



Marine Aggregates Study

Final Report

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EXECUTIVE SUMMARY

Introduction

URS Infrastructure and Environment UK Limited (URS) has been appointed by Leeds City Council¹ to undertake a study of the potential to deliver a larger supply of marine aggregates into the Yorkshire and Humber region. Any such increase would help address concerns relating to the long-term security of supply from traditional land won sources of sand and gravel raised by Mineral Planning Authorities (MPAs) in the region and related environmental concerns.

The study has been undertaken in three stages, namely:

Stage 1 - Desk based study and initial report;

Stage 2 – Stakeholder consultation; and

Stage 3 – Final reporting.

This document is the final report and concludes Stage 3 of the study.

The findings of Stage 1 of the study were reported to the project steering group in June 2013. Stage 2 was undertaken during August and September 2013 and included focus group stakeholder workshops organised by URS. Each workshop included a summary presentation of the findings reached in the Stage 1 report.

Stage 1 addressed the following key issues:

1. the future availability of the marine aggregate resource in the Humber dredging area (and other relevant areas), its suitability as a partial substitute for land won concreting sand and gravel and the constraints which apply to the amount which can be landed;
2. the potential for a significant increase in the supply (up to an indicative target of two million tonnes per annum) of marine aggregate into the Yorkshire and Humber region; and
3. the availability and indicative capacity of existing and any currently planned infrastructure needed to support delivery of marine aggregate into the Yorkshire and Humber region.

The consultation undertaken at Stage 2 enabled the Stage 1 findings to be tested through discussion with stakeholders. Separate workshops were held with three stakeholder groups:

- i. minerals industry and operators;
- ii. policy makers and regulators; and
- iii. transport representatives.

Stage 2 provided greater focus to the issue of 'deliverability', by raising a series of questions for each group to consider. The common objective was to establish if a

¹ The study was funded by Leeds City Council, North Yorkshire County Council, East Riding of Yorkshire Council (and other local authorities in the region), The Mineral Products Association and the Crown Estate, all of whom sat on the study steering group and approved this final report.

consensus could be reached on i) the scale of contribution that could be made, ii) timing, iii) the barriers and means of overcoming them, and iv) the economic factors.

Summary of Findings

Suitability and Availability

The main products derived from marine aggregates are fine aggregates (fine and coarse sands) and coarse aggregates (gravel). Of primary concern to the industry in the region is the availability of coarse sand for use in concrete (its primary use), also referred to as 'concreting sand'.

Quality

Marine aggregate is required to meet the same quality standards as land won sand and gravel. By virtue of their similar geological origins and composition, the aggregate processing requirements for both marine and land-won sources are the same.

The utilisation of marine sand and gravel is a key component of UK aggregate supply, contributing over 20% of total demand. In London and South Wales marine aggregates contribute over 80% of demand.

Humber Sand and Gravel Ltd is the only operator currently landing marine aggregate directly into the region (at Alexandra Dock, Port of Hull). It is the main supplier of concreting aggregate in the local area and they have confirmed there are no quality issues relating to their products.

The evidence therefore confirms that there are no quality issues which prevent a substitution of marine aggregates for land won sand and gravel.

Scale

The resources² considered to be of national significance for coarse and fine aggregate end uses have recently been mapped by the British Geological Society (BGS) across the southern North Sea, including the Humber licensing area. Although the unlicensed geological resource base has not been quantified by the BGS, the area identified as containing suitable resources will amount to many tens of millions of tonnes. Only a fraction of the identified resource has been the subject of dredging in the past and/or is currently licensed for dredging.

It is therefore concluded that the unlicensed resource of marine aggregate (as defined by the BGS) is very substantial and of such scale that it provides a robust basis to allow for the strategic change in supply considered in this study.

Constraints

A number of constraints have been identified which present competing demands in relation to the future extraction of the identified resource e.g. off shore wind power and pipeline routes. Extraction of the marine aggregate resource will therefore only be authorised after the Crown Estate (within whose ownership the sea bed is vested) and Marine Management Organisation (MMO) have resolved any competing interests as part of the licence application determination process.

² In the terminology of economic minerals 'resources' are classed as the entire geological deposit, 'reserves' are those resources known to be commercially extractable at the present time.

Potential to Increase the Supply of Marine Aggregates

In order to assess the potential to increase the supply of marine aggregate, the status of existing dredging licences has been reviewed. The available capacity of both the marine dredging fleet and landing facilities has also been examined.

Licence Utilisation

Licences within the Humber area are not currently exploited to their full capacity and have not been in the past. Based on 2011 figures around a further two million tonnes per annum could be supplied from existing licensed areas without the need to grant further licences in the short term.

Fleet Capacity

The British Marine Aggregates Producers Association (BMAPA) has confirmed that, in general, there is adequate capacity in the UK dredging fleet (operated by its members) to increase production significantly.

It is understood that (as a reflection of current market conditions) there is a high degree of under-utilisation in the fleet at the present time. There are a large number of other wharves with the potential to land marine dredged aggregates within the Humber or in waterways adjacent to it - notably at the Trentside Ports, subject to constraints.

Wharf Capacity

As the only operating wharf within the region, the Humber Sand and Gravel Ltd operation is considered the most likely point for any short term uplift in landings.

Annual landing statistics show that in 2011 Humber Sand and Gravel Ltd was operating at less than half the maximum achieved during the previous five years and well below the 300,000 tonnes maximum throughput previously achieved. The decline is attributed wholly to the recent recession and the reduction in construction activity.

The Company expects to relocate to the neighbouring King George Dock in the near future and plans to maintain the same level of capacity when it does. King George Dock benefits from the option of a rail connection and will therefore provide opportunities for the Company to expand its market reach and potentially realise greater economies of scale.

Humber Sand and Gravel Ltd. provides an established facility in Hull that could provide a short-term uplift in the supply of concreting aggregate into the region relative to the current depressed level of throughput. The proposed replacement facility is expected to be able to make a greater contribution. However, given the capacity limitations of the site it is evident the full uplift in supply to the region of two million tonnes per annum could not be met by this facility alone.

There are many other commercial (i.e. non marine aggregate) wharves operating in or near the Humber. Discussions with other wharf operators and stakeholders have identified where dredgers could potentially berth. All the potential wharves have restrictions relating to draft, beam and the amount of available land. Only dredgers smaller than those normally berthing at Hull could access some of the smaller independently owned wharves, A programme of dredging and some infrastructure investment would be required to make these wharves accessible by larger vessels. How many of the smaller vessels are available for use in the Humber licensing area is a question which the study have not been able to answer.

Aggregate cargoes are not generally considered to be a preferred cargo by wharf operators because of their relatively low value and large stocking area requirements when compared to other cargoes e.g. steel, coal and timber. Therefore, although many wharves have the potential to land marine aggregates the number of operators willing to make their wharves available at this time has been found to be significantly more limited.

Indicative Capacity of Infrastructure Required

A review of all relevant local authority adopted and emerging Local Plans and an email survey circulated to Local Authority planning policy officers has been undertaken to identify the number and location of marine wharves, rail depots and canal and waterway wharves. The locations of identified infrastructure facilities have been mapped in relation to the main urban areas and a note has been made of whether the sites are safeguarded in planning policy terms.

Level of Existing Infrastructure

No wharves considered to have the potential to land and process marine aggregates within the region currently safeguarded in adopted local plans. Thirty-two other waterway wharves, are considered to have the potential to either land the aggregate or contribute to its transport around the region my canal and waterway, have been identified following consultation with local authorities.

There are no rail depots considered to have the potential to transport marine aggregates within the region safeguarded in adopted Local Plans. Over twenty rail depots considered to have this potential have been identified (including those already used for the transport of crushed rock aggregate).

The location of wharves and barge capacity along the various branches of the waterway network, along with the location of aggregate rail depots on the railway network has been mapped.

Additional infrastructure has been identified at Tees docks (in the former North East region) with the potential to export marine aggregate to the region by road and rail.

Capacity

There is a general absence of information to define the capacity of the different infrastructure required for handling marine aggregates, however, some parameters have been determined from consultation and wider research. Factors for determining the size of site area required for the infrastructure are found to include the volume of stockpiling needed, the required rate of throughput, processing requirements and the needs of additional activities e.g. concrete batching.

Workshop Consultation

Three workshops were held in September 2013 attended by twenty invited stakeholders. The principle conclusions reached are set out below.

Scale of Contribution and Timing

In general, the stakeholders considered that the region is not likely to see a substantial increase in the use of marine aggregates in the short term (i.e. within the next 5 years) unless a major new operator enters the market. Should a major new operator not materialise, the general view was that one of the major aggregate companies will seek to develop a large scale marine aggregate facility in the medium and longer term – meaning

that in 20 years' time there may be one or more such operations active in the region. In terms of the smaller scale facilities to be developed by local independents, the stakeholders considered that these are more likely to come forward at any time.

In this context, large scale means a capacity similar to the Hull example of some 300,000 tonnes and above, and small scale in the order of 25-42,000 tonnes per annum (one small dredger delivery per month). Due to the draft and tide limitations identified by the study, it is likely any large scale operation will be developed at Hull and/or Immingham. Small scale operations will probably only utilise independent wharves where wharf rents are cheaper. Goole could be suitable for a small or large scale facility if vessels of the correct size can be used on a regular basis.

The availability of options to transport aggregate in high volume (other than by road) to the rest of the region will be key to any significant uplift. Based on the present levels of infrastructure the study found it is more likely this will happen by rail transport from the major ports and barge transport from the independently owned wharves.

Relative Merits - Marine verses Land Won

The stakeholders generally agreed that the displacement of land won aggregate by marine aggregates would give rise to an overall net benefit (in environmental, social and economic terms) – but accepted that the evidence to prove this would be difficult to obtain.

Barriers and Constraints

Barriers to the implementation of a strategy for the increased use of marine aggregates were said by the stakeholders to include i) the absence of a formal regional planning policy structure, ii) the difficulties in safeguarding infrastructure from alternative development and iii) a lack of competition in the management of the major ports.

Constraints were acknowledged to include a lack of immediately available land adjacent to marine berths for the development of a major new aggregate wharf. The stakeholders also considered there is a limited number of sites adjacent to railways and canal or waterway wharves that could be developed for the import of marine aggregate. Many are under pressure from alternative development which the MPAs find difficult to prevent.

Economics

The study were informed that a small number of business plan proposals for facilities to increase the amount of marine aggregates landed in the region and transported to inland markets have been undertaken by operators and potential operators in the last few years. Although all have been judged to be non-viable, the differential cost from producing land won and marine aggregate was viewed as narrowing, and currently considered to be in the region of £2/tonne.

Stakeholders suggested various measures to improve the viability of the marine option including operational factors e.g. guarantees from dredging companies to land single sized aggregates to minimise processing, fiscal support measures, and increased competition in port ownership to reduce port dues. Making grant funding available for transport initiatives that reduce lorry use should also be extended to include infrastructure build costs was also raised by operators and potential operators.

Conclusions and Recommendations

In conclusion the study found there was a very large marine aggregate resource of the required quality, and sufficient fleet capacity to land it. No fundamental barriers to the

granting of additional licensed capacity were identified. Many wharves are available in the Humber area with the potential to land marine aggregates, but limitations apply restricting the size of dredger that could berth, and the amount of land immediately available lying adjacent to the berths to develop the necessary infrastructure required to facilitate processing and/or onward transport at the scale proposed by the study.

Only a limited amount of infrastructure utilised for or with the potential to be utilised for the transport of marine aggregates is safeguarded. Stakeholders considered the move towards a greater utilisation of marine aggregates will most likely take place beyond 5 years and thereafter increase with time. Economically, operators did not think the marine option was viable at this point of time but the viability gap against land won aggregate was narrowing.

URS has made recommendations for further work that include MPAs reviewing Local Plans to consider the requirements of the National Planning Policy Framework (NPPF) for safeguarding aggregate infrastructure and a formal regional local authority group to collaborate on cross boundary aggregate issues (which may fall within the scope of reference for the Aggregates Working Party).

1 INTRODUCTION

1.1 Purpose of this Report

This report presents the findings from a three part study commissioned by Leeds City Council (LCC) (in association with others) titled 'Deliverability of Marine Dredged Aggregate'. It examines the potential for a substantial increase in the supply of marine aggregates into the Yorkshire and Humber region³. Any such increase would help address concerns relating to the long term security of supply from traditional land won sources of sand and gravel which has been raised by Mineral Planning Authorities (MPAs) in the region, and environmental concerns. Of primary concern is the availability of coarse sand for use in the manufacture of concrete. The gravel component of concrete can be readily substituted by crushed rock, usually limestone. While there are no short-term security of supply issues for limestone, policy constraints on the granting of additional planning consents is also likely to increase the importance/reliance of marine gravel over the long-term. The study therefore considers the deliverability of a strategy that would result in an increased reliance on marine aggregate resources.

1.1.1 Study Outline

The three part study comprised the following stages:

Stage 1 - Background research and information gathering;

Stage 2 – Engagement with key stakeholders; and

Stage 3 – Final Report.

1.1.2 Reporting

This report comprises the final study report and utilises as its base a report produced at the end of Stage 1, submitted to the study steering group in June 2013, and formally accepted in July 2013.

1.1.3 Study Stage 1

Stage 1 of the study centred upon a desk based literature review and stakeholder consultations. It considered the following key issues:

1. the future suitability and availability of marine aggregate resources in the Humber dredging area (and other relevant areas), its suitability as a partial substitute for land won concreting sand and gravel and the constraints which apply to the amount which can be landed;
2. the potential for a significant increase in the (up to an indicative target of 2 million tonnes per annum) of marine aggregate into the Yorkshire and Humber region; and

the availability and indicative capacity of existing and any currently planned infrastructure needed to support the delivery of marine aggregate into the Yorkshire and the Humber region. Chapters 2 to 5 address the issues raised by Stage 1.

³ Although the English regional government assemblies were abolished individually in 2012 and 2013 the study area has been defined by the project brief as the boundaries of the former Region.

1.1.4 **Study Stage 2**

Stage 2 of the study involved wider stakeholder involvement to build upon the Stage 1 evidence base. Separate workshops were held with three stakeholder groups:

- i. minerals industry and operators;
- ii. policy makers and regulators; and
- iii. transport representatives.

Stage 2 focused on the issue of ‘deliverability’, by raising a series of questions for each group to consider. The common objective was to establish if a consensus could be reached on i) the scale of contribution that could be made, ii) timing, iii) the barriers and means of overcoming them, and iv) the economic factors.

Chapter 6 addresses the issues raised by Stage 2 and summarises the views expressed at the stakeholder workshops. To complete Stage 3 chapter 7 provides the final conclusions of the study and URS’ recommendations.

1.2 **Study Area**

The main study area is the former administrative region of Yorkshire and Humber comprising the following MPAs and as identified on Figure 67015.MA.002:

- Barnsley Metropolitan Borough Council;
- City of Bradford Metropolitan District Council;
- Calderdale Metropolitan Borough Council;
- Doncaster Metropolitan Borough Council;
- East Riding of Yorkshire Council;
- Kingston-Upon-Hull City Council;
- Kirklees Metropolitan Council;
- Leeds City Council;
- North East Lincolnshire Council;
- North Lincolnshire Council;
- North York Moors National Park Authority;
- North Yorkshire County Council;
- Redcar and Cleveland Borough Council (partially within boundary);
- Rotherham Metropolitan Borough Council;
- Sheffield City Council;
- Wakefield Metropolitan District Council;
- City of York Council; and
- Yorkshire Dales National Park Authority.

There are 18 MPAs in the region; North Yorkshire County Council (a two tier authority area) and 17 unitary (single tier) authorities – including the two National Park authorities - Yorkshire Dales and North York Moors.

All the MPAs have been contacted in the preparation of this report.

On the suggestion of stakeholders, the study has also made reference to the small number of marine aggregate wharves falling just outside the region which have the potential to supply aggregate into the region e.g. at docks on the River Tees.

1.3 Terminology

'Marine aggregates' is the term used to describe aggregate dredged for both construction aggregate and beach replenishment. Dredging for beach replenishment forms an important element of the industry but for the purpose of this study is excluded except in the context of competing demands. This definition accords with that used by the British Marine Aggregates Association.

With only a few exceptions marine aggregates are used for the same wide range of purposes as land won sand and gravel. For the purposes of the study the main use considered is sand and gravel utilised for construction purposes.

1.4 Legislative Background

For background purposes, a short summary of the legislative and planning policy background to the extraction of marine aggregates is provided in Appendix A.

2 BACKGROUND TO THE REPORT

This chapter describes the contribution marine aggregates make to the supply of construction aggregates in the UK and contrasts this with the present situation within the region to illustrate the potential for change. A review of the amount of marine aggregate dredged from the Humber licensing area has been undertaken to quantify the amount of the reserve that is not currently utilised.

