VikingCCS

Viking CCS Pipeline

Environmental Statement Volume IV – Appendix 12-5: Draft Construction Traffic Management Plan

Document Reference: EN070008/APP/6.4.12.5

Applicant: Chrysaor Production (U.K.) Limited,
a Harbour Energy Company
PINS Reference: EN070008
Planning Act 2008 (as amended)
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
Date: October 2023

Harbour Energy | AECOM

PINS Reference	Document Reference	Document Revision	Date
EN070008	EN070008/APP/6.4.12.5	Revision 1	October 2023

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Viking CCS Pipeline

Construction Traffic Management Plan
20428-EN-PLN-000-0001 Rev 5
PEN-GEN-P-XX-X-EN-108-00001 Rev D5

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Revision and Change Control History

Revision	Date	No. of Pages	Summary of Changes
5	26/09/2023	38	Re-issued for Information
4	02/06/2023	36	Re-issued for Information
3	17/04/2023	36	Re-issued for Information
2	20/07/2022	22	Updated for Purple Route
1	26/05/2022	22	Updated for Red Route
0	02/03/2022	22	Issued for Information

1. INTRODUCTION

1.1 Background

The Oil and Gas Authority has awarded a carbon dioxide (CO_2) appraisal and storage licence to Harbour Energy, formerly known as Chrysaor Production [UK]. This license allows Harbour Energy to move forward to develop their Viking CCS project.

It involves the strategic development plans for a Carbon Capture Storage (CCS) business model in the region which will transport conditioned and compressed CO_2 by buried steel pipeline from a nominated outlet at the South Killingholme industrial cluster near Immingham, North Lincolnshire, into secure storage by repurposing depleted southern North Sea gas reservoirs. A new onshore pipeline will terminate at the former Theddlethorpe Gas Terminal (now demolished), where the CO_2 will transfer into the former LOGGS off-shore pipeline to be transported into storage, 9,000feet below the sea bed.

1.2 Planning Development

Following all-party involvement in preparing and agreeing various re-route recommendations, Penspen has developed this outline Construction Traffic Management Plan (CTMP) for the “preferred” route, called the “Purple route”, to be taken forward into the next phase of Planning and Environmental Impact Assessment and subsequent Front-end Engineering and Design (FEED).

Equally, now that the pipeline route and locations of permanent Above Ground Installations (AGIs) and temporary facilities for the storage of materials and site offices have been established, it has allowed consultation of the selected transportation routes with the local authority highways departments to commence.

This document covers the anticipated network of public highways that work vehicles will be using during delivery of approximately 4,667 pipes and other Long Lead materials from Immingham Docks to pipe dumps, and from pipe dumps to the Right-of-Way (Spread) making the most of the best available roads and associated access points. Private side accesses, (either existing tracks, field entrances or new openings created for this project) may be utilised for expediency at some locations, although direct access at the pipeline crossing point is preferred wherever possible.

The planned route of this proposed high pressure 609.6mm external diameter pipeline, associated permanent Above Ground Installations (AGIs) and temporary construction facilities (site compound and pipe dumps), are shown on maps attached in Appendix A.

1.3 Purpose of this Document

The purpose of this document therefore, is to demonstrate how it is intended to utilise the public highway infrastructure to its full potential whilst ensuring it can be managed in a responsible and safe manner, and accommodating the everyday requirements of local communities through minimum disruption.

Additionally, this document should be read in conjunction with the Traffic Estimate Schedule: Document No. PEN-GEN-P-XX-X-EN-63-00009 D2 (Penspen Document No. 20428-PL-SCH-000-0008) and the native file that contains all the Excel Spreadsheets for the estimated traffic numbers. Tables from that document have been inserted into this CTMP but not all as they are too large, and breaking them down into smaller segments obfuscates their meaning.

2. ABBREVIATIONS

The following abbreviations have been used in the document:

AGI	Above Ground Installation
CCS	Carbon Capture Storage
CNX	Canal Crossing
CO_2	Carbon dioxide
DCO	Development Consent Order
DMRB	Design Manual for Roads & Bridges
DX	Drain Crossing
EIA	Environmental Impact Assessment
ELX	Overhead Electricity Powerline Crossing
GRF	Gas Reception Facility
HCX	Hornsea (buried) Cable Crossing
HGV	Heavy Goods Vehicle
ITT	Invitation to Tender
KP	Kilometre Point
LOGGS	Lincolnshire Offshore Gas Gathering System
LGV	Light Goods Vehicle
NRSWA	New Roads and Streetworks Act 1991
PLX	Pipeline Crossing
PROW	Public Right of Way
RDX	Road Crossing
RLX	Railway Crossing
ROW	Right-of-Way
RVX	River (or major watercourse) Crossing
CTMP	Construction Traffic Management Plan *(this document)*
TX	Track Crossing
VNZ	VNZ CO_2 Transport and Storage project.

3. LEGISLATION

Listed below are applicable UK Acts, Regulations and Codes of Practice, relevant to this aspect of the project relating to Traffic Management and Works traffic movement on public highways during construction:

a) Health and Safety at Work Act 1974;

b) Construction (Design and Management) Regulations 2015;

c) Highways Act 1980;

d) Road Traffic Act 1988;

e) NRSWA – 3rd Edition – Code of Practice for the Co-ordination of Street Works & Works for Road Purposes & Related Matters.

f) Design Manual for Roads & Bridges (DMRB) Volume 6 Section 2 Part 7 (TD 41/95) Road Geometry. Junctions. Vehicular access to all purpose trunk roads;

g) Traffic Signs Manual 2009 – Chapter 8 – Traffic Safety Measures and signs for Road works and Temporary Situations;

h) Traffic Signs Regulations and General Directions 2002 (revised version 2015 - published May 2014);

    1) Manual for Streets 2– Wider Application of the Principles - 2010; and

    2) Vehicle Access to all Purpose Trunk Roads – DMRB TD41/95.

