Forecasting London's Freight Demand and Wharf Capacity

on the Thames

2015 – 2041

Ocean Shipping Consultants Version

Acknowledgements

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enquiries 020 7983 4100
minicom 020 7983 4458

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Executive Summary

Overall Conclusion

- London will have sufficient wharf capacity to meet forecast demand for the period up to 2041.

Demand

- In 2015, the Thames carried 10.7 million tonnes (mt) of freight. An increase of 1.6mt or 18% over the decade from 2005.
- OSC forecast that overall trade will increase to 13.4 mt by 2028, an increase of 26%. Thereafter, it will decline to approximately 12.3 mt by 2041.
- There are 7 commodity groups currently using the Thames, which will remain through to 2041.
- In 2015, the use of the Thames was skewed towards two commodity groups accounting for over 75% of the freight on the Thames – Construction Materials and Waste. Construction materials alone accounted for 65%.
- In contrast, sugar and steel accounted for less than 6% of the freight on the Thames and 3 commodity groups were no longer being moved by the river – Other Liquid Bulks, Other Dry Bulks and General Cargo.
- By 2041 it is forecast that this distribution between commodity groups will be unchanged.

Capacity

- For 2015, the capacity of the safeguarded wharves is estimated at 18 mt. This includes an estimate for the currently vacant wharves of 2.1 mt (12%).

- By 2041, it is forecast that this capacity will be unchanged.

Distribution

- London's wharves are not evenly distributed along the Thames. For convenience, they are grouped into three areas – North bank of the Thames East of Tower Bridge (North East), South bank of the Thames East of Tower Bridge (South East) and West of Tower bridge (West).

- The analysis undertaken reveals that there will be excess wharf capacity for the North East Sector of 2.9 mt, excess wharf capacity for the South East Sector of 2.1 mt, excess wharf capacity for the West Sector of 0.8 mt by the end of the study period.

1 Introduction

1.1 The purpose of this report is to provide forecasts for the movement of freight on the Thames and estimate the capacity of the 50 safeguarded wharves for the 2015-2041 period. It is not a

review of the 50 safeguarded wharves, this will be a separate exercise undertaken later by the Mayor. Nor is it a study of changes in and capacity for passenger based river transport.

1.2 These forecasts will be an important consideration, but not the only one, that the Mayor will take into account in formulating his decisions on safeguarding wharves. The list of safeguarded wharves has not been updated since 2005. The Mayor believes an update is overdue.

1.3 The period up to 2041 has been chosen to be consistent with the forthcoming full review of the London Plan that will run over the same time period.

1.4 In 2011 the Greater London Authority (GLA) commissioned independent consultants URS/Scott Wilson to produce estimates of freight trade forecasts and wharf capacity. This consultant's study produced forecasts of demand up to 2031, examined the capacity of the wharves and the distribution of demand and capacity identifying surpluses and shortfalls in the capacity of the wharves network up to 2031. This work was made publically available in the Mayor's Safeguarded Wharves Review – Final Recommendation[1] March 2013.

1.5 This 2016 report, produced internally by the Mayor, but subjected to a 'critical friend review' by Ocean Shipping Consultants (OSC), draws on that 2011 URS/Scott Wilson study as a template to work from, accepting a number of the earlier study's assumptions and conclusions. For example, the 2011 study examined the feasibility of the use of the canal network for freight distribution and came to the conclusion that without much higher levels of public subsidy there would be little demand for the use of the canal network. Those much higher levels of public subsidy have not been forthcoming. Accordingly, this 2016 report does not look at the feasibility of using the canal network to transport freight, concentrating on the Thames.

1.6 The 2011 Study grouped the commodities moved on the Thames into 10 categories. To provide some consistency and allow some comparisons with the data provided by the 2011 study, the same commodity groupings have been used in this 2016 report.

1.7 Ocean Shipping Consultants (OSC), established in 1985 and now part of the Royal Haskoning DHV group, have over 30 years' experience in the fields of shipping economics and port development. They have extensive experience projecting cargo volumes, assessing the

[1] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves

viability of ports and undertaking strategic studies. Their recent work for the Port of London Authority (2016) looking at forecasting vessels using the Thames up to 2030 and their study in 2015 examining the aggregates dredging activity in the South East of England looking at the aggregates industry and the potential for a new hub wharf highlights their suitability for this task. Given their track record, OSC were ideally placed to advise the Mayor on this piece of work and be a knowledgeable and robust 'critical friend' for this report.

1.8 OSC undertook their own consultations with users of the Thames and produced their own forecasts to 2041. The Mayor therefore takes the view that this report on forecasting freight and capacity on the Thames up to 2041 is a robust and reasonable one given the data constraints and inherent uncertainties involved in forecasting. Accordingly, the Mayor will use this report as an important consideration when he comes to his conclusions on reviewing the 50 safeguarded wharves.

1.9 Most of the data for this report has been provided by the Port of London Authority (PLA). Their assistance in compiling this report has been invaluable.

1.10 Section 2 of this report looks at the policy context for waterborne freight at all relevant levels, national, mayoral and local. It highlights strong support, at all levels, for this mode of freight transport.

1.11 Section 3 looks at demand for waterborne freight on the Thames. It highlights the current situation of freight on the Thames before moving on to discuss different ways of forecasting freight up to 2041. It compares the updated report with the earlier 2011 study to establish the extent of change between the newer forecast and the earlier 2011 study.

1.12 Section 4 highlights forecast demand for waterborne freight on the Thames through to 2014 via modelling undertaken by Ocean Shipping Consultants

1.13 Section 5 provides an estimate of capacity from the 50 currently safeguarded wharves, again examining change since the earlier 2011 study. London's wharves are divided into three sub groups, North East (east of Tower Bridge, north side of the Thames), South East (east of Tower Bridge, south side of the Thames) and West (west of Tower Bridge, both sides of the Thames). The capacity for each sub region is provided.

1.14 Section 6 tries to pull these two earlier sections together looking at surpluses and shortfalls in capacity to deal with the forecast demand for each of the three sub regions.

1.15 Section 7 sets out some overall conclusions on what the report has found.

2 Context

2.1 The purpose of this chapter is to examine the national, regional and local policy context for wharves. In summary, there is strong policy support at national, regional and local level for the use of the Thames for freight movement.

National Policy

2.2 National policy is set out in the National Planning Policy Framework[2] (March 2012) (the NPPF). The following paragraphs are of most relevance for this topic area;

2.3 Paragraph 17 *"Within the overarching roles that the planning system ought to play, a set of core planning principles should underpin both plan-making and decision-taking. These, 12 principles are that planning should;…proactively drive and support sustainable economic development to deliver the homes, business and industrial units, infrastructure…support the transition to a low carbon future in a changing climate,…contribute to conserving and enhancing the natural environment and reducing pollution."*

2.4 Paragraph 30 *"Transport policies have an important role to play in facilitating sustainable development but also in contributing to wider sustainability and health objectives."*

2.5 Paragraph 31 *"Local authorities should work with neighbouring authorities and transport providers to develop strategies for the provision of viable infrastructure necessary to support sustainable development…"*

2.6 Paragraph 35 *"Plans should protect and exploit opportunities for the use of sustainable modes for the movement of goods or people…"*

2.7 Paragraph 143 *"In preparing Local Plans, local planning authorities should…safeguard existing, planned and potential rail heads, rail links to quarries, wharfage and associated storage, handling and processing facilities for the bulk transport by rail, sea or inland waterways of minerals, including recycled, secondary and marine-dredged materials.."*

2.8 The Marine Policy Statement[3] (March 2011) (the MPS) sets out a framework for preparing marine plans and for taking decisions that affect the marine environment and is a material consideration for both land use and marine planning. Any decision made by planning authorities in relation to safeguarded wharves is required to have regard to the MPS. Three

[2] https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan
[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

sections of the MPS are relevant to this report – Shipping and ports, marine aggregates and dredging.

2.9 In paragraph 3.4.1 the MPS states *"Ports and shipping play an important role in the activities taking place within the marine environment. They are an essential part of the UK economy, providing the major conduit for the country's imports and exports."* In paragraph 3.4.7 it adds *"Marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity…".* 'Decision makers' includes both the Mayor and the boroughs. In paragraph 3.4.11 it advises *"When decision makers are advising on or determining an application for an order granting development consent in relation to ports, or when marine plan authorities are developing Marine Plans, they should take into account the contribution that the development would make to the national, regional or more local need for the infrastructure, against expected adverse effects including cumulative impacts."*

2.10 In paragraph 3.5.1 the MPS supports the continued use of marine aggregates *"The UK has some of the best marine aggregate resources in the world. Marine sand and gravel makes a crucial contribution to meeting the nation's demand for construction aggregate materials, essential for the development of our built environment. They are particularly important in England, accounting for 38% of the total regional demand for sand and gravel in the South East (80% in London),…*It continues" *The extraction of marine dredged sand and gravel should continue to the extent that this remains consistent with the principles of sustainable development, recognising that marine aggregates are a finite resource and in line with the relevant guidance and legislation".* In paragraph 3.5.2 it adds *"Marine aggregates contribute to diversity of supply and deliver high quality aggregate into the centre of areas of high demand with minimum disruption."* London is an area of high demand. In paragraph 3.5.3 the MPS advises *"Marine aggregates can present reduced impacts on local communities compared to the extraction of land-won aggregates, in particular with regard to the extraction process and transportation. Substantial volumes of marine aggregates are landed on wharves close to where they are needed and locally distributed by rail, water (through barges) and road. Wider social and economic benefits include skilled, stable employment and the generation of income through the construction industry supply chain."*

2.11 When considering dredging activity, decision makers are encouraged to consider the potential adverse impacts of dredging on the marine environment.

2.12 Following on from the MPS, the Marine Management Organisation (MMO) is now in the process of producing marine plans for different stretches of the coast. The Thames Estuary is covered by the emerging South Inshore Marine Plan[4] (October 2014). That plan contains 2 objectives relevant to this policy area *"Objective 6 To avoid, minimise or mitigate displacement of marine activities that provide social benefits (especially to coastal communities)."* And *"Objective 13 To support marine activities that create and enhance employment opportunities at all skills levels, particularly where this reflects existing or developing skills among the workforce of coastal communities using the South marine plan areas."*

Greater London Authority Act (1999)

2.13 Section 41 of this Act[5] places duties on the Mayor with regards to the strategies the Mayor produces, such as the Mayor's Transport strategy or the spatial development strategy, usually referred to as the London Plan. Given this, in sub sections 4 and 5, of Section 41, the Act states that:

- *In preparing or revising any strategy mentioned in subsection (1) above, the Mayor shall have regard to—*
- *the principal purposes of the Authority;*
- *the effect which the proposed strategy or revision would have on—*
- *the health of persons in Greater London; and*
- *the achievement of sustainable development in the United Kingdom; and*
- *the matters specified in subsection (5) below.*
- *Those matters are:*
- *the desirability of promoting and encouraging the use of the River Thames safely, in particular for the provision of passenger transport services and for the transportation of freight.*

London Plan Policy

2.14 The London Plan[6] (March 2016) contains a number of relevant policies such as:

[4] https://www.gov.uk/guidance/south-inshore-and-south-offshore-marine-plan-areas
[5] http://www.legislation.gov.uk/ukpga/1999/29/pdfs/ukpga_19990029_en.pdf
[6] https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan

2.15 Policy 5.20 Aggregates *"A The Mayor will work with all relevant partners to ensure an adequate supply of aggregates to support construction in London. This will be achieved by: 3 importing aggregates to London by sustainable transport modes. Fb – safeguard wharves and/or railheads with existing or potential capacity for aggregate distribution Fc minimise the movement of aggregates by road and maximise the movement of aggregates via the Blue Ribbon Network."*

2.16 Policy 6.14 Freight *"A The Mayor will work with all relevant partners to improve freight distribution…and to promote movement of freight by rail and waterways…B Development proposals that: c) increase the use of the Blue Ribbon Network for freight transport will be encouraged. C DPDs should promote sustainable freight transport by: a safeguarding existing sites and identifying new sites to enable the transfer of freight to rail and water…"*

2.17 Policy 7.26 Increasing the use of the Blue Ribbon Network for freight transport *"A The Mayor seeks to increase the use of the Blue Ribbon Network to transport freight. B Development proposals a) should protect existing facilities for waterborne freight traffic, in particular safeguarded wharves should only be used for waterborne freight handling use. The redevelopment of safeguarded wharves for other land uses should only be accepted if the wharf is no longer viable or capable of being made viable for waterborne freight handling…Temporary uses should only be allowed where they do not preclude the wharf being reused for waterborne freight handling uses…The Mayor will review the designation of safeguarded wharves prior to 2012. B) which increase the use of safeguarded wharves for waterborne freight transport, especially on wharves which are currently not handling freight by water, will be supported. C) adjacent or opposite safeguarded wharves should be designed to minimise the potential for conflicts of use and disturbance D) close to navigable waterways should maximise water transport for bulk materials, particularly during demolition and construction phases. C) Within LDFs boroughs should identify locations that are suitable for additional waterborne freight."*

2.18 Other plan policies also promote waterborne freight. Policy 5.17 on Waste Capacity promotes the use of the river *"B Proposals for waste management should be evaluated against the following criteria:…e) achieving a positive carbon outcome for waste treatment methods and technologies (including the transportation of waste,… g the full transport and environmental impact of all collection, transfer and disposal movement and, in particular, the scope to maximise the use of rail and water transport using the Blue Ribbon Network. G Land to manage borough waste apportionments should be brought forward through: …d safeguarding*

wharves (in accordance with Policy 7.26) with an existing or future potential for waste management."

2.19 Policy 5.18 dealing with Construction, Excavation and Demolition waste the use of the river *"A New construction, excavation and demolition (CE&D) waste management facilities should be encouraged at existing waste sites, including safeguarded wharves,… B Waste should be removed from construction sites, and materials brought to site, by water or rail transport wherever that is practicable…"* In addition London Plan Policy 4.10 promotes the development of green enterprise as part of the Circular Economy, waste materials will have a key role in developing the Circular Economy.

2.20 In January 2005 the Mayor published the London Plan Implementation Report Safeguarded Wharves on the River Thames[7] to support what was then London Plan Policy 4C.9. It reviewed the suitability of maintaining the safeguarding for 28 wharves upstream of the Thames Barrier and assessed the appropriateness of safeguarding additional wharves eastward. This review was conducted in consultation with the Port of London Authority and the riparian boroughs. Fifty wharves were subsequently safeguarded by the Secretary of State, based on the Mayor's recommendation, through an article 10(3) direction. This direction requires the Mayor to be consulted before planning permission on a safeguarded wharf is granted.

2.21 Government guidance calls for development plans to be updated at least every five years. Consequently, as part of a proposed update to the safeguarded wharves policy the Mayor commissioned the 2011 URS/Scott Wilson study to advise him on safeguarding policy. In 2013 the Mayor submitted his proposals for safeguarding wharves to the Secretary of State. However, the Secretary of State declined to make a decision on this matter. As it stands the 50 safeguarded wharves designated as such in 2005 are the currently safeguarded wharves.

2.22 This 2016 report is the first stage in reviewing the safeguarded wharves network. As part of the Government's Localism agenda it is likely that the power to safeguard wharves will be devolved from the Secretary of State to the Mayor (subject to secondary legislation being issued under sections 2A and 74 of the Town and Country Planning Act 1990 (as amended by the Housing and Planning Act 2016)). The date for this devolution is currently unknown.

[7] http://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves

Other Relevant Mayoral Strategies

2.23 The Mayor's Transport Strategy[8] (May 2010, pg. 167) sets out a complementary approach to that of the London Plan, it contains the following proposal *"The Mayor, through TfL, and working with the Port of London Authority, London boroughs and operators, will seek to ensure that existing safeguarded wharves are fully utilised for water borne freight (including waste), and will examine the potential to increase the use of the Thames and London's canal network for waterborne freight transport."*

2.24 In November 2011, the Mayor adopted his statutory Municipal Waste Management Strategy 'London's Wasted Resource'[9] This contains Policy 2 (pg. 77) '*Reducing the climate change impact of London's municipal waste management'* This is underpinned by a series of proposals such as Proposal 2.5(pg. 77) which states *"The Mayor, through Transport for London (TfL), will work with waste authorities to maximise cost efficiencies and reduce the environmental impact of transporting municipal waste…"*. On page 90 the strategy states *"The Mayor also wishes to see greater use of rail and water for transporting London's municipal waste and supports the development of more waste infrastructure at railheads and wharves…"* This is developed further in Proposal 5.3 (pg115) *"The Mayor, through TfL, will encourage the movement of municipal waste using sustainable modes of transport.*

2.25 The Mayor, through TfL, will promote sustainable forms of transport for municipal waste, maximising the potential of rail and water transport where practicable

2.26 The Mayor, through TfL, will work with waste authorities to make better use of London's wharves and canals and the River Thames for developing the city's municipal waste management infrastructure."

2.27 In his adopted Business Waste Strategy (November 2011) 'Making Business Sense of Waste'[10] the Mayor is seeking a similar approach for business waste Proposal 3.6 (pg83) encourages the integration of waste infrastructure into the urban environment noting that "London needs to make better use of its rivers and canals, particularly for waterborne freight, including waste. This can also provide an opportunity for the waste sector to reduce its own

[8] https://www.london.gov.uk/what-we-do/transport/transport-publications/mayors-transport-strategy
[9] https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/mayors-municipal-waste-management-strategy
[10] https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/mayors-business-waste-management-strategy

transport-related environmental impacts. Water transport is particularly suited to bulk movements of relatively low value cargoes, including waste and recyclates, and waste and materials associated with construction and demolition activities."

2.28 This proposal is underpinned by a number of actions "*Action 3.6.1 The Mayor will examine opportunities for transporting waste by rail or water. Transport for London will, as appropriate, support businesses to explore opportunities to open up the rail and navigable water network for the transportation of waste, to allow the waste sector to reduce its vehicle mileage and the associated environmental and social impacts, including emissions, air quality, health impacts, noise and dust."* and *"Action 3.6.2 Through Policy 5.17 of the London Plan, the Mayor will continue to require that wharves with an existing or future potential for waste management should be identified and safeguarded specifically for that use."*

2.29 "Delivering London's Energy Future"- London's Climate Change Mitigation and Energy Strategy[11] (October 2011, pg. 181) highlights that the transport sector was responsible for 22% of London's CO_2 emissions (9.9Mt) in 2008. Policy 10 seeks to tackle these emissions by *"Minimizing CO_2 emissions through a shift to more carbon efficient modes of transport. The Mayor , through TfL and working with boroughs and partners will support and incentivise carbon efficient travel behaviour, minimise the need to travel, and encourage a switch to lower carbon modes of transport….for freight, it will include water and rail-based movement*."

2.30 The strategy notes that (pg 184) *"In total nearly three quarters of London's CO_2 emissions from transport are from road-based modes."* In contrast, water based transport contributes less than 1% of the emissions (Pg185). The strategy (pg. 189) notes that *"The average emissions from vans below 3.5 tonnes are 340g of CO_2e per tonne of freight moved per kilometre (tkm). The average emissions from large heavy goods vehicles (HGV's) are 83g of CO_2e per tkm. Rail is much lower at 32g of CO_2e per tkm. Rail and water are only suited to certain types of freight flows and often have to be used in conjunction with road for collection and delivery. However, given London's relatively dense network of railways and waterways, there is an opportunity to reduce CO_2 emissions from transporting freight in London."*

[11] https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/delivering-londons-energy-future-climate-change

2.31 The strategy does not give an equivalent figure for the movement of freight by water. Although not strictly comparable the Logistics Research Centre (2004), based at Heriott-Watt University gave a figure of 30g of $C0_2e$ per tkm for shipping[12]. These figures are set out more clearly in Table 2.1 below.

Table 2.1 Comparative CO_2 Emissions per tonne-km by mode

Mode	CO_2e per tkm
Goods Vehicle < 3.5 tonnes	340
Goods Vehicle > 3.5 tonnes	83
Rail	32
Maritime	30

(Source: GLA 2011, Heriott- Watt University 2004)

2.32 The European Environment Agency[13] (2013) shows figures for carbon emissions per tonne – km (see Table 2.2 below) which reveals the same general picture of rail and water having a similar level of carbon impact, both well below the carbon emissions of road based vehicles.

Table 2.2 Comparative CO_2 emissions per tonne-km 2011 EU Level

Road	75.3
Rail	21.0
Maritime	14.0

(Source: European Environment Agency Website (2013)

2.33 These carbon savings are the basis for the Strategy's Action 10.7 (pg. 192) *"The Mayor will continue to… safeguard wharf sites for water freight."* This is developed further on (pg. 196/7) in that *"Water transport is particularly suited to bulk movements of relatively low value cargoes for which speed is less critical…Increasing waterborne freight will depend on the availability of wharf facilities to transfer cargo between land and water. To encourage this shift, the Mayor is seeking to ensure that existing safeguarded wharves are fully utilised for waterborne freight*

[12] http://www.greenlogistics.org/SiteResources/d82cc048-4b92-4c2a-a014-af1eea7d76d0_CO2%20Emissions%20from%20Freight%20Transport%20-%20An%20Analysis%20of%20UK%20Data.pdf
[13] http://www.eea.europa.eu/data-and-maps/figures/specific-co2-emissions-per-tonne-2

and will look at the potential to increase use of the Thames and London's canal network for freight transport."

