.0	3.3 Minor	0.0	3.3 Minor	0.0				
			C4	Major injuries or single fatality			Limehouse Reach	1.7	2.5	4.3 Minor	4.3 Minor	0.0	4.3 Minor	0.0	4.3 Minor	0.0				
			C7	Minor or superficial damage to vessel			Greenwich Reach	1.8	2.5	4.4 Minor	4.5 Minor	0.0	4.5 Minor	0.0	4.4 Minor	0.0				
			C17	Minor damage to works / barges alongside works / infrastructure			Blackwall Reach	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Bugsbys Reach	1.4	2.5	3.6 Minor	3.8 Minor	0.3	3.8 Minor	0.3	3.7 Minor	0.1				
			C28	Regional adverse publicity			Woolwich Reach	1.8	2.5	4.5 Minor	4.6 Moderate	0.2	4.6 Moderate	0.2	4.6 Moderate	0.2				
							Gallions Reach	2.0	2.5	5.0 Moderate	5.1 Moderate	0.1	5.1 Moderate	0.1	5.1 Moderate	0.1				
							Barking Reach	1.8	2.5	4.6 Moderate	4.7 Moderate	0.1	4.7 Moderate	0.1	4.7 Moderate	0.1				
							Halfway Reach	1.9	2.5	4.7 Moderate	5.1 Moderate	0.4	5.1 Moderate	0.4	5.1 Moderate	0.4				
							Erith Reach	1.9	2.5	4.6 Moderate	4.7 Moderate	0.1	4.7 Moderate	0.1	4.7 Moderate	0.1				
							Erith Rands	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0				
							Long Reach	2.3	2.5	5.7 Moderate	5.7 Moderate	0.1	5.7 Moderate	0.1	5.7 Moderate	0.1				
				St Clements Reach	1.9	2.5	4.8 Moderate	4.8 Moderate	0.1	4.8 Moderate	0.1	4.8 Moderate	0.1							
				Northfleet Hope	2.7	2.5	6.8 Moderate	6.9 Moderate	0.1	6.9 Moderate	0.1	6.9 Moderate	0.1							
				Gravesend Upper	2.1	2.5	5.3 Moderate	5.3 Moderate	0.0	5.3 Moderate	0.0	5.3 Moderate	0.0							
				Tilbury Docks	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							
				Barking Creek	1.0	2.5	2.5 Minor	2.5 Minor	0.0	2.5 Minor	0.0	2.5 Minor	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
9	Collision	Grounding of Commercial Shipping	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C1	No injuries	L2	Pilot error	Battersea Raech	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C7	Minor or superficial damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C21	Insignificant impact on the environment	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C26	No adverse publicity	L10	Action of the tidal stream	Lambeth Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Kings Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			WORST CREDIBLE				Upper Pool	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C3	Major injuries			Lower Pool	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C9	Major damage to vessel			Limehouse Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C23	Limited impact on the environment with short-term or long-term effects (Tier 2)			Greenwich Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
			C28	Regional adverse publicity			Blackwall Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0		
							Bugsbys Reach	1.0	3.0	3.0 Minor	3.4 Minor	0.4	3.4 Minor	0.4	3.0 Minor	0.0				
							Woolwich Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Gallions Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Barking Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Halfway Reach	1.5	3.0	4.6 Moderate	5.2 Moderate	0.6	5.2 Moderate	0.6	5.2 Moderate	0.6				
							Erith Reach	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Erith Rands	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0				
							Long Reach	2.0	3.0	6.1 Moderate	6.1 Moderate	0.0	6.1 Moderate	0.0	6.1 Moderate	0.0				
							St Clements Reach	2.2	3.0	6.5 Moderate	6.5 Moderate	0.0	6.5 Moderate	0.0	6.5 Moderate	0.0				
				Northfleet Hope	2.4	3.0	7.2 Moderate	7.2 Moderate	0.0	7.2 Moderate	0.0	7.2 Moderate	0.0							
				Gravesend Upper	2.3	3.0	7.0 Moderate	7.0 Moderate	0.0	7.0 Moderate	0.0	7.0 Moderate	0.0							
				Tilbury Docks	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							