4. METHODOLOGY

This CTMP has been developed harnessing Penspen's own constructability experience, and the results of vantage point site visits conducted between January and March 2023, and local knowledge. Moreover, its progression has been assisted by meaningful effort advancing a number of project deliverables:

- Work Plans
- Work Schedule
- Crossing Schedule
- Construction Access Route, Access Point & Side Access Schedule
- Purple Route RLB updates
- Construction Methodology
- Easement Philosophy
- Utility and Identification Sources Report
- Aylesby, Thoroughfare and Louth Rd Block Valve plot plans
- Laydown – Welfare and Parking Area Drawing
- Welfare and Parking Area Drawing
- Access and Right of Way drawings
- Access and Right of Way Schedule
- Typical Pipeline Crossing Drawing
- Typical Flumed Crossing Drawing

This Construction Traffic Management Plan (CTMP) has been prepared to form part of Harbour Energy's DCO application package. Notwithstanding that initial approaches have been made, further consultations with local authority highways' departments, National Highways, other interested parties, and affected landowners/occupiers will be necessary to obtain the required consents, which may extend into the FEED stage, before a definitive routing strategy is achieved. Thereafter, the appointed Construction Contractor will be required to carry out a detailed assessment to assist their own development of a CTMP that demonstrates how they will manage construction traffic, in a safe and responsible manner, within the parameters of the road networks already identified, regulatory and statutory requirements, or such other requirements or restrictions imposed in granting the DCO by the relevant Secretary of State.

5. TRANSPORTATION ISSUES

5.1 General

Transporting personnel, plant and materials to the pipeline Spread during a construction season (normally from March to November) will result in a temporary and slight increase in traffic flow. It is this aspect of the Works that has been carefully considered to provide a month-by-month estimate of the number of Works traffic movements expected to occupy the public highways across North Lincolnshire, North East Lincolnshire, and East Lindsey District of Lincolnshire.

5.2 North Lincolnshire / Lincolnshire Road Network

In general, the "A" road network between Immingham and Louth is adequate with a number of routes available to service the pipeline construction corridor, as shown in the CTMP maps in Appendix A. It is presumed that linepipe may be imported from pipe mills abroad. The pipe mill location is yet to be established but will probably be in Europe depending largely on price and available production window for manufacture. If that is the case, then the arrival point is likely to be Immingham Docks, which is relatively close to the proposed pipe dump locations.

It is anticipated that the North Compound (required for project offices and project support services) and Pipe Dump will be established in the Immingham area (adjacent to A160 Habrough Roundabout). Works' vehicles will mainly use the A160, A180 and A1173 to reach the A18 and A16 and beyond. Other pipe dumps will be established at a central position close to Barnoldby le Beck, accessed from the A18-Barton Street, and at the southern end of the pipeline, adjoining the former Theddlethorpe Gas Terminal, Theddlethorpe.

The A18 and the A16 will become the main thoroughfares for works traffic heading south. The pipeline runs in close proximity to the A18 for some 17 kilometres, before crossing over to the A16 and heading south easterly towards Louth. The road network from Louth to Theddlethorpe is limited to the Manby Middlegate, Grimoldby Road (B1200), and the A1031 that runs down the coast from Grimsby to Theddlethorpe Terminal. Significant route planning has been done to eliminate narrow country lanes, especially in and around Brigsley, North and South Cockerington. The premise of the study, including site visits, was, by and large, to analyse HGV routes and orientation of travel to facilitate safe and good traffic flow, while navigating around these built-up areas, as the primary consideration. Thereafter, at the very least, to make the most of single carriageway roads within these vicinities or maintain construction traffic on the Spread.

"Fenland" is prevalent between North Cockerington and Theddlethorpe punctuated with deep field drainage ditches that run perpendicular to, and alongside the roads. Harrowsea, Grayfleet, and The Cut are prime examples of these impediments for construction traffic on the Spread, and will need bridging to maintain construction traffic on the Spread to the greatest extent possible. There is also the opportunity to utilise existing side accesses on Red Leans Lane and Pick Hill Lane that would facilitate crossing Harrowsea and Grayfleet Drains via road culverts. However, the weight limits for these culverts would need further analysis during FEED to prove their viability. Flumed crossings of field drains, that hold little importance from an environmental perspective, will also be an effective way of keeping construction traffic on the Spread.

Additional challenges arise from several watercourses, some with flood-banks that include: Louth Navigation Canal and River Lud, Long Eau (River), Old Engine Drain and Great Eau (River). These watercourses will either involve "move-around" or bridges. The outcome of which will depend on consultation with the Environment Agency, River and Navigation Canal Trust, Internal Drainage Board and other stakeholders.

5.3 Haulage of Construction Plant and Equipment

Low-loaders with rear wheel steering, and additional axles that convey the load across the road surface will be used to transport heavy plant to various identified access points onto the Spread. These access points will have large stoned areas (for access, laydown, welfare, and parking) to allow the low-loaders to get off the road and off-load their payloads safely and without hold-up to other road users. The heavy plant includes, but is not limited to: specialised pipeline construction equipment (Pipelayers, Cold-bending Machines, etc.), Earthmoving Machinery (Bulldozers, Tracked Excavators, etc.). This heavy plant will remain on the "Spread" for much of the time, moving forward as the construction work progresses. Upon reaching a "dead-end"(Lock Out) – Dual Carriageway, Railway or Major Watercourses – where crossing is prohibited, the plant will be turned around and tracked back to the nearest suitable road crossing before being carried by low-loader to the next appropriate road access on the opposite side of the crossing. This will also apply for all other equipment and workforce.

Where possible, existing farm track entrances with good visibility onto the highway will be exploited. They may need to be upgraded to accommodate the turning radius of HGVs as appropriate. In due course, individual drawings will be created to show that swept path analysis can achieve safe access off a public road and onto private land or farm track. These drawings will require consent from the local highways departments.

6. DESIGN OF ROAD ACCESSES

6.1 General

Specific and typical swept path drawings for Works entrance off public roads and onto private land will be designed in accordance with the Acts, Regulations, and Design manuals listed in Section 3 – Legislation, to be presented to local authority highways departments in order to work in partnership and lead to formal approval. The list of drawings will normally include:

a) Road Signage during Enabling Works;

b) Road Signage during Pipeline Construction;

c) Visibility Splay at Works Entrances;

d) Swept Path Analysis at Works Entrances;

e) Local Traffic Management – Portable Traffic Lights during Enabling Works.

All access points that require the creation of a junction bellmouth will be designed based on the relevant standard from DMRB CD 123 Geometric Design of at grade priority and signal-controlled junctions and in consultation with the LHA, thereby negating any potential safety impact associated with construction activity.