Local Policy

2.34 Safeguarded wharves are located in the following London boroughs (from west-east); LB Hammersmith & Fulham, Wandsworth, Kensington & Chelsea, City of London, Lewisham, Tower Hamlets, Greenwich, Newham, Barking & Dagenham, Bexley and Havering. All local plans have to be in general conformity with the London Plan. Accordingly, they all safeguard the wharves in their respective boroughs.

West

2.35 In LB Hammersmith & Fulham's adopted Core Strategy[14] (October 2011) paragraph 7.140 seeks the consolidation of wharf capacity onto fewer better located sites and paragraph 7.141 calls for the removal of the safeguarding designation at Hurlingham wharf via the next Mayoral safeguarded review.

2.36 LB Wandsworth have an adopted Core Strategy[15] (March 2016) that in Policy PL9 (pg68) maintains its protection for the 5 currently safeguarded wharves.

2.37 The consolidated local plan for RB Kensington & Chelsea[16] (October 2015) calls the preservation of the safeguarded Cremorne Wharf, currently for waste uses, but acknowledging its potential to be reactivated for river cargo handling purposes.

2.38 The City of London Local Plan[17] (January 2015) Policy CS17 calls for the continued safeguarding of its safeguarded wharf recognising its current contribution to sustainable waste management and its potential use for river transport of materials.

South East

[14] https://www.lbhf.gov.uk/planning/planning-policy
[15] http://www.wandsworth.gov.uk/downloads/file/11500/local_plan_-_core_strategy_adopted_march_2016
[16] https://www.rbkc.gov.uk/planning-and-building-control/planning-policy/local-plan/local-plan
[17] https://www.cityoflondon.gov.uk/services/environment-and-planning/planning/planning-policy/local-plan/Documents/local-plan-2015.pdf

2.39 The Adopted Core strategy for LB Lewisham[18] (June 2011, pg. 139) in Policy SSA 2 calls for the mixed use redevelopment of the Convoys wharf site without prejudicing its current and future operation as a safeguarded wharf.

2.40 The Local Plan for the RB of Greenwich[19] (July 2014, pg. 165) in Policy IM5 calls for the existing safeguarded wharves to be protected.

2.41 LB Bexley's Core Strategy[20] (February 2012, pg. 82) in paragraph 4.7.13 refers to Bexley's commitment to retaining and improving its safeguarded wharves.

North East

2.42 The LB Tower Hamlets Core Strategy[21] (September 2010, Policy SP08, pg. 74) seeks to promote the sustainable transport of freight by safeguarding existing wharves.

2.43 LB Newham's Core Strategy[22] (January 2012, pg. 148) in Policy INF 1 protects its wharves but seeks the consolidation /relocation of the wharves especially in the Royal Docks area.

2.44 The LB Barking & Dagenham Core Strategy[23] (July 2010, pg. 56) in Policy CE4 sets out its protection for safeguarded wharves only allowing their release if this meets the criteria set out in the London Plan.

2.45 Similarly, the LB Havering Core Strategy and Development Management Policy Document[24] (2008) seeks in Policy CP10 pg. 122) to promote sustainable transport by seeking to maximise the use of the Thames, this is underpinned by DC 39 (pg. 232) that protects the safeguarded wharves, only allowing their loss when the criteria set out in the London Plan are met.

[18] https://www.lewisham.gov.uk/myservices/planning/policy/LDF/development-policies/Documents/DMLPAdoption.pdf
[19] http://www.royalgreenwich.gov.uk/info/1004/planning_policy/869/local_development_framework/2
[20] http://www.bexley.gov.uk/corestrategy
[21] http://www.towerhamlets.gov.uk/lgnl/environment_and_planning/planning/planning_guidance/local_plan.aspx
[22] https://www.newham.gov.uk/pages/services/local-plan.aspx
[23] https://www.lbbd.gov.uk/residents/planning-and-building-control/planning-guidance-and-policies/development-plan/core-strategy-dpd-2010/
[24] https://www.havering.gov.uk/Pages/Services/Adopted-LDF-documents.aspx

Other Relevant Strategies

2.46 OSC has undertaken their own literature review and outlined additional schemes and programmes that could provide increased cargo flows on the Thames. This calls on decision makers, such as the Mayor and local planning authorities to have a multi-focused approach in an effort to boost the use of waterborne freight.

Port of London Authority (2016) Vision for the Tidal Thames

2.47 In July 2016 the Port of London Authority published its 20 year 'Vision for the Tidal Thames'[i] which provides a framework for the development of the tidal Thames through to 2035. The Vision was developed in partnership with estuary stakeholders and includes six key goals for growth and actions to deliver these goals. A number of these goals relate to waterborne freight and the future use of safeguarded wharves.

2.48 The Vision includes a goal to '*see more goods and materials routinely moved between wharves on the river – every year over 4 million tonnes carried by water – taking over 400,000 lorry trips off the region's roads'*. The Vision also includes a goal to '*see the Port of London becoming the biggest it's ever been, handling 60 – 80 million tonnes of cargo each year'*. The vision recognises the importance of maintaining and improving exit and entry points to the river to enable freight and cargo transport and includes a goal to '*maintain or reactivate viable cargo handling facilities, with at least five additional facilities brought into operation by 2025'*. The Vision also includes a goal to extend the Mayor's River Concordat, originally set up to promote passenger transport, to include the promotion of freight movement by water.

The Thames Estuary Growth Commission

2.49 The Thames Estuary 2050 Growth Commission was announced by the Chancellor of the Exchequer in March 2016. The Commission is charged with developing a vision and delivery plan for North Kent, South Essex and East London, reporting back by 2017 with a clear and affordable delivery plan for achieving the vision. As outlined in DCLG's July 2016 discussion paper[ii], a key work stream for the Commission will be to review opportunities and constraints associated to 'increasing connectivity', which will include a review waterborne transport and associated infrastructure.

Environment Agency (2015) Thames River Basin District – River Basin Management

2.50 The Environment Agency's Thames River Basin District – River Basin Management Plan 2015[iii] establishes a framework for protecting and enhancing the environmental, social and economic benefits provided by the water environment, implementing the requirements of the European Water Framework Directive. The Plan recognises that value of the estuary, and wider water environment, in supporting transportation and economic development. The plan recognises that value of the estuary in supporting commerce and navigation, through its designation as a Heavily Modified Water Body (HMWB).

National Needs Assessment

2.51 The National Needs Assessment (NNA) is a cross-sector policy review of the UK's national economic infrastructure needs to 2050. Coordinated by the Institute of Civil Engineers (ICE), it covers energy, transport, communications, housing, water, waste and flooding. The NNA has established a shared vision for infrastructure, stating *'The UK will invest efficiently, affordably and sustainably in the provision of infrastructure assets and services to drive the economic growth necessary to enhance the UK's position in the global economy, support a high quality of life and shift towards a low carbon future'.*

Thames Estuary Partnership - Management Guidance for the Thames Estuary (1999).

2.52 Ensuring commercial activities continue to thrive and grow without compromising the natural, heritage, recreational, and landscape resources of the estuary is an overarching aim of the guidance. The guidance highlights that using the river as a sustainable transport corridor could result in significant reductions in road traffic and congestion. The guidance also includes Principles for Action for the safeguarding of riverside areas with good navigational access for river dependant activities.

Thames Strategy East – Tower Bridge to Tilbury (2008).

2.53 Thames Strategy East is a strategic planning document providing a 100 year vision for the Thames area stretching from Tower Bridge to Gravesham. The plan focuses on providing landscape and development design guidance based on heritage, natural habitat preservation, recreational and access needs, economic considerations and flood defence requirements. Thames Strategy East forms part of the Mayor's London Plan. The strategy includes reach specific guidance and policy which highlights the potential of waterborne transport.

3 Demand

3.1 This chapter begins by looking at the current use of the Thames for freight before moving on to discuss alternative approaches to forecasting demand up to 2041. It then concludes by setting out a forecast to 2041.

3.2 It was stated in paragraphs 1.4 and 1.5 that this 2016 report builds from the 2011 URS/Scott Wilson study. To allow some comparisons this 2016 update takes a similar approach to analysing commodities on the Thames by grouping them together (further detail on this is set out in Appendix 2). A number of the categories are self-explanatory - petroleum, steel, sugar and vehicles - some are not;

- Construction Materials – Aggregates, Cement, Crushed Rock, CD&E waste
- Other Liquid Bulks – Vegetable Oils, Liquid Fertilisers
- Agricultural Bulks – Cereals, Animal Feeds, Oil Seed

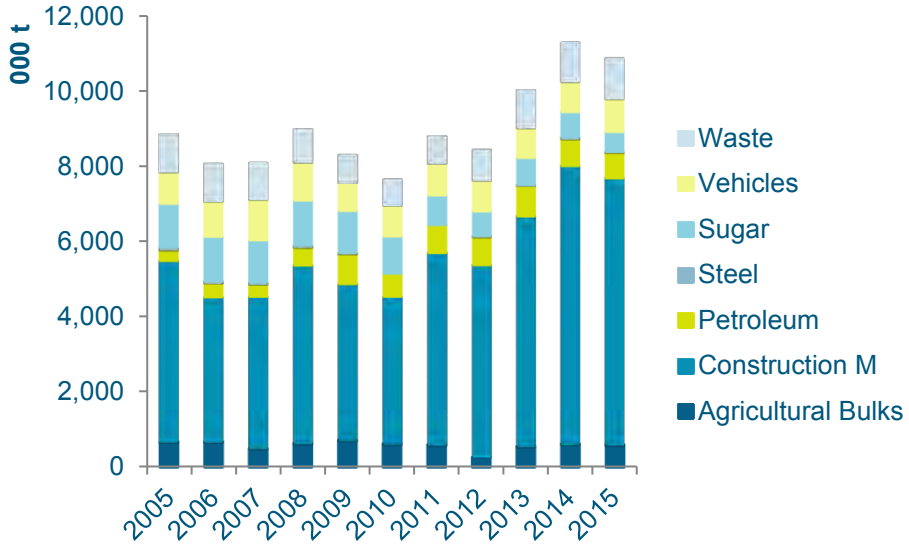
- Other Dry Bulks – Fertilisers, Dry Chemicals, Salts
- Waste – recycled materials, household and commercial waste but not CD&E waste
- General Cargo – Goods outside any of the other categories, for instance timber.

Current Position

3.3 Traffic on the Thames has been increasing over the last decade. Within the wharves under consideration overall trade reached almost 11mn tonnes in 2015. This is an increase in 20% since 2005. The main cargo handled is construction materials (including CD&E waste) which in 2015 accounted for 65% of the total traffic, as highlighted in Figure 3.1 below.

3.4 Table 3.1 shows the composition of freight on the Thames for 2015. It shows a highly skewed demand with construction materials and waste accounting for 75% of the traffic, while, Steel, Other Liquid Bulks, Other Dry Bulks and General Cargo account for less than 1% of the traffic. It is also clear that most of the uses relate to specific sectors of the economy – primary & utilities, manufacturing, construction and transport & communications.

Figure 3.1 Thames Freight Traffic, 2005-2015



(Source: PLA 2016)

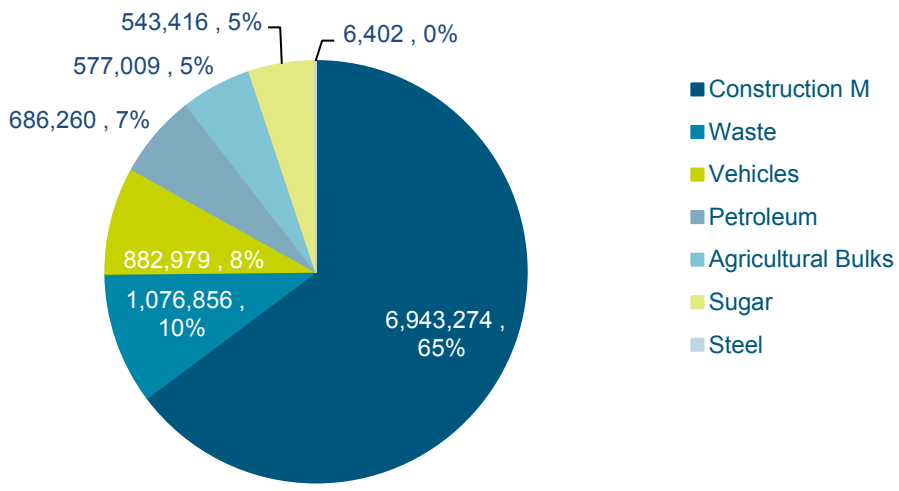
Table 3.1 Composition of Freight Traffic on the Thames 2015

Commodity	Tonnes	% of Total

Construction Materials	6,943,274	**64.8%**
Waste	1,076,856	**10.0%**
Vehicles/Unitised	882,979	**8.2%**
Petroleum Products	686,260	**6.4%**
Agricultural Bulks	577,009	**5.4%**
Sugar	543,416	**5.1%**
Steel	6,402	0.1
Other Liquid Bulks	0	0
Other Dry Bulks	0	0
General Cargo	0	0
Total	**10,716,196**	

(Source: PLA 2016)

Figure 3.2 Trade Commodities on the Thames, 2015 (tonnes)



(Source: PLA 2016)

3.5 For their 2011 study the consultants used a 10 year window (2000-2010) to examine change in freight on the Thames[25]. This 2016 update takes a similar approach of using a 10 year window to examine change (2005-2015). This is considered reasonable as it includes both a recessionary period and a growth period. Table 3.2 below shows that the pattern of those commodities using the Thames has changed over the last decade (2005-2015). The

[25] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves pg 22

importance of Construction materials has increased, there has been a slight increase in waste and slight decline in vehicles, petroleum products have increased sharply. Agricultural Bulks have declined slightly. Sugar and Steel have seen large falls. The remaining three categories have fallen to zero.

3.6 Table 3.3 below shows change in freight traffic on the Thames over the 2005-2015 period. It shows overall growth of 18%. This total figure masks some variations between commodity groups. Whilst construction materials grew by 42%, sugar declined by 53%. The table also shows the compound annual growth rate for each commodity group (CAGR). CAGR is used as it shows geometric growth over a longer time period rather than the wide fluctuations that can occur with annual change figures.

Table 3.2 Composition of Freight Traffic on the Thames 2005

Commodity	Tonnes	% of Total
Construction Materials	4,823,936	**53.1%**
Sugar	1,164,999	**12.8%**
Waste	1,009,224	**11.1%**
Vehicles/Unitised	862,625	**9.5%**
Other Liquid Bulks	0	-
Agricultural Bulks	652,712	**7.2%**
Steel	54,667	**0.6%**
Petroleum Products	295,550	**3.3%**
Other Dry Bulks	0	-
General Cargo	0	-
Total	**9,092,167**	

(Source: GLA Safeguarded Wharves Review 2013 Table 3.5)

Table 3.3 Change in Freight Traffic on the Thames 2005-2015

Commodity	Tonnes 2005	Tonnes 2015	Overall Change	% Change from 2005	% Compound

					Annual Growth Rate
Construction Materials	4,894,407	6,943,274	2,048,867	41.9%	3.6%
Sugar	1,164,999	543,416	- 621,583	-53.4%	-7.3%
Waste	1,009,224	1,076,856	67,632	6.7%	0.7%
Vehicles/Unitised	862,625	882,979	20,354	2.4%	0.2%
Agricultural Bulks	652,712	577,009	- 75,703	-11.6%	-1.2%
Steel	54,667	6,402	- 48,265	-88.3%	-19.3%
Petroleum Products	295,550	686,260	390,710	132.2%	8.8%
Total	**9,092,167**	**10,716,196**	**1,624,029**	**17.9%**	**1.7%**

(Source: Tables 3.1 and 3.2 above)

3.7 Compound annual growth rate is calculated using the following formula;

$$CAGR = \left(\left(\frac{End\ Value}{Start\ Value} \right)^{\frac{1}{n}} \right) - 1$$

3.8 Table 3.4 below shows the compound annual growth rate (CAGR) URS/Scott Wilson found over the 2000-2010 compared with the equivalent figure for the 2005-2015 period found in Table 3.3. It shows that in the more recent 2005-2015 period that the overall rate of change has been positive +1.7%, well above the -3% found for the 2000-2010 period. For individual sectors it has seen acceleration in growth in agricultural bulks whereas sugar has seen an accelerated rate of decline. Other commodities, such as waste have seen their predicted rate of decline slow. Vehicles and agricultural bulks are now forecast to grow, rather than decline. Petroleum products are still assumed to grow strongly, albeit at a less expansive rate than found in the earlier period.

Table 3.4 Change of Rate in Freight Traffic on the Thames

Commodity	% CAGR 2000-2010	% CAGR 2005-2015

Construction Materials	-2.5	3.6%
Sugar	-3.0	-7.3%
Waste	-4.0	0.7%
Vehicles/Unitised	-1.0	0.2%
Other Liquid Bulks	+7.0	
Agricultural Bulks	-12.0	-1.2%
Steel	n/a	-19.3%
Petroleum Products	+33.0	8.8%
Other Dry Bulks	n/a	
General Cargo	-45.0	
Total	**-3.0**	**1.7%**

(Source: GLA Safeguarded Wharves Review 2013, Table 3.5 and Table 3.3 above)

3.9 So the current context for freight traffic on the Thames reveals on overall picture of growth, masking variation within the commodity groupings that highlight growth in some sectors, construction materials and decline in others, such as steel. There has also been a contraction in the range of commodities moved on the Thames and the increasing importance of construction materials. URS/Scott Wilson (pg. 28) considered the decline of 3% in CAGR could be related to structural changes in the economy rather than a short term fall caused by the impact of the 2008 recession. This was due to their assumptions that those sectors of the economy that made most use of the river were forecast to shrink, impacting on wharf activity. By 2015, the position has reversed with growth now occurring. High levels of development activity in London may be causing the increase in construction materials found above, giving, in turn, an overall growth in activity.

3.10 Having established a current picture for freight traffic on the Thames, this report will move on to looking at ways to forecast future demand to 2041.

Forecasting Demand – Possible Approaches

3.11 One way to do this would be to look at economic forecasts, produced by organisations like the Office of Budgetary Responsibility and apply the percentage growth rates to the 2015 position. However, the tables above make it clear that the different commodity groups do not perform

in a uniform way. In addition, the London economy, with its higher proportion of service sector employment, does not perform in an identical pattern to the broader UK economy, a general pattern being that in good times, London does slightly better than the UK as whole and that in bad times recessions are less severe in London.

3.12 In 2006 the Department for Transport, appointed MDS Transmodal Ltd[26] to forecast UK port demand to 2030. While they forecast an overall growth of 30% in port demand for the 2005-2030 period, the bulk of this growth was forecast to be in unitised cargo and other liquid bulks. For the London region, the long term forecast showed no growth within London and URS/Scott Wilson found no correlation between DfT trade forecasts and London's wharf trade[27].

3.13 In November 2015, the Port of London Authority (PLA) published forecasts for the period 2014 – 2035[28]. These forecasts apply to the entire PLA area (i.e. they include Essex and Kent). The forecasts were prepared by the Stamford Research Group, using a mixture of top-down econometric modelling and bottom-up market intelligence (talking to operators and owners). They produced a range of forecasts, low, central and high.

3.14 Table 3.5 below shows their central forecast to 2035. It shows overall growth in total traffic with unitised traffic growing at double the overall rate and only petroleum forecast to decline (in line with assumptions that the UK de-carbonises its economy). Unfortunately it is not possible to extract the London only data from this study. However, it does provide an indication of likely growth patterns for freight on the Thames for most of the relevant period under consideration. London's wharves are unlikely to benefit from the growth in unitised traffic as it lacks the deep water berths unitised traffic needs. However, there is no reason to believe that London could not share in the growth in aggregates and the all other commodity groups.

Table 3.5 PLA Forecasts Central Scenario 2014-2035 (Mt)

Commodity	Tonnes 2014	Tonnes 2035	Overall Change	% Change
Unitised	16.9	48.3	31.4	186

[26] http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/consultations/archive/2006/ppr/ukportdemandforecaststo2030.pdf
[27] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves, pg 33
[28] https://www.pla.co.uk/assets/forecasts-consultationdocumentv11december-1.pdf

Petroleum	11.9	10.7	-1.2	-10
Aggregates	9.6	12.4	2.8	29
All Other	6.1	7.6	1.5	25
Total	**44.5**	**79.0**	**34.5**	**78**

(Source: PLA 2015)

3.15 Another way to forecast London-specific growth would be to apply the standard Gross Value Added (GVA) assumption of 2.5% per annum used by GLA Economics in their long term forecasting for London[29]. This figure could be said to represent the long term view taking account the cyclical nature of economies. However URS/Scott Wilson[30] (pg. 29) found the correlation between London's GVA and its trade through the wharves to be a weak correlation of 0.3. This indicates that GVA is not an accurate predictor of demand for wharves. Given that the London economy has been de-industrialising over a number of decades it is unsurprising that overall economic growth is decoupled from the industrial sectors that currently dominate wharf activity.

3.16 This point is underlined by URS/Scott Wilson[31] (pg. 31) when they found a negative correlation of -0.8 between GLA employment forecasts and wharf activity as the GLA forecasts (2007) found those sectors that use the wharves, primary & utilities, manufacturing, construction and transport & communications, were forecast to decline. The most recent GLA employment projections (June 2016) continue to show decline in primary & utilities, manufacturing and transport & communication sectors with some growth in construction.