The operation of the Humber Sand and Gravel Ltd. wharf in the Port of Hull provides a good example of an averaged sized facility. It is described here to illustrate the main type of facility the region will need more of if a significant shift in the supply pattern is to take place. Other examples are referenced later in the report when defining the scale of facility that may be required to fully deliver the project synopsis.

2.1 Marine Aggregates – UK Industry Overview

The utilisation of marine aggregates for construction purposes is a long established practice in the UK and a key component of the aggregate supply chain.

Some 70 dredging licences exist for specific dredging areas in the coastal waters of England and Wales, with about 12 companies operating over 20 vessels⁴, and 70 active wharfs where the marine aggregate is landed⁵. A number of the largest capacity modern wharfs are rail linked.

Most of the principal aggregate supply companies participate in marine dredging either directly or via joint ventures and partnerships. In 2008, the landed value was £116 million with a gross value added (GVA) of £54 million. Processing and concrete sales associated with marine aggregates represent a further £303 million⁶.

The majority of marine aggregate used in construction (around 80%) is utilised as concreting aggregate and thus supply levels reflect the level of activity in the construction sector. The significant decline in aggregate sales since the onset of the economic downturn in the UK economy in 2009 was less pronounced for marine aggregate than for land won⁴.

Marine aggregate contributes about 23% of the sand and gravel sold in England and Wales some 6% of total aggregate sales (including crushed rock). Table 2.1.1 summarises regional and national landing statistics. It is therefore evident that at an annual production level of nearly 11 million tonnes, marine aggregates make a vital contribution to the overall supply of construction aggregates in the UK. The 2009 11 million tonnes figure represents a decline from 14.5 million tonnes in 2007 (at the start of the recession).

The pattern of contribution made by marine aggregate to overall aggregate supply varies considerably when viewed by region (the basis on which many mineral statistics are reported). For example in London and the South-East of England the contribution is around one third of demand. In South Wales up to 90% of natural sand supply is marine dredged. In both cases the supply scenario is due to the lack of available land won resources and the high level of constraints that restrict their exploitation. In these locations despite high capital costs marine aggregates hold an economic and supply

⁴ Russell M A Sea Change for the Marine Aggregates Sector (BMPA) December 2010 www.Agg-Net.com.

⁵ Collation of the Aggregates Minerals Survey 2009 (CLG) para 1.10.

⁶ Marine Management Organisation www.marinemangement.org.uk/licensing/marine/activities/dredging.htm

advantage as they can be delivered directly into (or very close to) the point of demand e.g. via wharves on the River Thames in London, Cardiff and Newport docks.

TABLE 2.1.1: THE PROPORTION OF SAND AND GRAVEL SALES FROM LAND WON AND MARINE DREDGED SOURCES BY REGION IN 2009.

Region	Land won Sand and Gravel Sales (1000 Tonnes)	Marine Dredged Sand and Gravel Sales (1000 Tonnes)	Marine as % of Total Sand and Gravel Sales
South West	3,152	487	13
South East	6,007	4,985	45
London	577	3,662	86
East of England	9,666	322	3
East Midlands	5,501		0
West Midlands	5,860		0
North West	2,180	97	4
Yorkshire and the Humber	2,929	192	6
North East	758	563	43
England	36,631	10,308	22
South Wales	144	613	81
North Wales	589	32	5
Wales	733	645	47
England and Wales	37,636	10,953	23

Source: Compiled from figures published by CLG and BGS (2009).

Table 2.1.1 indicates that the 2 million tonne uplift from the Humber licensing area suggested by the study would mean a 20% increase in the total UK sales of marine aggregates.

A substantial volume (up to 40%) of the marine aggregate dredged in areas licensed by the UK is landed in Belgium and the Netherlands where land-won resources are very limited and the policy approach resists new land based mineral extraction. This scenario is true for the Humber licensing area where a large proportion of the total dredged is landed in foreign ports.

The next section outlines the present situation within the Yorkshire and Humber region and neighbouring parts of the North East region.

2.2 The Regional Perspective

In the Yorkshire and Humber region the contribution made by marine aggregates to both sand and gravel and total aggregate sales has been small. This is mainly because land won sources have been located closer to the centres of demand. Table 2.2.1 indicates that the contribution to total sand and gravel sales made by marine aggregate was only 6% in 2009.

The 192,000 tonnes landed in the region in 2009 were landed at the region's only operating marine aggregate wharf, at Alexandra Dock, Port of Hull. Distribution from this point is by road and usually over a limited distance (see 2.3 below for details). There is no evidence to suggest there is or has been direct or indirect delivery of substantial amounts of marine aggregates into the more central/urban parts of the region in the recent past.

The Crown Estate annually report the amount of marine aggregate dredged within the Humber licence area and landed at each port, as summarised by tables 2.2.1 and 2.2.2 respectively. The Crown Estate identifies ports on the Tees and Tyne as within their Humber regional licensing area, although they do not fall within the region as defined for the purposes of this study. Table 2.2.1 indicates that on average about 30% of the marine aggregate dredged in the Humber licensing area are landed there. Thus geographically the greater majority of marine aggregates dredged off the Yorkshire and Humber coast is landed and utilised outside the region.

Landings made at the port of Hull and those on the Tyne and Tees (in the North East region) are understood to be dredged only from within the Humber licensing area.

TABLE 2.2.1 SUMMARY OF DREDGING FOR MARINE AGGREGATES IN THE HUMBER LICENSING AREA 2007-2011

Dredgings in metric tonnes	2007	2008	2009	2010	2011	5 Year Average
Permitted Licenced Total	4,650,000	4,400,000	5,050,000	5,050,000	5,050,000	4,840,000
Construction Aggregate Dredged in Licence Area.	3,184,814	3,154,070	2,524,328	2,622,126	2,175,846	2,732,237
Beach Replenishment	1,300,000	450,000	550,000	550,000	730,000	716,000
Unutilised	165,186	795,930	1,975,672	1,877,874	2,144,154	1,391,763

Table 2.2.1 indicates that with a relatively constant licensed annual tonnage of 5 million tonnes, over 2 million tonnes of extraction capacity remained unutilised in the last reported year of 2011, with a five year average of nearly 1.4 million tonnes.

Table 2.2.2 shows that landings in Hull amount to only 19% of the total landed in the region (all of which was dredged from the Humber Licensing Area).

From Table 2.2.2 it is apparent that the uplift of 2 million tonnes of marine aggregate landings suggested by the study would amount to a 250% increase in the five year average for construction aggregates landed in the region. It should also be noted the permitted licensed total in Table 2.2.1 is for all forms of sand and gravel, whereas the study has identified that the primary concern for the industry is the long-term availability of concreting sand. The gravel component can be readily substituted by crushed rock aggregate for which there are significant reserves⁷.

⁷ Although concrete sand can also be replaced by crushed rock fines (to a greater or lesser extent) which are produced as a by-product of the crushing process, there distribution, availability in sufficient volume and utilisation is less certain (e.g. concrete produced using crushed rock fines is more demanding of cement a high cost component).

TABLE 2.2.2 SUMMARY OF LANDINGS OF MARINE DREDGED CONSTRUCTION AGGREGATES IN HULL, AND NORTH EAST REGION PORTS 2007-2011.

Landings in metric tonnes	2007	2008	2009	2010	2011	5 Year Average
Construction Aggregates landed in Yorkshire and Humber and North East regions	1,301,635	1,036,173	596,691	734,775)	541,726	842,200
Landings in Humber Wharf (as % of dredged)	269,599 (23)	212,538 (21)	92,202 (15)	115,490 (16)	108,927 (20)	159,743 (19)
Balance of Landings (in North East Wharves)	1,032,076	823,635	504,489	619,285	432,799	682,457

2.3 Port of Hull Case Study

The only current marine aggregate wharf operating in the region is located at Alexandra Dock, Port of Hull and is operated by Humber Sand and Gravel Ltd. The Company is a joint venture operation between Hanson and Cemex formed in 1989. It only supplies marine aggregate from this one location and is not involved directly in value added markets e.g. ready mixed concrete, bagged sales etc. Photographs illustrating some elements of the operation are provided in Appendix 5.

Alexandra Dock allows vessels of up to 7 metres draft to enter via a single lock from the River Humber, the aggregate wharf lies in the far west of the dock. The 7m draft is sufficient to allow entry by large size and capacity dredgers in the range 4500 tonnes - 8000 tonnes capacity. 5000 tonnes is the typical modern dredger capacity with a draft laden of around 6 metres.

A dedicated dredger does not operate solely from the Hull wharf. The wharf manager is able to book a delivery from the combined dredging fleet of Hanson and Cemex via a central office in Southampton. The type and quantity of aggregate is specified and the central office assigns a vessel to one of the Humber licence area dredging grounds licensed to the two companies.

When a dredger has been directed to the licence area the wharf manager is able to communicate to the captain his preference for the specific dredging location that lies within the current active dredging area. The choice is based upon the characteristics of previous cargos and in this way a predominantly coarse aggregate, fine aggregate or a combined load can be pre-selected with good accuracy. Screening takes place as the aggregate is brought onto the ship to remove oversized material.

When dredging is complete the load is delivered to Hull docks at a specified time subject to tides. The two high tides per 24hrs allow vessels two opportunities to enter and leave the dock. When factoring the time required to off-load the cargo (4-6 hours) there is minimal down time so that the tidal dock is not considered to be a limiting factor. The longer period may introduce a delay before the ship can depart on the next tide. During times of peak production ship deliveries were made on at least a weekly basis. In recent years the reduced volume of sales has required an average of only one vessel per month.

Unloading utilises a self-discharging bucket scraper into a hopper and conveyor system for direct delivery to the processing area, so that it does not touch the dockside and there is no 'double handling' before it enters the processing area. The wharf operates under Permitted Development rights for docks and as such has no express planning permission. Accordingly it has no operating hours or tonnage restrictions other than the physical constraints of the site. Unloaded sand is stockpiled and then processed through a traditional sand and gravel plant. Unloading may take place over night but processing usually only takes place during the day.

The wharf occupies about 1.5ha (4 acres) but is linear in shape. This configuration is considered more inefficient to operate compared to a regular shaped site. The wharf can comfortably process 250,000 tonnes per annum, over that amount stocking becomes more of an issue but up to 300,000 tonnes has been reached in the recent past. This scale of throughput is considered the equivalent of a single medium sized sand and gravel quarry.

After unloading the aggregate is first stockpiled (uncovered) for about 4 days to allow it to drain of entrained seawater, at the end of which the salt water (chloride) content meets industry standards so that it can be used directly. However, to produce the different products required by the market and to avoid wastage, the stockpiled material is passed through a standard aggregate vibrating deck wash plant, screens and a sand tower. This process separates out the various grades of coarse and fine aggregates required by the market. Mains water is used for washing with the process achieving almost 100% resource recovery. All the products meet a specification e.g. no 'off spec' product is sold as cheap product or arises as waste. The salt water content and river side location makes the processing harder wearing on plant and machinery than at a quarry. Industry advise that a modern high volume plant would be expected to be pre-treated to make it more resistant to salt water corrosion.

Almost all the material landed is less than 40mm diameter; two types of sand are the main products sold. The greatest market demand is for concreting sand, six local batching plants are supplied including Cemex, Hope Construction Materials and some local firms. Humber Sand and Gravel Ltd. does not trade elsewhere and Hanson has no presence in Hull. Soft sand for use in mortars is not usually produced.

The main land won sand and gravel producers are located to the north near Brandesburton, so the market area served from the wharf is generally no greater than 25 miles. Beyond this distance transport costs make prices uncompetitive. Deliveries over greater distances are more occasional for some specific products e.g. asphalt sand for use as a filler is supplied to a few specific plants in the region (an unusual product to be sourced from marine aggregate). Toll prices for HGVs on the Humber bridge are stated as being a significant barrier to wider distribution to the south.

Alexandra Dock is not rail linked at the aggregate wharf. To facilitate redevelopment of this dock for use as a construction and assembly point for off-shore wind farm development all the existing dock buildings are scheduled for demolition and most of the dock itself will be filled in. Humber Sand and Gravel Ltd. is therefore at an advanced stage of negotiating the relocation of the aggregate wharf to the neighbouring King George Dock with Associated British Ports (ABP), see Figure 67015.MA.005. The relocation will necessitate developing a completely new site with new processing plant.

The King George dock wharf is already provided with a single rail line siding that connects to the wider rail network outside the port. The potentiality of the rail link is viewed as an asset to the longer term viability of the new aggregate wharf. The

Company will occupy land at King George Dock that will be at least sufficient to maintain the historical levels of production at Alexandra dock.

3 SUITABILITY AND AVAILABILITY

3.1 Introduction

This section considers three issues:

1. Quality - Are there any quality issues which prevent marine aggregates substituting for land won sand and gravel. This issue will be addressed by considering both the geological data available and the experience of the only wharf operator in the region.
2. Scale - Is the scale of marine aggregate resources in the Humber dredging area and elsewhere of suitable scale to allow a strategy of greater dependence on marine sources of sand and gravel to be developed. This issue is addressed by a review of the marine dredging licence situation in the Humber dredging licence area and the wider resource area identified by the British Geological Survey (BGS).
3. Constraints - What is the level and nature of competing demands/interests on the marine aggregate resources? This issue is addressed by a review of the type and extent of competing interests within the context of marine spatial planning and dredging licensing procedures.

3.2 Quality.

3.2.1 *Origins and Composition*

The BGS reported on the suitability of sea bed resources within the East Inshore and East Offshore (which includes the Humber dredging licence area) in 2011⁸. The report outlines that most of the marine aggregates in the Humber dredging area originate as glacial deposits in much the same way as the land won resources in the region. Rising sea levels at the end of the last (Devensian) glacial period having flooded the landscape now occupied by the North Sea. Most marine gravel deposits are static, sand waves may however be mobile.

The shape, strength and other physical characteristics of marine sands are found to be generally identical to land-based aggregates with a high percentage of silica based gravels which make them relatively hard and suitable for high strength concrete applications. Marine gravels are typically smooth and rounded due to their transport by glacial or fluvial means. Sands are generally sharper than river or Aeolian (windblown) deposits because they have undergone less fluvial rounding since deposition, although some specific sand waves may comprise almost entirely well rounded sand.

3.2.2 *Quality Standards*

The aggregates industry works to common European Standards applicable equally to the production of land won and marine aggregates i.e. EN12620 Aggregate for Concrete, and EN13055 Lightweight Aggregate.

Generally speaking the largest aggregate companies operate a centralised ordering system so that an order is delivered to the customer guaranteed to meet EU specification regardless of their source. Thus whether the aggregate is land won or marine dredged is irrelevant. There is some evidence to suggest that historically

⁸ BGS 2011: The Mineral Resources of the East Inshore and East Offshore Marine Plan Areas Southern North Sea OR/11/049.

suspicion regarding the quality of marine aggregate qualities did arise from time to time, but in those areas where marine aggregate is used extensively this no longer applies due to adoption of common EU standards.

The key differences between land and marine won aggregate are generally the presence of chloride and shell, which are explained below.

Chloride content

Marine aggregates when first lifted from the sea bed are saturated with entrained sea water that raises overall chloride composition of the aggregate and so needs to be addressed before use.

The main concerns relating to chloride content are:

- in concrete production Alkali Silica Reaction (ASR) is a test criteria, however the contribution to available alkali by sodium and potassium salts is strictly controlled for both land won and marine aggregates. In washed aggregates the contribution is relatively small, nevertheless this is taken into account to ensure guidelines and specifications to minimise the risk of ASR. ASR is not generally a problem in building mortars and screeds⁹; and
- risk of corrosion of metals embedded in concrete and mortar. To minimise the risk of corrosion of metals, it is usual to limit the amount of chloride contributed in concrete and mortar from all constituents. Electronic monitoring during processing ensures that specification requirements are met¹⁰.

The salt content of sea water can vary by location so the industry undertakes various methods to limit chloride content as required on a case by case basis. Initially rapid draining of the aggregate is undertaken within the dredging vessel when it enters the cargo hold to decant off the sea water. Further draining after unloading at the wharf may be sufficient to dry the aggregate enough so that no further cleaning is required (see the case example at Hull at section 4.3 below). Dockside washing is a usual component of processing at a number of UK wharves but this is not necessarily done to wash out sea water. The grading and screening of mixed aggregates into saleable products is usually undertaken as a wet process such that the washing to reduce chloride content may be a secondary consideration.

Shell content

Shell is calcium carbonate, the same chemical compound as limestone which is often used as coarse aggregate in the production of concrete. Shell is stable in concrete and mortars, nevertheless checks on the quantity of shell content in coarse aggregates are carried out to ensure compliance with European Standards. As with chlorides, shell content is also associated with land won aggregates¹¹.