6.2 Chapter 8 Traffic Signage Requirements

PRINCIPAL CONTRACTOR qualified NRSWA supervisor(s) shall be responsible for overseeing the setting up, checking and regular maintenance of the Chapter 8 traffic signage and barriers during Enabling Works on a public highway and checking signage has not been interfered with, during the programme of Works.

6.3 Mud on Road

PRINCIPAL CONTRACTOR must ensure that public road surfaces are kept clean and free from mud and other debris, at all times. This may entail the PRINCIPAL CONTRACTOR hiring road-sweeping truck(s) and providing wheel-washing equipment at some road crossing entrances.

6.4 Working Hours During Construction

It is anticipated that the programme of works may encompass: late winter, spring, summer, and autumn for one construction season working. With this in mind, and with the possibility of starting on site in January with restricted daylight hours, and subject to weather conditions, activities will normally involve setting up temporary facilities. By mid-February, sun-rise is around 7.15am and sun set at 5.30pm, so it is envisaged Monday to Friday working hours are likely to be 7:30am to 5:00pm. However, during the main construction period, April to October, the working day will extend from 7am to 7pm and depending on the Contractors' attitude to weekend working, Saturday working hours may be between 7am to 1.30pm.

It is envisaged that 24hour working would be required for certain activities at key times: hydrostatic testing (when the pipeline is pressurised and under 24-hour holding period) Specialist trenchless crossings (especially during horizontal directional drill (HDD) pullback). In addition, there will be pumps and generators in operation outside normal working hours but noise levels will be kept to an absolute minimum, through the use of silenced plant.

7. LINEPIPE TRANSPORTATION AND STORAGE

7.1 General

There are three main construction phases that may impact slightly on general traffic levels associated with pipe handling, they are:

a) Setting up pipe dumps and there reinstatement after use, which requires import and eventually disposal of aggregates for roads and constructing sand berms for safe pipe storage.

b) Delivery of pipes to the pipe dump(s) from Immingham port close to the nominated pipe dumps (approximate distances 5 to 37kms away);

c) Construction phase - pipe haul and stringing along the Spread.

There has been preliminary discussion about whether to prepare the Construction Compound/Pipe Dump sites in the year before pipeline construction begins, between October and December to facilitate pipe receipt commencing November. The reason for this consideration is to ensure sufficient quantities of pipe are readily available to meet a one-year construction programme beginning March of the following year. There is also comprehensive weld procedure qualification and testing to be performed beforehand so early pipe receipt is vital to accomplishing this undertaking.

It is worth noting that the output of a pipe mill is normally between 15kms to 20kms of pipe per month. Therefore, on full capacity a mill should be able to manufacture 56kms in 3 to 4 months.

As such, and with approximately 4,667 pipes to be offloaded plus a large number of induction-bends and AGI materials, this task is likely to take 12 to 15 weeks to complete (for 2 pipe carry) from point of entry to the pipe dumps.

7.2 Pump Dumps

- North pipe dump has an approximate area of 21,500 sqm and capacity 4,947 pipes (59.364km). Require storage is 1952 pipes (23.422km) at this location to service construction needs from the CO^2 Offtake at South Killingholme to the negative side of Thoroughfare, Ashby cum Fenby.
- Central pipe dump has an approximate area of 20,892 sqm and capacity 1.944 pipes (23,328km). Required storage is 1908 pipes (22.894km) at this location to service construction needs from the positive side of Thoroughfare, Ashby cum Fenby to the negative side of Marsh Lane, South Cockerington, which is 1696 pipes (20.358km) in total. The additional 212 pipes (2.544km) is to accommodate the lack of storage capacity to meet requirements at the Southern pipe dump.
- Southern pipe dump approximate area of 13,000 sqm and capacity 807 pipes (9,864km). The full storage capacity will be utilised at this location to service construction needs from the positive side of Marsh Lane, South Cockerington to the Viking Gas Terminal. In total 1018 pipes (12.220km) is required (see above). It should be noted that the Southern pipe dump was previously proposed for Option B: 36-inch diameter pipe storage. However, the current strategy relies on this facility for optimising overall pipe distribution. However, if this location is not made available then the 807 pipes would need to be stored in the North pipe dump, which would mean stringing 15.5km further south to Pear Tree Lane (RDX031P) before the central pipe dump, just south of RDX019P, would have sufficient capacity for stringing the remaining 23.5km.

To meet the anticipated construction schedule, it will be necessary for haulage and receipt of linepipe at the pipe dumps to start early as previously discussed. The suggestion therefore, is to place a separate contract to cover the preparation of the Construction Compounds/Pipe Dumps: secure the area in

temporary fencing, top-soil strip to maximum depth of 300mm, lay down a geotextile membrane and cover with hardcore to form roadways suitable to support a mobile cranes and the incoming 44T HGV haulage trucks, and also to set out sand berms on which to place the pipes. This facility will only initially require a small office, welfare cabin (canteen and drying room) and toilets. Coating inspector(s) appointed by the CLIENT will check off each pipe against a tally list before it is taken "off the hook," making note of any visible mechanical and or coating damage before it becomes the responsibility of the CLIENT or PRINCIPAL CONTRACTOR. The CLIENT may wish to employ 24hour surveillance and/or security to guard the facility.

7.3 Pipe Transport

The number of trips to the various pipe dumps is dependent on the number of pipes carried per trip and the following tables provide information for both 2 and 5 pipe scenarios transporting pipe 12 metres long.