3.17 Table 3.6 below compares the forecast change in GLA Economics employment projections for London as a whole and for the four sectors referred to in paragraph 3.16 above. It looks at the pattern in the earlier 2011-2031projections[32], used by URS/Scott Wilson to establish the negative correlation between employment forecasts and wharf activity and compares this with the most recent 2016 employment projections[33]. The 2016 forecasts continue to show three of the sectors making no contribution to London's anticipated growth, although primary and manufacturing are now forecast to decline at a slower rate than the earlier projection. The

[29] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves
[30] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves
[31] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/safeguarded-wharves
[32] https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/wp38-web-final.pdf

[33] https://www.london.gov.uk/business-and-economy-publications/london-labour-market-projections-2016

decline in the transportation sector is thought to be greater than anticipated previously. In contrast, the above London total projected change for construction, suggests strong growth in this sector.

Table 3.6 GLA Employment Projections

Sector	Projected Change 2011-2031	Projected Change 2014 – 2041
All	**+ 14%**	**+15%**
Primary & Utilities	-52%	-19%
Manufacturing	-54%	-44%
Construction	-1.0%	+16%
Transport & Communication	-1.0%	-18%

(Source: GLA Economics 2010 and 2016)

4 Historic Trends & Forecasting Demand

4.1 One way to forecast change into the future is to assume that what held true in the past will hold true into the future. Assuming that the change found over the 2005-2015 period can be applied over the 2016-2041 period.

4.2 OSC were asked to apply their specialist knowledge of the shipping industry and advise if they believed that there were other sectors the Mayor should be forecasting for up to 2041. Currently, construction materials and waste are the main focus for future transportation on the Thames. Both in-house discussions with engineers and various industry sector interviews provide an outline on some of the recent findings for current and future shipping on the Thames.

4.3 London is well served for container capacity; both Tilbury and London Gateway are within 25 miles of central London. In addition, Southampton, which has is a major container terminal on the south coast is only 70 miles from central London. However, the containers that service London stem mostly from road and rail transportation. Various schemes have been suggested that could encourage containers on to barges and shipped to local destinations within London. However, as the previous URS (2013) study mentioned, investment for the transhipment of containers is currently unviable, as expensive infrastructure equipment would be required for

a wharf (or wharves) to handle containers. As such, a container handling facility in central London would require a large site to encourage economies of scale for the transhipment of containers. This option could be politically encouraged, but would require significant investment from both central and local government to establish suitable facilities. It is reasonable to suggest that this is not a high enough priority for this to occur.

4.4 Whilst considering possible modal shifts in transportation, OSC in consultation with its in-house engineers highlighted that if political will was sufficient, the transportation of lorries and their associated cargoes (it is suggested possibly containers loaded at Tilbury or London Gateway) could be undertaken via barge. The lorries could be driven on to barges and then transported along the river to a depot/berth for disembarkation. Depending on the end destination of the cargo this could alleviate a number of truck movements into and through London. However, this is not a fully modelled suggestion, and would need examination/investigation for its viability.

4.5 The movement of household and light industrial waste, which can either be unsorted or sorted or baled, has also been highlighted by OSC. Materials either as a bulk cargo or in a container are being transported down the Thames to Tilbury for either further sorting or storage, then onward being transported to recycling plants in Europe. This is a growing sector that could provide significant quantities for barging in the future.

4.6 An interview with London Construction Link (LCL) highlights the possibilities to utilise the Thames more for the transportation of goods and materials. LCL is a collaboration between the Port of Tilbury and S. Walsh & Sons (a barge and tug owner/operator). The partnership is seeking to reduce congestion within London by promoting river transport. With the many largescale projects that are underway or planned in the Capital, the initial focus will be on construction materials and large equipment. However, in the longer term, this partnership is looking to provide a service to other cargoes.

4.7 The Port of Tilbury provides an area for cargoes to be consolidated before being transported up river to the appropriate wharf. It is envisaged that several of the safeguarded wharves could be utilised as ‘spoke’ wharves. Potentially, there could be a system whereby cargoes are loaded at Tilbury then transported up river to a spoke wharf in the ‘East’ or ‘West’.

4.8 One concern that the LCL has encountered is that there are many local planners, councils, and stakeholders along the river, each having their own focus. A more holistic approach to encourage more river transport would be if there is a proposed development close to the river, planning approval should be provided with the stipulation that river transport is used for materials to and from the site. .

4.9 Overall, with the backing of LCL, there is clear potential for increased river transportation – not just construction materials but other commodities in the future.

4.10 In addition, OSC used their knowledge of the commodities analysed in this study identified that movements of large vessels on the Thames are restricted by draft and length of vessels. Vessels with a long overall length need to be accompanied by tugs through the Thames tidal barrier; such vessels include large cruise ships and naval vessels. Smaller bulk vessels that, for instance, supply the Tate & Lyle sugar refinery are able to proceed upstream unassisted. Overall, smaller vessels or barges offer the main form of transportation along the Thames.

4.11 Overall, the main focus of expansion for additional cargo flows on the Thames will stem from the numerous construction projects that are currently in progress or will commence in the near-future. This will require additional movements of barges for the construction industry and the materials utilised in each project.

4.12 For waste - there is increased interest in Refuse Derived Fuel (RDF) which could lead to increased quantities of waste being transported via the Thames to waste sorting depots - such as Tilbury.

4.13 Discussions with Stolt at Pinnacle Terminals highlighted that recent investment at their facility could provide additional storage and throughput capacity for petroleum products in the near-term.

4.14 Discussions with the Thames Refinery outline that for sugar the outcome of Brexit will be the largest single determinant of future trades. A positive exit and an open sugar policy have the potential to double sugar imports in the near-term.

Heathrow announcement

4.15 The Government has recently announced its support for the construction of a third runway at Heathrow. It is assumed that the majority of the material required for the project (construction and waste materials) will be transported by road and rail via a logistics centre – as was the case for Terminal 5. The plans are still at a preliminary stage, with additional details of the logistic requirements being furnished as the project develops. Overall requirements for construction materials are still in the design and planning stages. Unlike, T5, which was a new terminal, with accompanying pavement areas for planes, the third runway at Heathrow will require significantly more material movement.

4.16 There is potential for material for the site to be transported via the Thames. However, there are significant limitations. Firstly a new wharf would need to be established for the loading/offloading of material (at a location near Heathrow – possibly Staines). Second, a logistics centre would need to be established for the vehicles servicing the airport construction. Thirdly, there are a number of road and rail bridges and six locks (see below) to navigate when transporting materials to and from the upriver wharf.

4.17 Locks in the Upper-Thames

- Richmond Half lock
- Teddington Lock
- Hampton Court lock
- Sundury lock
- Chertsey Lock
- Egham Lock

4.18 These various restrictions, and there could be additional factors not mentioned here, would make utilising the Thames for the Heathrow project in any meaningful capacity highly unlikely.

4.19 However, it should be noted that Surrey county council 'consider opportunities to support commercial initiative for river freight transport on the River Thames on a case by case basis, subject to appropriate environmental safeguards and consideration of impact on other users'[34].

4.20 In their study, URS/Scott Wilson used historic trends to forecast wharf activity for most, but not all, of the commodity groupings. Instead they examined 'bottom up' trends in these sectors discussing potential for growth with operators in the relevant industry. These were waste and construction materials.

Waste

4.21 Paragraph 3.2 makes clear that for the purposes of classifying commodities into relevant groups that Construction, Demolition and Excavation (CD & E) waste is not categorised as waste but as construction materials. Accordingly, this important waste stream is not discussed under waste but in the following section as part of construction materials. The Mayor's role in waste planning is a limited one, mainly focussing on persuasion and bringing the diverse players in the waste industry together. The Mayor is not a waste collection, disposal nor planning authority, but the Mayor does have specific waste duties under the GLA Act.

4.22 However, the now rescinded PPS10 (Waste) gave the Mayor a role in forecasting Household waste and Commercial/Industrial waste. The London Plan[35] (March 2016) contains forecasts for waste arisings for these streams. These forecasts were accepted by the Examination in Public Inspector as a sound and reasonable basis to work from. They are set out below in Table 4.1 and shows forecast change for these two waste streams for the 2016-2036 period. Although it is the household waste sector, the smaller of the two waste streams, that the bulk of the growth (86%) is forecast to occur, this reflects the strong upward demographic projections the Plan is based on. Over the forecast period household waste increases from 40% of the total in 2016 to 43% by 2036.

Table 4.1 London Plan Forecast Waste Arisings (000's tonnes pa) 2016-2036

	2016	2021	2026	2031	2036	Change

[34] https://www.surreycc.gov.uk/__data/assets/pdf_file/0006/29985/STP-Freight-Strategy.pdf

[35] https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan

Household	3,115	3,226	3,387	3,492	3,589	474
Commercial	4,654	4,637	4,647	4,681	4,734	80
Total	**7,769**	**7,863**	**8,034**	**8,173**	**8,323**	**554**

(Source: London Plan 2016 – Table 5.2)

4.23 An important consideration that needs to be borne in mind when looking at the waste industry is the very different approaches taken to these two waste streams. The Commercial/Industrial stream is almost exclusively dealt with within the private sector. Individual firms that generate waste enter into short term commercial contracts with waste management firms. These contracts can be as short as six months or one year. However, there is significant interest within this sector. As such there are a number of facilities being developed around the country specifically for this waste stream.

4.24 In contrast, the Household waste is collected either by or on behalf of the London boroughs. They will enter into long term contracts, twenty to twenty five years, with the waste management industry. The long term stability and certainty these contracts offer allow the private sector waste management firms to develop facilities to deal with this waste, knowing that they can rely on a steady stream of waste flowing into their facility.

4.25 Household waste has been moved by water historically for two purposes, moving material to landfill sites and moving material to incineration facilities. The Landfill tax escalator has made landfilling increasingly more expensive making alternative forms of waste management financially viable. Accordingly, the amount of Household waste being sent to landfill has been in decline for a number of years now. The movement of household waste by water to landfill sites ceased in 2010 with the closure of a landfill site in Essex.

4.26 Household waste is still moved on the Thames. Waste from the Western Riverside Waste Authority (comprising the boroughs of Hammersmith & Fulham, Kensington & Chelsea, Lambeth and Wandsworth) as well as waste from the City of London is moved down stream for processing at the Riverside Resource Recovery energy from waste facility at Belvedere – either for departure or receipt of waste. This has been occurring since 2011 when the facility was commissioned and will continue at least for the 30-year life of the Western Riverside contract. In addition, waste from Tower Hamlets (Northumberland Wharf) is also moved downstream to Belvedere. The planning permission restricts movement by road to a maximum of 85,000 tonnes pa., so movement by river is guaranteed unless the planning conditions are changed, which is unlikely.

4.27 In addition, the incineration process creates incinerator bottom ash (IBA). The IBA from the Riverside Resource Recovery facility is moved by barge from Middleton Jetty to Tilbury in Essex where it is processed for use as aggregate.

4.28 There are two other operational energy from waste facilities in London, LondonWaste in Edmonton (LB Enfield) and SELCHP (LB Lewisham). Both of these plants are remote from the Thames and although access by the canal network is possible the need to double handle any waste means river transport unlikely to be a viable option for either facility. LondonWaste has looked into this extensively, as have other waste operators such as ByWaters in Frog Island. River or canal transport is generally considered to be feasible if external funding can be sourced for the wharves / interchange facilities.

4.29 The facility at Belvedere is likely to continue to operate after 2036. There is currently a Development Consent Order for determination by the Secretary of State for the on-going operation of the facility at Edmonton. If approved this will extend the operational lifetime of the facility to 2051. It was 'originally' forecast to close in 2014. The facility at Belvedere is extremely likely to have its life extended, as is proposed for the facility in Edmonton, due to the financial benefits of continuing to operate a facility that is now 'paid for', and the difficulty in getting approval for a large scale replacement, the main reason why the facility at Edmonton continues to operate.

4.30 At the time that URS/Scott Wilson undertook their study they could not use the movement of household waste by water to Belvedere as part of well-established trend and therefore had to make some assumptions about waste. The facility at Belvedere has received approval (Dec 2015) to increase its annual throughput by 115,000 tonnes, which is expected to be sourced from the Port of Tilbury in Essex, and therefore will be transported by barge.[36]

4.31 OSC highlight that Refuge Derived Fuel (RDF) exports from the UK have increased from approx. 10,000 tonnes in 2010 to 3.3 million tonnes in 2015. London Ports (Purfleet, Barking, Tilbury, Gillingham / Chatham, Thamesport, Ridham) are one of four key port hubs exporting RDF material (with Humber, Suffolk, and Kent ports being the other three). These four hubs handle 90% of England's RDF exports, sending material to the Netherlands, Germany,

[36] http://www.letsrecycle.com/news/latest-news/cory-expansion-points-to-london-efw-growth/

Sweden, Denmark, Latvia, Norway, Belgium, Portugal, France, Estonia and Portugal.[37] This new market for waste has developed in response to the reduction in landfill availability in the UK, limited growth in energy from waste capacity, and cheap disposal fees at continental energy from waste plants. The market continues to grow, and much of this export will continue to be from London given its proximity to the continent, but the level of future exports will be influenced by a number of issues:

- increased capacity in the UK for treating the waste;
- affordability e.g. increase in transport costs or disposal costs (gate fees) charged by continental facilities;
- government policy changes e.g. energy security – exporting RDF is exporting energy (none are currently signalled, but much can change between now and 2041); and
- .impacts of Brexit (e.g. greater bureaucracy / increased difficulty of gaining approval for export / trade barriers / operators in the EU preferring to work with other EU suppliers, especially from Eastern Europe, which has a shortage of waste treatment facilities).
- Recycled materials continue to be exported from London ports, however London's recycling rate appears to have plateaued. Without significant government intervention, which has not been signalled by the current government, it seems unlikely that the amount of material recycled (and therefore exported) will increase substantially in the foreseeable future.[38] Following Brexit, it is reasonable to assume the impact of the Circular Economy Package (increased reuse and recycling rates) will be minimal as the government will need to develop its own environmental legislation.

Construction Materials

4.32 The approach to looking at construction materials has changed since the earlier study. The URS/Scott Wilson study made reference to Minerals Policy Statement 1, since replaced by the National Planning Policy Framework (NPPF) (March 2012) and Minerals Planning Guidance 6 that set out guidelines for aggregate production. The earlier study assumed that the trends identified in that guidance up to 2020 would continue on to 2031. They also made some assumptions about the amount of excavation waste that could be generated from schemes like Crossrail and the Thames Tideway Tunnel and further assumptions about tonnages of construction and demolition waste that could be moved via the river from other projects.

[37] http://link2energy.co.uk/929
[38] https://www.london.gov.uk/press-releases/assembly/jenny-jones/londons-worst-annual-recycling-fall

4.33 The NPPF[39] (March 2012) changes the approach to be taken on ensuring there is a steady and adequate supply of aggregates. Minerals Planning Authorities should now prepare (para 145)*"an annual Local Aggregate Assessment, either individually or jointly by agreement with another or other mineral planning authorities, based on a rolling average of 10 years sales data and other relevant local information, and an assessment of all supply options (including marine dredged, secondary and recycled sources);"* The paragraph goes on to advise that published National and Sub National Guidelines should be used as a g*uideline* (Mayor's emphasis) when planning for the future demand for and supply of aggregates. London has deposits of sand and gravel and as such this paragraph of the NPPF requires London to maintain a land bank of at least 7 years.

4.34 The Mayor is not a mineral planning authority so is not required to produce an annual local aggregates assessment (LAA) nor define a 7 year land bank for himself. However, recognising that his role is a strategic one and that staff resources in the boroughs are stretched thin in the current financial climate he has produced a London-wide Local Aggregate Assessment (2013). Adopted London Plan policy 5.20 (Aggregates) seeks to maintain a 7 year land bank of sand and gravel by setting a target for at least 5 million tonnes up to 2031, an annual figure of 0.7mt pa. This was accepted by the Examination in Public Inspector as a rate that was stretching but deliverable by the boroughs given that there are only 4 boroughs (Havering, Hillingdon, Hounslow and Redbridge) were mineral extraction was currently, or likely, to take place.

4.35 Table 4.2 below shows the rolling average of 10 years sales data, as advised by the NPPF to show likely levels of supply.

Table 4.2 Ten years sales data 2004-2013 (mt)

	Annual Average
Alternatives (CD&E)	5.5
Marine Dredged Sand & Gravel	3.8
Crushed Rock	3.5
Land won Sand & Gravel	0.8
Total	**13.6**

(Source: London Local Aggregates Assessment 2014)

[39] https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan

4.36 Table 4.3 below summarises data from the London LAA[40] (September 2014). It shows the important contribution of marine dredged sand and gravel (MDSG) to London's aggregate supply. It also shows that the relative importance of MDSG is increasing over time from 25% in 2009 to 28% in 2013. The 2015 Aggregates Annual Monitoring Survey[41] show a higher level of MDSG at 5.0mt being landed at London's wharves, approximately 30% of the total supply.

Table 4.3 Contribution of Different Materials to London's Aggregate Supply

Source	2009	2013
Total (mt)	15.4	15.6
Recycled CD&E Waste	6.0 (39%)	6.1 (39%)
Marine Dredged Sand & Gravel	3.8 (25%)	4.4 (28%)
Crushed Rock	4.1 (27%)	3.6 (24%)
Land won outside London	1.1 (4%)	1.1 (4%)
Land won within London	0.4 (3%)	0.3 (2%)

(Source: London Local Aggregates Assessment 2014)

4.37 The table above also shows the importance of recycled construction, demolition and excavation waste to London's total aggregate supply. Much of this material, because of its bulky, low value nature, is suited to movement on the river. Recent examples of this trade are the construction of Crossrail and the Lee Tunnel. Table 4.4 below shows the recent movement of CD&E waste on the Thames from these two construction projects.

4.38 Crossrail - An east-west train line across London and beyond, the Crossrail Bill was enacted in July 2008, tunnelling began in 2012; there will be 42km of tunnels. Waste is taken out from the western end at Paddington where it is moved by rail to Northfleet (Kent CC) before being put on the river. Waste at the eastern end has been put straight onto the river at three different wharves in the Canning Town area of LB Newham. Tunnelling has now finished and is estimated that 7mt of CD&E waste will have been generated. Data from Table 4.4 shows an

[40] https://www.london.gov.uk/what-we-do/planning/who-we-work/planning-working-groups/london-aggregates-working-party
[41] https://www.london.gov.uk/what-we-do/planning/who-we-work/planning-working-groups/london-aggregates-working-party

annual average movement of 776,000 tonnes from three wharves. Out of the total of 7mt of CD&E waste, 3.1mt or 44% was moved by river within London.

4.39 The Lee Tunnel – is a tunnel to move sewage from the Abbey Mills pumping station to Beckton sewage works, both in LB Newham. It is 6.4km long, construction started in earnest in 2010 and boring began in 2011, tunnelling finished in Jan 2014. This material was moved from Abbey Mills and Beckton wharf at an annual average rate of 321,200 tonnes.

Table 4.4 CD&E Material moved by river from recent large scale construction schemes (kt)

Scheme	2010	2011	2012	2013	2014	2015	Total
Crossrail	-	-	1103	1,184	1,480	329.9	3103.9
Collonite			110	597.8	870	108.4	1686.2
Limmo			-	80	110	-	190
Thames			-	506.0	500	221.5	1227.5
Lee Tunnel	27	327	373	781	98	-	1,606
Abbey Mills	-	24.1	87.6	34.5	39.4		185.6
Beckton	27	302.8	285.7	746.1	58.7		1,420.3

(Source: Port of London Authority)

4.40 There are a number of other large scale construction projects that are currently either underway or are planned to take place during the forecast period. They are set out in the following paragraphs.

4.41 TfL are proposing a **Bakerloo line extension** (BLE), south-east from the Elephant & Castle to Lewisham via the Old Kent Road, work would begin in the 2020's and be finished by 2030. This would be via 2 tunnels each 7.5km long.

4.42 TfL are working with the Department for Transport on **Crossrail 2**, a train service proposed to run from Surrey through SW London to Hertfordshire via NE London, via 37kms of twin bore tunnels under central London. TfL hope to have consent by late 2019 with construction beginning in 2021 and the scheme operational by 2030.

4.43 The Government is proposing **HS2** to improve connectivity between London and Birmingham initially; the scheme will be in a tunnel under London to/from Euston. It will involve the redevelopment of Euston itself and c.20 km of twin tunnels under London. The tunnels between 7.5-8m diameter are larger than those for Crossrail (6.2m). Initial construction work is due to begin in 2017 and tunnelling in late 2019.

4.44 TfL has consent for a **Northern Line extension** (NLE) from Kennington via an intermediate station at Nine Elms and a terminal with crossover box at Battersea. The Transport and Works Act order was granted in November 2014 with tunnelling beginning in 2016. The extension would become operational in 2020.

4.45 TfL are promoting an additional road based river crossing between north Greenwich and Silvertown to relieve congestion in the Blackwell tunnel and improve connectivity in east London. TfL hope to have a decision on the **Silvertown Tunnel** by 2018, with construction beginning in 2018 with the scheme completed by 2023.

4.46 Thames Water has a Development Consent Order for the **Thames Tideway Tunnel**, to upgrade the capacity of London's sewer network. The new sewer will have 25 kilometres of tunnel, taking the waste from across London to Abbey Mills pumping station. Preliminary construction is due to start in 2016 with tunnelling taking place 2017-2021. In addition to the tunnel there will be 5 shafts, varying in depth from 30m to 66m.