Peat and Lignite

Peat and lignite, which comprise highly compressed organic sediment, have the potential to contaminate aggregates to be used in the construction industry due to their weak structures and chemical instability, and it may appear as small black flecks that can rise to the surface of a concrete mix. Lignite is common to land won and marine sources. To overcome potential contamination peat deposits (which may also

⁹ BMAPA, 2002. Marine Sands in Concrete and Marine Sands in Mortars and Screeds

¹⁰ Ibid

¹¹ Ibid

represent an archaeological interest) are avoided via prior mapping and ground proofing during marine dredging¹².

3.2.3 **Distribution of Resources**

The BGS have undertaken periods of phased sampling of the sea bed over many years leading to a good understanding of the distribution of potentially viable aggregate resources off the east coast. The BGS 2011 report (see 3.2.1) re-examined historical survey data (sample and hydrographic survey) and reclassified sea bed composition in relation to EU adopted aggregate quality standards. The resulting map (attached in Appendix 2) indicates where coarse aggregate (gravel), fine and coarse sand may be found which meet these criteria in economically viable quantities (the definition of which is described in the report). The area so defined crosses a very large area of the southern North Sea including the Humber licensing area, the East Coast licensing area to the south, and significant areas between and surrounding them.

3.3 **Funding**

The study steering group and workshop attendees suggested that the Stage 3 report include some information about the current status of grant funding. The following details have been sourced from UK government websites.

After the Comprehensive Spending Review (CSR) in 2010, the Government suspended the Freight Facilities Grant (FFG) scheme which formerly provided financial incentives to businesses willing to invest in facilities which would reduce freight traffic on congested roads and use rail or water instead. The scheme officially closed in England on January 2011.

Government funding is however available to support the shift away from road to rail and water transport through the Mode Shift Revenue Support (MSRS) and Waterborne Freight Grant schemes (WFG). The schemes do not support capital infrastructure projects they only provide revenue support for existing facilities, the current 3 year scheme runs until 2015. Budgets for the operating grants are £19 million for 2012 to 2013 and a suggested further £19 million for both 2013 to 2014 and 2014 to 2015¹³.

The schemes funded through MSRS and WFG in 2013 suggest that the movement of (crushed rock) aggregate by rail rather than road is a significant element of the support funding. Some individual grants exceeded £1 million.

Funding may also be available for projects that divert transport away from road to rail, ship and waterways from the EU via the Marco Polo fund.

3.3.1 **Conclusion**

Marine aggregate resources are required to meet the same industry standards as land won sand and gravel.

The Humber Sand and Gravel Ltd. case study and wider UK industry practice shows that marine aggregate operations are able to meet industry standards for construction aggregates without special processing i.e. over and above what is usual for land won aggregates.

¹² Crown Estate, BMAPA and MPA, 2010. Marine Aggregate Terminology- A Glossary

¹³ <https://www.gov.uk/government/collections/freight-grants>

Therefore it is concluded that marine dredged sources are readily substituted for land won sand and gravel and thus no quality barriers have been identified to the proposed uplift in supply.

3.4 Scale

This section outlines the scale (rather than quantity) of the total marine aggregate resource within the Humber licensing area and the degree to which it is actually licensed and exploited. By considering the total area that is licensed and the degree the area is utilised the amount of underutilisation can be estimated.

To aid future marine spatial planning the Crown Estate has identified one area (of some 12,000km²)¹⁴ as the main prospective area for coarse sand and gravel (considered the resources of 'national significance') off the coast of the region. The area generally mirrors (though is slightly larger than) the Humber Environmental Characterisation Area (REC). All existing Humber licence area dredging licences fall within this prospecting area. The area does not define the limits of resources but highlights where they are known to exist in suitable concentration.

The following limitations in the Crown Estate report should be noted:

- although the mapping indicates that no resources have been inferred across much of the prospective area which is not considered to be a true reflection. Due to the resolution of the pixelated graphics, the uneven distribution of available data and the scale of the mapping in some areas, all mean that the mapping may not be a fair reflection of the potential resource;
- the scale of the 1km grid squares allows for the classification of the majority area to dominate the minority area for each grid square; and
- due to resource constraints the BGS relied on its own data and did include that collated by the dredging industry¹⁴.

Therefore (at the published resolution) the map should be considered simply as an aid to future aggregate prospecting and spatial planning¹⁴.

Notwithstanding these shortcomings, it is evident that the BGS consider the potential aggregate resource in the Humber licensing area to be very substantial.

The Humber dredging area is not formally defined but has been recorded as spanning from the coastline at Spurn Head and Holderness (at the mouth of the Humber estuary) for some 160km eastwards along a corridor of some 60km width, and so covering an area of some 11,000km². This area has more formally been the subject of a Regional Environmental Characterisation (REC) undertaken by the BGS, and may be adopted for the purpose of this report as the resource base for Humber licensing area.

In January 2013 the Crown Estate stated there are ten active dredging areas and at least as many areas the subject of licence applications (some of which are renewals and consolidations of existing licences). The total area licensed at some 470km² is the largest of any of the licensing areas in UK waters.

Dredging has historically been centred within the 12 mile territorial limit. Licences awarded to companies exporting to the continent are usually in the east of the area over 80km from the English coast.

¹⁴ BGS (pers comm) June 2013.

The main licence holders are Cemex, Tarmac, Hanson, DEME Building Materials Ltd. (Dutch owned), and British Dredging Ltd.

The Crown Estate publishes annual statistics for a range of factors in its 'Area Involved' reports and 'Environmental Monitoring System' report of ship tracking data, including:

- area licensed and surrendered;
- tonnage dredged;
- tonnage landed by port; and
- active dredging time and distance in licence area.

The Crown Estate's 14th Area Involved publication reports for 2011 that:

- the areas licensed within the region added up to 469.89km² (4.27%);
- the total area available for dredging (within an active zone) was 166.94km²;
- dredging took place within 22.02km² (4.69% of the licensed area);
- 90% of dredging took place within 10.79km²;
- the permitted licensed tonnage was 5.05 million tonnes (unchanged from 2010);
- 2.18 million tonnes was dredged for aggregate use; and
- a further 0.73 million tonnes was dredged for specifically for beach replenishment (total dredged 2.91 million tonnes).

The Crown Estate have also reported that during the period 1998-2007, 80% of the total licensed dredging area had been dredged previously, and 120km² of historical licences had been surrendered. They have also confirmed that the area of seabed that has been actively dredged and where the licence has been surrendered is relatively small as a proportion of the whole Humber licensing area. Since 2007 a further 30km² of licence areas have been surrendered (*Crown Estate pers comm August 2013*). Therefore it can be concluded the extent of past dredging has only involved a small proportion of the total licensing area.

3.4.1 **Conclusions - Scale**

The scale of the potential resources is considered to be of a suitable scale to allow a strategy of greater dependence on marine sources of sand and gravel to be developed. The BGS definition of economic resources included a minimum depth of 1 metre of seabed sediment. Each passage of a dredger boom lifts around 0.3 metres of sediment. Therefore the potential geological resource for marine aggregate is many tens of million tonnes. Although the main regional long term supply concern is for concreting sand the BGS mapping suggests the sand resource is still very substantial indeed.

The amount of dredging taking place dropped by 1 million tonnes in the five years 2007-11, which will increase the remaining life of the existing licensed areas (all things remaining equal). Applications for additional licence areas have also been lodged with the Crown Estate. Theoretically it would be possible to calculate the life of the marine 'landbank' of aggregate in a similar way to land won aggregates by subdividing the total licensed resource by annual dredging tonnages. However, the limitations of sea bed mapping and modelling precise recoverable volumes, combined with the fact the

greater majority of extraction from the Humber region is exported, would make the exercise of only modest value.

In the absence of development constraints it can be safely concluded from the available published data set out above, that the scale of the potential geological resource of key aggregate resources is considerable and therefore has the potential to contribute to the supply of concreting aggregate for the region over the very long-term.

3.5 Constraints

The following constraints to the exploitable extent of marine aggregate resource have been identified:

1. Sea Water Depth – The boom used to vacuum the sea bed is attached to the side of the dredging vessel when in transit. The length of the boom thus limits the depth the vessel can dredge at. Generally 30-50 metres depth is the operational maximum. The majority of the Humber licensing area and vessels operating in the area operate within this limit.
2. Length, draft and beam – the length of the vessel limits the length of boom used for dredging, the draft limits both the storage capacity of the aggregate hold and landing options. A deep draft vessel will have less wharf options than a shallow draft. The beam limits the movement of the vessel through docks and waterways.. These issue are relevant when considering the port option for landing at wharves up river from Hull.
3. Hold Capacity – marine dredging works partly because of economies of scale therefore larger vessels can become more economic. However, larger vessels (5000t and over) may have less options for berthing. Small vessels (2-3500t) are less suitable for deeper waters (see water depth above) and less able to operate in poor weather conditions but more flexible in terms of their point of landing.
4. Pipelines, cables and wrecks – many locations of cables and pipelines are known with good accuracy and can be avoided with adequate safety margins. The number of wrecks and other archaeological sites is highly numerous (dating from the pre-historic to WW2). Licence applications and licence conditions require survey procedures to assess risks to known sites.
5. Offshore Wind Energy – wind farms are a recent addition to the list of constraints and have grown in scale considerably between each Crown Estate leasing round (Round 3 sites presently in development). The government objective is to meet at least 18GW of capacity off the UK coast by 2020. There are nine licensed (Round 1 and 2) sites within the Humber licensing area (lying within or just outside the 12 mile territorial limit). The activity of dredging and location of wind farms is considered incompatible after turbine construction however, the entire licensed zone would not be developed with turbines. Round 3 includes the 4GW Hornsea Zone of some 4735km² along the northern boundary of the licensing area to be developed in four phases by SMart wind (see www.smartwind.co.uk/). The location of the lease area and the buried sea bed cable connection to the shore near Immingham in North East Lincolnshire includes large tracts lying within the Humber licensing area (see the Crown Estate map in Appendix 3) and crosses the prospecting area identified by the BGS in 2011 (see section 3.2.2) and interactive maps at www.4coffshore.com/offshorewind/.
6. Wave and Tidal Power – Leasing the sea for tidal power is vested in the Crown Estate who issued a report Key Resource Areas Project in October 2012. There

are no commercial tidal or wave power facilities yet operating in the UK. The report did not identify the Humber area as one of high suitability for wave or tidal power generation.

7. Military Areas – the military undertakes sea training within defined military practice areas and exercise (PEXA) training areas, the military also imposes access restrictions to a number of areas.
8. Shipping Routes – the Humber dredging area falls within the North Sea, which is one of the busiest navigated seas in the world. Traffic segregation systems and deep water routes are established to guarantee swift and safe shipping traffic.
9. Waste Disposal Areas - the disposal of waste material into the marine environment includes the regulated discharge of wastewater and the disposal of hazardous and non-hazardous waste. Solid wastes include disposal of dredged material from capital and maintenance dredging. Dredging has the potential to disturb waste disposal areas and vice versa. The Crown Estate have some control over areas for Waste Disposal through their licencing regime.
10. Habitats - there are a number of habitat designations within the Humber Estuary and the Humber dredging area. Such designations will need to be taken into account in the EIA process when applying for marine dredging permissions. The designations include Special Areas of Conservation (SAC) which are strictly protected sites designated under the EC Habitats Directive; Special Protection Areas (SPA) classified for rare and vulnerable birds and migrating species; and RAMSAR sites which are wetlands of international importance.
11. The Marine and Coastal Access Act (the Act) sets out the grounds by which Marine Conservation Zones (MCZ) can be designated. MCZ seek to conserve marine flora or fauna; marine habitats; and features of geological or geomorphologic interest. The Act allows provision for the Marine Maritime Organisation to create bylaws, which or particular relevant can: prohibit or restrict entry into, or movement or other activity within the MCZ by vessels; restrict vessel speed within and outside of the MCZ; prohibit or restrict anchoring; prohibit disturbance of animals or plants; and prohibit or restrict anything which would interfere with the sea bed or damage or disturb any object in the MCZ. Following on from consultation ending in March 2013, designations are expected to be confirmed shortly.
12. Commercial Fishing Operations and Fish Stocks Fishing Grounds - Commercial fishing operations take place throughout the North Sea which may lead to conflicts relating to shipping routes. Dredging has the potential to impact upon fish stocks through temporary habitat creation and sound stimulus.
13. Recreation Areas - recreation is a potential area of conflict, either indirectly or directly, with aggregates. Direct costs relate to displacement of recreation activity, such as diving, sea angling and sailing. Indirectly, marine aggregates extraction could damage features in local/regional ecosystems and therefore reduce attractiveness to recreational activities. However, as dredging is a transient activity the period over which areas are potentially disturbed is limited.
14. Beach Replenishment – the use of marine aggregates in beach replenishment fluctuates in relation to the programme of works undertaken on an annual basis and may be substantial. Applications for beach replenishment dredging licences are considered by the Crown Estate on the same basis as those for construction aggregates. Although utilising the same resource it is considered to be one of a such large scale supply for both will be adequate.

3.5.1 **Conclusions - Constraints**

There are numerous constraints which have potential to limit the extraction of the identified marine aggregate resource. Some of the constraints are prima facie conflicts such as pipeline routes and constructed wind farms; others are relevant but are the subject of case specific assessment through the licensing procedure e.g. fishing grounds and wreck sites.

Offshore wind power and associated infrastructure are a recent addition to the offshore environment with a number falling within the dredging licensing zone. Their scale has increased substantially with a number in Round 3 significantly larger than individual active or proposed dredging licence areas. The construction of a wind farm sterilises the aggregate resources but no evidence has been identified by this study to indicate what weighting is given to wind farm applications relative to mineral sterilisation.

The licence application procedure and role of the Crown Estate in granting and reviewing conditional licences is the means by which competing interests are evaluated. Licence determinations in the past have occurred outside the framework of a holistic maritime spatial plan.

For each individual licence area each operator undertakes regular resource assessments to evaluate the remaining aggregate quality and quantity relative to their supply needs. Therefore the requirement for additional licensed capacity is planned for years in advance of actual need.

The Crown Estate in its role as land owner and licensing body is best positioned to judge how these constraints currently limit and have potential to limit future marine aggregate extraction. Taking into account the identified constraints the Crown Estate have advised that due to the scale of both the licensed and unlicensed resource in the Humber licensing area it does not envisage any difficulty in meeting the proposed uplift over the long term. The Crown Estate confirms it will seek to promote seabed optimisation informed by the identification of key resource areas.

The advent of new maritime spatial planning will incorporate the need to maintain marine dredging. The publication of the BGS resource assessment report (see 3.2.1 above) will form part of the evidence base when balancing these interests.

4 POTENTIAL FOR AN INCREASE IN MARINE AGGREGATE SUPPLY

4.1 Introduction

This section considers whether an increase in marine aggregate landings from the current level of some 160,000 tonnes per annum (5 year average - see Table 2.2.2) to an indicative target of 2 million tonnes per annum is achievable¹⁵.

This issue has therefore been considered on the basis of practical and physical deliverability at this time and in the foreseeable future. The review is therefore divided into maritime issues and land based issues and draws on the case study review of operations at the existing aggregate wharf in the Port of Hull provided in section 2.3 and a wider assessment of the existing infrastructure that could be utilised in the region to help meet the study brief.

A review of the potential economic parameters of marine dredging in comparison to land won aggregates has been informed through Stage 1 of the study and the stakeholder engagement of Stage 2.

This section is divided as follows:

- dredging fleet capacity;
- the potential to increase landings; and
- the potential to transport landings to the areas of need.

4.2 Dredging Fleet Capacity

In the most recent reported year of 2011 some 2 million tonnes (1.4 million tonnes 5 year average) of licensed capacity is presently not dredged from the Humber licensed areas (see section 2.2 above). Applications for new or additional dredging licences are also under consideration. The Crown Estate has confirmed that it foresees no significant constraints (subject to proper assessment and application) to the grant of additional licences to maintain this level of capacity in the medium term. (Crown Estate *pers comm* June 2013).

The British Marine Aggregates Producers Association (BMAPA) has confirmed that there is adequate capacity in the UK dredging fleet operated by its members to increase production significantly, indeed it is understood that as reflection of current market conditions there is a high degree of underutilisation in the fleet (BMAPA *pers comm* June 2013).

There is an industry trend for new dredgers and in particular those landing in the south-east region and London to be larger in size and cargo capacity than their predecessors. The increase allows them to take advantage of economies of scale and to allow dredging in deeper waters. All the wharves in the region have individual constraints relating to berth size, draft limits etc. (see Table 4.4.1 below). Therefore although in volume terms there is substantial spare capacity, deliverability options may be less flexible in practice. This issue is discussed further in chapter 5.