Pipe (Based on 2 Pipes Per Load)	Quantity (m)	No. Pipes	No. Single Trips	No. Trips Per Day 6 Trucks (4 Trips Each)
Habrough Roundabout Pipe Dump - Capacity 59,364km - Required 23,422km	23,422	1,952	976	41
Central Pipe Dump - Capacity 23,328km - Required 22,894m	22,894	1,908	954	40
Theddlethorpe GRF Pipe Dump - Capacity 9,684km - Required 9,684km	9,684	807	404	22
	56,000	**Total Days**		**103**

Table 1 Number of Trips - 2 Pipe Carry

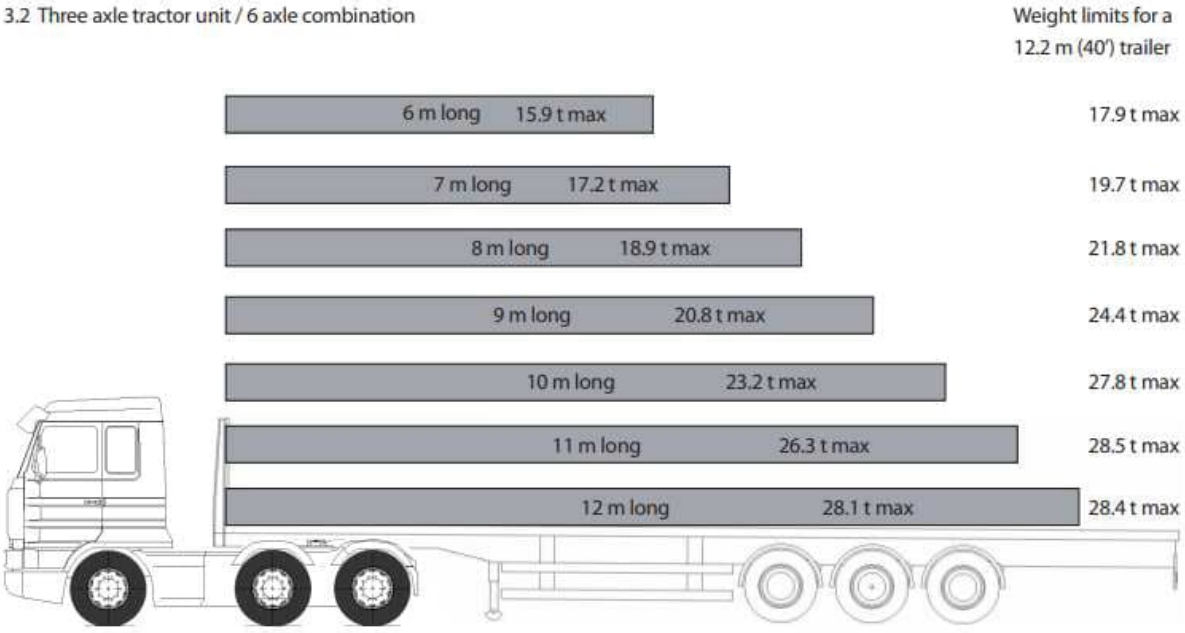
Pipe (Based on 5 Pipes Per Load)	Quantity (m)	No. Pipes	No. Single Trips	No. Trips Per Day 6 Trucks (4 Trips Each)
Habrough Roundabout Pipe Dump - Capacity 59.364km - Required 23,422km	23,422	1,952	390	16
Central Pipe Dump - Capacity 23.328km - Required 22,894km	22,894	1,908	382	16
Theddlethorpe GRF Pipe Dump - Capacity 9.684km - Required 9.684km	9,684	807	161	9
	56,000	**Total Days**		**41**

Table 2 Number of Trips – 5 Pipe Carry

7.4 HGVs for Pipe Transport

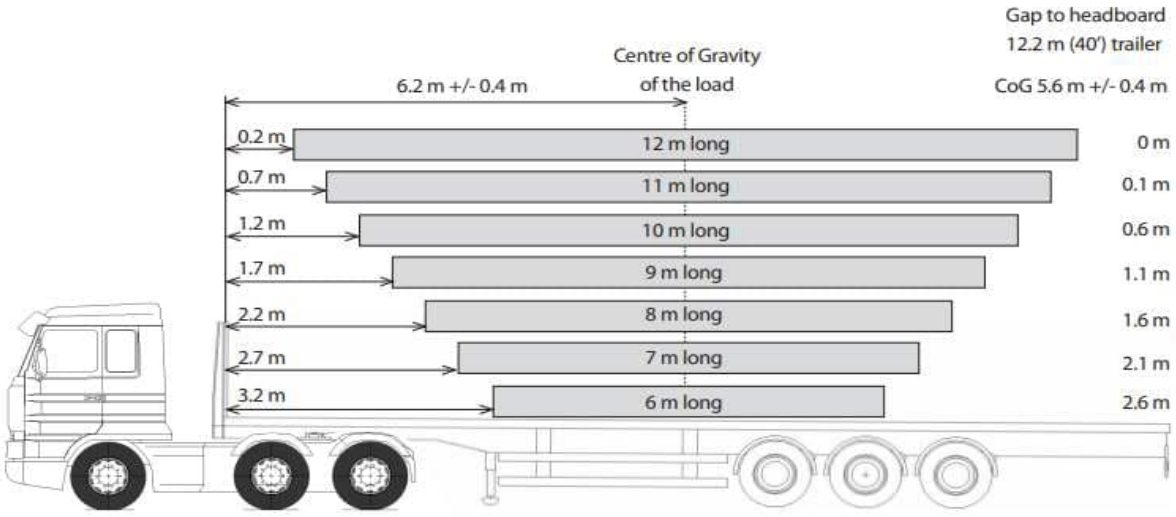
* Steer axle and 2nd axle Authorised Weights are make/model specific.
** In the UK Drive axle limit is 10.5 t if GTW exceeds 40 tonnes.

Note: The weight borne by the drive axle must not be less than 25 % of the GTW for international traffic.



Maximum payload for different length product loaded to the headboard with a typical 3 axle tractor unit and a 13.6 m (45') trailer

4.2 Three axle tractor unit and a Gross Train Weight of 44 tonnes



Distance from the trailer headboard of a 28 tonne payload on a typical 6 axle vehicle with a 13.6 m (45') trailer.

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7.5 2 and 5 Pipe Transportation Clarification

In October 2022 the following document: Preliminary Works Vehicles and Workforce Report 20428-PL-RPT-000-0005 (IFI) (PEN-GEN-P-XX-X-EN-02-00008). Under Section 3.2, early stage assumptions were made regarding quantities of heavy wall and standard wall pipe, wall thicknesses, and transportation of pipe on the basis that a "44 Tonne gross weight articulated flatbed HGV with a hydraulically extended trailer and rear wheel steering operating on UK roads, can transport a maximum cargo weight of 10.5 tonnes as set by the DoT. Therefore, one truck can only haul 2nos. HWall pipes or 4nos. SWall pipes." These assumptions are no longer valid.