4.47 Four of these six schemes have environmental statements setting out likely tonnages of CD & E waste they will generate. This data is shown below in Table 4.5. It is too early to have an environmental statement for the Bakerloo Line Extension or Crossrail 2. In Table 4.5 below the figure for the Bakerloo Line Extension is an assumption, based on the tonnage of CD&E waste per kilometre of tunnel dug generated by the Northern Line Extension (143 kt per km) applied to the predicted tunnel length of the scheme. Tube tunnels are the same size, this is a reasonable assumption.

4.48 There are currently 16 different tunnelling options for Crossrail 2, generating a range from 18.9mt -22.1mt for excavation waste alone. Crossrail found that Construction and Demolition waste added 20% to the total. Assuming this holds true for Crossrail 2, the range increases to 22.7mt-26.6mt, the midpoint of this range is used.

Table 4.5 Potential CD&E waste generated by large scale construction schemes (mt)

Scheme	Total tonnes
HS2[42]	21.7
Northern Line Extension[43]	0.9
Silvertown Tunnel[44]	0.8
Thames Tideway Tunnel[45]	4.9
Total from Environmental Statements	28.3
Bakerloo Line Extension	2.1
Crossrail 2	24.7
Estimated Total	**55.1**

(Source: GLA, taken from relevant Environmental Statements)

4.49 There is no guarantee that all of these schemes will proceed, or that they will all be delivered to their agreed timetables. If they all proceed according to schedule, then over the 13 year period in which construction could start for the first scheme (2016 – the NLE) and end for the last scheme (2028 – the BLE), an annual rate of 4.2 mt of CD&E waste will be. This average figure masks significant variations in when CD&E waste is expected to be generated.

4.50 Taking the known excavation profile for the Thames Tideway Tunnel from its environmental statement and making further assumptions about the profiles for the other schemes, gives an indicative waste phasing profile shown in Table 4.6 below. The Northern Line Extension and the Silvertown Tunnel are both much smaller schemes than the others. So it is assumed they will only have one years' worth of tunnelling. There is a time profile for both Crossrail 2 and HS2, although they have different timeframes from the Thames Tideway tunnel. It is assumed that they will both experience a ramping up of activity, followed by a peak period of activity

[42] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265885/AllCFAs_Waste_and_Material_Resources_Assessment_WM-001-000.pdf
[43] http://content.tfl.gov.uk/nle-twa-environmental-statement-volume-iia-appendices-a-b-d-e-and-f-a17-2a.pdf
[44] http://content.tfl.gov.uk/st-silvertown-tunnel-enviro-report.pdf
[45] https://www.tideway.london/media/2025/6203_environmental_statement_volume_3_appendices_a_to_a4.pdf

then a falling off, along the lines that the environmental statement for the Thames Tideway Tunnel suggests and the actual pattern for the Lea Tunnel, shown above in Table 4.6. The indicative phasing below shows the peak period for waste generation will be 2024/2025.

4.51 The key issue that needs to be addressed is to establish how much of this waste can be reasonably assumed to be moved on the river. For four of these six schemes the Mayor, through Transport for London, is either solely or jointly responsible for their delivery. Section 2 of this report highlights the high level of Mayoral support for waterborne freight movement so it is reasonable to assume that, for these schemes, there will be a high level of freight movement on the Thames. The Tideway Tunnel is being promoted by Thames Water Ltd and HS2 is being delivered by a company established by central Government.

Table 4.6 Indicative Phasing of Waste Generation for all schemes

Year	Scheme	Total
2016	NLE – 915,260 TTT – 94,167	1,009,427
2017	HS2 – 1,082,782 TTT – 581,167	1,663,949
2018	HS2 – 1,082,782 TTT – 1,971,167	3,053,949
2019	HS2 – 2,165,642 ST – 807,620 TTT – 1,881,167	4,854,429
2020	HS2 – 2,165,642 TTT – 176,167	2,341,809
2021	HS2 – 5,413,911 TTT – 186,167	5,600,078
2022	HS2 – 5,413,911	5,413,911
2023	CR2 – 4,472,000 HS2 – 2,165,642	6,637,642
2024	CR2 – 8,944,000 HS2 – 1,082,782	10,026,782
2025	CR2 – 8,944,000	10,026,782

	HS2 – 1,082,782	
2026		
2027	BLE – 1,000,000	1,000,000
2028	BLE – 1,145,135	1,145,135

(Source: GLA estimates)

4.52 The Northern Line Extension is going to use the Thames, with its CD&E waste being loaded onto the river at Battersea. The Environmental Strategy Volume IIa[46] (May 2011) sets out in Appendix B its materials management strategy. On page 11 of Appendix B it states *"Under Option A and Option B an estimated 70% and 68% (by volume) respectively of material will be removed by barge, with the remainder by road. A description of each of these transportation methods is provided below….Removal of surplus material via the River Thames provides a viable and sustainable mode of transport. Barges offer a large capacity for bulk transport (i.e. 1000 tonnes per barge) when compared with an average lorry load (20 tonnes). This results in a much lower amount of movements than would be required for road transport and avoids the contribution of traffic to London's road network and associated air quality effects… The excavated material is to be removed from the tunnel entrance via an inclined conveyor into an inverted hopper. Material will then be transported via a series of conveyors to the jetty, where it will be loaded into barges at a two berth facility at the Battersea Power Station jetty."* The jetty at Battersea Power Station is currently unsafeguarded.

4.53 If the Silvertown tunnel proceeds then its location between RB Greenwich on the south bank and the London Boroughs of Newham and Tower Hamlets on the north bank makes it ideally located to use the wharves in this part of London. TfL are intending to use the river to transport CD&E waste, in the Silvertown Tunnel 'Introductory Environmental Assessment Report'[47] (2014, pg. 134) para 11.3.8 *"It is anticipated that any spoil generated may be re-used off-site for landscaping or other beneficial purposes, therefore it is expected that only minimal volumes of material may require disposal at landfill…, to minimise disruption to the highway network, and reduce carbon emissions, river facilities are currently being considered for delivery of tunnel segments and other bulk materials to the site and removal of spoil via Thames Wharf. Due to proximity to the river and wharf, river transport is a logical option."*

[46] http://content.tfl.gov.uk/nle-twa-environmental-statement-volume-iia-appendices-a-b-d-e-and-f-a17-2a.pdf
[47] http://content.tfl.gov.uk/st-silvertown-tunnel-enviro-report.pdf

4.54 It is too early to know what could happen with either the Bakerloo Line Extension or Crossrail 2 but at this stage it is TfL's intention to maximise the contribution of movement by barge. HS 2 are looking to move waste by road or preferably rail when the distances involved make this financially worthwhile.

4.55 In constructing the Thames Tideway Tunnel[48], Thames Water have indicated that *"the transport strategy equates to approximately 53% of the total tonnage of construction materials being transported by river across the construction period."* This has now been increased to 77%.

4.56 Based on the preceding paragraphs it is reasonable to assume that the following levels of CD&E waste will be moved on the Thames as shown in Table 4.7 below. This is based on the following assumptions that;

- 69% of the Northern Line Extension material is moved by barge;
- That 77% of the CD&E waste for the Thames Tideway Tunnel is moved by barge;
- The Silvertown tunnel project proceeds and 90% of the Silvertown Tunnel material is moved by barge.
- The Bakerloo Line Extension project proceeds and achieves the 69% rate average used for the Northern Line extension;
- Crossrail 2 proceeds and matches the removal rate by barge achieved by Crossrail, 44% .
- In addition to the large-scale infrastructure projects that are currently under construction, or are scheduled in the near term, there is also a large market for building private dwellings within the London boundaries.

[48] https://www.tideway.london/media/2034/6203_environmental_statement_volume_3_project_wide_effects_assessment.pdf Section 12 pg 4 para 12.2.19

Table 4.7 Potential Future Movement of CD&E Waste by River

Year	Scheme	Scheme Total	Year Total
2016	Northern LE Thames Tideway	631,500 49,900	681,400
2017	Thames Tideway	308,000	308,000
2018	Thames Tideway	1,044,700	1,044,700
2019	Silvertown Tunnel Thames Tideway	726,900 997,000	1,723,900
2020	Thames Tideway	93,400	93,400
2021	Thames Tideway	98,700	98,700
2022			
2023	Crossrail 2	1,967,700	1,967,700
2024	Crossrail 2	3,935,400	3,935,400
2025	Crossrail 2	3,935,400	3,935,400
2026			
2027	Bakerloo LE	690,000	690,000
2028	Bakerloo LE	790,100	790,100
Total			**15,268,600**

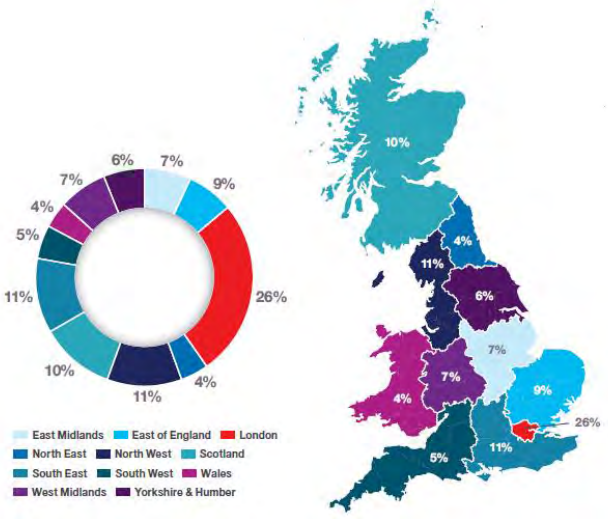
Annual Average	2016 – 2028 (13 years)		1,174,500

(Source: GLA Estimates based on Environmental Statements)

4.57 The London Plan contains a target for housing supply for the 2015-2025 period. This sets out an annual target of c.42,400 dwellings London wide. In theory, it should be possible to estimate the amount of aggregate these dwellings will require. However, no reliable estimates are available for assessing this, there is no way of knowing the split between flats and houses or between 4 bedroom and 1 bedroom dwellings. The sites on which the development will occur cannot be known exactly, so proximity to the river cannot be guaranteed. Even if sites are located close to the river there is no way of estimating what percentage of their construction material would arrive via the river.

4.58 OSC advised that, for the construction materials sector, their market intelligence suggested that overall the London construction industry represents 26% of the contracts awarded across the UK according to Barbour ABI Economics and Construction Market Review (Dall, 2016) as highlighted in Figure 4.1.

Figure 4.1 Location of Contracts Awarded



(Source: Dall, 2016)

4.59 Large projects such as Cross Rail, Thames Tideway Tunnel and a waste facility in Beddington have contributed to London's position in the construction industry. The Barbour ABI report also highlights that the London region is currently experiencing the highest activity in a number of construction sectors including housing, infrastructure, commercial & retail, hotel, leisure and sport, medical and health and education.

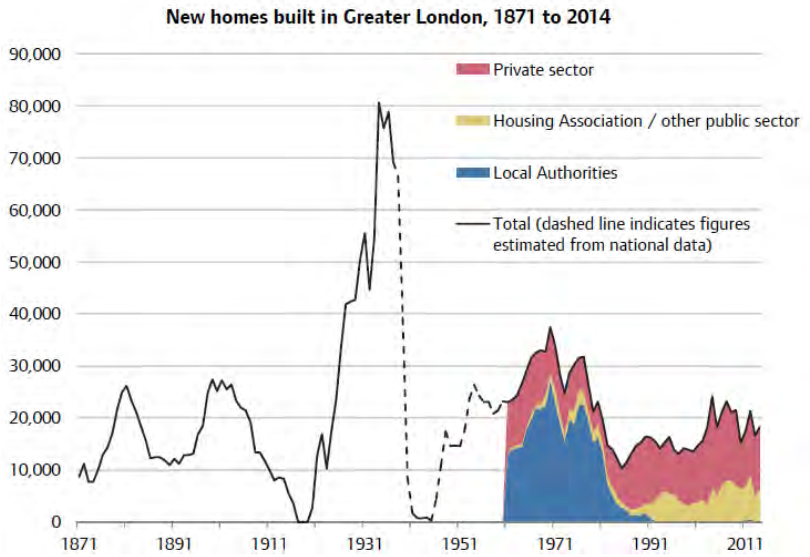
4.60 As such the demand for construction materials is critical to these projects. However, there are concerns regarding the supply of required materials. In London and the South East, it is estimated that demand for aggregate outstrips local supply by 500%. This has increased the commercial pressure to recycle aggregates. An example of this was the construction of the Wembley Stadium Access Corridor in which over 90% of materials were obtained from the demolition of major structures and recycled as aggregates and over half the aggregates used in building the new infrastructure were procured from recycled sources[49]. Indeed the PLA have already set a target to recycle 95% of construction waste by 2020 in their London Plan.

4.61 London has seen an increase of 29% in infrastructure activity, a 3% increase in industrial activity, a 15% increase in medical and health activity and a 10% increase in education activity since March 2015. This highlights that London is still a growing and developing city.

4.62 According to Barbour ABI, London is the hub for residential sector activity, accounting for 20% of the value of contracts awarded within the UK. The National House Building Council (NHBC has claimed that 25,994 houses were built in 2015, which represented a 9% decrease on the previous year. House building trends in London can be found in Figure 4.2.

[49] Foresight Future of Cities Project: "What will cities of the future be made of?"

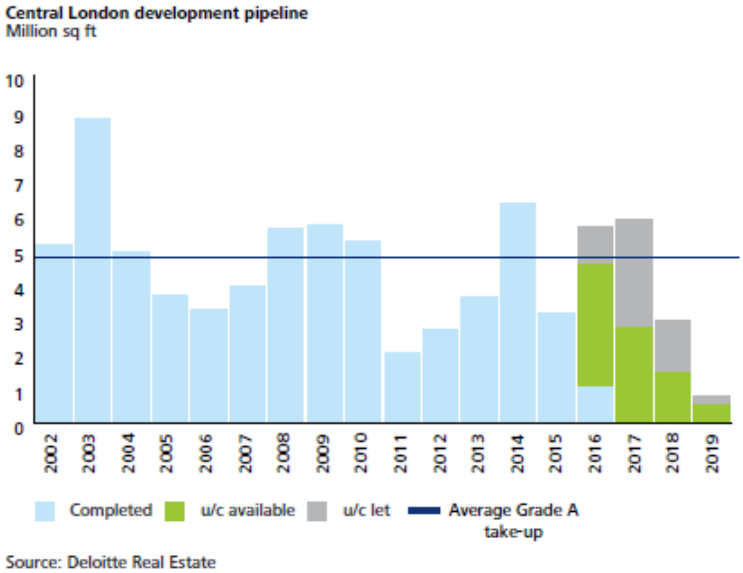
Figure 4.2 New homes built in Greater London, 1871 to 2014 (GLA, 2016)



(Source: GLA, 2016)

4.63 The London Office Crane Survey, produced by Deloitte in 2016 expects the construction industry in London to continue its increase in activity, especially related to office space. This increase is supported by the continued high levels of letting of space under construction, with 42% of space under construction already let. The expected short-terms trends in developments in Central London are demonstrated in Figure 4.3 below

Figure 4.3 Central London Development Pipeline



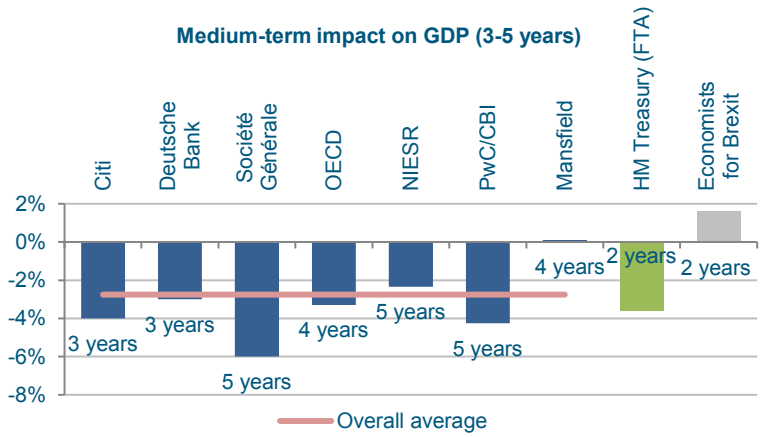
4.64 Overall, London is the single largest area for construction in the UK. Increased demand for construction materials from largescale infrastructure projects are planned through to the late-

2020s. Recycling of construction material and waste material from the proposed largescale government funded infrastructure projects will be a main focus for the industry within London. Therefore it is anticipated that the contribution of different material to London's aggregate supply will continue to be dominated by recycled construction materials and marine dredged sands & gravels.

The effects of Brexit

4.65 In addition to the aforementioned, the implications of the recent Brexit vote need to be outlined within the study. While there are many issues that need to be considered, the only certainty currently regarding the UK leaving the EU is that there is large-scale and significant uncertainty surrounding the withdrawal. HM Treasury has identified three possible scenarios that will impact UK GDP ranging from -3.4% to -9.5% after 15 years. Other institutions also forecast that in the medium-term that there will be an adverse effect on the UK economy.

Figure 4.4 Effect of Brexit on UK



(Source: OSC/market intelligence)

4.66 However, trade and demand in the short-term is forecast to remain relatively unaffected, but there is uncertainty regarding funding for UK agriculture, whilst UK housing market looks to continue its upward prices trend due to limited availability of housing stock. Whilst a reduction in economic growth until 2020 is anticipated, a prolonged recession is not now expected.

4.67 Therefore, the complexities of modelling the net results of Brexit on trade for the Thames are extremely unpredictable currently. However, there are commodities (sugar/vehicles) that may be more susceptible to the potential impacts of the Brexit vote, which are further investigated below.

Future Forecasts

4.68 OSC suggests that the basis for all commodity forecasts is the Compound Annual Growth Rate (CAGR) which is used to calculate an annual average growth rate over the historical period 2005-2015. CAGR accounts for fluctuations in the annual data and provides an average rate of change in volumes which can be used for forecasting.

4.69 The formula for CAGR is:

$$CAGR = \left(\left(\frac{End\ Value}{Start\ Value} \right)^{\frac{1}{n}} \right) - 1$$

Where n = time period

4.70 Even though CAGR can accurately reflect historical trends, it cannot, on its own, constitute an accurate forecasting method, especially over a longer time horizon. So, even though it is used as a basis for the forecasts, it is not applied uniformly over the forecast period. As we move from the short-term to the longer-term, additional market assessments and assumptions are made which influence future commodity trends, therefore OSC utilise a CAGR 'Adjusted' measure. These will be discussed in more detail for each of the main commodities together with the overall forecast results.

4.71 Within this forecast methodology (CAGR 'Adjusted'), a high, base and low case scenario can be formulated. The base case scenario represents the most likely outcome whereas the high and low cases serve as a sensitivity analysis.

4.72 The dataset includes the 50 safeguarded wharves on the River Thames (full list and wharf characteristics may be found in the appendix). The same dataset is used to create the forecasts below, as well as discuss capacity and formulate the gap analysis in later sections. This is to ensure data consistency and to enable accurate comparisons. Even though there

were throughput data for a number of additional, non-safeguarded wharves, capacity estimates were not available; therefore only the 50 safeguarded wharves have been included.

4.73 The CAGR of the different commodities from the historical dataset are presented in Table 4.8 below:

Table 4.8 Historical Commodity CAGR

Commodity	Start Value	End value	Period	% CAGR
Agricultural Bulks	652,712	577,009	2005-2015	-1.2%
Construction M.	4,894,407	6,943,274	2005-2015	3.6%
Petroleum	295,550	686,260	2005-2015	8.8%
Steel	54,667	21,313	2005-2016*	0.1%
Sugar	1,164,999	550,000	2005-2016*	5.1%
Vehicles	862,625	882,979	2005-2015	0.2%
Waste	1,009,224	1,076,856	2005-2015	0.7%

*2016 values were estimated and so forecasts begin a year later for these two commodities

4.74 As an example, the CAGR for Agricultural Bulks is calculated as follows:

$$CAGR = \left(\left(\frac{577{,}009}{652{,}712} \right)^{\frac{1}{2015-2005}} \right) - 1 = -0.01$$

Or -1% if expressed as a percentage.

4.75 It should be noted that cargo types assigned to individual wharves do not change over time i.e. a wharf is assumed to have been used for the same type of cargo over the period 2005-2015. This is an assumption that does not significantly affect estimated commodity volumes since it is accurate for the majority of cases. If a wharf is categorised as vacant during 2015, it is assumed that they are vacant throughout the study period – although this may change in practice.

4.76 In the majority of cases, as the following table shows, CAGR calculations were used as a foundation for the base case scenario. In the case of Petroleum, the calculated CAGR was significantly high, based on our market intelligence information. This was deemed too high to reflect market conditions as a base case scenario. Therefore this was utilised as the high case scenario. For Steel and Sugar, the opposite is true.

Table 4.9 Commodity CAGR Scenarios

Commodity	CAGR Scenario
Agricultural Bulks	Base Case
Construction Materials	Base Case
Petroleum	High Case
Steel	Low Case
Sugar	Low Case
Vehicles	Base Case
Waste	Base Case

4.77 It should be highlighted however, that none of the scenarios, even the ones formulated on historical CAGR, are solely based on this value. As previously mentioned, they are combined with market condition assumptions and market intelligence. Each year in the period under consideration is given its own growth rate; rates for representative years are shown in tables after each commodity forecast.