¹⁵ Although a figure of 2 million tonnes is stated in the brief the study's steering group has confirmed that 'target' does not mean 'goal'. The principle is of a substantial step change increase.

4.3 Landing Capacity

4.3.1 Scale of UK Wharf Facilities

Marine aggregate wharves operating in the UK vary from the small-scale dock side operations of less than 50,000 tonnes per annum to facilities in ports within London and the south of England able to operate in excess of 1 million tonnes per annum. Appendix 5 includes photographs providing examples of both small and large scale marine wharves operating in the UK.

The Hull case study shows that a 300,000 tonnes per annum output can be reached from an irregular shaped site some 1.5ha in extent, where there are no or very few operating constraints i.e. the ability to work 24hrs, no sensitive neighbouring land uses and good transport links to markets.

The wharves with the highest throughput utilise the largest vessels in the dredging fleet of 5,000 tonne capacity and above. These vessels are of the largest length and draft operating and are restricted to the wharves they can access. The area of wharf occupied at the largest facilities which include a wide range of additional facilities for concrete batching and block making is about 10 hectares.

Although a minimum wharf area is required for processing and stockpiling and any value added activities e.g. concrete batching, the volume throughput of aggregate is not usually restricted by land area alone. Market demand is usually the limiting factor. As a semi-continuous process the material can be sold as quickly as it is made ready for market and very large stockpiles are not needed as long as they are sufficient for a minimum of 1.5 ship loads i.e. enough space for a new load when 50% of the previous one is depleted. A medium sized processing plant of 500 tonnes/hr capacity can for example readily achieve 0.5 million tonnes throughput a year.

4.4 Increasing Supply

4.4.1 Port Facilities

Although increased capacity at Hull will help to achieve the aim of increased marine aggregate landing capacity in the region, it is evident further wharf capacity would have to be developed to make the significant step change in landings proposed by the study. Based on the Hull example, at least three further comparable wharves would be required of similar capacity (over 300,000 tonnes per annum).

The availability and capacity of port facilities in the region is a key consideration to increasing supply to the levels proposed by the study. Consultations have taken place during Stages 1 and 2 in an attempt to establish the key options and constraints at the ports and wharfs in the region.

The location of port and wharf facilities considered by the study where it has been determined aggregates could be landed directly from a dredger are indicated on Figure 67015.MA.007 (subject to restrictions on an individual basis) and listed in Table 4.4.1 below.

It has been established by the study that in principle direct delivery of marine aggregates into the region by a typical fleet dredger is limited to the River Humber up to and including the Port of Goole, and the lower reaches of the River Trent and the River Ouse. No dredger could access the Aire and Calder Canal directly (at its start point at Goole Port) or any of the other available waterways beyond these points primarily due to draft limitations.

Direct access to all the available wharves by a dredger are restricted by the following physical constraints:

- the depth of the river channel in the Humber (especially west of Hull), the River Trent and River Ouse;
- the available draft at the wharf;
- limitations of any locks at the entrance to docks;
- length of berth;
- tides (higher river locations have a reduced sailing window and lower available draft); and
- location and height of low bridges and other up-channel constraints.

A number of port and wharf operators have been approached to understand how restricted or flexible the ports and wharves are to accommodate aggregate landings and onward delivery and distribution. The draft and berth size limitations of each of the wharves are identified in Table 4.4.1.

Table 4.4.1 also summarises consultations held with a number of parties regarding whether these locations are:

- suitable for landing marine aggregates at this time;
- readily available or could be made available for landing marine aggregate; and
- in a position where the operator would be willing to accept such a cargo/operation.

These findings are summarised as a 'Yes/No' answer in the table. A number of potential locations of suitable size have thus been ruled out as inappropriate or where the operator is unwilling to accept such a cargo at this time or indefinitely. A 'No' at an otherwise suitable wharf was expressed as (mainly) due to the space required for established wharf activities and the low commercial rates anticipated for aggregates compared to other cargos.

It is evident from the table that only Hull and Immingham can accommodate the larger dredging vessels. The other wharf locations could only accommodate smaller dredgers or possibly the large vessels with reduced cargos that result in a shallower draft than when fully laden. It is understood less than full vessels would be willing to operate, however such an operation will incur cost penalties for piloting and berthing are based in part on ship tonnage.

TABLE 4.4.1 REVIEW OF POTENTIAL AGGREGATE WHARF LOCATIONS

Location/Name	Berth Limit	Max Draft (m)	Tonnage (dwt)	Operator/ownership	Potential to land marine aggregates in future
Humber					
Alexandra/Royal Dock (Grimsby)	145m	5.8	6,000	ABP	No
Immingham Dock	300m	14	200,000	ABP	Yes
Alexandra Dock (Hull)	153m	7.9	9,000	ABP	Yes (until redeveloped)
King George Dock (Hull)	199m	10.4	34,000	ABP	Yes
Albert and William Wright Docks (Hull)	122m	7	5,000	ABP	Yes
Killingholme (Humber Sea Terminal)	230m	10	38,000	ABP	No
New Holland Dock	119m	6	4,500	New Holland Dock (Wharfingers) Ltd (TTS Timber)	No
Barrow Haven (Old Ferry Wharf)	120m	5.3	3,500	William Foster and Sons	Yes
Port of Goole	100m	5.5	4,500	ABP, RMS Trentside Ports.	Yes
Hessle	small berth and river jetty	not known	not known	For Sale (Possibly Waverley Shipping)	Yes
Trentside					
Flixborough	100m	5.5	3,500	RMS Trentside Ports	Yes
Groveport (and Neap House)	100m	5.5	4,500	Warton Grove	Yes
Gunness		5.3	3,500	RMS Trentside Ports	Yes
Others					
Howdendyke (River Ouse)	100m	5	3,500	PD Port Services Ltd.	Yes

4.4.2 **Port of Hull**

The Humber Sand and Gravel Ltd. Alexandra Dock operation in the Port of Hull (and its replacement) has potential to increase aggregate throughput in the short term. The facility can operate 24hrs per day, 365 days per year and has very good road connections. While no details of the new wharf proposed at King George Dock are available, it is understood a similar sized facility is being considered i.e. one with the flexibility to reach up to at least 300,000 tonnes per annum throughput.

The King George Dock location has the option of a rail link which if developed will increase the Company's ability to distribute aggregate and raise throughput. The dock would also have the ability to load commercial aggregate barges for transfer along the inland waterway network (see 5.1.4 below).

The port owner Associated of British Ports (ABP) has been approached and asked whether it would consider allowing an additional large scale wharf facility to be developed at Hull (subject to commercial agreement). ABP have stated there may be room to accommodate as second small unloading only facility at King George Dock in the short term, but it would only be in the medium to longer term when existing leases come to the end of their term that an expansion of the proposed replacement facility and/or a further new large scale facility could potentially be accommodated.

4.4.3 **Port of Immingham**

The Port of Immingham provides very substantial docking facilities and handles imports of many types of bulk cargos notably coal, fertilisers and metal ores. It has no history of landing marine aggregates. The largest aggregate dredgers could access the port. ABP have confirmed that at least one dockside location (which is rail linked) could be made available as a new marine aggregates wharf in the short-medium term, of sufficient size to accommodate a Hull sized aggregate wharf.

Longer term as coal fired power stations are expected to close the land required to facilitate the import of coal is expected to reduce. The extensive areas presently utilised for coal handling and storage if released will provide additional opportunities for large scale aggregate imports.

The port lies closer to the sea than Hull and lies beyond the mark where bulk cargo barges are permitted all year round thus limiting the options for onward transfer to road and rail only unless the existing barge fleet is modified or replaced.

4.4.4 **Port of Goole**

ABP and RMA Trentside Ports (as part operator) have confirmed the port of Goole at the west end of the Humber probably has the potential for a new marine aggregate wharf facility, but a specific location has not been identified. The port handles mainly bulk cargos and steel but has no history of landing substantial amounts of marine aggregate. ABP have confirmed there is some spare wharf capacity at the docks. The port has direct road access onto the M62 and some wharves are rail connected. The port also provides access into the Aire and Calder Navigation, in some cases the connection is direct (avoiding additional locks) providing direct barge access to the wider waterway network including a Leeds. The various wharf options potentially available at Goole have not been explored in detail by the study.

Table 4.4.1 shows the limitation of draft at Goole is 5.5m, less than that required by the current dredgers landing at Hull. The extra journey time up the river to Goole

means a dredger could not discharge and depart on the same tide (as it can at Hull) which has an impact on the economic viability of a Goole operation.

4.4.5 **Other Port Locations**

The other identified wharf locations (Barrow Haven on the Humber, the Trentside Ports of Kings Ferry, Flixborough, Grove, Gunness and Keadby, and the River Ouse wharf at Howden Dyke) are all very active independent commercial operations all be it at a smaller scale than the major ports. Some of the wharf operators have taken part in Stage 2 of the study while all locations have been discussed with various stakeholders. The following issues relating to the Study have been identified:

- Flixborough is the largest and rail linked;
- Barrow Haven is the smallest wharf and is accessible directly from the Humber via a small river inlet (see photograph in Appendix 5);
- wharf space for the development of additional infrastructure is limited at each location;
- tidal and channel restrictions apply to each location including the journey time to and from the sea which means the vessel may have to remain for more than one tide, this factor may affect the willingness of a dredger to berth all year round;
- each location is accessible by commercial barge;
- the quality of road access varies.

4.4.6 **Additional and New Port Locations**

Additional port capacity may be a development option in certain locations as new capital projects e.g. involving new dockside facilities and land reclamation.

A further option raised through Stage 2 of the study is the construction of a new riverside jetty to carry an unloading conveyor to land. A terminal of this kind could therefore occupy deeper water and allow use by large scale dredgers. A jetty of this kind is in operation at New Holland (Old Ferry Terminal) on the south side of the Humber opposite Hull for the import and export (primarily) of grain and animal feeds. This option would require large scale capital investment and new planning consents and permits.

4.4.7 **Other Supply Considerations**

Although the relative operational costs of the different wharf options have not been investigated, the following relevant information and views have been obtained and expressed in the preparation of the study:

- ship piloting charges increase when ships travels up river beyond Hull;
- a dredger will desire to reach a wharf, discharge and then depart on the same tide. The ability to do so reduces the further upriver the wharf lies;
- rental rates at wharves in the major ports are viewed as premium rents comparable to commercial/industrial rents outside the port. Rents at independently owned wharves are lower and are therefore viewed more favourable for small scale marine aggregate operations;
- a number of parties expressed concern that all the major ports were under the control of a single owner (ABP) which placed them in a monopoly situation when negotiating commercial terms. Although the study has not investigated this issue

any further (or asked ABP for comment) exclusive control of these ports by a single owner has the recognisable potential to create commercial barriers to delivery of the study brief; and

- the wharf rents achievable for aggregate cargos and infrastructure are viewed as lower value commodities than other more traditional cargos e.g. steel and timber. Wharf operators consider themselves under no obligation to give any commercial preference to an aggregate operator i.e. to help facilitate deliverability of the study brief on a wider regional scale, if it means reducing their ability to attract higher value cargos.

5 INFRASTRUCTURE

5.1 Introduction

This chapter considers the type of infrastructure required to distribute marine aggregates, the capacity of existing infrastructure and the increase that may be required to deliver the additional marine aggregate to the market. It therefore considers infrastructure requirements for wharves, rail and canal transfer depots.

Facilities that are safeguarded in planning policy have already been determined (by the relevant MPA) as undertaking an aggregate role, or have the potential to perform that role. These locations have been identified from Local Plans and by direct consultation with local authorities. A short description of the information gathered on each location is provided in Appendix 4.

The locations of existing infrastructure used to transport minerals are illustrated on Figure 60715.MA.003.

The ability to transfer marine aggregates landed and processed at wharves to rail or barges could offer the dual benefits of more sustainable means of onward transportation and greater market range than by lorry alone. The infrastructure required to load rail waggons or barges has a capital cost implications that will depend on individual site circumstances. The availability of grant funding may influence the level and type of infrastructure.

Due to their high bulk low intrinsic value material handling costs and transport are a high proportion of the operational costs of any aggregate loading facility. Containerisation is not an element of aggregate transport which is handled as loose bulk material, but substantial plant and machinery is not usually required. Most dredgers are self-discharging but a grab hoist may be employed from the dockside to unload small vessels and to load and unload a barge. Just a wheeled loading shovel is required to load a lorry.

All parties questioned during the study agreed that to minimise costs the transfer distances involved in loading and unloading at any wharf or depot must be as short as possible. Indirect transfer that involves 'double handling' significantly prejudices economic viability to the extent it could make a scheme non-viable. Therefore in transport terms the most important infrastructure is where the potential for multi modal transport options exist.

5.2 Transport Methods and their Utilisation in the Region

In the absence of an ability to direct deliver marine aggregates from the dredger further into the region beyond the Port of Goole and the lower reaches of the River Trent or Ouse, a modal transport shift is required. The proposal to transfer aggregates from a marine aggregate wharf to market is limited to three options:

- transfer by road;
- transfer by rail; and
- transfer by canal and/or waterway.

An overview of issues which have been identified in relation to these options is provided below.

5.2.1 **Transfer by Road**

Road transfer is considered straight-forward and flexible. Loading need only be undertaken by mobile loading shovel or hopper into a tipper lorry of c20 tonne capacity for short haulage, or for long journeys articulated lorries of c28 tonne capacity. A 1 million tonne throughput facility equates to at least 35,700 loads (71,400 movements), or 143 loads (286 movements) per day over a 5 day, 50 week year.

Lorry transport is the primary method of distribution of concreting and other sands in the region and the UK as a whole.

Loaded lorries are presumed to be able to deliver directly to the customer without further transfer unless additional processing is undertaken e.g. concrete batching, bagging etc. Transport by road has implications in terms of environmental sustainability but it remains for journeys of less than 50 miles the cheapest economic option against which alternative options are considered.

The option to utilise a return load system so that lorries do not return empty can substantially improve commercial viability.

5.2.2 **Transfer by Rail**

Rail transfer has the advantage of economies of scale over road transfer and is used widely by the aggregate industry. Each aggregate train carries between 800-1500 tonne (75 tonne per wagon). In terms of carbon footprint and reduced congestion it is also considered more sustainable than road transport.

Figure 67015.MA.006 indicates the main rail network and the location of existing rail served aggregate depots within the region. One location identified on the plan located in Hull is at Dairycoates (Lafarge Tarmac), it imports crushed rock aggregate to a coated roadstone plant (tarmacadam - a use for which marine aggregate is unsuitable) but it lies distant from any potential aggregate wharf, is not used to transport marine aggregate, and could not easily be adapted for that use.

The three aggregate depot locations in Leeds (operated by Lafarge Tarmac, Cemex and Aggregate Industries) import crushed rock from rail linked quarries in the East Midlands and North Yorkshire and are located in the Knowsthorpe and Stourton areas south-east of the city centre. The study found no examples of concreting sand being transported around the region by rail i.e. concreting and asphalt sand (and gravel if required) are imported to these sites by road only.

The most recent development in the region is a brand new Aggregate Industries rail served facility at Tinsley near to the M1 in north-east Sheffield, granted planning permission in 2013. Developed on a former railway yard the site is 5.9ha in size (including landscaping area) within a large industrial setting. When fully operational it will include asphalt production, concrete batching, a large recycling facility and a rail import depot for crushed rock with a total throughput of some 320,000 tonnes per annum¹⁶. The facility will in part supply asphalt for a major long term PFI funded road surfacing contract granted by the City Council.

Otherwise no capacity limits for the active rail infrastructure serving these aggregate depots has been made available by the aggregates industry. However, URS' industry experience suggests that the capacity is firstly a function of the number of railway slots (trains allowed on the network) and storage capacity.

¹⁶ Details obtained from the registered planning application 12/02771/FUL Sheffield City Council.

A number of operational and economic issues have been identified relevant to the development and use of rail infrastructure for the transport of aggregate:

- direct loading of a train at the wharf requires less infrastructure and mobile plant, and is preferred over a satellite location that involves double handling;
- specific rail infrastructure is needed at both ends of the delivery route;
- stockpiling capacity is required at both ends of the route;
- access to rail sidings and shunting routes are limited;
- the length of rail sidings may limit train size and therefore capacity;
- rail freight capacity on the rail route may constrain train numbers and the timing of working;
- road infrastructure is required at the destination depot for onward transfer;
- there is a potential for return loads of other materials; and
- obtaining planning permission for new rail infrastructure may be difficult to secure.