New precepts regulates wall thickness to 30mm for the entire pipeline, and as can be deduced from the British Steel Technical Information Sheet, for axle weights and load distribution a typical 6 axle vehicle with 13.6m trailer can carry a 28 tonne payload. Therefore, since the weight of 5 pipes is less than the 28 tonne payload limit it is perfectly legal to transport 5 pipes for each trip, which significantly reduces the number of trips required overall. The following calculation substantiates this assessment:

1. Pipe diameter 609.6mm - Wall thickness 30mm - Assumed Pipe length 12m for Weight Calculation
2. Pipe weight with 3LPE - 3.5mm of Coating Thickness = 436.88Kg/m - 5.25 tonnes/12m
3. 3 Axle Tractor with 3 Axle 13.6m Trailer- Gross Train Weight 44 tonnes - Tare Weight 15.6t - Max Load 28.4t/60m - **5 pipes** = 26.22 tonnes

1 British Steel UK Limited, Brigg Road, Scunthorpe, DN16 1BP - Technical Information Sheet Axle weights and load distribution TIS-0012 Issue 1

Road ID	Access for String
RDX001P	Rosper Road, South Killingholme and Humber Road, South Killingholme - One way gyratory system
RDX002P	Humber Road, South Killingholme- One way gyratory system
RDX003P	Private Road
RDX005P	A1173 Road (dual-carriageway)
RDX008P	B1210 - Habrough Road, Immingham
RDX010P	Roxton Road, Immingham
RDX011P	Keelby Road, Stallingborough
RDX012P	Riby Road, Stallingborough (A1173)
RDX015P	Washingdale Lane, Aylesby
RDX016P	A46 Road
RDX017P	Old Main Road, Irby Upon Humber
RDX020P	Beelsby Road, Barnoldby le Beck
RDX025P	Whites Road, North Thoresby
RDX030P	Pear Tree Lane, Fulstow
RDX035P	Louth Road, Alvingham
RDX037P	Louth Road, North Cockeringham
RDX042P	Manby Middlegate, Grimoldby (B1200)
RDX043P	Lordship Road, Great Carlton
RDX046P	Mablethorpe Road, Theddlethorpe St Helens (A1031)

Table 3 Roads with Major Access and Laydown Areas

Haul and String								
2 Pipes Per Truck					5 Pipes Per Truck			
Pipe Distribution for Identified Road Crossings (m)	# Pipes for Distribution to Identified Road Crossings	# Trips to Identified Road Crossings	Distribution Based on 8 Pipes Per Truck Per Day		Pipe Distribution for Identified Road Crossings (m)	# Pipes for Distribution to Identified Road Crossings	# Trips to Identified Road Crossings	Distribution Based on 20 Pipes Per Truck Per Day	**Stringing Sequence**
A	B	C	D		A	B	C	D	
90	8	4	1		90	8	2	0	Stringing positive C02 Offtake to negative RDX001P
75	6	3	1		75	6	1	0	Stringing positive RDX001P to negative Railway - RLX001P
66	5	3	1		66	5	1	0	Stringing positive Railway - RLX001P to negative RDX002P
264	22	11	3		264	22	4	1	Stringing positive RDX002P to negative RDX003P
589	49	25	6		589	49	10	2	Stringing positive RDX003P to negative RDX005P
544	45	23	6		544	45	9	2	Stringing positive RDX005P to negative of Children's Avenue
2,348	196	98	24		2,348	196	39	10	Stringing positive of Children's Avenue to negative of RDX008P
487	41	20	5		487	41	8	2	Stringing positive of RDX008P to negative of RDX009P
996	83	41	10		996	83	17	4	Stringing positive RDX009P to negative RDX010P
528	44	22	6		528	44	9	2	Stringing positive RDX010P to negative Railway - RLX002P
1,625	135	68	17		1,625	135	27	7	Stringing positive Railway - RXL002P to negative RDX011P
658	55	27	7		658	55	11	3	Stringing positive RDX011P to Negative North Beck Drain - DX022P
1,278	107	53	13		1,278	107	21	5	Stringing positive North Beck Drain - DX022P to negative RDX012P
2,703	225	113	28		2,703	225	45	11	Stringing positive RDX012P to negative RDX014P
449	37	19	5		449	37	7	2	Stringing positive RDX014P to Negative RDX015P
1,794	150	75	19		1,794	150	30	7	Stringing positive RDX015P to Negative RDX016P
59	5	2	1		59	5	1	0	Stringing positive RDX016P to negative RDX017P
2,282	190	95	24		2,282	190	38	10	String from positive RDX017P to negative RDX019P
1,835	153	76	19		1,835	153	31	8	Stringing positive RDX019P to negative RDX020P
4,753	396	198	50		4,753	396	79	20	Stringing positive RDX020P to negative RDX022P
Metreage	**# Pipes**	**# Trips**	**Days**		**Metreage**	**# Pipes**	**# Trips**	**Days**	
23,422	**1,952**	**976**	**41**		**23,422**	**1,952**	**390**	**16**	
4,241	353	177	44		4,241	353	71	18	Stringing positive RDX022P to negative RDX025P
1,935	161	81	20		1,935	161	32	8	Stringing positive RDX025P to negative RDX028P