4.78 So, for example, the 2021 estimated value of a commodity will be:

$$2021value = 2020value * (1 + 2021growthrate)$$

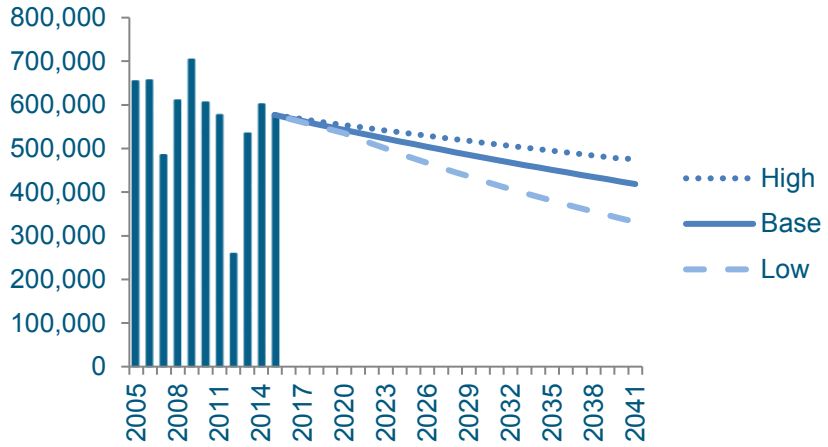
4.79 The base case scenario represents the most probable estimation of future market conditions. However, for the sake of sensitivity analysis, we also present High and Low scenarios. They are an indication of possible volumes if growth rates fluctuate from our base case mean. The three scenarios broadly follow a similar trend for most commodities. When they do not, the cases are based on alternative market scenarios that can influence throughput in a significant way and are discussed under the individual commodity forecasts.

4.80 OSC provides the following assessment of this updated forecasting work. Forecasts are presented on a commodity basis with discussion of potential sector developments and representative CAGR:

Agricultural Bulks

4.81 Whilst agricultural bulks represent a relatively small portion of overall traffic, it accounts for approximately 600,000t. Even though there have been significant fluctuations, the overall trend is slowly decreasing over time. The base case scenario is formulated by applying the CAGR uniformly across the forecast horizon as it is anticipated that there will be no significant alteration to either supply or demand within the trading area. OSC were unable to confirm our forecast with a major oil seed importer. Accordingly, by 2041, the volumes will be around the 400,000t. In all three scenarios, a small decrease is expected in agricultural bulks. However, the forecasted values are anticipated to be within range of observed historical volumes.

Figure 4.5 Forecast Agricultural Bulks (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.10 Forecast Agricultural Bulks CAGR by focus year

Agricultural Bulks	2016	2021	2031	2041
High	-0.85%	-0.75%	-0.75%	-0.75%
Base	-1.23%	-1.23%	-1.23%	-1.23%
Low	-1.50%	-2.25%	-2.25%	-2.25%

(Source: Ocean Shipping Consultants)

Construction Materials

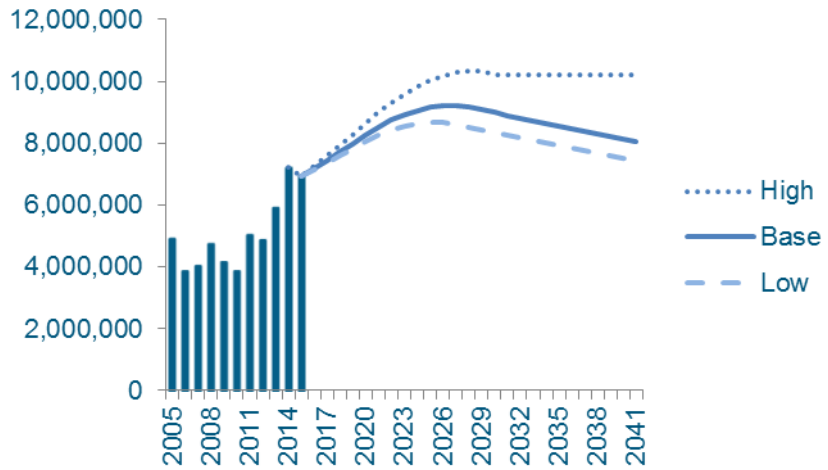
4.82 Construction Materials represent the majority of cargo for traffic on the Thames and have been rising rapidly over the recent past. CAGR for the period 2006-2015 was 4%. Construction materials are expected to continue on this upward trend especially since there are major projects planned in or around London. These include:

- The High Speed Rail (HS2)
- The Northern Line Extension
- Silvertown Tunnel
- Thames Tideway Tunnel
- Bakerloo Line Extension
- Crossrail 2

4.83 In addition to the above schemes, the recent announcement from the Mayor's office (October 2016) that there will be new Thames crossings (bridges and tunnels) will also add to the potential for construction material to be transported via the Thames.

4.84 These projects are expected to generate both an increase in construction materials and an increase in CD&E waste moved via the river. Given the historic trend and the planned projects, this commodity is expected to increase substantially, in line with build-out of large infrastructural projects. The base case scenario is based on CAGR, however a 3.5% increase is unlikely to be sustained in the long-run. The planned projects given above are due for completion by 2028 and it is uncertain whether there will be further projects of this magnitude to sustain the same level of growth. Therefore, the growth rate gradually slows over latter the forecast period. Overall, construction materials are forecast to increase to 9.2mt by 2026, before declining to approximately 8.0mt by the end of the study period.

Figure 4.6 Forecast Construction Materials (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.11 Forecast Construction Materials CAGR by focus year

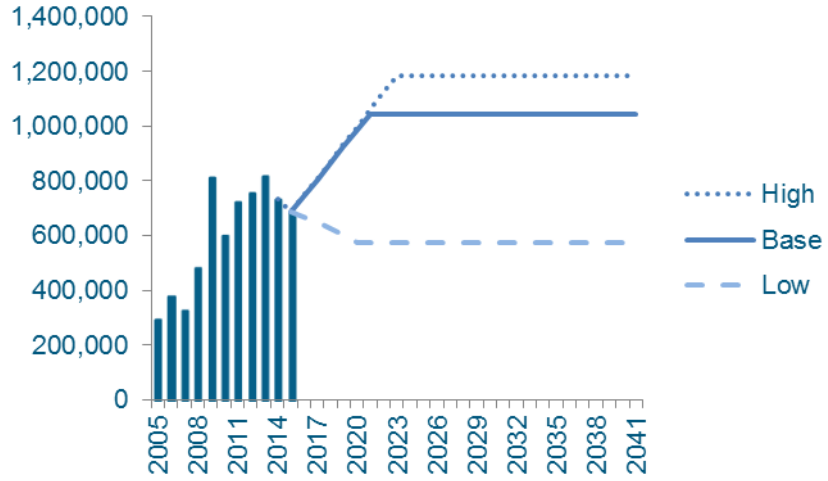
Construction M	2016	2021	2031	2041
High	4.50%	4.00%	0.00%	0.00%
Base	3.56%	3.06%	-1.00%	-1.00%
Low	3.00%	2.50%	-1.00%	-1.00%

(Source: Ocean Shipping Consultants)

Petroleum

4.85 Growth in petroleum products has been strong with a CAGR of 9%. All the petroleum products that are transported on the Thames flow to the Pinnacle Terminal where Stolt have a processing and storage facility. It is unlikely that another terminal will begin operations within the study area during the forecast period. Discussion with Stolt highlighted the investment that the company has made at the site in recent years. They also have expansion plans, meaning that potential throughput at the terminal will increase in the near-term. Overall, there is positive potential for petroleum products on the Thames. The forecast highlights that the base case could rise to 1,000,000 tonnes per annum - if additional capital is invested at the facility- thus leading to a higher annual throughput.

Figure 4.7 Forecast Petroleum (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.12 Forecast Petroleum CAGR by focus year

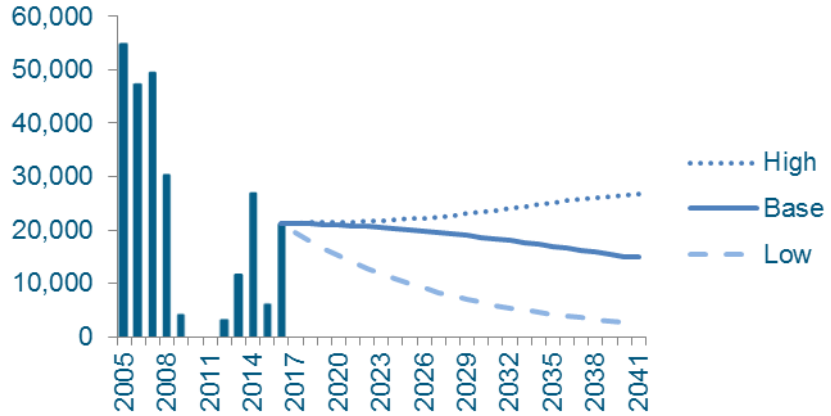
Petroleum	2016	2021	2031	2041
High	8.79%	6.29%	0.00%	0.00%
Base	8.50%	6.00%	0.00%	0.00%
Low	-2.50%	0.00%	0.00%	0.00%

(Source: Ocean Shipping Consultants)

Steel

4.86 Steel traffic on the Thames mostly refers to scrap steel/metal and amounts to approximately 20,000 tonnes (average of past 10-years). Historical data is characterised by very large fluctuations in scrap metal throughput. Forecasting future throughput for the base case is based on declining throughput. This has not been verified via interviews, as these were declined. The low case scenario is formulated using CAGR and according to this, there is potential that this trade could cease during the forecast period. However, given the large inconsistency of the data, the base case is deemed the most likely scenario.

Figure 4.8 Forecast Steel (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.13 Forecast Steel CAGR by focus year

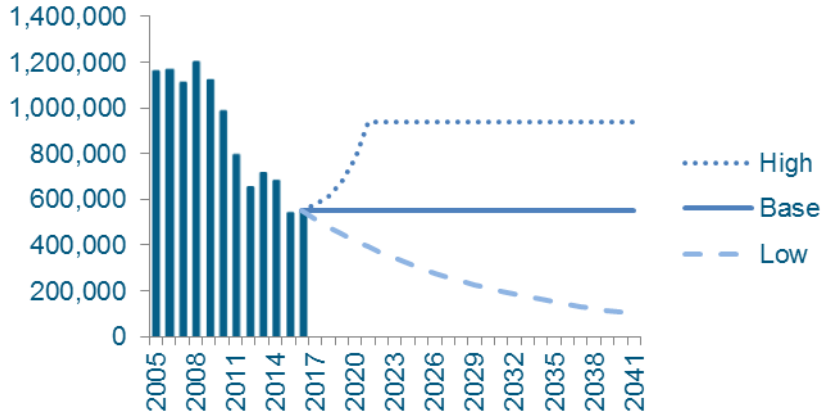
Steel	2016*	2021	2031	2041
High	21,313	0.40%	1.40%	0.80%
Base	21,313	-0.60%	-1.60%	-2.60%
Low	21,313	-8.21%	-8.21%	-8.21%

*2016 throughput for steel has been estimated as the average of the period 2005-2015, this was done due to missing values and large fluctuations to the dataset
(Source: Ocean Shipping Consultants)

Sugar

4.87 The Thames Refinery plant has undergone a downgrading of refining capacity in recent years, as an adjustment to the changing demands from the sugar market. Capacity is around 500,000t annually. However, there are two milestones that could affect the refineries throughput in the near-term. The first is the de-regulation of the sugar beet market in Europe during 2017. This is thought, due to the recent changes in the plant, not to be of major concern. The other milestone is the effects of Brexit on the UK sugar market. It is hoped that a positive exit, with more open policies, and improved customs and tariffs will benefit the plant. Potentially the plant could double its current capacity if this were to occur.

Figure 4.9 Forecast Sugar (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.14 Forecast Sugar CAGR by focus year

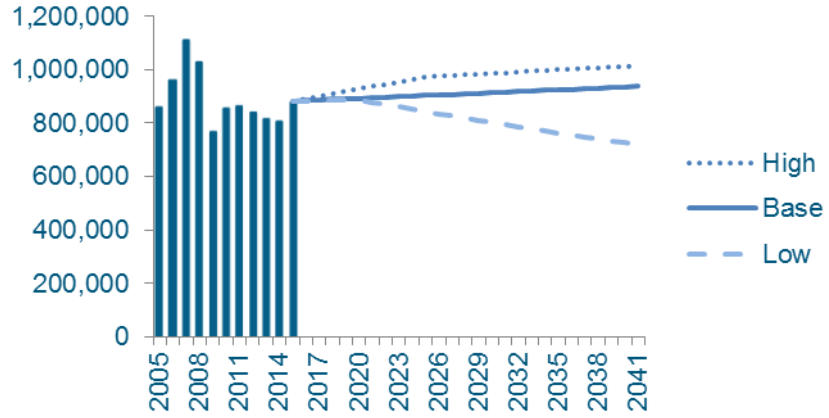
Sugar	2016*	2021	2031	2041
High	550,000	20.50%	0.00%	0.00%
Base	550,000	0.00%	0.00%	0.00%
Low	550,000	-6.60%	-6.60%	-6.60%

*2016 throughput for sugar has been estimated based on market intelligence
(Source: Ocean Shipping Consultants)

Vehicles

4.88 Vehicle traffic has been stable with a CAGR of 0.2%. This is forecasted to continue as shown in the base case scenario. Ford at Dagenham have recently invested in refurbishing the jetty and during 2015 purchased new tugs. Approximately, 300,000 vehicles per year are imported at the facility, whilst Dagenham-made diesel engines, plus eco-boost engines that are made at Bridgend are exported back to the Continent. As with sugar, the effects of Brexit could impact future throughput of vehicles.

Figure 4.10 Forecast Vehicles (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.15 Forecast Vehicles CAGR by focus year

Vehicles	2016	2021	2031	2041
High	1.00%	1.00%	0.25%	0.25%
Base	0.23%	0.23%	0.23%	0.23%
Low	0.10%	-1.00%	-1.00%	-1.00%

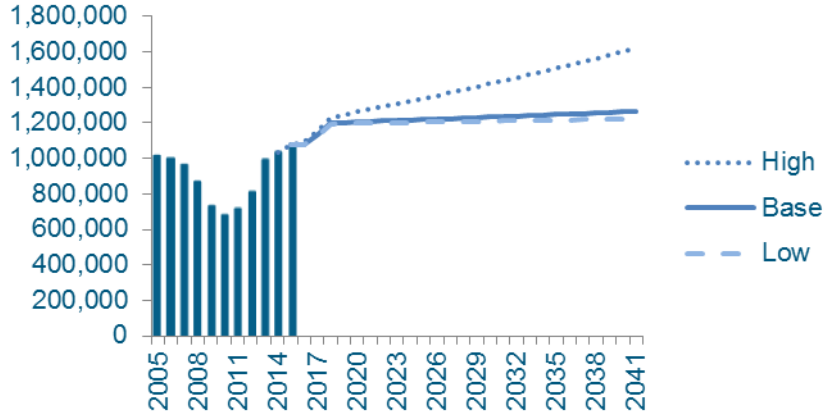
(Source: Ocean Shipping Consultants)

Waste

4.89 The outlook for waste transportation on the Thames is a positive one. There is growing interest in the movement of waste via the Thames along with increased pressure on local councils to provide sustainable ways to handle waste. The recent news that the Belvedere incinerator will be able to handle an additional 115,000t above current capacity will provide increased momentum for waste flows to the plant. Waste, which is handled on 10 safeguarded wharves, is forecast to increase throughout the study period. The base case scenario below highlights

the potential increases of capacity at the Belvedere facility in the near-term, followed by historic rate increase per annum.

Figure 4.11 Forecast Waste (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.16 Forecast Waste CAGR by focus year

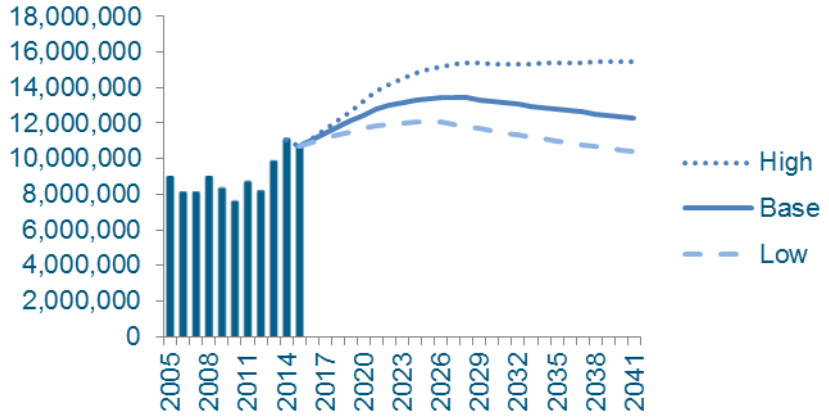
Waste**	2016	2021	2031	2041
High	1.20%	1.20%	1.20%	1.20%
Base	0.65%	0.65%	0.65%	0.65%
Low	0.10%	0.10%	0.10%	0.10%

(Source: Ocean Shipping Consultants)
**50,000 and 65,000t have been added to the forecasts for 2017 and 2018 respectively

Total

4.90 The overall trend for the amount of cargo handled is forecast to increase to 13.4m tonnes by 2027. This peak could be pushed forward if there are significant delays in the major government backed infrastructure projects. Thereafter, is it anticipated that potential building/construction projects will continue, albeit at a lower less intensive rate than seen in previous decades. By the end of the study period, overall tonnes handled are approximately 12.3m tonnes.

Figure 4.12 Forecast Total (tonnes)



(Source: Ocean Shipping Consultants)

Table 4.17 Overview of Commodity Forecast, by Case (tonnes)

Commodities	2015	2021	2031	2041
Agricultural Bulks				
High		549,583	509,728	476,336
Base	577,009	535,870	473,718	418,775
Low		522,974	416,532	331,754
Construction M				
High		8,998,686	10,229,853	10,229,853
Base	6,943,274	8,522,773	8,899,229	8,048,303
Low		8,250,386	8,245,252	7,456,858

Petroleum				
High		1,061,225	1,182,041	1,182,041
Base	686,260	1,044,215	1,044,215	1,044,215
Low		574,205	574,205	574,205
Steel				
High		21,527	23,661	26,737
Base	6,402	20,786	18,328	15,002
Low		13,890	5,900	2,730
Sugar				
High		941,454	941,454	941,454
Base	543,416	550,000	550,000	550,000
Low		391,019	197,637	99,894
Vehicles				
High		937,300	990,080	1,015,113
Base	882,979	895,421	916,549	938,175
Low		878,529	794,526	718,555
Waste				
High		1,276,565	1,438,295	1,620,515
Base	1,076,856	1,207,955	1,236,457	1,265,632
Low		1,198,729	1,210,770	1,222,933
Total				
High		13,786,340	15,315,112	15,492,048
Base	10,716,196	12,777,019	13,138,497	12,280,103
Low		11,829,733	11,444,821	10,406,927

(Source: Ocean Shipping Consultants)

Note on vacant wharves

4.91 OSC has been made aware that there are a number of wharves on which operators have submitted bids to bring wharves back into active use, but which have not been taken forward by land owners in the hope of eventually obtaining residential planning permission. This involves the following wharves:

- Hurlingham Wharf-approx. 2006, in support of potential CPO
- Peruvian Wharf-approx. 2007, in support of CPO & wharf planning application by LDA/PLA
- Convoys Wharf-approx. 2010, in support of mixed use redevelopment planning application

- Orchard Wharf-approx. 2011, in support of CPO and wharf planning application by PLA
- Cremorne Wharf-2016, in support of Counters Creek Sewer Planning application

4.92 Peruvian, Convoys and Orchard Wharves have an estimated joint capacity of 1,310,000t. It is by no means certain that these wharves will be used in the near future and therefore they are categorised as vacant in the forecasts capacity assumptions. Even though it is recognised that there could be an issue of suppressed demand, there is uncertainty regarding which commodities these wharves are going to handle if re-commissioned or if their current estimated capacity is adequate. It is also a possibility that interested parties have already transferred their business to other operating wharves and so demand is already accurately reflected in current throughput. Therefore, there are no demand adjustments made in the forecasts.

5 Capacity

5.1 This chapter looks at the capacity available at the 50 currently safeguarded wharves, by commodity group and sub region. It provides a comparison with the position URS/Scott Wilson found.

5.2 Estimating capacity is an almost impossible task, as it can be affected by so many variables. Obviously, water depth can limit the size of a vessel using a wharf restricting capacity to high tide only. Many wharves have some form of on-site processing (such as washing marine gravel). On-site processing will take up land that could otherwise be used for storing material

and on-site processing may occur at a slower rate than loading/unloading, restricting capacity. A lack of suitable transport access can increase dwell times as streets may only be suitable for smaller lorries. A wharf's size and morphology can effect on site storage capacity. Restrictions on working hours, imposed as a condition of a planning permission, to reduce the impact of noise and dust on sensitive neighbouring uses are an obvious limit on capacity, especially when high tides fall outside of normal working hours.

5.3 All of these factors make it extremely difficult to provide a totally accurate assessment of wharf capacity. The data set out in Appendix 5 and summarized in Table 5.1 and Table 5.2 is drawn from a number of sources. The Port of London Authority gives figures on the maximum throughput achieved for a number of wharves since 1995. This highpoint is taken as their capacity. If the PLA were unable to provide a capacity figure, the 2011 URS capacity figure has been used.

5.4 OSC suggests that the actual capacity of the wharves under consideration have remained relatively stable in recent years, assuming that overall throughput is an indicator of a wharfs capacity. However, an ideal and current calculation of capacity can be a 'moving target' depending if throughput oscillates from year to year. Full calculations under PIANC, where stockyard capacity, crane capacity, whether a wharf is an import or export facility can all be measured to establish the potential capacity of a site. However, this assumes these sorts of data are readily available. Therefore, capacity figures provided through the PLA and the 2011 URS report are deemed suitable and appropriate considering the scope and timescale of this study. This has led the Mayor to conclude that these capacity estimates are theoretically correct.