5.2.3 ***Transfer by Canal and Waterway***

The commercial transport of goods including coal and aggregates has been established on the region's waterways for centuries and still occurs to a modest extent on the Aire and Calder Navigation, the lower reaches of the River Trent and River Ouse, and the Sheffield and South Yorkshire Navigation. Barges have a cargo capacity of circa 200-500 tonnes therefore this method of transfer can also benefit from economies of scale over road transport. It is also considered to have a lower carbon footprint and thus more sustainable than road transport. The amount of infrastructure required for loading and unloading may be less than required for rail transport. Disadvantages may include a longer delivery time and the reduced potential to make use of return loads. However, the speed of delivery for aggregates is rarely time critical and the distances along the available waterways for commercial barges are relatively short.

A map of the navigable waterways and the barge capacity along each length of waterway has been prepared in consultation with stakeholders and is attached as Figure 67015.MA.005. The map illustrates commercial barges can travel extensively from the Humber e.g. to Leeds, Rotherham, Newark, Wakefield and the approaches to York.

The commercial boat operators and the Canal and River Trust have stated there a large number of unutilised wharves and former wharves on the network but only a small number will have the potential to facilitate the transport of marine aggregate, primarily due to availability, size and location in relation to demand centres, road communications and sensitive neighbouring land uses.

Until mid-2013 Lafarge Tarmac utilised a barge operation to transfer sand and gravel from Besthorpe Quarry near Grantham up the River Trent and along the Aire and Calder navigation to Whitwood Wharf, near Castleford (see photograph in Appendix 5) to supply a concrete batching plant and aggregate depot located on a purpose built wharf of about 1 hectare of former brownfield land. The barges employed were owned by the Company or independently owned and moved up to 200,000 tonnes per annum.

The Whitwood wharf operation began in 2002 and was supported by a conditional government grant of some £1.1 million for a 10 year minimum term operation. At the end of the conditional period in 2013 the operator chose to replace barge imports with lorries. URS understand that as of November 2013 this decision is under review and may be restarted. The study has found no other regular movements of aggregates by waterway in the region in the recent past.

A number of operational and economic issues have been identified relevant to the development and use of waterway infrastructure and the use of barges for transporting aggregate:

- the length of wharf and area required for offloading a barge is small. Photographs in Appendix 5 of Whitwood Wharf and at West Drayton wharf (north London) illustrate the small amount of infrastructure required;
- the commercial barge operators state there are sufficient spare bulk cargo barges in the region to supply 250,000 tonnes per annum at short notice;
- the Whitwood example indicates an aggregate barge cargo of 450 tonnes can be unloaded by a mobile grab hoist sited on the wharf in 2 hours;
- a one way barge journey along the Aire and Calder from Goole to Leeds takes about 9 hours;
- due to legal tide limitations barges cannot travel the entire length of the Humber, Hull is accessible but Immingham is not;
- barges are able to travel at night if necessary; canal infrastructure for loading and unloading is required at both ends of the journey;
- the draft of a fully laden barge is less than the limit of all the potential wharves listed in Table 4.4.1 i.e. in this respect all the potential wharves are accessible by barge;
- stockpiling capacity is required at both ends of the route;
- direct loading from a dredger into a barge may be feasible by grab hoist;
- substantial capital infrastructure would be required to increase the maximum size of barge to Euro standard size of 600 tonnes (larger than a normal Humber barge);
- having a return load cargo would greatly increase the economic viability of any proposal;
- some operational restrictions were raised by stakeholders such as lock access and wharf silting. The Canal and River Trust have however stated that if there was good commercial reason to ease such restrictions they would undertake the necessary works e.g. by site specific dredging; and such issues should not be seen as a barrier to employing a greater number of barges on the network; and
- wharf and canal fees/tolls apply for each vessel.

5.3 The Amount of Existing Infrastructure with Reference to Planning Policy

5.3.1 Introduction

The location of existing infrastructure has been informed by a review of relevant planning policy documents and discussions with the region's MPAs. A list of identified marine, canal and waterway wharves and rail depot locations is included at Appendix 4. The following summaries state the number of locations where adopted local

authority planning policy documents have specifically identified the site as one which should be preserved for that use i.e. safeguarded.

5.3.2 ***Marine and Waterway Wharves***

Safeguarded

There are no safeguarded wharves within the region's existing local plans. Two safeguarded wharves are identified on the Tees in Redcar, Hartlepool and Stockton local authority that lie outside of the region but are relevant to the Study.

Non-Safeguarded

Neither the existing or proposed Hull marine aggregate wharves are safeguarded.

A total of thirty- seven waterway wharves have been identified as used for, or having potential for, transport of minerals but are not safeguarded. A further five waterway wharves are identified outside of the region but are relevant to the study.

5.3.3 ***Railways and Rail Depots Locations***

All the main urban centres are served by railways; West and South Yorkshire also contain branch lines into their main industrial areas. The location of aggregate depots that are rail linked have been reviewed and illustrated on Figure 67015.MA.006.

Safeguarded

There are no safeguarded rail depots within the region's existing local plans. Two further locations within the Tees Valley lying outside the region are safeguarded rail depots and are considered relevant.

Non-Safeguarded

A total of twenty additional rail depots have been identified as used for, or are considered as having potential for transport/acceptance of minerals but are not safeguarded.

5.3.4 ***Waterway Safeguarding***

The region is well served by a system of rivers, waterways and navigable ways. Ownership of these routes is vested in the Canals and River Trust on behalf of the nation. Of key interest is the Aire and Calder Navigation and its many branches and the River Trent.

Although the Trust is consulted on planning applications and emerging Local Plans, there is no evidence that this position has highlighted the need for policies to preserve / maintain these routes for the transport of goods. No policies relating to safeguarding of the actual routes (rather than infrastructure along them) have been found.

5.3.5 ***Summary of Locations by Infrastructure Type***

Within the region only the Leeds City Council (LCC) Natural Resources and Waste Local Plan 2013 safeguarded wharf and rail depot sites with the potential to distribute marine aggregate. However the High Court in *Schenker and Towngate v. Leeds City*

Council 2013¹⁷ quashed the relevant safeguarding policies on the basis the council had not established there was a reasonable prospect of them being used and the Inspector had erred in endorsing the safeguarding. The relevant policies will now be reconsidered and re-examined by Leeds CC. Therefore, the six canal wharves and six rail sidings named in the Plan have been added to the list of potential sites listed in Table 5.3.1 below.

Table 5.3.1 identifies wharves and rail depots with the potential to transport marine aggregates within the region identified by local authorities but that are not currently safeguarded in Local Plans.

Each location has been considered by URS for its significance as a potential destination for marine aggregates. Because of the potential size of market available locations in urban areas with good transport links are considered to be of higher significance than a remote rural location with poor transport links. It has not been possible within the scope of this study to consider these locations on the basis of wider criteria e.g. size of site, availability, new infrastructure requirements, sensitive neighbours etc.

No existing or potential facilities have been identified in Bradford.

TABLE 5.3.1: LOCATIONS WITHIN THE REGION WITH IDENTIFIED WHARVES OR RAIL DEPOTS (NON SAFEGUARDED) WITH POTENTIAL FOR THE TRANSPORT MINERAL AGGREGATES

Location	Significance of location (high/medium/low)	Wharf	Rail Depots
Calderdale	Low/Medium	N/A	Stockbridge Depot
Doncaster	Medium	Rawcliffe former oil wharf	Hatfield Colliery
East Riding	Urban locations-Medium Rural locations-Low	New Bridge Wharf Glucose Wharf Croda Wharf Linpac Wharf M.O.D Wharf Tilcon Wharf Howendyke (3 locations) Goole Wharf Port of Goole	N/A
Hull	High	Alexandra and King George/Queen Elisabeth Docks	N/A

¹⁷ DB Shenker Rail (UK) Ltd (2) Towngate Estates v Leeds City Council [2013] WL 5328642 QBD (Admin) Judge Belcher 24 September 2013.

Kirklees	Urban locations-Medium Rural locations-Low	Calder and Hebble Wharf	Bretton Street Dewsbury Dewsbury to Mirfield Area (various) Hillhouse Fartown (Huddersfield)
Leeds	Urban Locations High Rural locations Medium	Cinder Oven Bridge, Stourton, Old Mill Lane, Fleet Land, Skelton Grange Road, Bridgewater Road.	Canal wharf Bridgewater Road, Pontefarct Road, Knowesthorpe Lane, Skelton Grange, Rail sidings, Bridgewater Road, Cadeby Quarry
North East Lincolnshire	High	Port of Immingham	N/A
North Yorkshire	Urban-Medium Rural locations-Low	Drax Power Station Selby Ouse Wharf, Selby Heck Landing Wharf	South Milford Junction Gascoigne wood sidings Eggborough Power Station Selby Depot Great Heck rail head
Rotherham	Medium	Kilnhurst Canal Waddingtons Dockyard	Masborough Sidings Maltby Colliery
Sheffield	High		Tinsley Europa Way
Wakefield	High	Whitwood wharf Castleford BW Wharf Ferrybridge PS wharf Ferrybridge to Knottingley (3 locations) Steetley Wharf Lamson Wharf	Horbury to Healy rail sidings Knottingley
York	Medium	N/A	Hessay

5.4 Infrastructure Capacity

There are no published figures for the potential capacity of any of the existing used or unutilised infrastructure identified. Consultations with stakeholders during the course of the study have however, allowed the following factors and estimates of infrastructure capacity and site area to be reached (assuming all other factors are equal and subject to the qualification below):

- the size of area required is not necessarily proportionate to the volume of throughput; a small area e.g. less than 1ha, can efficiently handle large volumes if the aggregate is exported at a high rate without the need for extensive stockpiling or utilised in end products e.g. concrete batching;

- the size of site needed is significantly dependant on the area required for stockpiling;
- at a dock or wharf where processing is required an area of at least 2 hectares is preferred for a throughput of circa 300,000 tonnes per annum;
- at a dock or wharf where processing is required an area of at least 5 hectares is preferred for a very high throughput e.g. in excess of 500,000 tonnes per annum and including some value added product(s);
- stockpiling at the marine wharf sufficient for 150% of a dredger load is required i.e. a full load can be landed when 50% of the previous load has been removed, unless processing plant throughput is slow and continuity of supply is not required;
- the area required for stockpiling of train loads should be sufficient for at least 150% of a single train load;
- the length of siding should be sufficient so that the train does not block the branch line during loading/unloading;

In all these circumstances it is assumed the location is in a non-sensitive industrial / commercial setting and no additional stand-offs are required to account for nearby sensitive receptors. To provide adequate buffers from adjoining sensitive neighbours, substantially larger areas may be needed and will require risk appraisal on an individual basis.

5.5 Infrastructure Requirements to Meet the Uplift

The Hull example supported by the findings of the Stage 2 consultation illustrates that new wharves will be required. To land sufficient marine aggregates required to meet the proposed uplift of up to 2 million tonnes at least three new large additional wharves would be required.

Stage 1 of the study found that in numerical terms enough wharves and rail depots exist to suggest there is a good prospect that there was sufficient infrastructure in locations relevant to the main markets in West Yorkshire and South Yorkshire, to allow a substantial increase in marine aggregates to be utilised.

Stage 2 of the study has refined the Stage 1 findings in relation to marine wharves by identifying that only a small number of the wharves are of sufficient draft to accept all the vessels in the dredging fleet, are available in the short term, and are of sufficient size to accommodate a large capacity facility (as reported in section 4.4).

Section 5.4 above provides an indication of the size of site required to develop new infrastructure from the small scale to the large scale marine aggregate handling facility. Above the smallest scale landing stage the study found the size of site is more dependent on the requirement for aggregate stockpiling (before and/or after processing) and an ability to co-locate additional value added infrastructure e.g. for concrete batching, block making etc. However, to meet the uplift suggested by the study of up to 2 million tonnes per annum it is probable that at least two additional very large scale wharf landing facilities would be required (in addition to the existing or replaced Hull facility),

The study has not confirmed the potential capacity of the existing infrastructure used to transport aggregates. The nine rail served aggregate depots in the region are known to handle (import or export) crushed rock aggregate and cement. The existing rail supplied depots in Leeds, Hull and Sheffield are utilised to import crushed rock

aggregate from elsewhere in the region and beyond. The Hanson depot in Leeds already lies adjacent a branch line that is well placed to be developed for rail imports in the short-term (it lies adjacent the Lafarge Tarmac rail depot and could probably utilise the same branch line).

The need to potentially modify existing infrastructure i.e. plant and machinery, to import sand and gravel and the lack of available site details for each location means it has not been possible to predict the level of marine aggregate import that could be realised at these existing locations (if the operator chose to do so). The location and size of the existing Leeds sites has been nominally reviewed by the study and each is found to be confined, sufficient to undertake their current operation with little apparent scope for expansion. In the absence of more detailed assessment it is considered unlikely there is sufficient land available to build the additional infrastructure required to facilitate the import of very large additional volumes of (marine) aggregate by rail, and the area required for stockpiling once discharged from the train, unless the marine aggregate wholly replaces the crushed rock aggregate (to avoid contamination). As the crushed rock import is in part used as roadstone to produce asphalt full conversion is considered very unlikely.

In the absence of any existing infrastructure already built or utilised for the import of sand and gravel (rather than crushed rock) additional rail export (from the wharf) and unloading infrastructure is necessary. Because of the land constraints at existing facilities it is expected additional land or new sites would be required to meet the proposed uplift. The industry is dominated by five national and international companies (Lafarge Tarmac, Hanson, Cemex, Aggregate Industries, and Hope) each with different sources of supply and demand requirements. It is likely therefore that in the absence of a single joint venture operation a number of additional rail sites would be needed in the region e.g. at least one for each large conurbation. The example of the former Mendip Rail joint venture for the supply of aggregates out of Somerset quarries and the Humber Sand and Gravel Ltd joint venture suggests that a common need could allow a number of companies to join together to utilise economies of scale and develop the necessary infrastructure.

Canal and waterway wharves are numerous in the southern part of the region but none are presently being utilised for the import of aggregates. The study has found that if there is sufficient demand for the product only a small berth and wharf area can transfer high volumes of aggregate. The canal and waterway network is more extensive than the railway network and could provide a more flexible means of delivering the aggregate from some of the Humber wharves into a spread of demand centres. Although only a few wharf locations have been safeguarded there are known to be many unused wharves in the network. This study has not been able to specifically assess any of these wharves as potential sites for aggregate infrastructure.

To meet the requirement to minimise aggregate double handling the location of wharves need to be at the point of use or sale and therefore locations in the urban centres will be most likely to be needed in the future if the uplift proposed by the study is to be met (even partly) by utilising canal and waterway transfer.

6 SUMMARY OF STAGE 2 ENGAGEMENT WITH STAKEHOLDERS

6.1 Introduction

Stage 2 of the study comprised discussions with stakeholders to establish their views on the potential future role of marine aggregates in the region - based on the findings of Stage 1.

The Stage 2 stakeholder discussions sought to address the following issues outlined in the study brief.

1. the potential scale of contribution over the short (0-10 years), medium (11-20years) and longer (21 years +);
2. the relative merits (in environmental, social and economic terms) of land-won and marine dredged aggregate supply and whether an appropriate balance can be identified;
3. the barriers (including and real and perceived barriers) to the delivery of increased supply of marine aggregates into the region and what would be needed to overcome them; and
4. the likely economic viability of marine dredged aggregate as a substitute for land won.

The project steering group instructed that the scope of the Stage 2 consultation was not to be limited to these points and that any relevant avenue could be explored if it aided understanding and delivery of the overall study objectives.

In September 2013, three workshops were held for invited stakeholders to discuss the four points, and other issues arising from Stage 1. The list of invitees was approved by the steering group in advance of the workshops. Each workshop followed the same format - beginning with a briefing on the study, a summary presentation of the findings of Stage 1 followed by a discussion of the specific issues.

The workshops were organised to group stakeholders together based on their specific areas of interest, namely:

- aggregate industry operators and practitioners;
- planning authorities and policy makers; and
- representatives of transport bodies and operators.

As a preliminary to each workshop the basic premise of the study was discussed and agreed – namely that a strategy for increasing the proportion of aggregates supply to the region met by marine aggregates is needed – having regard to issues such as deliverability, timing, scale and affordability.

6.2 Scale of Contribution

The following points were expressed by stakeholders:

1. It was more likely that the move towards greater utilisation of marine aggregate resources will see an incremental increase over time rather than a sudden change. This is because each existing aggregate supplier has different levels of land based reserves which will decline at varying rates, and each has a variety of

supply options available to make up any shortage before needing to invest in alternatives including the potential for marine. However, if a new major operator came into the market without access to local resources the marine supply option may be the only means of securing the necessary supply and as such a step change may happen.