Haul and String									
2 Pipes Per Truck					5 Pipes Per Truck				
Pipe Distribution for Identified Road Crossings (m)	# Pipes for Distribution to Identified Road Crossings	# Trips to Identified Road Crossings	Distribution Based on 8 Pipes Per Truck Per Day		Pipe Distribution for Identified Road Crossings (m)	# Pipes for Distribution to Identified Road Crossings	# Trips to Identified Road Crossings	Distribution Based on 20 Pipes Per Truck Per Day	**Stringing Sequence**
A	B	C	D		A	B	C	D	
2,880	240	120	30		2,880	240	48	12	Stringing positive RDX28P to negative RDX31P
3,286	274	137	34		3,286	274	55	14	Stringing positive RDX31P to negative RDX033P
3,505	292	146	37		3,505	292	58	15	Stringing positive RDX033P to negative RDX035P
300	25	13	3		300	25	5	1	Stringing positive RDX035P to negative Louth Navigation Canal - CNX001P
1,729	144	72	18		1,729	144	29	7	Stringing positive Louth Navigation Canal - CNX001P to negative RDX037P
2,483	207	103	26		2,483	207	41	10	Stringing positive RDX037P to negative RDX040P
Metreage	**# Pipes**	**# Trips**	**Days**		**Metreage**	**# Pipes**	**# Trips**	**Days**	
20,358	**1,697**	**848**	**35**		**20,358**	**1,697**	**339**	**14**	
2,564	214	30	8		2,564	214	43	11	Stringing positive RDX040P to negative RDX042P
1,610	134	30	8		1,610	134	27	7	Stringing positive RDX042P to negative Long Eau Drain - RVX002P
341	28	14	4		341	28	6	1	Stringing positive Long Eau Drain - RVX002P to negative RDX043P
4,205	350	175	44		4,205	350	70	18	Stringing positive RDX043P to negative of Great Eau - RVX007P
2,145	179	89	22		2,145	179	36	9	Stringing positive of Great Eau - RVX007P to negative RDX046P
1,354	113	56	14		1,354	113	23	6	Stringing positive RDX046P to negative Theddlethorpe GRF
Metreage	**# Pipes**	**# Trips**	**Days**		**Metreage**	**# Pipes**	**# Trips**	**Days**	
12,220	**1,018**	**509**	**28**		**12,220**	**1,018**	**204**	**11**	

Table 4 Pipe Distribution

8. WORKS VEHICLES AND PLANT

8.1 General

The types of pipeline construction vehicles and heavy plant have hardly changed over several decades although some advances in digital technology have been introduced with more efficient diesel engines. It is an industry where other means of power apart from oil and gas have yet to be fully exploited. However, innovation into hydrogen energy has caught the interest of manufacturers of tractors, trucks, and other commercial vehicles.

The quantities and types of works vehicles are determined by various factors - length of pipeline route, pipe diameter, wall thickness, the duration of construction (one or two seasons), whether construction is through urbanisation or open country, number of crossings and methods to be employed, terrain, ground conditions, and access.

Quantities offered in this section are based on previous Penspen projects. Ultimately, it is the responsibility of the PRINCIPAL CONTRACTOR to make the necessary choices to meet their operational needs.

8.2 Works vehicle and plant categories

Works vehicles and plant fall into five categories, as below:

a) Personnel transport;

b) Light Goods Vehicles (LGVs);

c) Light Plant;

d) Heavy Goods Vehicles (HGVs);

e) Heavy Plant.

8.3 Personnel transport

This category comprises: 13 and 21 seater mini-coaches, 4x4 4WD works vehicles, and private cars that the workforce will use on a daily basis from accommodation to site compound and/or directly to the Spread. With the majority of the workforce living away from home and probably close to one another: hotels, rented properties and caravans, it is likely that vehicle-sharing will be a distinct possibility to reduce daily traffic movements to and from their place of work, which is a “moving target” as Works progress southwards. The traffic movement summary for private vehicles is based on 60% single occupancy and 20% sharing.

Unlike a static building site, where the whole workforce descends on one site each day, pipeline construction is a slow-moving development with a workforce dispersed over several kilometres. The workforce will access the “Spread” at various designated road crossings with parking facilities along the pipeline route.

Table 5 shows personnel vehicles licenced to drive on public roads to ferry personnel and tools from accommodation to site offices and/or directly to the Spread.

Personnel Transport	Quantity
Mini bus	21
Cars	529
4x4 4WD Vehicles	89

Table 5: Personnel transport using public roads

8.4 Light Goods Vehicles (LGVs)

A light goods vehicle, or LGV is defined as a commercial motor vehicle with a gross weight of 3,500kg or less. Light goods vehicles include commercial vehicles such as vans and pick-up trucks. The anticipated number of vehicles in this category outside of those required for construction will be low in comparison.

Personnel Transport	Quantity
Vans (including delivery vans)	20
Pick-up trucks (some will be the workforces' own vehicles)	20

Table 6: Light Goods Vehicles (LGVs)

8.5 Heavy Goods Vehicles

The term Heavy Goods Vehicle or HGV applies to any road-worthy vehicle that has a Gross Vehicle Weight (GVW) of over 3.5 tonnes and up to 44 Tonnes. In UK, HGVs are categorised by: weight, number of axels and dimensions of the truck. An HGV must have Weight Plating both the Manufacturers Plate and a Ministry Plate or DVSA Certificate. Table 7 lists the expected types and quantities of plant in this category.

Heavy Goods Vehicles (HGVs)	Quantity
65ton Low-loader	4
10ton Truck & Hot Box	1
20ton 6-wheel Tipper Truck	24
44t Artic Truck (Flatbed)	34
50ton All Terrain Mobile Crane	12
6m^3 Ready Mix Concrete	3
6-ton 4x4 Truck	10
8x2 Rigid Truck with HIAB	10
Fuel Tanker 5,000 L	2
Lube Truck	2
Mechanic Truck	2
Road Sweeper	2
Rubbish Truck	1
Skip Lorry	1
Sludge Gulper Truck (Toilet Cleaning)	2
Tractor & Flatbed Trailer	2
Water Tanker Truck 5,000/30,000 Litres	10
Welding Rig	8

Table 7: HGVs using public roads

Note 1: Articulated flatbed trucks belonging to a separate haulage company will deliver pipes from sea-port to pipe dump(s). Other trucks will be used during the construction period to haul pipes from the pipe dump(s) to the Spread (stringing).

Note 2: Tipper trucks will be used throughout: 1) to deliver aggregate to the site office / pipe dump in the early phased works, 2) gravel during pre-construction and post construction land drainage installations, 3) sand if required as “intimate backfill” (laid in the trench to supplement trench material if necessary), and 4) during reinstatement.

Note 3: The numbers of vehicles are based on construction crews and will be hired and off-hired as necessary at various times during the construction period.

8.6 Light Plant

Table 8 lists some light plant, not licenced for use on the public roads, but to be used at pipe dump(s) / materials storage areas and on the Spread.