5.5 Appendix 6 provides the background of how to calculate capacity for a bulk facility under PIANC.

5.6 Appendix 3 shows the location of the 50 safeguarded wharves and Table 5.1 shows the estimated capacity of the wharves by sub region for 2015. Table 5.2 provides a London-wide summary by commodity group. The full detail is set out in Appendix 4. On current evidence there is no reason to expect the capacity of the wharves to change further by 2041, this point is confirmed by OCS, who advised that the current number of commodities moved on the Thames will continue to remain the focus of future trades.

5.7 OSC has been informed that wharves in the West region will be used for the movement of construction materials in the relation to the Thames Tideway Tunnel. This includes the following, currently vacant, wharves:

- Hurlingham Wharf
- Cremorne Wharf
- Middle Wharf

5.8 These have a combined estimated capacity of 467,000t. Given this information, these wharves are assumed to become active in the very near future as the project is due to start in 2017. They are therefore classified under the Construction Materials category for the purposes of demand and capacity estimations as well as the gap analysis. After the completion of the project, they are assumed to remain operational for the remainder of the forecast horizon, thus increasing the available capacity for this commodity type.

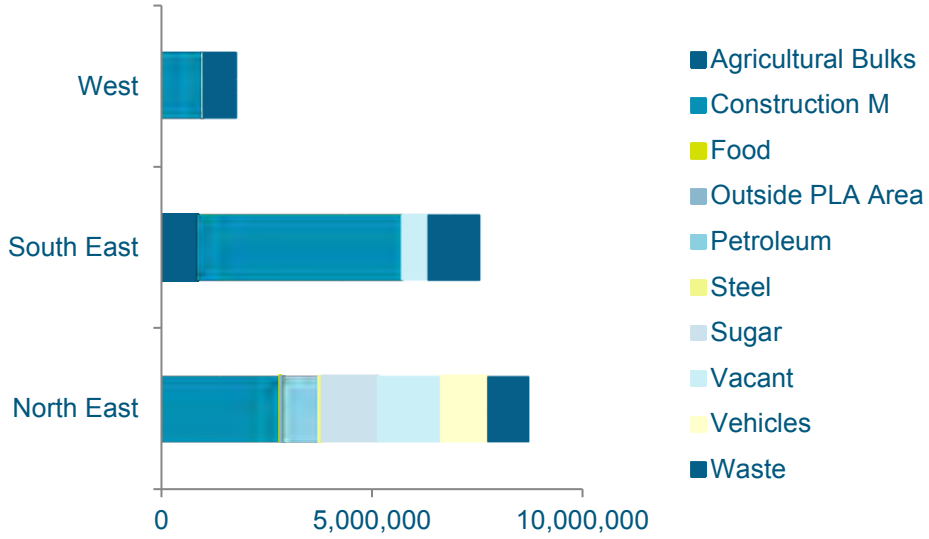
Table 5.1 Estimated Capacity of Wharves by Commodity and Sub-Region, 2015

Commodities	North East	South East	West
Agricultural Bulks	-	857,000	-
Construction M	2,804,700	4,859,000	979,000
Food	21,400	-	-
Outside PLA Area	84,000	-	-
Petroleum	819,000	-	26,900
Steel	85,000	-	-
Sugar	1,331,000	-	-
Vacant	1,493,000	612,800	
Vehicles	1,112,000	-	-
Waste	961,000	1,220,000	771,000
Total	8,711,100	7,548,800	1,777,100

%	48%	42%	10%

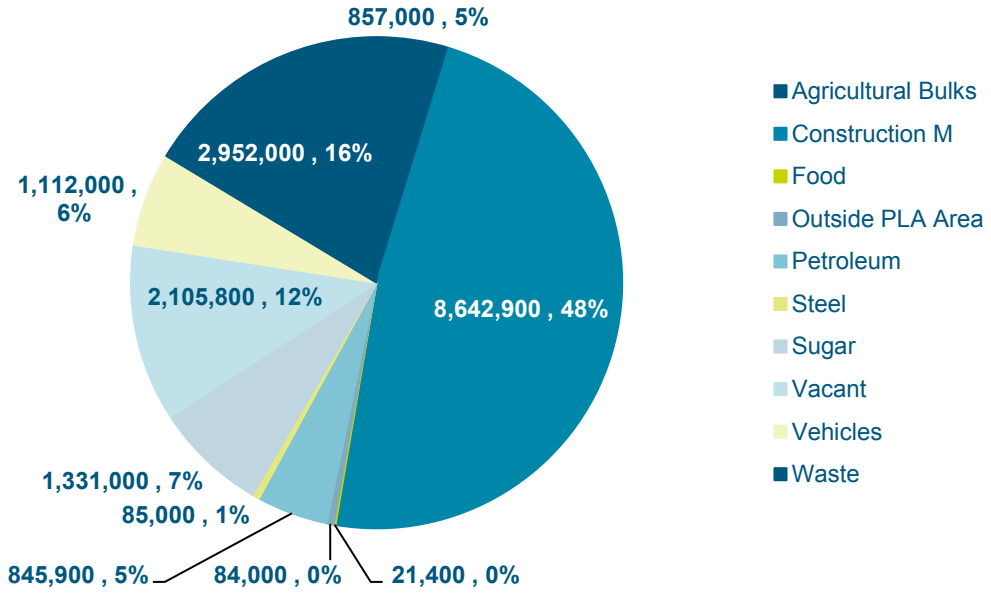
(Source: PLA 2016)

Figure 5.1 Capacity by Commodity and Area, 2015



(Source: PLA 2016)

Figure 5.2 Capacity by Commodity, 2015



(Source: PLA 2016)

Table 5.2 Estimated Capacity of Wharves by Commodity, 2015

Commodity	Tonnes	%
Construction M	8,642,900	47.9%

Waste	2,952,000	16.4%
Vacant	2,105,800	11.7%
Sugar	1,331,000	7.4%
Vehicles	1,112,000	6.2%
Agricultural Bulks	857,000	4.8%
Petroleum	845,900	4.7%
Steel	85,000	0.5%
Total	**18,037,000**	

(Source: Table 5.1)

5.9 For comparison purposes, Table 5.3 and Table 5.4 show the same information from the URS/Scott Wilson Study (further detail is provided in Appendix 5). Comparing Table 5.1 and Table 5.3 shows a small decrease in overall capacity. There is a small increase in the capacity of the west and south east sub regions. There has been a decrease in capacity in the North East sub region, leading to small overall variations in the level of capacity each sub region makes to London's overall capacity. The North East sub region still dominates, (48% of overall capacity down from 52%) just slightly less than in 2011.

Table 5.3 Estimated Capacity of Wharves by Sub region 2011

Sector	Commodity	Capacity
West	Construction Materials	443,500
	Petroleum	27,000
	Vacant	356,000
	Waste	731,500
West Sub Total		**1,558,000 (9%)**
North East	Agricultural Bulks	21,500
	Construction Materials	2,209,750
	General Cargo	66,700
	Liquid Bulks	1,015,000
	Petroleum	4,000
	Steel	279,000
	Sugar	1,500,000
	Vacant	2,278,600
	Waste	551,500
North East Sub Total		**9,476,050 (52%)**

South East	Construction Materials	4,845,800
	Liquid Bulk	889,700
	Vacant	556,000
	Waste	746,000
South East Sub Total		**7,037,500 (39%)**
London Total		**18,071,550**

(Source: PLA)

Table 5.4 Estimated Capacity of Wharves by Commodity 2011

Commodity	Tonnes	%
Construction Materials	7,499,050	41.5
Vacant	3,190,600	17.7
Waste	2,029,000	11.2
Liquid Bulks	1,904,700	10.5
Vehicles	1,550,000	8.6
Sugar	1,500,000	8.3
Steel	279,000	1.5
General Cargo	66,700	0.4
Petroleum	31,000	0.2
Agricultural Bulks	21,500	0.1
Total	**18,071,550**	

(Source: Table 5.3)

5.10 Similarly, comparing Table 5.2 and Table 5.4 reveals that there has been a small growth in the capacity for construction materials and waste and large growth for petroleum and

agricultural bulks. Vacant capacity has fallen slightly likewise Sugar and Vehicles. Steel has fallen dramatically.

5.11 Another factor to bear in mind is that some wharves are designed for specific operations or commodities whereas others are available to handle multiple commodities. Moving a wharf from dealing with a specialist commodity to general handling if that specialism ceases, may require a level of investment that makes its reuse, for what are intrinsically low value commodities (aggregates, waste) unviable.

5.12 Paragraph 5.3 above explains how these capacity estimates were derived. An alternative way to estimate capacity would be to do as follows. For those wharves for which the PLA were unable to provide a throughput figure, the PLA have a standard efficiency figure of 163 kt/ha (based on throughputs, commodity types, wharf size), this standard efficiency figure could be applied to those wharves with 'missing data' to provide a figure. This would have the advantage of providing data from one source, the PLA, rather than mixing data sources. However, the data in Table 5.5 shows the impact of using this second option on the overall capacity results.

Table 5.5 Comparative Wharf Capacity Approaches

Area	PLA 2016 + URS 2011	PLA 2016 + 163kt/Ha	Difference	% Change
Total	18,037,000	18,580,000	+543,100	+3.0
West	1,777,100	3,995,200	+2,218,100	+124.8
North East	8,711,100	7,299,600	-1,411,500	-16.2
South East	7,548,800	7,285,300	-263,500	-3.5
Selected Wharves				
Manhattan (NE)	4,000	326,000	+322,000	+8050.0
Middle (W)	70,600	1,630,000	+1,599,400	+2208.8
Mayer Parry (NE)	4,000	81,500	+77,500	+1937.5
Swedish (W)	26,900	370,400	+343,500	+1277.0
Cremorne (W)	40,500	418,000	+377,500	+932.1

Sunshine (NE)	15,000	108,700	+93,700	+624.7
Convoys (SE)	200,000	17,900	-182,100	-91.1
Peruvian (NE)	500,000	45,300	-454,700	-90.9
Town (SE)	400,000	54,300	-345,700	-86.4
Phoenix (NE)	386,000	65,200	-320,800	-83.1
Victoria Stone (NE)	460,000	81,500	-378,500	-82.3
Orchard (NE)	610,000	116,400	-493,600	-80.9

(Source: GLA 2016)

5.13 While overall the impact on London's capacity is small, only +3.0, there are wide variations between the three sub regions. In the West, where the wharves are generally small, using the standard efficiency figure results in very high capacity figures. Conversely larger wharves, mainly found in the North East sub region, end up with a much lower capacity figure. Taking this into consideration the Mayor has decided, despite its flaws, to retain the approach set out in paragraph 5.4 to capacity estimates.

6 Distribution

6.1 This chapter relates the forecast demand for wharves with the existing capacity of the wharves. In doing so, it will look at each of the three sub regions. Having a London-wide overall balance in demand and capacity for a commodity is meaningless if this is made up, for example, of a large capacity undersupply in the West sub region and a large capacity oversupply in the South East sub region.

6.2 Section 5 provides capacity by sub region whereas Section 4 provides demand by commodity. The first step is to turn the commodity figures into sub regional figures. This is shown in Table 6.1 and reveals that all sub regions experienced decline in the 2005-2010 period, probably due to the 2008/9 recession. Over the 2010-2015 period, there has been growth in all three sub regions. The data for the North East and South East sub regions shows they have enjoyed strong growth so that the 2015 figure is now above the 2005 baseline, this is especially true of the South East sub region. In the West sub region, the 2015 figure is still below the 2005 baseline but recovering from the 2010 figure.

Table 6.1 Historic Demand by Sub region 2005-2015

Sub region	2005	2010	2015	Change	% CAGR
North East	4,454,008	3,941,008	4,934,828	480,820	1.0%
South East	3,524,822	2,987,065	4,937,405	1,412,583	3.4%
West	1,113,337	665,027	843,963	269,374	-2.7%
Total	**9,092,167**	**7,593,100**	**10,716,196**	**1,624,029**	**1.7%**

(Source: URS/Scott Wilson Table 6.1 and Table 3.1 above)

6.3 Sub regional demand figures are shown below. They are based on the assumption, that if a sub region had 20% of a commodity in 2015, then it will have 20% of the 2041 total. They reveal the following sub regional patterns. In the North East sub region it is anticipated that strong growth will occur and the same pattern is found in the South East and West sub regions.

Table 6.2 Distribution of Commodities by sub region

Commodity	Total 2015	North East	South East	West
Construction Materials	6,943,274	36.1%	59.6%	4.3%
Waste	1,076,856	28.5%	20.7%	50.8%
Vehicles	882,979	100%	0%	0%
Petroleum	686,260	100%	0%	0%
Agricultural Bulks	577,009	0%	100%	0%
Sugar	543,416	100%	0%	0%
Steel	6,402	100%	0%	0%
Total	**10,716,196**	**46.1%**	**46.1%**	**7.9%**

(Source: GLA calculations)

Table 6.3 Estimated Demand by sub region 2015-2041

Sub region	2015	2041	Change	% Change	% CAGR
North East	4,934,828	5,655,010	720,182	16.2%	0.53%
South East	4,937,405	5,657,963	720,558	20.4%	0.53%
West	843,963	967,130	123,167	11.1%	0.53%
Total	**10,716,196**	**12,280,103**	**1,563,907**	**17.2%**	**0.53%**

(Source: GLA calculations)

6.4 The 2011 URS/Scott Wilson study findings of their gap analysis for the 2011-2031 period for their medium growth scenario are summarised below in Table 6.4. It reveals that, in comparison to the position in 2011, that the overall position has reduced the amount of spare capacity available. The 2011 analysis revealed that there would be a decline in the excess capacity over demand from 8.0mt in 2011 to 5.9mt by 2031.

Table 6.4 Future Demand and Capacity by Commodity by sub region 2011-2031 (mt)

	2011 Demand	2011 Capacity	2011 Gap	2031 Demand	2031 Capacity	2031 Gap
West						
Construction	0.3	0.4	0.1	0.7	0.4	-0.3
Waste	0.7	0.7	0.0	1.0	0.7	-0.3
Others	0.0	0.0	0.0	0.0	0.0	0.0
Vacant	0.0	0.4	0.4	0.0	0.4	0.4
Sub Total	1.0	1.5	0.5	1.7	1.5	-0.2
North East						
Construction	2.2	2.2	0.0	3.3	2.2	-1.1
Waste	0.3	0.6	0.3	0.3	0.6	0.3
Others	2.7	4.4	1.7	2.3	4.4	2.1
Vacant	0.0	2.3	2.3	0.0	2.3	2.3
Sub Total	5.2	9.5	4.3	5.9	9.5	3.6

South East						
Construction	3.2	4.9	1.7	3.5	4.9	1.4
Waste	0.0	0.8	0.8	0.9	0.8	-0.1
Others	0.6	0.8	0.2	0.8	0.8	0.0
Vacant	0.0	0.6	0.6	0.0	0.6	0.6
Sub Total	3.8	7.1	3.3	5.2	7.1	1.9
Total	**10.1**	**18.1**	**8.0**	**12.2**	**18.1**	**5.9**

(Source: URS/Scott Wilson Study 2011 Table 5.2)

6.5 Now that there are estimates of demand by sub region it is now possible to undertake a gap analysis. This will highlight where there are surpluses or deficits in capacity to handle the expected change in demand for 2041 and is discussed in the following section.

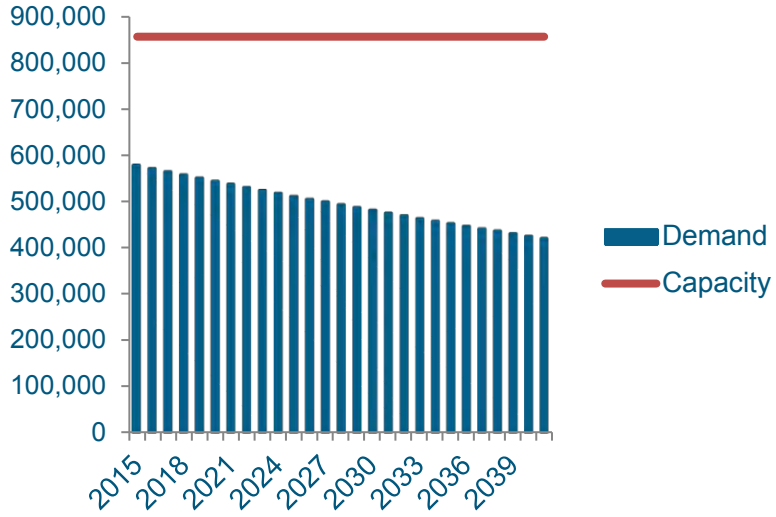
Gap Analysis by Commodity

6.6 The gap analysis is provided by highlighting the current capacity of the combined wharves that handle each product. It is assumed that the capacity of each commodity will remain at current levels throughout the forecast period. This is then compared to the forecast demand for each commodity over the forecast period.

Agricultural Bulks

6.7 The overall trend within the forecast for agricultural bulks is one of slow and sustained decline. Overall the gap between total wharf capacity and demand will decline from 67% of capacity to 49% by the end of the study period.

Figure 6.1 Gap Analysis-Agricultural Bulks (tonnes)

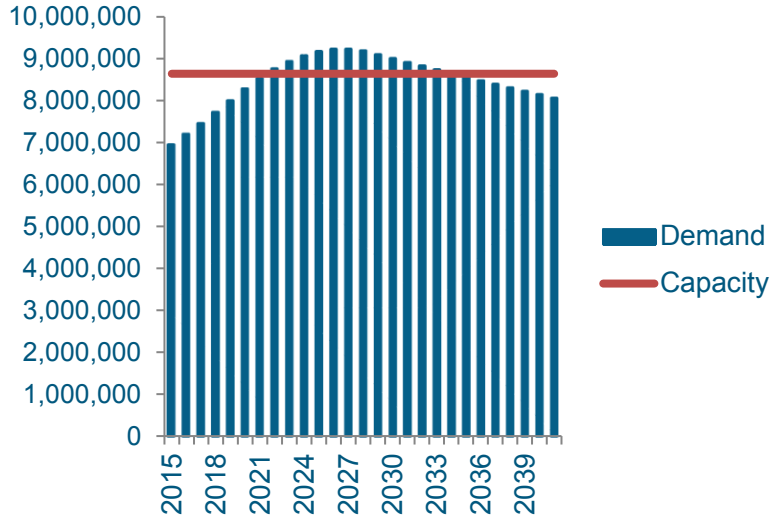


(Source: Ocean Shipping Consultants)

Construction Materials

6.8 There is a positive trend within the construction materials sector, in which by 2022, there could be more demand than current calculated capacity. Demand is forecast to peak at 106% of current capacity by 2026. It is thereafter forecast to decline to 93% of capacity by the end of the study period. The overall capacity could be aligned with demand as wharves (and their operators) re-arrange and re-develop their workflows within their wharves, through more efficient material handling and processing, more efficient equipment and even more frequent loading/unloading of material from vehicles.

Figure 6.2 Gap Analysis-Construction Materials (tonnes)

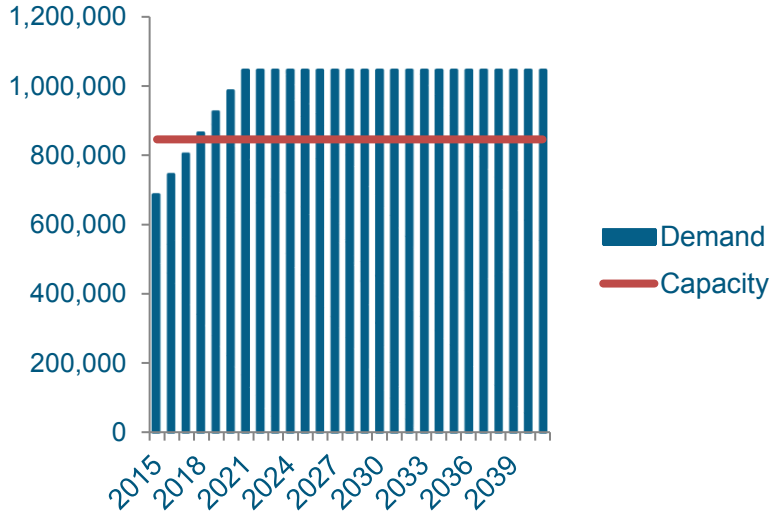


(Source: Ocean Shipping Consultants)

Petroleum

6.9 Current capacity is pegged at approximately 0.8 mt This could potentially increase to 1m tonnes. This would require additional storage capacity, however, the timescale is unclear as to when or if this will occur. Therefore, overall capacity if forecast to increase to 123% of current capacity, however, this may reach 100% if overall capacity is increased in the near future.