3. Without knowing the total amount of land based resources aggregate companies have available or wish to realise (which is commercially confidential), it is not possible to predict what the scale of contribution from marine aggregate will be at any specific point in the future.
4. A small independent operator may be able make a small scale contribution scheme viable on the basis of one dredger delivery per month delivering to an independently owned wharf. URS calculate this to be in the range of 25-42,000 tonnes per annum. This would involve a single aggregate depot (potentially supplying a single concrete batching plant) supplied either directly at a marine wharf or via onward transfer by road or barge but not by rail.
5. It is likely that because of the high capital costs involved, only a major aggregate company (or joint venture company) will pursue a new high volume scheme that takes advantage of the economies of scale provided by regular dredging and bulk transport from the marine wharf to the wider region. URS calculate this potential will start from in excess of 75,000 tonnes per annum. This figure is based upon two small dredger loads of 3500 tonnes per month (or one large dredger) and one train per week of 1500 tonnes. These are the minimum numbers expected to make the operation viable utilising a regular dredging contract.
6. The option for transfer loading by road or barge from a marine wharf is considered not to be a constraining issue in tonnage and area terms at a site designed to handle up to 300,000 tonnes per annum. Above this level of throughout the area required for stocking, frequency of loading and number of vehicle movements may become operationally difficult to achieve and the scale of facility has to become substantially greater.
7. It is unlikely a single major new facility of a scale equal or greater than the Hull example (300,000 tonnes per annum plus) will take place other than at the ports of Hull or Immingham because of the draft requirements for large capacity dredgers at other wharves and the area of land required for stockpiling and loading.
8. The Port of Goole has port access to all three transport options but location and access constraints means it is limited to use by smaller dredgers. Because of this it may not be able to achieve the economies of scale of the larger ports, but a medium sized wharf facility of c75,000 - 200,000 tonnes per annum may be feasible.

6.3 Timing

The study brief required consideration of the timescales for any increased contribution from marine aggregates. The following consensus was reached by stakeholders (with time periods at slight variance to those suggested by the study):

1. In the short-term (5 years or less) the amount of available land won reserves and the relative costs of supplying to the market is sufficient so that there is unlikely to be a substantial shift away from the reliance on land won aggregate, unless either a major new operator enters the market or an existing operator had an unexpected supply constraint. However, a small independent operator may seek

to ensure their own security of supply and be able to make a small marine aggregate import scheme viable within this timeframe.

2. In the medium term (5-20 years) the likelihood is that one of the major aggregate operators will develop this option to provide long term security of supply;
3. In the longer term (20 years plus) it is likely one or more operators will be actively importing marine aggregate from the Humber licensing area.

6.4 Relative Merits

There was a common belief amongst the stakeholders that the option of marine aggregates did have merit (in environmental, social and economic terms) over land won aggregate but evidence to test and prove the hypothesis would be difficult to obtain. The relative merits of marine over land won aggregate is likely to become stronger with time.

It was also agreed that it would be difficult to establish an appropriate mechanism to evaluate what the appropriate balance with other supply options should be on these three grounds. This is because of the wide number of generalisations that would have to be included and the different scenarios and variables that would have to be considered, the relative weighting many factors would have to be given, and the cross boundary nature of the different supply options. A concern was also raised regarding who would scope, initiate and finance such an assessment. It was also felt that any such report would only ever be informative rather than binding.¹⁸

It was agreed that existing known land based aggregate resources should be utilised while they are accessible, rather than there being any presumption (in planning policy terms or otherwise) in favour of any alternative supply option e.g. the study scenario. The relative merits of releasing additional land based resources will be tested through the existing procedures of Mineral Local Plans and determination of planning applications. The aggregate industry will always supply the market via one or other supply scenario.

It was also felt that the balance of supply should not be set by policy in advance of the need to do so, but the decline in available land based resources should be predicted and planned for, with the replacement/alternative supply strategy facilitated by planning policy co-operation across the region.

6.5 Barriers and Constraints

6.5.1 Planning Policy Issues

The stakeholders considered that the lack of a formal regional planning policy structure e.g. the former Regional Spatial Strategy (RSS), that could actively promote and facilitate cross border delivery of complex aggregate supply options (including marine), would make it more difficult for them to be realised, because it relies on the

¹⁸ URS has undertaken carbon equivalent emission comparisons for different transport supply scenarios using various modelling techniques including WRATE (Waste and Resources Assessment Tool for the Environment). Such modelling could be applied to the transport and distribution element of different models to compare potential environmental air quality impacts. In general terms WRATE modelling shows on a like for like basis carbon equivalent emission levels are lowest for rail transport, followed by barge and highest for road transport.

'duty to co-operate'¹⁹ approach incumbent on local authorities. This is considered less structured and less binding on the participants, and with no ability to refer any policy contradiction to the regional level for adjudication.

The former nationalised ports (now owned by ABP) have substantial rights under the General Permitted Development Order 1995 (GDPO) to redevelop its marine wharves for other portside activities without requiring express planning permission from the local authority. This flexibility allows a marine aggregate wharf to be developed from an existing wharf without any delays, but it also means that (in practice) no such wharf can be safeguarded from alternative port related development in Local Plans (none port related developed would require planning approval).

Owners of wharves which do not have the benefit of "permitted development rights" would normally require planning permission to operate a marine aggregate wharf and transfer facility - which would add to the cost and delivery of any such project.

There is frequently pressure for the release of infrastructure land for alternative non-compatible development especially in urban areas. The NPPF provides no guidance how a local planning authority should balance such competing interests e.g. in delivery of housing supply targets while safeguarding aggregate infrastructure. Politically aggregate supply policy is seen as the 'poor relation' in relation to other forms of development e.g. housing and regeneration. Without strong safeguarding policies the available infrastructure could be lost before the need for it becomes more apparent or urgent.

6.5.2 **Available Wharfs and Depots**

Table 4.4.1 summarises the conclusions of discussions held with stakeholders regarding the limitations due to vessel draft at the potential marine wharves and the view of their operators about facilitating such a use. Ship draft is a limiting factor for fully laden larger scale dredgers at all locations other than at the ports of Hull and Immingham. Tidal restrictions (amongst other matters) provide additional constraints at the other wharves listed which could only be addressed (if at all) by capital expenditure e.g. regular dredging. However, the entire Humber channel is a Special Conservation Area and no such works are allowed without detailed environmental appraisal which is considered costly.

There is a limited amount of land available in the right locations for the development of additional rail and canal wharves infrastructure and some of that which is available is becoming constrained by non-compatible development on adjacent land.

The view was expressed that the option of a wholly new purposes built marine aggregate wharf or jetty being constructed in the Humber should not be discounted.

6.5.3 **Knowledge**

An apparent lack of appreciation for the potential to transport bulk goods on the region's canals and waterways at competitive costs was viewed as a barrier to developing the marine import strategy. This lack of appreciation was said to be manifest in several of the cost assessments carried out by the largest operators – which only appear to consider road and rail.

¹⁹ Localism Act 2011 s110.

6.5.4 **Economics**

Aggregates are a high bulk low value product with historically low profit margins that largely rely on volume sales and value added uses e.g. concrete batching or bagged products to realise good returns on investment. The economic viability of aggregate production is finely balanced; the recent (2009-12) large fall in demand and revenues due to the recession in construction expenditure has not been seen in the last 30 years and as such the current picture should not be taken as a portent of future supply and thus infrastructure requirements.

The market for the supply of aggregates is highly flexible, the recent recession has resulted in many quarry site closures and mothballing where over capacity developed, resulting in material being transported greater distances than has happened historically to maintain supplies to the market. The industry expressed the view that *'the market will always be supplied'* but the method and price for doing so changes over time. The economic case for marine aggregates has to compete against land won, imports, recycled products etc. and is considered a less flexible supply option than these alternative supply options in the short term, and more capital intensive which has been very relevant during the recession since 2007. Over time this cost difference is expected to narrow as high quality land won aggregates become expensive to supply to the region's main conurbations and security of supply becomes more critical.

Outside the workshops URS were provided with information by various parties that cost assessments for the development of different large and small-scale marine aggregate import schemes have been undertaken in recent year but they were found not to be financially viable at that time. It was stated the margin for making a scheme viable was relatively small. URS understand the margin of profitability was in the region of £2/tonne but details of these schemes were not provided for comparison purposes or independent checking by URS.

Any potential to reduce the capital and operational costs or to attract grant funding would increase the likelihood of such proposals to fruition. A general increase in demand and the prices/margins gained would also help improve such appraisals.

The following additional cost issues and considerations were raised by stakeholders:

1. If only a concreting aggregate is required and a dredger can guarantee delivery of single sized sand that does not require processing to meet EU standards for concreting aggregate, the infrastructure requirements are low and the area of land needed is substantially reduced, thus the economic case for a scheme that delivers an increased contribution of marine aggregate is more viable.
2. Although overall there is sufficient dredger fleet capacity, ownership and availability of individual vessels is uncertain, therefore it is difficult to determine how many dredgers are available to land at the different wharves identified by the study, and therefore how competitive is the offer price.
3. The aggregates levy of £2/tonne applies to land won and marine aggregates. If it was applied to support sustainable extraction it should be removed or reduced for marine aggregates in circumstances where alternative supply options were considered less sustainable e.g. those that involve road transport over greater distances. Such a step would make marine coupled with rail or barge transport more viable.
4. By owning all the Humber ports where marine wharves allow large dredgers to dock (Hull, Immingham and to a less extent Goole), ABP are viewed as having an

un-competitive market position. Their monopoly position should be reduced to allow cheaper wharf rents to be negotiated.

5. Specific funding options for capital projects that will facilitate the use of alternative means of transport other than by lorry should be re-introduced, while retaining the funding available in support of operational costs (described at section 6.6).
6. The regeneration of contaminated or brownfield land should be given a tax advantageous position for industrial/commercial afteruse (rather than housing and retail) to make land that could be used as strategic aggregate infrastructure more commercially viable.
7. Some specific investment in the canal infrastructure may assist utilisation of the waterway network to the full but nothing fundamental is needed to supply central Leeds if the existing safeguarded Aire and Calder wharves are retained. Operational and management issues can be resolved through the Canals and River Trust.
8. The aggregate companies should consider establishing a joint venture company for dredging and/or delivery of aggregate to depots in the urban areas. The dredging companies are frequently organised as joint ventures and there has been historical joint venture operational companies working in the industry in certain regions which set a precedent e.g. Mendip Rail in Somerset.
9. Tolls over the Humber bridge constrain the distance lorries carrying marine aggregate can travel to compete with land won sources.

6.6 Supply from Outside the Region and Alternative Sources

Stage 1 of the study identified that the greater proportion of landings from the Humber licensing area took place in ports on the Tees and the Tyne in the North-East region. URS have been informed that distribution from the ports is limited to road transport and (like the Hull example) relatively limited by distance. URS has established that at least two of the docks used are rail connected which raises the potential for export to the region.

Similarly there are marine aggregate wharves in other regions which are rail linked which could be considered by the aggregate industry as supply routes.

The scope for the potential contribution from alternative supplies options e.g. from crushed rock sources whether from within the region or outside it may also need to be considered in any development of alternative supply scenarios. Crushed rock fines were historically seen as a by-product or wastes are now sometimes used as a substitute for concreting sand. Operators with large crushed rock assets may seek to utilise crushed rock fines before they advance new supply routes such as marine aggregates, especially if they have little knowledge or experience in that area. Other secondary or recycled sources may also be sought but the scale of supply of these sources is considered unlikely to contribute substantially to the volume suggested by the study.

7 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary of Stage 1 Findings

The review of published resources and initial discussions with stakeholders indicates that marine aggregates are considered to be a suitable substitute for land-won aggregates. In addition the scale of the marine aggregate resource is considered to be very large scale - sufficient to provide a robust basis for a long term strategy of greater dependence within the region on marine sources.

Although an increase of up to 2 million tonnes per annum in the amount of marine aggregate landed in the region would represent a significant (20%) increase in the amount landed in the UK in recent years, discussions with the British Marine Aggregate Producers Association and the Crown Estate have confirmed that there is sufficient capacity in the existing marine dredging fleet to accommodate that scale of increase. Additional landing facilities would be required to meet that degree of increase. In the short-term the only operating wharf within the region (Alexandra Dock, Port of Hull) has under-utilised capacity which could make a contribution. In the medium term the replacement facility at (King George Dock, Port of Hull) will have the potential to utilise a rail link to access a wider market and thus increase the range and amount .

No published evidence has been found that prescribes the areas of land required to achieve a specific throughput at an aggregate wharf or depot. However, the Hull facility can achieve 300,000 tonnes per annum on a 1.5 hectare site including processing. Plant capacity, size of stocking areas, area required for value added uses, and level of demand are considered the main defining parameters for the area of land required.

Constraints through competing demands have been identified which have the potential to limit the extraction of the identified marine aggregate resource. The licence application procedure and the role of the Crown Estate in granting and reviewing conditional licences is the platform for evaluating the balance of competing interests.

A number of wharves and rail depots have been identified which are used or have potential to be used for the transport of marine aggregates. However, only a small proportion of these are currently safeguarded in adopted Local Plans. All locations considered to be high demand centres for sand and gravel have either safeguarded or non-safeguarded facilities with potential for mineral aggregate transport, except for Bradford.

The available options identified for the transport of marine aggregates from wharf to market are transfer by road, rail and canal. The road network in the region is considered to be very good and the railway capacity is considered to be adequate. The network of waterways meanwhile, provide many opportunities for the transport of aggregate from marine wharves to the main centres of demand. The foremost of these opportunities are considered to be on the Aire and Calder Navigation,

7.2 Summary Findings of Stage 2 Stakeholder Engagement

This Stage 1 report provided the context for further engagement with key stakeholders in the form of face to face meetings and a series of round table workshops with stakeholders. Three stakeholder workshops were held in September 2013 attended by some 20 individuals from the aggregates industry, policy makers and transport practitioners.

The main points of conclusion are set out below.

7.2.1 **Scale of Contribution**

A significant step change towards the 2 million tonnes landings figure is considered unlikely in the short term (less than 5 years) unless a major new aggregate operator enters the region without recourse to land won resources and needs to ensure security of supply. The likelihood of a step change will increase over the medium term (5-20 years). A significant increase in the amount of marine aggregate landings is considered by stakeholders to be 'inevitable' in the longer term (over 20 years). The precise amount of increase and the timing of that increase is however difficult to predict. The demands of new very large infrastructure projects may also influence need and the timing of need.

A small-scale increase may be seen at the existing Hull facility as local markets improve following the recent economic downturn. The potential of a rail linked facility at Hull in the replacement King George Dock would provide the flexibility needed to initiate a significant change, but the size of wharf and processing plant may be a limiting factor preventing the scale of uplift suggested by the study being reached by this facility alone. The entry of one or more small scale independent operator at an independent riverside wharf may also realise a small tonnage increase, perhaps in the range 25-42,000 tonnes per annum in the short to medium term.

The very substantial increase suggested by the study could only therefore be facilitated by a substantial expansion of the proposed Hull facility or a wholly new operation or operations elsewhere in the ports of Hull and/or Immingham, and to a lesser extent Goole. One or more of the riverside wharves may also be able to make a case but this scenario seems the least likely (being rail linked Flixborough is the best positioned). Only Hull and Immingham can currently be accessed by the large dredgers with drafts in excess of 6m when fully laden. In the context of this study these two ports can be considered regionally important for their potential to deliver the proposed uplift.

Therefore it is at these locations that one or more of the new large scale facilities of 500,000 tonnes per annum scale or more is most likely. On the basis of the amount of available wharf side space for stocking in the foreseeable future, Immingham is considered the most likely location in the medium term when coal imports are expected to decline. Immingham is not accessible by the current barge fleet and thus bulk distribution from there would be reliant on rail if not by lorry.

The potential for new case specific wharf capacity on the Humber built to transfer marine aggregates is a new option but due to the very high capital and investment costs involved it has not been considered further by the study.

7.2.2 **Scale of Infrastructure**

Aggregate rail depots utilised for the transport of aggregate in the region have been identified, they all only handle crushed rock aggregate (and cement). The import depots are within or close to urban centres and benefit from good road connections. The depots utilise the crushed rock aggregate as stone and in the value added products of asphalt and concrete. From an initial appraisal only it is considered unlikely these sites could (as they stand) also accommodate very large volumes of marine aggregate e.g. for lack of storage space. If by specific assessment this is confirmed, site extension, additional infrastructure and probably additional sites will be required to accommodate the imported marine aggregate.

A significant number of potential depot sites have been identified around the region by individual planning authorities but they have not been assessed for development suitability by this study. Any regional distribution model for marine aggregates will require new depot infrastructure to be provided on a regional basis. New development will be market led so that individual company circumstances will dictate which are the most suitable sites, however an assessment of the potential suitability on a regional basis would help inform the development plan making process and may satisfy the requirements of the High Court decision in *Schenker and Towngate v Leeds City Council* 2013 (see 5.3.5).