Light Plant	Quantity
Telehandler (Forklift Truck)	1
24/30-150 Auger Boring Machine	4
2-inch Pumps	4
3.5ton Mini Digger	1
300 cfm Air Compressor	2
400 amp Weld Sets	4
4-inch Pumps	20
750cfm Atlas Copco XAS750CD6 Air Comp	2
Absorption Dryer (desiccant)	2
Atlas Copco CP232 Compressor	3
Dumper 2ton	1
Kubota Tractor with 3 Point Post Hole Borer	1
Micro tunnel Boring Machine (MTBM)	1
Pedestrian Roller - Bomag Single Drum	3
PFM & Hydraulic Power Unit (HPU)	3
Quad Bikes	8

Table 8: Light Plant at site yard or Spread

8.7 Heavy Plant

Table 9 lists the heavy plant to be transported directly to the Spread on low-loader trucks at the beginning of the project and then to remain there, moving south as the Works progress. See sections 5.3 and 9.1 regarding “dead-ends” and move-arounds. Generally, all heavy plant will be fuelled up and maintained on the Spread.

Heavy Plant for use on the Spread	Quantity
10ton Dumper Truck	3
100ton HDD Rig	2
22-36 Bending Machine	1
561 Pipelayer	3
583 Pipelayer	15
Cat CB10 Tandem Vibratory Roller	3
CAT D7 Bulldozer	10
CAT Excavator 20-45ton	40
CAT G14 Grader	7
LIEBHERR SR714LGP Welding Tractor	7
Pipe Carrier	2
Rammax 850 Remote control Trench Roller	6
Superior SPD-150 Padding Machine	2

Table 9: Heavy Plant

Heavy plant will need to cross public roads to move from one field into another. This is called “haul route traffic”, as defined in Section D3.23 of the Chapter 8 Signs Manual. Haul traffic should approach the

public highway crossing in a defined line and on a level gradient. Priority shall be given to the public highway and not to the haul route. It may be necessary to provide traffic signal control or stop/go boards. Due consideration must be given to queue management to cater for stationary traffic.

Most heavy plant using the haul route will run on continuous steel track pads as shown in Fig 1 below, so it will be essential to take precautionary measures to protect the road from surface damage, especially when fitted with grouser pads. Road surface prevention normally comprises of placing rubber tyres, mats or similar material on to the road surface during the short period it will take to complete the plant movement. Such protection will then be removed to the inside of the working width access gates. Qualified NRSWA supervision will be on hand to ensure traffic is controlled in a safe and timely manner at haul traffic access points and during operations on the public highway.

Figure 1: Typical Plant Crossing - Heavy plant crossing a road on a "haul route".

9. MOVE AROUNDS

9.1 Crew Moves

Under section 5.3 above the issue of reaching a “Lock-out” was discussed. Following a detailed analysis of the pipeline route there are 9 locations where geographical features will halt mainline construction activities resulting is such moves. Table 10 provides information on where the construction crews will move from and to in order to circumnavigate these features and allow construction to continue on the opposite side of the crossing. The coloured section of the Table highlights the roads (RDX) that have been identified for this purpose. The +ve (positive) and –ve (negative) orientations indicate the side of the road with -ve being upstream (Killingholme) and +ve downstream (Theddlethorpe) from a linear construction perspective and also depicts the side of the road where the Access, Laydown, and Parking Areas will be established.

Section	Weld From		Weld To		Move From		Move To	
1b	Children's Avenue	+ve	RDX009P	-ve	RDX008P	-ve	RDX010P	+ve
2a	RDX009P	+ve	RLX002P	-ve	RDX010P	+ve	RDX011P	+ve
2b	RLX002P	+ve	DX022P	-ve	RDX011P	+ve	RDX012P	+ve
2b/c	DX022P	+ve	RDX014P	-ve	RDX012P	+ve	RDX015P	-ve
2b/c	RDX014P	+ve	RDX016P	-ve	RDX016P	-ve	RDX017P	+ve
3a	RDX017P	+ve	RDX019P	-ve	RDX017P	+ve	RDX020P	-ve
3b	RDX019P	+ve	RDX028P	-ve	RDX025P	+ve	RDX031P	+ve
3c/4a	RDX028P	+ve	RDX035P	-ve	RDX035P	+ve	RDX037P	-ve
4b	RVX001P	+ve	RDX042P	-ve	RDX042P	-ve	RDX042P	+ve
5a	RDX042P	+ve	RVX002P	-ve	RDX042P	+ve	RDX043P	+ve
5b	RVX002P	+ve	RVX006P	-ve	Bridge		Bridge	
5c	RVX007P	+ve	RDX046P	-ve	RDX046P	-ve		

Table 10: Road crossings to be used for move-arounds

10. TRAFFIC MOVEMENTS

10.1 Estimate

The construction traffic has been estimated from a construction crew build-up to predict the level of traffic movements on a month-by-month basis (see document No. PEN-GEN-P-XX-X-EN-63-00010 (Penspen Document No. 20428-PL-SCH-000-0009). The construction period is March to October and as would be expected these months attract the highest volumes of traffic. The build-up is fairly rapid due to the nature of the linear construction associated with cross-country pipelines, once the work on site starts in earnest the various activities commence in a regimented fashion but in fairly tight order so that the distance between the front-end and back-end operations is optimised, keeping the time from topsoil strip to reinstatement as short as practicable, which is reflected in a gap of 12 weeks for current planning, allowing testing and commissioning to proceed in a timely manner to meet completion milestones. Consequently, the peak months for traffic up and down the construction corridor is August and September with a speedy decline thereafter as crews finish their purpose and are demobilised.

10.2 Consideration of Calculation

The calculation of trips includes a return journey so everything that moves on the road has been factored by 2 to reproduce this movement. A private car will travel to work, park during working hours and travel back to its point of origin at the end of the working day, making a total of 2 trips in one day. Similarly, a low-loader will make 2 journeys for each piece of plant delivered to a road crossing, and a tipper truck or a 44t artic lorry will make 2 trips per load. What cannot be calculated are project management or project service support vehicles (diesel bowser, road sweeper, mechanics truck, sludge gulper truck, etc.) because their movements are too complicated to predict, in terms of where they will visit and how many times in a day, so these vehicles only have 2 journeys per day each. Besides, they are not that numerous so the order of magnitude is not significant in terms of total construction numbers when considering the 258,149 trips estimated and number of miles that will be expended throughout the construction phase. Especially, when you consider that most trips are completed by private cars, transport of aggregates, and pipe movement.