Figure 6.3 Gap Analysis-Petroleum (tonnes)

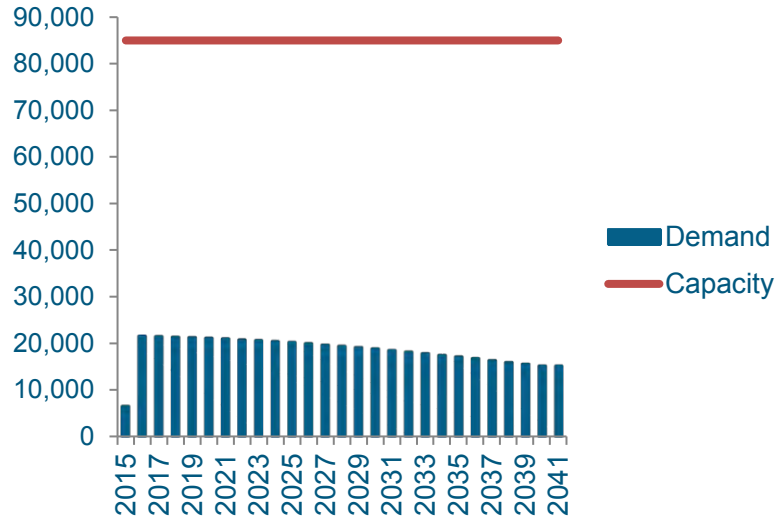


(Source: Ocean Shipping Consultants)

Steel

6.10 There is a relatively small trade in steel products on the Thames. Overall, demand accounts for only 25% of capacity. This is forecast to decline to 18% by the end of the forecast period.

Figure 6.4 Gap Analysis-Steel (tonnes)

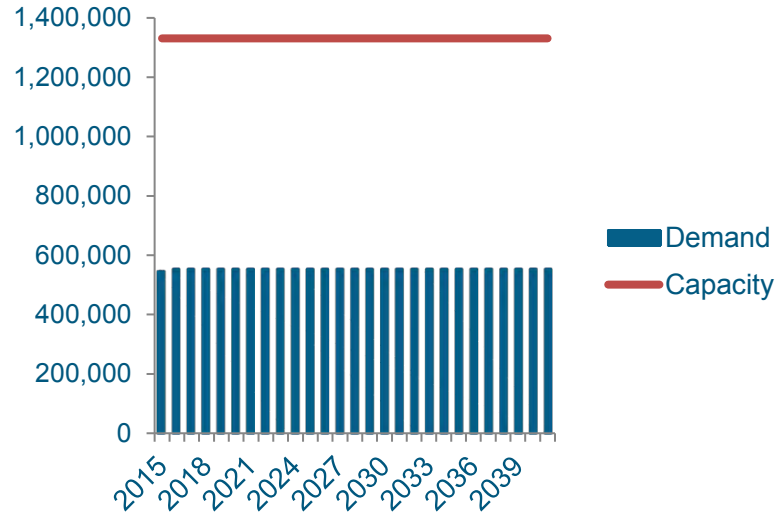


(Source: Ocean Shipping Consultants)

Sugar

6.11 Under the base case, forecast sugar demand is anticipated to remain at approximately 0.5 mt per year throughout the study period. This accounts for approximately 41% of capacity.

Figure 6.5 Gap Analysis-Sugar (tonnes)

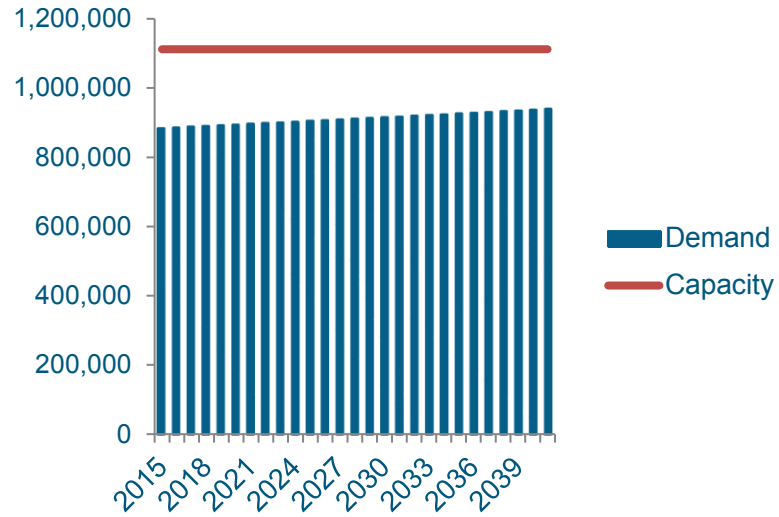


(Source: Ocean Shipping Consultants)

Vehicles

6.12 Trends within the vehicle sector suggest that there could be growing demand during the forecast period. Currently demand is approximately 80% of capacity. This is forecast to increase to 84% by 2041.

Figure 6.6 Gap Analysis-Vehicles (tonnes)

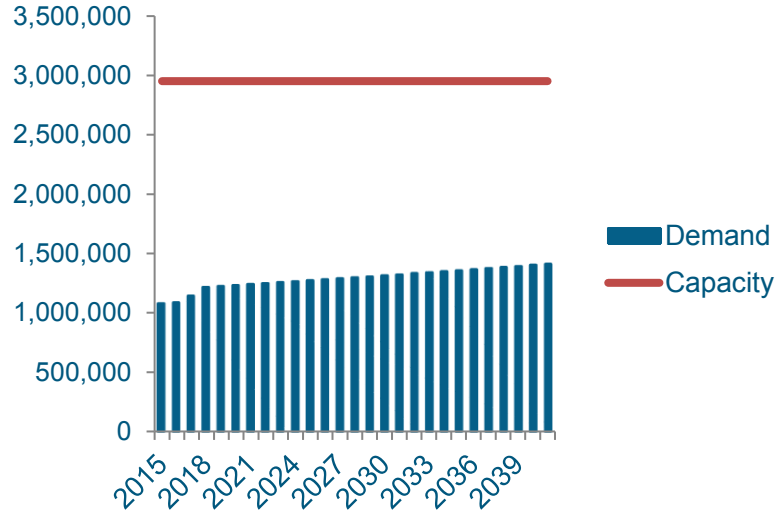


(Source: Ocean Shipping Consultants)

Waste

6.13 The overall trend within the waste sector is one of gradual increase. Overall the gap between total wharf capacity and demand is forecast to increase form 36% currently, to 48% by 2041.

Figure 6.7 Gap Analysis-Waste (tonnes)

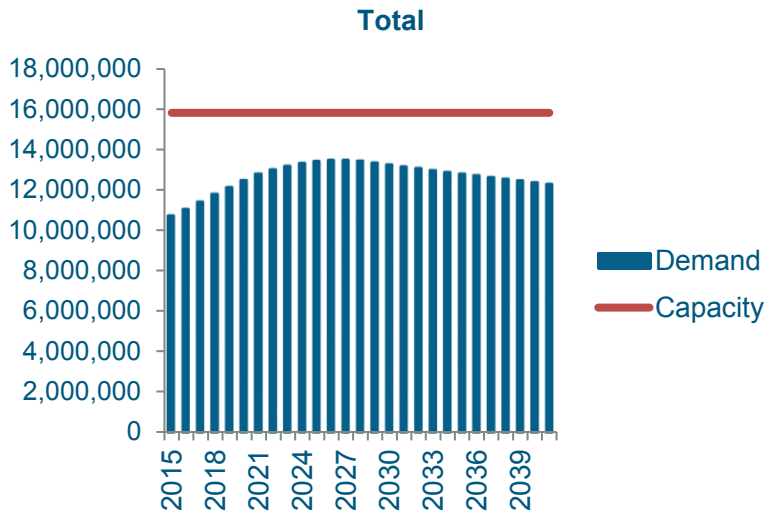


(Source: Ocean Shipping Consultants)

Total

6.14 The overall wharf capacity is approximately 15.8 mt, of which, current total demand accounts for 70% of overall capacity. This figure does not include vacant wharves as they cannot be assigned to any particular commodity. The total demand for all commodities under consideration is forecast to increase through to 2026, which will equate to 85% of current capacity. Thereafter, overall demand is forecast to decline resulting in capacity demand of 78%.

Figure 6.8 Gap Analysis-Total (tonnes)



(Source: Ocean Shipping Consultants)

Gap Analysis by Sub-Region

6.15 The commodity gap analysis highlights the potential gap (in most cases) between the demand for commodities and the capacity of the wharves that handle the commodities. On a regional basis, the capacity has been calculated, along with the associated commodity demand within each sub-region. The gap between commodity totals and the overall capacity is highlighted by region below.

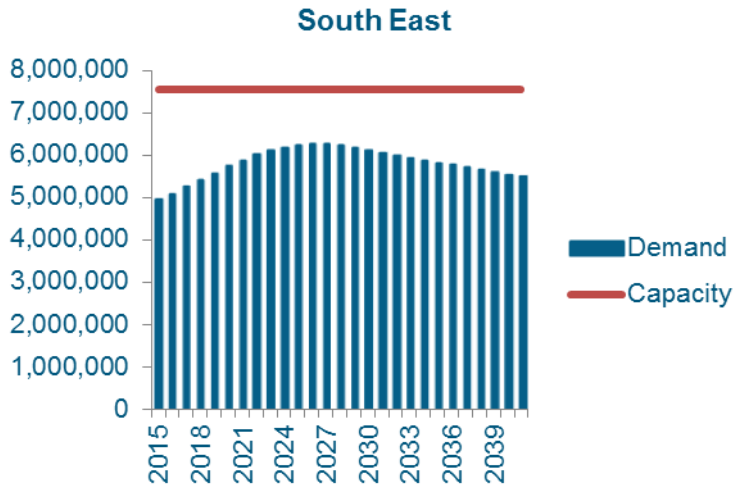
6.16 Demand within the West sub-region is forecast to increase from approximately 0.8 mt currently to 1.0 mt by 2028. This is followed by a decline to 0.9 mt by the end of the study period. The West sub-region has the lowest demand compared to capacity at 47.5% in 2015. This is forecast to increase to 57.2% of capacity by 2028. Thereafter overall demand is forecast to decline to 55.5% of the regions capacity. This translates in to a decline in overall capacity from 0.9 mt in 2015 to 0.8 mt by 2041.

Figure 6.9 Gap Analysis-West (tonnes)

(Source: Ocean Shipping Consultants)

6.17 Demand within the South East is forecast to increase from 4.9 mt currently to 6.2 mt by 2028. Thereafter it is forecast to decline to 5.5 mt by 2041. The current capacity usage is 65%. This is forecast to increase to 82.3% by 2028. Demand is then forecast to decline to 72.6% of capacity by 2041. This translates in to a decline in overall capacity from 2.6 mt in 2015 to 2.1 mt by the end of the study period.

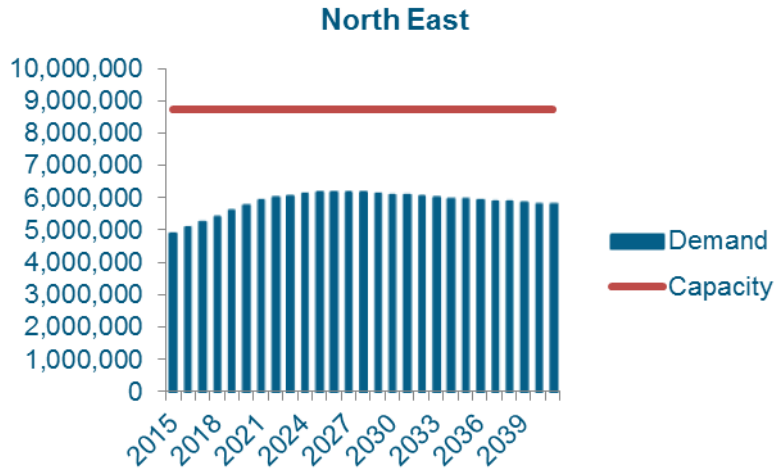
Figure 6.10 Gap Analysis-South East (tonnes)



(Source: Ocean Shipping Consultants)

6.18 Demand in the North East is forecast to increase from 4.9 mt currently to 6.19 mt by 2028. By the end of the study period demand is forecast to decline to 5.8 mt. This translates currently to 57% of capacity. This is set to increase to 71% by 2028. Thereafter, demand is forecast to decline to 67% of capacity by the end of the study period. This translates in to a decline in overall capacity from 3.8 mt in 2015 to 2.9 mt by the end of the study period.

Figure 6.11 Gap Analysis-North East (tonnes)



(Source: Ocean Shipping Consultants)

6.19 Table 6.5 below highlights both commodity and capacity by sub region and the potential capacity gap. However, this excludes vacant wharves as these are not assigned a commodity, and the handling of food at Halfway Wharf which stopped in 2006.

Table 6.5 Future Demand and Capacity* by Commodity and sub region 2015-2041 (mt)

Area	2015	2021	2031	2041
West				
Construction M				
Demand	296,914	364,458	380,556	344,168
Capacity	979,200	979,200	979,200	979,200
Gap	682,286	614,742	598,644	635,032
Waste				
Demand	547,049	613,648	628,127	642,948
Capacity	771,000	771,000	771,000	771,000
Gap	223,951	157,352	142,873	128,052
Petroleum				
Demand	-	-	-	-
Capacity	26,900	26,900	26,900	26,900
Gap	26,900	26,900	26,900	26,900
South East				
Agricultural Bulks				
Demand	577,009	535,870	473,718	418,775
Capacity	857,000	857,000	857,000	857,000
Gap	279,991	321,130	383,282	438,225
Construction M				
Demand	4,137,624	5,078,876	5,303,213	4,796,131
Capacity	4,859,000	4,859,000	4,859,000	4,859,000
Gap	721,376	- 219,876	- 444,213	62,869
Waste				
Demand	222,772	249,893	255,789	261,825
Capacity	1,220,000	1,220,000	1,220,000	1,220,000
Gap	997,228	970,107	964,211	958,175
North East				
Construction M				
Demand	2,508,736	3,079,439	3,215,460	2,908,004
Capacity	2,804,700	2,804,700	2,804,700	2,804,700
Gap	295,964	-274,739	-410,760	- 103,304
Petroleum				
Demand	686,260	1,044,215	1,044,215	1,044,215
Capacity	819,000	819,000	819,000	819,000
Gap	132,740	-225,215	- 225,215	- 225,215
Steel				
Demand	6,402	20,786	18,328	15,002
Capacity	85,000	85,000	85,000	85,000
Gap	78,598	64,214	66,672	69,998
Sugar				
Demand	543,416	550,000	550,000	550,000
Capacity	1,331,000	1,331,000	1,331,000	1,331,000

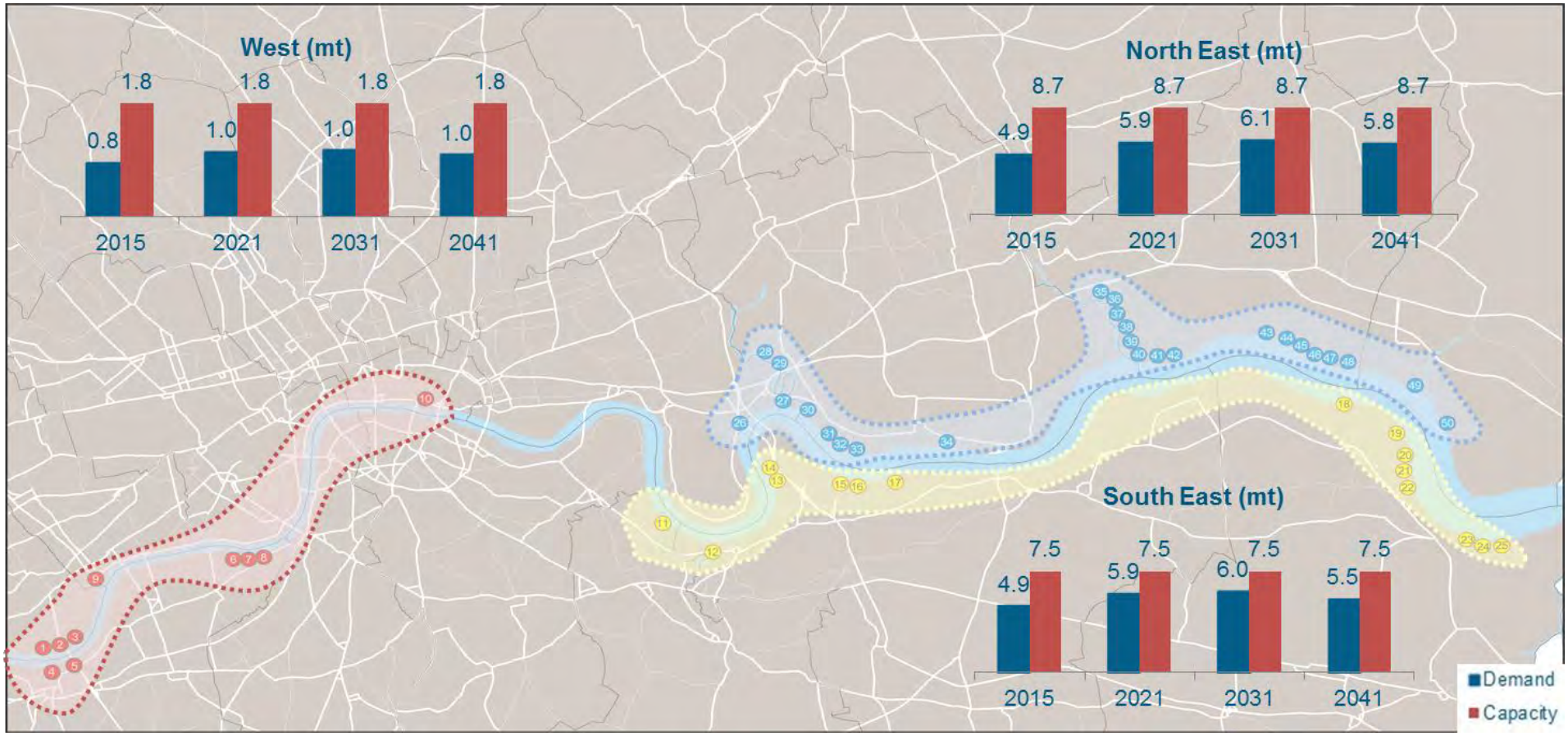
Gap	787,584	781,000	781,000	781,000
Vehicles				
Demand	882,979	895,421	916,549	938,175
Capacity	1,112,000	1,112,000	1,112,000	1,112,000
Gap	229,021	216,579	195,451	173,825
Waste				
Demand	307,035	344,414	352,541	360,859
Capacity	961,000	961,000	961,000	961,000

* Excludes vacant wharves
(Source: Ocean Shipping Consultants)

6.20 Figure 6.12 highlights the overall demand and capacity in each region through to 2041. These include current capacity assumptions for all wharves in each area, both operational and vacant as provided by the PLA.

6.21 In their examination of the gap analysis OSC advised that there is sufficient capacity to handle the forecast demand increases during the study period. On an aggregated sub-regional basis there is sufficient capacity to accommodate the increase in demand. However, in the near-term there could be concerns with both construction materials and petroleum that are forecast to have higher demand than capacity.

Figure 6.12 Future Demand & Capacity by Sub-Region 2015-2041 (mt)*



*Including current vacant wharves

7 Conclusions

7.1 This chapter summarises the findings of this report.

7.2 At all levels of Government, national, regional and local there is strong policy support for the sustainable movement of freight by water. Given the number of clear policy steers contained in multiple policy documents, it would be perverse of the Mayor to ignore this support.

7.3 There is no one obvious way to forecast future demand for wharf activities. A number of approaches are available. Given that London's economy is different from that of the rest of the UK economy and that wharf activity tends to relate to specific sectors of the economy, expected to decline, conventional forecasting methods are not helpful.

7.4 OSC have advised the Mayor that given the structural trends in shipping the commodity groups forecast in 2010 will be the same ones that should be forecast forward to 2041.

7.5 One long-standing forecasting method is to assume past behaviour guides future performance. This approach has been adopted for most of the commodity groupings. However, there are a number of policy interventions open to the Mayor and it is assumed that, based on the experience of Crossrail and the Lea Tunnel, there could be an increased use of the river for the movement of CD&E waste from future infrastructure projects such as tube line extensions and major rail schemes like Crossrail 2. Obviously, if these infrastructure projects are not progressed or the levels of movement by water are not achieved then the forecasts will need to be revised.

7.6 Overall, freight on the Thames is forecast to increase from 10.7mt in 2015 to 13.4mt by 2028, before declining to 12.3 mt by 2041. This compound annual rate of change of 0.69% masks large variations between commodity groups. Most commodities are forecast to grow with agricultural bulks and steel forecast to decline during the forecast period at over -1.7% and -4.9% CAGR respective. In 2011 URS/Scott Wilson found a compound annual growth rate of 21%, on their medium forecast which is above the most recent forecast.

7.7 Capacity is estimated at 18.1mt for 2015, this is the same as in 2011. Overall, there is sufficient capacity to deal with forecast demand. Looking at the spatial distribution of this demand and capacity over the three sub regions, north east, south east and west reveals the following patterns.

7.8 In the North East sub region there is likely to be an oversupply of capacity, this is likely to fall from over 3.8mt in 2015 to 2.9mt by 2041.

7.9 In the South East sub region there is likely to be a decline in over capacity down from 2.6 mt in 2015 to 2.1mt by the end of the study period.