If the aggregate depot is only to undertake a transfer role without processing, the area of land required need only be small i.e. 1ha or less depending on stockpile requirements. Where processing and value added manufacture is undertaken a large throughput (c500,000 tonnes per annum) would be expected and a 5ha site would be required. In both cases it is assumed neighbouring land uses do not prejudice operation of the development up to the boundary e.g. without allowance for any standoff from sensitive users so that operations can be undertaken on 24hr, 7 days a week basis or with little restriction.

The study did not identify any specific constraints on the rail network into the main conurbations from the main port locations but individual assessment would be required on a case by case basis. Within the navigable waterway network for commercial barges, no significant constraints were identified. Short term flexibility is reported in both train waggon and barge haulage capacity but additional dedicated capacity will likely be required to meet the full increase.

7.2.3 **Relative Merits**

The study found common belief that the option of a shift towards the use of marine aggregates did have merit (in environmental, social and economic terms) over land won aggregates but acknowledged that finding evidence to prove this would be difficult.

7.2.4 **Barriers**

The lack of regional planning policy structure was considered by stakeholders to be a potential barrier to facilitating the cross boundary deliver of regional initiatives.

The ABP ports have the ability to utilise “permitted development rights” under the General Permitted Development Order 1995 to develop a new aggregate wharf, but for the same reason an established aggregate wharf cannot (in practice) be safeguarded from alternative development. The same rights do not apply to independent wharves.

Existing and potential aggregate wharf and depot sites face pressure for redevelopment – particularly in urban areas where there is a high demand for uses such as housing. Mineral policy is frequently seen as the ‘poor relation’ in planning so that safeguarding potentially important aggregate infrastructure for the long term is considered less of a policy imperative than for other land uses. The lack of secure safeguarding is recognised as a shortcoming in planning policy and plan making e.g. by giving enough weight to long-term need issues in the face of short-term competing interests.

An apparent lack of appreciation for the potential to transporting bulk goods on the region’s canals and waterways at competitive costs was viewed as a barrier to developing the marine import strategy. This lack of appreciation was said to be

manifest in several of the cost assessments carried out by the largest operators – which only appear to consider road and rail.

7.2.5 **Economics**

The recession in construction activity seen in the last few years has reduced prices and profit margins on aggregates generally - such that the question of a significant increase in marine aggregate landings and related infrastructure in the region is not considered by the industry to be viable in the short term. However, recent assessments by various parties have concluded the difference in the production cost of land won against marine won has narrowed and is currently in the order of £2/tonne.

Any measure to reduce the capital and operational costs would increase the likelihood and bring forward the timing of the marine aggregate supply option.

The economic viability could be improved by a range of practical, monetary and fiscal measures including:

1. Guarantees of the material type dredged and landed so that the need for processing at the wharf is eliminated or drastically reduced.
2. The aggregates levy is reduced or removed for production and distribution that is considered more sustainable than land won.
3. More competition is introduced into the management of the Humber ports to reduce wharf rents.
4. Capital grant aid and fiscal incentives are provided for projects that redevelop contaminated land and facilitate transport of aggregates other than by road.

7.3 **Overall Conclusions**

In terms of the key issues of the Study the following conclusions have been reached.

1. Marine aggregates can and are readily substituted for land won aggregates, therefore quality is not considered a barrier to an increase in their utilisation.
2. The marine aggregate resource is considered to be many tens of millions of tonnes and more than sufficient to supply the region over the long term at the level of uplift suggested of 2 million tonnes per annum, if required.
3. There is sufficient un-utilised licensed dredging tonnage to make a significant increase in landings in the short or long-term.
4. There is sufficient spare capacity in the dredger fleet to increase the amount being dredged from the Humber licensing area to 2 million tonnes per annum, but the number and size of these vessels, and where they may be able to berth has not been established in full.
5. The level and scale of other competing offshore interests is not expected to constrain future dredging activity significantly.
6. The one operating marine aggregate wharf in the region at the Port of Hull is operating at less than half its 300,000 tonnes per annum maximum throughput. Distribution from the port in the short-term is by road only and limited in terms of distance due to competition from land won sources. A rail option may be realised

- in the next few years which would extend the potential scope of distribution and scale of contribution.
7. In the absence of any specific proposals elsewhere, the Hull facility is the likely location from where an increase in landings and distribution will be realised in the short-term, but the increase is likely to be limited and reflect only an increase in local demand. An increase in the proposed site area may be needed to contribute significantly to the step change proposed by the study Distribution in the future could be by road, rail, or canal and waterway.
 8. Although a large number of additional potential Humber ports and river wharves have been identified which have the potential to be utilised as aggregate wharves, draft and tidal constraints limit the accessibility of the largest dredgers to the ports of Hull and Immingham only. Smaller vessels could access up to eight other ports and river wharves.
 9. The area of land required for a marine wharf may be limited to 1 ha for a small scale operation if no processing is required. A marine wharf or rail/canal supplied depot of 1.5 - 5 ha in size is needed if processing and value added manufacturing is required and throughput is to reach the level where a substantial uplift in utilisation rates are realised of 300 - 500,000 tonnes per annum.
 10. The existing ports and wharves have limited spare land available (or willing to be made available by the operator) for a large scale new aggregate landing facility in the short term. Over the medium to longer term flexibility is expected.
 11. Although the need for a shift to greater use of marine aggregates is not considered immediately apparent by stakeholders, it is accepted that this need will become more apparent in the medium term. Over the longer term, the shift to a greater reliance on marine aggregates for the regions needs is considered 'inevitable'.
 12. A large amount of infrastructure has been identified in the region which is used or has the potential to be used for aggregate handling for marine aggregate distribution, but little of it is safeguarded in adopted Local Plans. There is substantial spare capacity in the road, rail and waterway transport systems to facilitate the movement of additional marine aggregate to a wider extent across the region - although some capacity constraints will apply to each method.
 13. The recession in construction activity seen in the last few years has reduced prices and profit margins on aggregates generally - such that the question of a significant increase in marine aggregate landings and related infrastructure in the region is not considered by the industry to be viable in the short term. However, recent assessments by various parties have concluded the difference in the production cost of land won against marine won has narrowed and is currently in the order of £2/tonne.
 14. New and additional grant funding for aggregate supply operations could support investment in certain forms of new marine aggregate infrastructure
 15. The absence of a formal regional planning strategy was considered by stakeholders a hindrance to facilitating the cross boundary planning needed to realise the potential marine aggregates could provide the region in future.
 16. It is therefore considered very unlikely that the 2 million tonne uplift will be realised by the existing infrastructure (and infrastructure operators) in the short

term. Over the medium to longer term however the industry expects to see a significant increase. Any regional supply model at the scale proposed by the study will require additional infrastructure at existing depots and/or a number of new depot facilities to be developed in the main centres of demand.

17. Joint venture organisation of aggregate dredging, marine wharf operation and/or wider distribution could help to produce the economies of scale needed to make new schemes financially viable.
18. The aggregate producers have individual supply scenarios which usually include a degree of flexibility. When their existing supply options become less secure they will most likely pursue greater utilisation of their other assets or alternative supply routes before making large investments in new ventures, especially in times of recession. Those with experience of marine aggregate operations are more likely to consider it as an alternative option than those without.

7.4 Recommendations

Arising from the study and the above overall conclusions, the following recommendations are made:

1. NPPF paragraph 143 requires local planning authorities to safeguard existing and potential minerals related infrastructure. The study found few examples where specific steps have been taken in emerging and/or adopted Local Plans. It is therefore recommended that the MPAs in the region timetable and initiate a review procedure to identify where such infrastructure exists and consider the introduction of policies for the safeguarding of strategic sites based on a reasoned criteria for site suitability and selection. The review recommended by the courts decision in *Schenker and Towngate vs Leeds CC*, (see section 5.3.5) should in part inform this assessment.
2. The MPAs should discuss with the Aggregates Working Party (AWP) the potential to increase the scope of the Party's remit to include advising the region on a strategy for the development of a marine based supply strategy over the medium to long-term, and the need to safeguard or otherwise provide an adequate amount of infrastructure to deliver on that strategy.
3. Stakeholders should make representations to government and other potential funding streams for additional fiscal measures to support capital expenditure (rather than operational expenditure supported under the Mode Shift Revenue Support and Waterborne Freight Grant scheme) to help move the transport of aggregates from road to more sustainable means of transport.

BIBLIOGRAPHY AND REFERENCES

- Barnsley Council, 2011. Core Strategy [PDF]
<https://www.barnsley.gov.uk/media/Development%20-%20Planning%20and%20Transportation/Planning%20Policy/LDF/Core%20Strategy%20Submission/Adopted%20Core%20Strategy.pdf> [Accessed 27.06.13]
- Barnsley Council, 2011. Development Sites and Places Consultation Draft [PDF]
http://edemocracy.barnsley.gov.uk/0xac16000b%20x00575873?bcsi_scan_AB11CA A0E2721250=4XREF0BDRo+1NwJp9wuZNdMHPHIAAAA9ZQgwA== [Accessed 27.06.13]
- British Geological Survey, 2005. Mineral Resource Information in Support of National, Regional and Local Planning-Humberside [PDF]
- British Geological Survey, 2005. Yorkshire and the Humber Region: Sand and gravel resources and environmental assets. BGS [PDF]
<<http://www.northyorks.gov.uk/CHttpHandler.ashx?id=7993&p=0>> [Accessed 05.06.13]
- British Geological Survey, 2008. Yorkshire and Humber Region Aggregate Mineral Resource outside of selected environmental designations [PDF]
http://www.google.co.uk/url?sa=t&rct=j&q=yorkshire%20and%20humber%20region%20aggregate%20mineral%20resource%20&source=web&cd=1&cad=rja&ved=0CC0QFjAA&url=http%3A%2F%2Fnora.nerc.ac.uk%2F3736%2F9%2FGA07F024_Map_yorks_humber.pdf&ei=1OjTUbbIAerB0QW8IYGIAQ&usg=AFQjCNGDRcSEVixFMRI6So8MZf-ne7bwWg [Accessed 03.07.13]
- British Geological Survey, 2011. East Inshore and East Offshore Marine Plan Areas Marine Sand and Gravel Resources.
- British Marine Aggregate Producers Association, 2011. Marine Suppliers Look to the Future. Marine Aggregates [PDF] <<http://www.bmapa.org/downloads/reference.php>> [Accessed 06.06.13]
- British Marine Aggregate Producers Association, 2002. Marine Sands in Concrete. [PDF] <<http://www.bmapa.org/downloads/reference.php>> [Accessed 06.06.13]
- British Marine Aggregate Producers Association, 2002. Marine Sands in Mortars and Screeds. [PDF] <<http://www.bmapa.org/downloads/reference.php>> [Accessed 06.06.13]
- British Marine Aggregates producers Association, undated. Aggregates from the Sea. [PDF] Available at <www.mineralproducts.org/documents/brochure.pdf> [Accessed 06.06.13]
- Calderdale Council, 2006. Replacement Unitary Development Plan. [PDF]
<http://www.calderdale.gov.uk/housing/planning/developmentplan/index.html> [Accessed 27.06.13]
- City of Bradford Metropolitan District Council, 2005. Replacement Unitary Development Plan [Website] <http://gis.bradford.gov.uk/rudp/> [Accessed 27.06.13]

- City of York Council, 2013. Core Strategy Preferred Options Draft. [PDF]
http://www.york.gov.uk/downloads/download/2515/local_plan_preferred_options_main_documents [Accessed 27.06.13]
- Cooper, K.M., Eggleton, J.D., Vize, S.J., Vanstaen, K., Smith, R., Boyd, S.E., Ware, S., Morris, C.D., Curtis, M., Limpenny, D.S. and Meadows, W.J., 2005. Assessment of the re-habilitation of the seabed following marine aggregate dredging - part II. Sci. Ser. Tech Rep., Cefas Lowestoft, 130: 82pp. [PDF]
- D E Highley, L E Hetherington, T J Brown, D J Harrison and G O Jenkins, 2007. The strategic importance of the marine aggregate industry to the UK. BMAPA [PDF] <
http://www.bmapa.org/documents/BMAPA_download.pdf> [Accessed 06.06.13]
- David Tyldesley and Associates, 2000. Local Authority Jurisdiction in the Marine Environment. [PDF] http://jncc.defra.gov.uk/pdf/tyldesley_reportall.pdf [Accessed 08/07/13]
- Department for Transport, 2011. Planning for Freight on Inland Waterways. [PDF]
[http://www.aina.org.uk/docs/Planning4freight\(1\).pdf](http://www.aina.org.uk/docs/Planning4freight(1).pdf) [Accessed 27.06.13]
- Doncaster Council , 2012. Core Strategy. [PDF]
[https://www.doncaster.gov.uk/Images/Core%20Strategy%20\(Low%20res\)%20\(3.1MB\)37-93646.pdf](https://www.doncaster.gov.uk/Images/Core%20Strategy%20(Low%20res)%20(3.1MB)37-93646.pdf) [Accessed 27.06.13]
- Dredge point, Cemex Dredging Fleet, 2013. [Website]
<https://www.dredgepoint.org/dredging-database/equipment/welsh-piper> [accessed 10.06.13]
- East Riding of Yorkshire , 1996. Beverly Local Plan. [Website]
http://www.eastriding.gov.uk/planning/pdf/beverley_final/beverley/index.html Accessed [27.06.13]
- East Riding of Yorkshire , 1999. Boothferry Local Plan. [Website]
http://www.eastriding.gov.uk/planning/pdf/boothferry_final/east_riding%20Folder/index.html [Accessed 27.07.13]
- East Riding of Yorkshire and Hull City Council , 2004. Joint Minerals Local Plan. [PDF]
<http://www2.eastriding.gov.uk/environment/planning-and-building-control/current-strategic-plans/joint-minerals-local-plan/> [Accessed 27.06.13]
- East Riding of Yorkshire, 1997. Borough Wide Local Plan [Website]
http://www.eastriding.gov.uk/planning/pdf/east_yorkshire_final/east_riding/index.html [Accessed 27.06.13]
- East Riding of Yorkshire, 1999. Holderness Local Plan [Website]
<http://www.eastriding.gov.uk/planning/pdf/holderness/index.html> [Accessed 27.06.13]
- East Riding of Yorkshire, 2010. Potential Sites Consultation [PDF]
http://www2.eastriding.gov.uk/EasysiteWeb/getresource.axd?AssetID=98501&type=full&servicetype=Attachment&bcsi_scan_AB11CAA0E2721250=1 [Accessed 27.06.13]
- English Nature, 2004. The Southern North Sea Marine Natural Area-A contribution to regional planning and management of the seas around England. [PDF]
<http://www.google.co.uk/url?sa=t&rct=j&q=the%20southern%20north%20sea%20marine%20natural%20area-a%20contribution%20to%20regional%20planning%20and%20management%20of%20>

the%20seas%20around%20england&source=web&cd=1&cad=rja&ved=0CC0QFjAA&url=http%3A%2F%2Fpublications.naturalengland.org.uk%2Ffile%2F60008&ei=gOTTUbWkDcKm0QWj2YClCA&usg=AFQjCNGlrkEHZR9sAINE4CntoNQGk0WCzw&bvm=bv.48705608,d.d2k [Accessed 03.07.13]

Fisheries Research Services et al, 1998. Fisheries Sensitivity Maps in British Waters. [PDF]
http://www.google.co.uk/url?sa=t&rct=j&q=fisheries%20sensitivity%20maps%20in%20british%20waters&source=web&cd=1&cad=rja&sqi=2&ved=0CC0QFjAA&url=http%3A%2F%2Fwww.cefas.co.uk%2Fmedia%2F29947%2Fsensi_maps.pdf&ei=V-PTUdfWIYeW0QWVroAw&usg=AFQjCNH3GEkmVwDtNRSMVcMVhBbMvMT8zw&bvm=bv.48705608,d.d2k [Accessed 03.07.13]

Government Office for Yorkshire and the Humber, 2008. The Yorkshire and Humber Plan. Regional Spatial Strategy to 2026 [PDF]
[https://www.barnsley.gov.uk/media/Development%20-%20Planning%20and%20Transportation/Planning%20Policy/LDF/\(NEW\)%20RSS%20May%202008.pdf](https://www.barnsley.gov.uk/media/Development%20-%20Planning%20and%20Transportation/Planning%20Policy/LDF/(NEW)%20RSS%20May%202008.pdf) [Accessed 27.06.13]

Hanson Heidelberg Cement Group, Hanson Dredging Fleet, 2013 [website]
http://www.heidelbergcement.com/uk/en/hanson/products/aggregates_marine/our_fleet.htm [Accessed 10.06.13]

HM Government Northern Ireland, Executive Scottish Government, Welsh Assembly Government, 2011. UK Marine Policy Statement. [PDF]
<https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf> [Accessed 06.06.13]