				Barking Creek	1.0	3.0	3.0 Minor	3.0 Minor	0.0	3.0 Minor	0.0	3.0 Minor	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
10	Collision	Grounding of Inland Non-Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.0											
								1.7	2.0	3.4 Minor	3.6 Minor	0.2	3.5 Minor	0.1	3.4 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	1.5	2.0	3.1 Minor	3.3 Minor	0.2	3.2 Minor	0.1	3.1 Minor	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.2	2.0	2.4 Slight	2.6 Minor	0.2	2.5 Minor	0.1	2.4 Slight	0.0				
			C21	Insignificant impact on the environment	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.9	2.0	3.9 Minor	4.0 Minor	0.1	4.0 Minor	0.1	3.9 Minor	0.0				
			C26	No adverse publicity	L10	Action of the tidal stream	Lambeth Reach	1.2	2.0	2.4 Slight	2.4 Slight	0.0	2.4 Slight	0.0	2.4 Slight	0.0				
							Kings Reach	1.8	2.0	3.6 Minor	3.6 Minor	0.0	3.6 Minor	0.0	3.6 Minor	0.0				
			WORST CREDIBLE				Upper Pool	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C3	Major injuries			Lower Pool	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C9	Major damage to vessel			Limehouse Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	1.4	2.0	2.9 Minor	2.9 Minor	0.0	2.9 Minor	0.0	2.9 Minor	0.0				
			C27	Minor local adverse publicity			Blackwall Reach	1.6	2.0	3.2 Minor	3.3 Minor	0.0	3.3 Minor	0.0	3.2 Minor	0.0				
							Bugsbys Reach	2.1	2.0	4.1 Minor	4.3 Minor	0.2	4.3 Minor	0.2	4.2 Minor	0.1				
							Woolwich Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Gallions Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Barking Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Halfway Reach	2.2	2.0	4.4 Minor	4.6 Moderate	0.2	4.6 Moderate	0.2	4.6 Moderate	0.2				
							Erith Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Erith Rands	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Long Reach	2.2	2.0	4.3 Minor	4.4 Minor	0.0	4.4 Minor	0.0	4.4 Minor	0.0				
				St Clements Reach	2.4	2.0	4.7 Moderate	4.8 Moderate	0.0	4.8 Moderate	0.0	4.8 Moderate	0.0							
				Northfleet Hope	2.5	2.0	5.1 Moderate	5.1 Moderate	0.0	5.1 Moderate	0.0	5.1 Moderate	0.0							
				Gravesend Upper	2.7	2.0	5.4 Moderate	5.4 Moderate	0.0	5.4 Moderate	0.0	5.4 Moderate	0.0							
				Tilbury Docks	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							
				Barking Creek	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							

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								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
11	Collision	Grounding of Inland Pax	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.0											
								2.1	2.0	4.2 Minor	4.2 Minor	0.0	4.2 Minor	0.0	4.2 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	2.0	2.0	4.0 Minor	4.0 Minor	0.0	4.0 Minor	0.0	4.0 Minor	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.5	2.0	3.1 Minor	3.2 Minor	0.2	3.2 Minor	0.1	3.1 Minor	0.0				
			C21	Insignificant impact on the environment	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	2.3	2.0	4.6 Moderate	4.6 Moderate	0.0	4.6 Moderate	0.0	4.6 Moderate	0.0				
			C26	No adverse publicity	L10	Action of the tidal stream	Lambeth Reach	1.6	2.0	3.2 Minor	3.3 Minor	0.0	3.3 Minor	0.0	3.2 Minor	0.0				
							Kings Reach	2.6	2.0	5.2 Moderate	5.2 Moderate	0.0	5.2 Moderate	0.0	5.2 Moderate	0.0				
			WORST CREDIBLE				Upper Pool	1.6	2.0	3.1 Minor	3.2 Minor	0.0	3.2 Minor	0.0	3.1 Minor	0.0				
			C3	Major injuries			Lower Pool	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C8	Moderate damage to vessel			Limehouse Reach	1.7	2.0	3.3 Minor	3.3 Minor	0.0	3.3 Minor	0.0	3.3 Minor	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	1.9	2.0	3.8 Minor	3.9 Minor	0.0	3.9 Minor	0.0	3.8 Minor	0.0				