7.10 In the West sub-region there is likely to be a decline in over capacity from 0.9 mt in 2015 to 0.8 mt by 2041.

Appendices

Appendix 1 – List of Contacts for this study

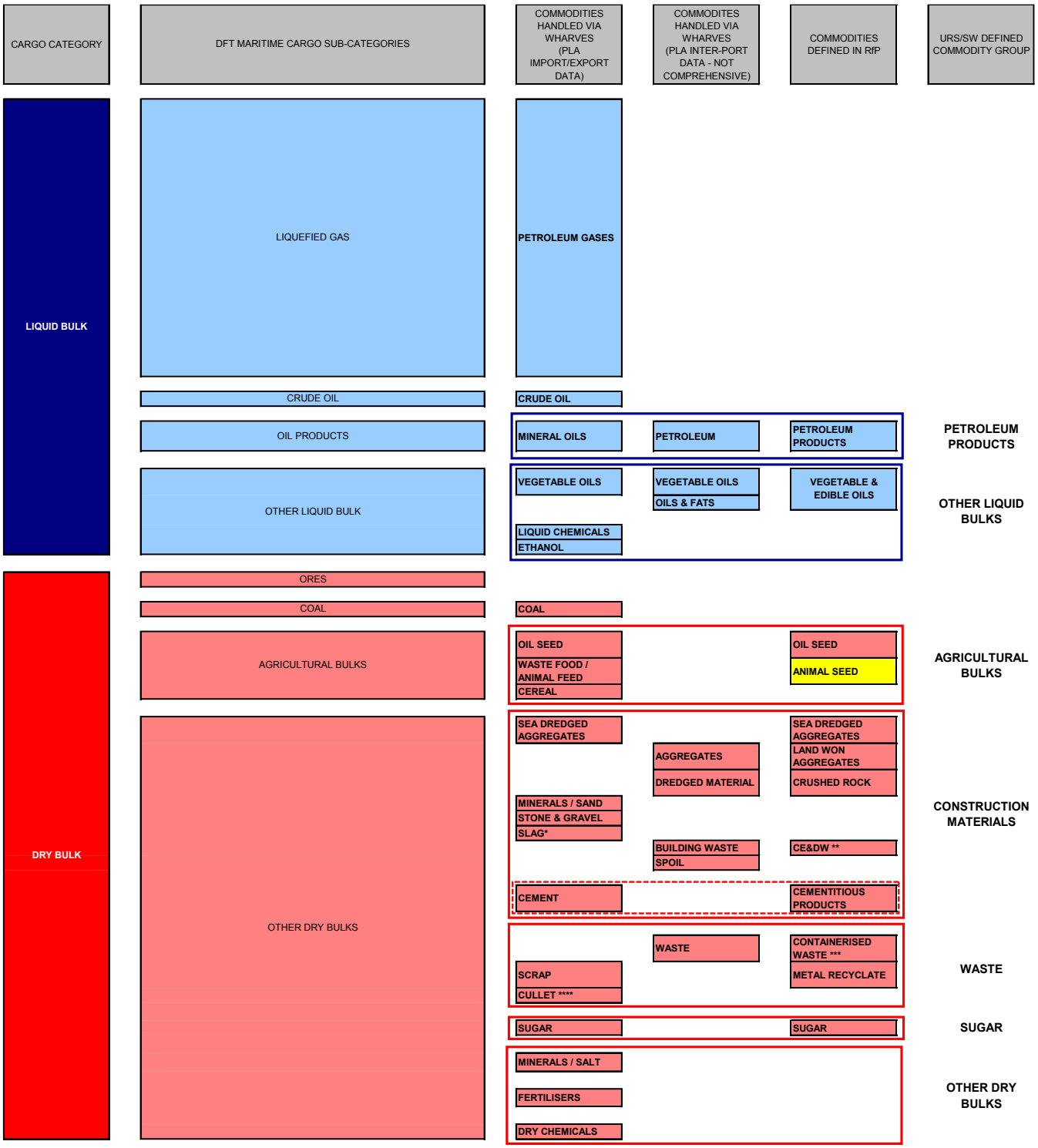
Companies that provided information

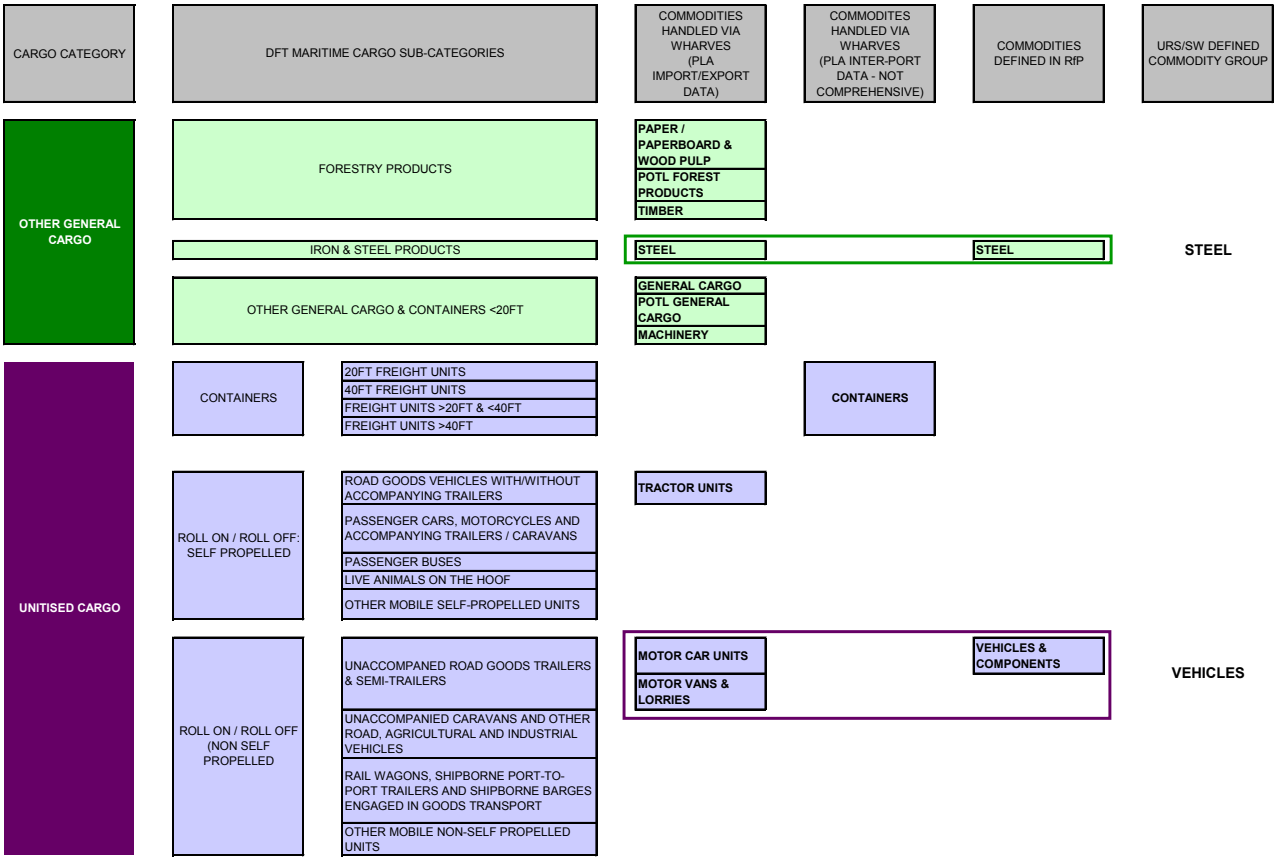
1) Segio Almeida - Stolthaven Dagenham Ltd
2) Gerald Mason – Tate & Lyle
3) Peter Ward – London Construction Link
4) David Rumbles - Bywater

Companies contacted but unable to provided information

1) ADM Oilseed Processing Plant
2) ADM Pura Foods Ltd
5) ELG Haniel Metals Ltd.

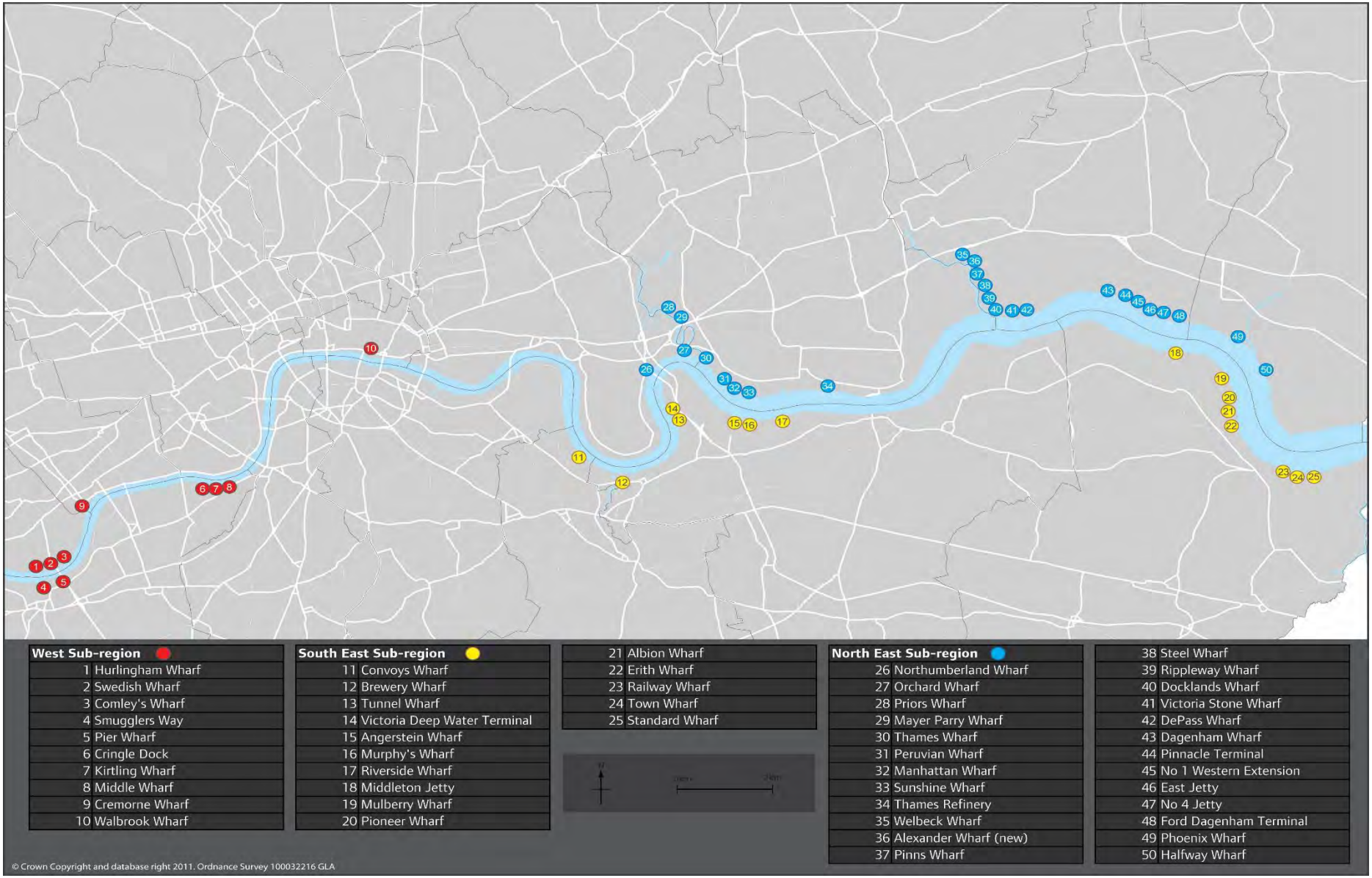
Appendix 2 – Commodity Classifications – taken from URS/Scott Wilson Study 2011 Fi





* *BY-PRODUCT OF METAL MANUFACTURE, PRIMARY USES IN CONSTRUCTION SECTOR*
** CE&DW = CONSTRUCTION, EXCAVATION & DEMOLITION WASTE
*** IF CONTAINERISED WOULD BE CATEGORISED BY DFT AS "AS OTHER GENERAL CARGO & CONTAINERS <20FT"
**** *CULLET = GLASS TO BE RECYCLED*

Appendix 3 – Map of Currently Safeguarded Wharves



Appendix 4-List of Wharfs and their location and cargo

Wharf No.	Wharf	Area	Cargo
1	Hurlingham Wharf	West	Construction M
2	Swedish Wharf	West	Petroleum
3	Comleys Wharf	West	Construction M
4	Smugglers Way	West	Waste
5	Pier Wharf	West	Construction M
6	Cringle Dock	West	Waste
7	Kirtling Wharf	West	Construction M
8	Middle Wharf	West	Construction M
9	Cremorne Wharf	West	Construction M
10	Walbrook Wharf	West	Waste
11	Convoys Wharf	South East	Vacant
12	Brewery Wharf	South East	Construction M
13	Tunnel Wharf	South East	Vacant
14.1	Victoria Deep Water	South East	Construction M
14.2	Victoria Deep Water	South East	Construction M
15	Angerstein Wharf	South East	Construction M
16	Murphy's Wharf	South East	Construction M
17	Riverside Wharf	South East	Construction M
18	Middleton Jetty	South East	Waste
19	Mulberry Wharf	South East	Vacant
20	Pioneer Wharf	South East	Construction M
21	Albion Wharf	South East	Agricultural Bulks
22	Erith Wharf	South East	Construction M
23	Railway Wharf	South East	Vacant
24	Town Wharf	South East	Waste
25	Standard Wharf	South East	Vacant
26	Northumberland	North East	Waste
27	Orchard Wharf	North East	Vacant
28	Priors Wharf	North East	Outside PLA Area
29	Mayer Parry Wharf	North East	Outside PLA area
30	Thames Wharf	North East	Construction M
31	Peruvian Wharf	North East	Vacant
32	Manhattan	North East	Vacant
33	Sunshine Wharf	North East	Vacant
34	Thames Refinery	North East	Sugar
35	Welbeck Wharf	North East	Vacant
36	Alexander Wharf	North East	Waste
37	Pinns Wharf	North East	Waste
38	Steel Wharf	North East	Steel
39	Rippleway Wharf	North East	Construction M
40	Docklands Wharf	North East	Waste

41	**Victoria Stone**	**North East**	**Construction M**
42	**DePass Wharf**	**North East**	**Vacant**
43	**Dagenham Wharf**	**North East**	**Construction M**
44	**Pinnacle Terminal**	**North East**	**Petroleum**
45	**No.1 Western**	**North East**	**Construction M**
46	**East Jetty**	**North East**	**Waste**
47	**No.4 Jetty**	**North East**	**Construction M**
48	**Ford Dagenham**	**North East**	**Vehicles**
49	**Phoenix Wharf**	**North East**	**Waste**
50	**Halfway Wharf**	**North East**	**Food**

Appendix 5 – Capacity Estimates by Wharf 2015 and 2011

Table A4.1 Capacity Estimates by Wharf 2015

Sub region	Commodity	Wharf	Capacity	Group total
West	**Aggregates**	**Comleys**	**58,100**	
		Pier	**227,000**	
		Kirtling	**227,000**	**512,100**
	Petroleum	**Swedish**	**26,900**	**26,900**
	Vacant	**Hurlingham**	**356,000**	
		Middle	**70,600**	
		Cremorne	**40,500**	**467,100**
	Waste	**Smugglers Way**	**319,000**	
		Cringle Dock	**342,000**	
		Walbrook	**110,000**	**771,000**
Sub total				**1,777,100**
South East	**Aggregates**	**Brewery**	**137,000**	
		Victoria Deep Water	**779,000**	
		Angerstein	**1,046,000**	
		Murphy's	**1,956,000**	
		Riverside	**95,000**	
		Pioneer	**477,000**	
		Erith	**369,000**	**4,859,000**
	Agricultural	**Albion**	**857,000**	**857,000**
	Vacant	**Convoys**	**200,000**	
		Tunnel	**116,000**	
		Mulberry	**56,800**	
		Standard	**140,000**	**612,800**
	Waste	**Middleton**	**820,000**	
		Town	**400,000**	**1,220,000**
Sub total				**7,548,000**
North East				
	Aggregates	**Thames**	**104,000**	
		Rippleway	**66,700**	
		Victoria Stone	**460,000**	
		Dagenham	**399,000**	
		No.1 Western	**212,000**	
		No.4 Jetty	**1,563,000**	**2,804,700**
	Petroleum	**Pinnacle**	**819,000**	**819,000**
	Steel	**Steel**	**85,000**	**85,000**
	Sugar	**Thames Refinery**	**1,331,000**	**1,331,000**
	Vacant	**Orchard**	**610,000**	
		Priors	**80,000**	
		Mayer Parry	**4,000**	
		Peruvian	**500,000**	
		Manhattan	**4,000**	
		Sunshine	**15,000**	
		Welbeck	**194,000**	
		DePass	**170,000**	
		Phoenix	**386,000**	
		Halfway	**21,400**	**1,984,000**
	Vehicles	**Ford Dagenham**	**1,112,000**	**1,112,000**
	Waste	**Northumberland**	**115,000**	
		Alexander	**12,000**	
		Pinns	**206,000**	
		Docklands	**131,000**	
		East Jetty	**111,000**	**575,000**
Sub total				**8,711,100**
Total				**18,037,000**

Table A4.2 – Capacity Estimates by Wharf 2011

Sub Region	Comodity Group		Wharf	Annual Capacity (tonnes) Wharf	Commodity Group Total
West	vacant	1	hurlingham	356,000	**356,000**
	petroleum	2	swedish	27,000	**27,000**
	waste	4	western riverside waste	319,000	
		6	cringle dock	295,000	
		9	cremorne	40,500	
		10	walbrook	77,000	**731,500**
	construction materials	3	RMC Fulham	58,000	
		5	pier	115,000	
		7	metro greenham	200,000	
		8	RMC vauxhall	70,500	**443,500**
	Subtotal West Region				**1,558,000**
North East	vacant	27	orchard	610,000	
		28	priors	80,000	
		29	mayer parry canning town	4,000	
		31	peruvian	500,000	**2,278,600**
		38	debden	238,600	
		41	victoria stone	460,000	
		49	frog island	386,000	
	petroleum	32	manhattan	4,000	**4,000**
	liquid bulks	33	sunshine	15,000	**1,015,000**
		44	thunderer jetty	1,000,000	
	agri bulks	50	tilda rice	21,500	**21,500**
	waste	26	northumberland	100,000	
		30	thames wharf	101,000	**551,500**
		36	pinns	220,000	
		40	docklands	130,500	
	construction materials	42	de pass	170,000	
		43	cemex dagenham	348,000	
		45	eurovia roadstone	180,400	**2,209,750**
		46	van dalen	111,350	
		48	hanson aggregates	1,400,000	
	sugar	34	thames refinery cairn	1,500,000	**1,500,000**
	steel	35	welbeck	194,000	**279,000**
		37	kierbech steel	85,000	
	vehicles	47	ford	1,550,000	**1,550,000**
	timber	39	rippleway	66,700	**66,700**
	North East Subtotal				**9,476,050**
South East	vacant	11	convoys	200,000	
		13	tunnel glucose	116,000	**556,000**
		23	RMC railway	100,000	
		25	standard	140,000	
	liquid bulk	21	albion	889,700	**889,700**
	waste	18	borax manor	690,000	**746,000**
		24	mayer parry erith	56,000	
	construction materials	12	brewery	150,000	
		14	victoria deep water	349,000	
		15	angerstein	1,300,000	
		16	murphys	2,000,000	**4,845,800**
		17	riverside	90,000	
		19	mulberry	56,800	
		20	pioneer	500,000	
		24	RMC erith	400,000	
	South East Subtotal				**7,037,500**
London Total	vacant				**3,190,600**
	petroleum				**31,000**
	liquid bulk				**1,904,700**
	agri bulk				**21,500**
	construction materials				**7,499,050**
	waste			*see note below	**2,029,000**
	sugar				**1,500,000**
	steel				**279,000**
	vehicles				**1,550,000**
	timber				**66,700**
	London Total				**18,071,550**

(Source: PLA)

Appendix 5

Pianc

A useful and recent reference for the planning of bulk handling material port facilities are the PIANC MarCom Report no. 158, where most of the numbers below are taken.

The handling capacity of solid dry bulk terminals is the minimum of two estimates:

- The berth annual handling capacity which relates to the
  - Number of cranes
  - Crane 'effective' handling rate and
  - The maximum practical berth occupancy
- The stockyard annual handling capacity which depends on a number of operational and physical factors, such as:
  - Whether the facility is for import or export
  - Segregation of the material by customer/ type/ grade
  - Seasonal peaking considerations or fluctuations in the vessel schedules that require a larger buffer
  - Net available area for stacking
  - Material density and angle of repose, or effective height
  - Type of storage (open, walled, covered, silos, etc.) and storage equipment
  - Stockpile turnover time

PIANC 158 has section 6 has detailed formulas for the calculation of berth and stockyard capacities, as functions of the above parameters.
When detailed information about the terminals are missing one can use rules of thumb to get an order of magnitude estimate of terminal capacity.
Such are:

- For Stockyard capacity:
  - Given the net area of the stockyard, the effective height for storage of the material and its density, estimate the static storage capacity
  - Typically assuming 20 turnarounds/ year, the annual storage capacity of the terminal is 20*static capacity or conversely:
    - For import terminals the yard has storage for 5-10% of the annual berth handling volume
    - For export terminals, the yard has storage for 10-25% of the annual berth handling volume
- For Berth handling capacity:
  - Number of cranes x effective handling rate x the berth occupancy at capacity x working hours in a year
  - The effective handling rate is the rate with which a crane can unload a whole vessel given as a percentage of the crane rated handling capacity

Berth occupancy is the maximum percent of hours that the berth can work to maintain a certain level of service for the ships and avoid long waiting times for the arriving ships.

[i] https://pla.co.uk/About-Us/The-Thames-Vision
[ii] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537578/Call_for_ideas.pdf
[iii] https://www.gov.uk/government/collections/river-basin-management-plans-2015#thames-river-basin-district-rbmp-2015