Humber Work Boats, Humber Boat Works Fleet, 2013 [PDF]
<http://www.humberworkboats.co.uk/> [Accessed 10.06.13]

Irish Sea Marine Aggregates Initiative, 2006. Review of Existing Methodologies for Assessing the Sustainability of Aggregate Supply Options. [PDF]

Kingston upon Hull City Council, 2000. Hull City Plan
http://www.hullcc.gov.uk/portal/page?_pageid=221,98083&_dad=portal&_schema=PORTAL {Website}
http://www.hullcc.gov.uk/portal/page?_pageid=221,98083&_dad=portal&_schema=PORTAL {Accessed 27.06.13}

Kirklees Council, 2013. Core Strategy Submission Draft. [PDF]
http://www.kirklees.gov.uk/business/regeneration/ldf/pdf/CoreStrategyProposed_Sep2012.pdf [Accessed 27.06.13]

Kirklees Council, 1999. Unitary Development Plan. [PDF]
<http://www.kirklees.gov.uk/business/regeneration/udp/pdf/UDP.pdf> [Accessed 27.06.13]

Leeds City Council, 2011. Marine Aggregate in the Yorkshire Region: Increasing the annual tonnage used. [PDF]

Leeds City Council, 2013. Natural Resource Development Plan Document (Local Plan)
[PDF]http://www.leeds.gov.uk/docs/FPI_nrw_Adpt_01%20Adopted%20NRWDPD%20Final%2024.01.13.pdf [Accessed 27.06.13]

Marine Aggregate Levy Sustainability Fund (MALSF), Mitigation of Marine Aggregate Dredging Impacts – Benchmarking

Equipment, Practices and Technologies against Global Best Practice April 2012, 2012 [PDF] <http://www.cefas.defra.gov.uk/media/462> accessed 10.06.13]

Marine Aggregate Levy Sustainability Fund (MALSF), 2011. Including the Socio-Economic Impacts of Marine Aggregate Dredging in Decision-Making Annex B: Deliverable le D4 – The Frame work. [PDF] <http://www.google.co.uk/url?sa=t&rct=j&q=%20including%20the%20socio-economic%20impacts%20of%20marine%20aggregate%20dredging%20in%20decision-making%20annex%20b%3A%20deliverab%20le%20d4%20%E2%80%93%20the%20frame%20work.%20%5Bpdf%5D&source=web&cd=1&cad=rja&ved=0CDAQFjAA&url=http%3A%2F%2Fwww.cefas.defra.gov.uk%2Fmedia%2F462749%2Fmepf%252009%2520p104%2520annex%2520b.pdf&ei=uHTUeaePOHC0QXHwYGYCQ&usg=AFQjCNHCUfeWJYOIDowa5MMs3gXDbQMCDA&bvm=bv.48705608,d.d2k> [Accessed 03.07.13]

Marine Aggregates information Centre. [Website] <http://marineaggregates.info/marine-aggregates-in-structural-concrete.html> [Accessed 06.06.13]

Marine Management Organisation, 2012. Seascape character area assessment East Inshore and East Offshore marine plan areas. [PDF] http://www.google.co.uk/url?sa=t&rct=j&q=seascape%20character%20area%20assessment%20east%20inshore%20and%20east%20offshore%20marine%20plan%20areas.&source=web&cd=1&cad=rja&ved=0CC0QFjAA&url=http%3A%2F%2Fwww.marine-management.org.uk%2Fmarineplanning%2Fareas%2Fdocuments%2Ffeast_seascape.pdf&ei=9-bTUdGJC4fV0QWgqICYCg&usg=AFQjCNERfSbmpyS8sf5ZDVdcqjJCmk5DMw&bvm=bv.48705608,d.d2k [Accessed 03.07.13]

MPA and The Crown Estate, 2013. Active Dredging Zones for the Humber Region [PDF] <http://www.bmapa.org/downloads/reference.php> [Accessed 06.06.13]

Natural England, 2012. Seascape Characterisation around the English Coast (Marine Plan Areas 3 and 4 and Part of Area 6 Pilot Study). [PDF] <http://www.google.co.uk/url?sa=t&rct=j&q=humber%20seascape%20character%20area%20assessment%20&source=web&cd=4&ved=0CD0QFjAD&url=http%3A%2F%2Fpublications.naturalengland.org.uk%2Ffile%2F2945179&ei=NZzSUZGcNKeo0QWmjoDACA&usg=AFQjCNHlyPeQVXzBCLzb5ORtkGTMhBChxw> [Accessed 03.07.13]

Network Rail, 2013. Map of Rail Served Aggregate Handling Sites. [PDF] http://www.google.co.uk/url?sa=t&rct=j&q=network%20rail%20aggregates%20%20&source=web&cd=1&ved=0CC0QFjAA&url=http%3A%2F%2Fwww.networkrail.co.uk%2FMap-of-rail-served-aggregate-handling-sites.pdf&ei=xv_SUbjBom70QW_g4CYBw&usg=AFQjCNGLjRld_hcFGorat6KoK8xlWvZSFw [Accessed 02.07.13]

Network Rail, 2013. Rail Served Aggregate and Minerals Handling Locations. [PDF] <http://www.google.co.uk/url?sa=t&rct=j&q=rail%20served%20aggregates%20and%20minerals%20handling%20locations&source=web&cd=1&ved=0CC0QFjAA&url=http%3A%2F%2Fwww.networkrail.co.uk%2FMore-information-about-aggregates-and-bulk-minerals->

sites.pdf&ei=MerTUcPeLqLP0AXMj4DgBQ&usg=AFQjCNE_ydaGsWx9SviHsGkd-EW5HrKnYQ [Accessed 03.07.13]

North East Lincolnshire, 2003. Local Plan. [Website]
<http://www.nelincs.gov.uk/localplan/localplan.htm> [Accessed 27.06.13]

North East Lincolnshire, 2010. Minerals Topic Paper Background Paper for LDF Core Strategy Submission December 2010. [Doc]
<http://www.nelincs.gov.uk/GetAsset.aspx?id=fAA5ADkANgA5AHwAfABUAHIAAdQBIAHwAfAAwAHwA0> [Accessed 27.06.13]

North Lincolnshire Council, 2003. Local Plan. [Website]
<http://www.northlincs.gov.uk/environment/planning/spatial-planning/the-written-statement/> [Accessed 27.06.13]

North York Moors Authority, 2008. Core Strategy and Development Policies. [PDF]
<http://planning.northyorkmoors.org.uk/ldf/text/Adopted%20Core%20Strategy%20and%20Development%20Policies.pdf> [Accessed 27.06.13]

North Yorkshire County Council, 1997. Minerals Local Plan. [Website]
<http://www.northyorks.gov.uk/index.aspx?articleid=3029> [Accessed 27.06.13]

North Yorkshire County Council, 2013. Minerals and Waste Local Plan Evidence Paper: Minerals Specific Evidence [PDF]

Northumberland Council , 2000. Northumberland Minerals Local Plan. [PDF]
http://www.northumberland.gov.uk/idoc.ashx?docid=93f91110-0f77-4c1a-9149-2a59618e6260&version=-1&bcsi_scan_AB11CAA0E2721250=+YwUcGUIINFJJ4NtwHs5XJS++7PIAAArP18wA==:1 [Accessed 27.06.13]

ODPM, 2004. A Development Plan for Marine Aggregate Extraction in England A Scoping Study [PDF]

Rotherham Metropolitan Borough Council, 2012. Core Strategy Submission Draft. [PDF]
http://www.rotherham.gov.uk/downloads/file/8588/rsd1_publication_core_strategy_june_2012 [Accessed 27.06.13]

Rotherham, 1999. UDP. [PDF]
http://www.rotherham.gov.uk/downloads/file/1172/udp_adopted_written_statement [Accessed 27.06.13]

Russel, M, 2010. A Sea Change for the Marine Aggregate Sector. British Marine Aggregate Producers Association. [PDF]
<<http://www.bmapa.org/downloads/reference.php>> [Accessed 06.06.13]

Sheffield City Council, 2009. Core Strategy. <https://www.sheffield.gov.uk/...core-strategy-/Core-Strategy---adopted-Mar...> [Accessed 27.06.13]

South Tyneside Council, 2011. Development Management Policies DPD. [PDF]
<http://www.southtyneside.info/chtphandler.ashx?id=13672&p=0> [Accessed 27.06.13]

South Tyneside Council, 2012. Site Specific Allocation DPD. [PDF]
<http://www.southtyneside.info/chtphandler.ashx?id=14710&p=0> [Accessed 27.06.13]

- Sunderland City Council, 1998. UDP. [Website]
<http://www.cartogold.co.uk/sunderland/text/00cont.htm> [Accessed 27.06.13]
- Tees Valley Joint Minerals Planning Authorities, 2011. Joint Mineral and Waste DPD. [PDF]
http://www.middlesbrough.gov.uk/CHttpHandler.ashx?id=1773&p=0&bcsi_scan_AB11CAA0E2721250=Cs6Ya6+tBHSL7aKPjkVkBaXb8JnlAAAkGx6wA==&bcsi_scan_filename=CHttpHandler.ashx [Accessed 27.06.13]
- The Crown Estate and Mineral Producers Association, 2011. Marine Aggregate Dredging 2011 [PDF]
- The Crown Estate, 2011. *Marine Aggregates* The Crown Estate Licences Summary of Statistics 2011 [PDF]
- The Crown Estate, 2013. Dredging application, exploration and option areas for the Humber region. [PDF] <http://www.thecrownestate.co.uk/media/344208/humber-application-area.pdf> [accessed 07.06.13]
- The Crown Estate, 2013. Marine Minerals UK [PDF]
- The Crown Estate, British Marine Aggregate Producers Association, MPA, 2010. Marine Aggregate Terminology- A Glossary [PDF]
<<http://www.bmapa.org/downloads/reference.php>> [Accessed 06.06.13]
- Tillin, H. M., Houghton, A. J., Saunders, J. E., Drabble, R. & Hull, S. C., 2011. Direct and Indirect Impacts of Aggregate Dredging. Marine Aggregate Levy Sustainability Fund MALSF. [PDF] Available at
<<http://www.cefas.co.uk/media/463388/monograph1.pdf>> [Accessed 06.06.13]
- UK Dredging Fleet, Website <http://www.ukdredging.co.uk/> [Accessed 06.06.13]
- UK Dredging, UK Dredging Fleet Brochure, 2013 [PDF]
http://www.ukdredging.co.uk/UKD_Fleet/ [accessed 07.06.13]
- Wakefield Council, 2009. Core Strategy. [PDF]
http://www.wakefield.gov.uk/NR/rdonlyres/708A113B-4417-4C7D-B048-C5AE36E07584/0/Core_Strategy.pdf [Accessed 27.06.13]
- Wakefield Council, 2009. Development Policies. [PDF]
http://www.wakefield.gov.uk/NR/rdonlyres/708A113B-4417-4C7D-B048-C5AE36E07584/0/Core_Strategy.pdf [Accessed 27.06.13]
- Yorkshire and Humber Region Aggregates Working Party, 2009. Annual Report 2003, Aggregate Monitoring 2009 [PDF]
- Yorkshire Dales National Park Authority, 2008. Waste and Minerals Local Plan. [PDF]
http://www.yorkshiredales.org.uk/planning/planningpolicy/current-policy/localplan/minerals_and_waste_local_plan_1998_saved_policies_october___8230_.pdf [Accessed 27.06.13]

FIGURES

APPENDIX 1: MARINE AGGREGATES PLANNING AND LICENSING.

APPENDIX 2: BGS RESOURCE MAPS.

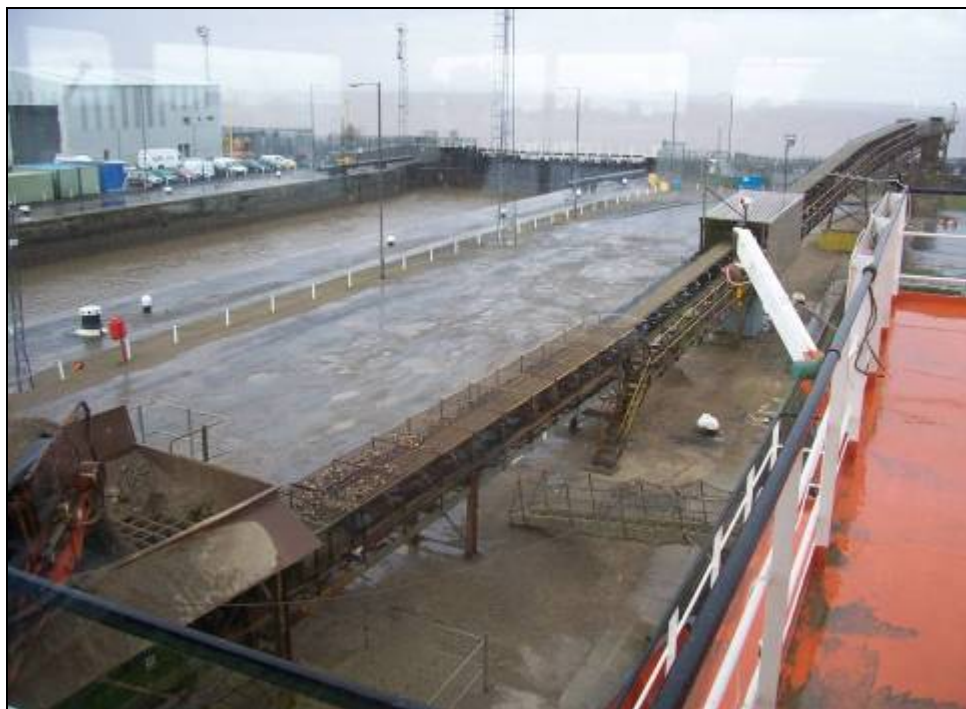
APPENDIX 3: CROWN ESTATE MAPS

**APPENDIX 4: SCHEDULE OF LOCAL AUTHORITY SAFEGUARDED AND NON-SAFEGUARDED
WHARVES AND RAIL DEPOTS**

APPENDIX 5: PHOTOGRAPHS



Photograph 1: Hanson dredger Arco Beck tied up at Alexandra Dock, Port of Hull. The ship has a reported load capacity of 4900 tonnes and draft of 6.51m (Courtesy of Humber Sand and Gravel Ltd.)



Photograph 2: Hanson dredger Arco Beck discharging at Alexandra Dock into a conveyor loading hopper for transport to the processing area. (Courtesy of Humber Sand and Gravel Ltd.)



Photograph 3: Sand Processing at Alexandra Dock Humber Sand and Gravel Ltd. (URS 2013)



Photograph 4: A very small scale aggregate (sand only) wharf at Port Penrhyn, Bangor 2005 (C Nicoll personal collection).



Photograph 5: The small dredger Sand Swan (1500 tonne capacity, 5m draft) unloading concreting sand at Mersey Sand Supplies aggregate wharf, East Bramley Moore Dock Liverpool 2005 (C Nicoll personal collection).



Photograph 6: Whitwood Aggregate Wharf, near Castleford on the Aire and Calder (URS 2013). See also Photograph 16.



Photograph 7: West Drayton Depot a canal side aggregate wharf with adjoining concrete batching and asphalt plant, North London. The depot is also rail linked. (URS 2013).



Photograph 8: Tarmac Marine Dredging's 'City of Cardiff' a medium sized dredger with 5.1m draft and cargo capacity of 2500 tonnes, here in Liverpool Bay (C Nicoll personal collection 2013).



Photograph 8: Tarmac Marine Dredging's large scale aggregate wharf Shoreham East Port (courtesy of Hanson UK).



Photograph 9: Hanson UK Dagenham Marine Wharf and Rail Depot a large scale multi-modal facility on the Thames (courtesy of Hanson UK).



Photograph 10: A typical aggregate depot rail siding with offload station. A receiving hopper is positioned under the small two sided structure positioned over the railway line. Rail waggons self-discharge into the hopper and a conveyor positioned underneath transfers the aggregate to the storage shed on the left. Hanson's West Drayton Depot, North London (URS 2013).



Photograph 11: Barrow Haven Wharf on the south side of the Humber, vessels may rest on the mud during loading and unloading. (Courtesy Barrow Haven Wharf Ltd).



Photograph 12: The Aire and Calder Navigation at a boatyard north of Castleford, illustrating the size of a commercial barge alongside pleasure craft (URS 2013).



Photograph 13: Canal wharves on the Aire and Calder Navigation, Knothrop Cut, Leeds (URS 2013).



Photograph 14: Immingham docks, wharf with rail sidings (URS 2013)



Photograph 15: Gravel barge 'Farndale H' owned by Branford Barge Owners about to pass under the A1 on the Aire and Calder with the last delivery to Whitwood Wharf in 2013 (see Photograph 6. (Source www.hulldockbargeworld.com, originator Maik Brown).