			C27	Minor local adverse publicity			Blackwall Reach	1.8	2.0	3.6 Minor	3.6 Minor	0.0	3.6 Minor	0.0	3.6 Minor	0.0				
							Bugsbys Reach	2.4	2.0	4.8 Moderate	4.8 Moderate	0.0	4.8 Moderate	0.0	4.8 Moderate	0.0				
							Woolwich Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Gallions Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Barking Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Halfway Reach	1.0	2.0	2.0 Slight	3.0 Minor	1.0	3.0 Minor	1.0	3.0 Minor	1.0				
							Erith Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Erith Rands	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Long Reach	1.0	2.0	2.0 Slight	2.3 Slight	0.3	2.3 Slight	0.3	2.3 Slight	0.3				
				St Clements Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							
				Northfleet Hope	1.0	2.0	2.0 Slight	3.4 Minor	1.4	3.4 Minor	1.4	3.4 Minor	1.4							
				Gravesend Upper	1.9	2.0	3.9 Minor	3.9 Minor	0.0	3.9 Minor	0.0	3.9 Minor	0.0							
				Tilbury Docks	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							
				Barking Creek	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							

Hazard ID	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Area	Baseline Risk - with existing risk controls in place				Scenario 1			Scenario 2			Scenario 3		
								Likelihood	Consequence	Baseline Risk	Baseline Level	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline	Baseline Risk	Baseline Level	Increase on Baseline
12	Collision	Grounding of Recreational	MOST LIKELY		L1	Master / Skipper error	Wandsworth Reach	1.0	2.0											
								1.3	2.0	2.7 Minor	2.9 Minor	0.2	2.8 Minor	0.1	2.7 Minor	0.0				
			C1	No injuries	L2	Pilot error	Battersea Raech	1.8	2.0	3.6 Minor	3.6 Minor	0.0	3.6 Minor	0.0	3.6 Minor	0.0				
			C6	Insignificant or no damage to vessel	L5	Mechanical defect / failure	Chelsea Reach	1.2	2.0	2.3 Slight	2.7 Minor	0.4	2.5 Slight	0.2	2.3 Slight	0.0				
			C21	Insignificant impact on the environment	L9	Adverse weather conditions / reduced visibility	Nine Elms Reach	1.7	2.0	3.4 Minor	3.4 Minor	0.0	3.4 Minor	0.0	3.4 Minor	0.0				
			C26	No adverse publicity	L10	Action of the tidal stream	Lambeth Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Kings Reach	1.7	2.0	3.3 Minor	3.4 Minor	0.1	3.4 Minor	0.1	3.3 Minor	0.0				
			WORST CREDIBLE				Upper Pool	1.3	2.0	2.5 Minor	2.6 Minor	0.0	2.6 Minor	0.0	2.5 Minor	0.0				
			C3	Major injuries			Lower Pool	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C8	Moderate damage to vessel			Limehouse Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
			C22	Minor impact on the environment with no lasting effects (Tier 1)			Greenwich Reach	1.2	2.0	2.5 Slight	2.6 Minor	0.1	2.6 Minor	0.1	2.5 Slight	0.0				
			C27	Minor local adverse publicity			Blackwall Reach	1.4	2.0	2.8 Minor	2.8 Minor	0.0	2.8 Minor	0.0	2.8 Minor	0.0				
							Bugsbys Reach	1.6	2.0	3.2 Minor	3.4 Minor	0.1	3.4 Minor	0.1	3.3 Minor	0.1				
							Woolwich Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Gallions Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Barking Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Halfway Reach	1.6	2.0	3.3 Minor	3.8 Minor	0.5	3.8 Minor	0.5	3.8 Minor	0.5				
							Erith Reach	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Erith Rands	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0				
							Long Reach	1.7	2.0	3.4 Minor	3.6 Minor	0.2	3.6 Minor	0.2	3.6 Minor	0.2				
				St Clements Reach	1.9	2.0	3.8 Minor	3.8 Minor	0.0	3.8 Minor	0.0	3.8 Minor	0.0							
				Northfleet Hope	2.0	2.0	4.0 Minor	4.3 Minor	0.3	4.3 Minor	0.3	4.3 Minor	0.3							
				Gravesend Upper	1.9	2.0	3.8 Minor	3.8 Minor	0.0	3.8 Minor	0.0	3.8 Minor	0.0							
				Tilbury Docks	1.0	2.0	2.0 Slight	2.0 Slight	0.0	2.0 Slight	0.0	2.0 Slight	0.0							