10.3 Start of Mainline Activities

It is envisaged that section 1A and 1B will be completed by a poor-boy crew up to the start of the HDD for Children's Avenue. These 2 sections combined are only 1,627 metres in length but too intermittent to warrant use of large crews.

Poor-boy is pipeline terminology for a smaller work crew that operates in addition to mainline activities. Productivity is lower but generally its deployment is highly effective for manoeuvring through and performing in more complex areas such as special sections. This crew is also useful for completing short sections between a road crossing and a "Lock-out" or fabricating side sections that are cumbersome for the mainline and impair dynamic progress.

Accordingly, all the heavy plant for mainline activities will be delivered by 65t low-loader to the pre-constructed access on the negative side of B1210 Habrough Road, Immingham. This is a major access with stoned area for laydown, welfare, and parking for construction personnel private vehicles. No parking will be allowed on roadside verges along the pipeline route. The allocated area is 100m x 100m (10,000m^2) and there are 15 other access points of this type. Similarly, 7 access points, each with an allocated area of 60m x 60m (3,600m^2), are provided

but with lesser facilities, since they are not selected for move-rounds (see Section 9.1). The road crossing locations for access are listed in the Traffic Estimate Document referenced in Section 10.1 above. Pipe stringing for mainline operations will start from the positive side of Children's Avenue and proceeds in a positive direction until it reaches A180 (RDX009P), for the remaining stringing sequence see Table 4. Likewise, Table 10 in Section 9.1, provides details on the crew moves from the negative side of B1210 Habrough Road (RDX008P) and all moves from and to road crossings thereafter as construction proceeds north to south (negative to positive).

11. OTHER CONSIDERATIONS

11.1 Public Rights of Way

Whilst this document details traffic management on public highways, it is equally important to have regard for the number of Public Rights of Way (PROWs) that the pipeline crosses and a separate plan has been developed for this: Access and Right of Way Plan Document No. PEN-GEN-P-XX-X-EN-108-00003-00 (Penspen Document No. 20428-PL-PLN-000-0003) and Access and Right of Way Schedule Document No. PEN-GEN-P-XX-X-EN-63-00010 (Penspen Document No. 20428-PL-SCH-000-0009).

12. APPENDIX A CONSTRUCTION TRAFFIC MANAGEMENT PLAN (IN MAPS)

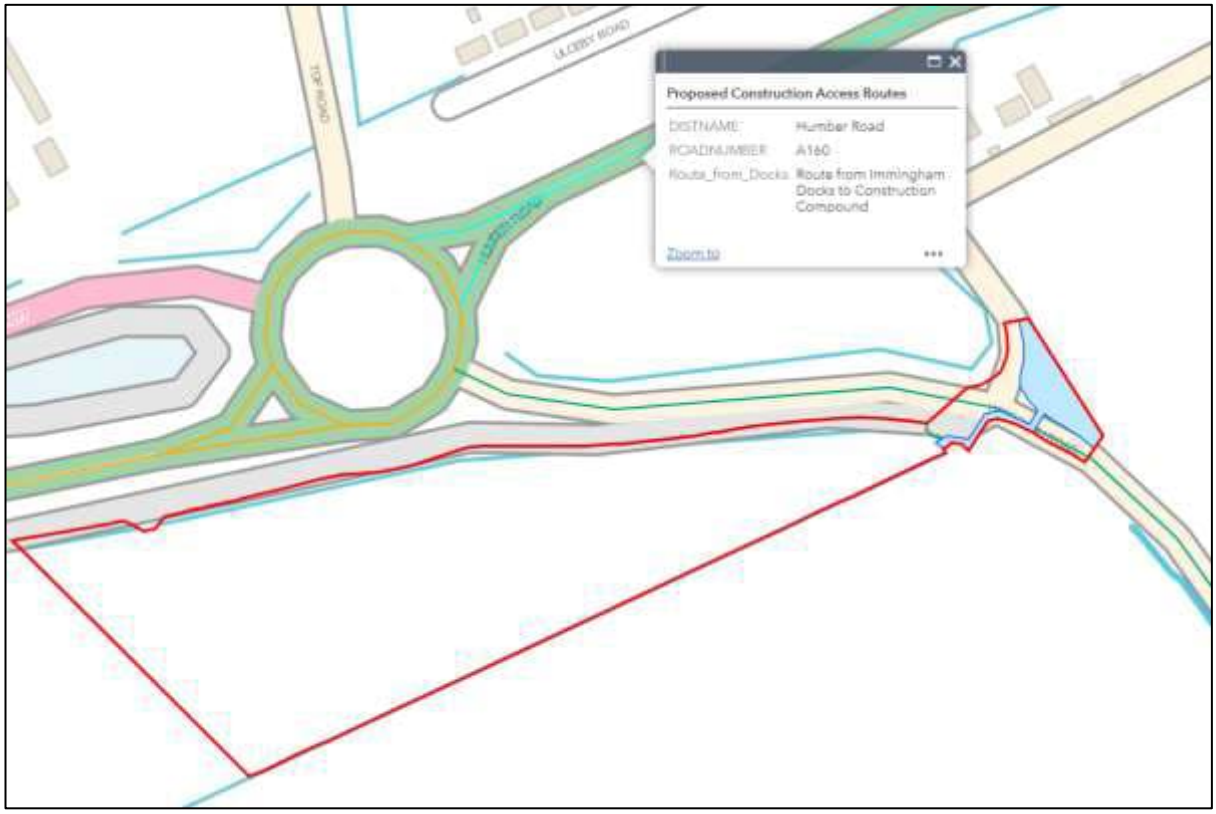
These map extracts show the routes haulage trucks are likely to take from Immingham Docks (as the proposed point of entry) to the temporary pipe dumps where approximately 4,667 lengths of pipe and other materials imported from abroad, will be off-loaded.

Sheet 1 of 9

Works vehicle routes using public highways during pipeline construction

The following enlarged map extracts show the proposed traffic routes using public highways that works vehicles will use to drive to and from the Northern Compound and Pipe Dumps No.1 close to the Habrough Road Roundabout, the Central Pipe Dump No.2 (A18, just south of RDX019P near Barnoldby le Beck) and the smaller South Pipe Dump No3 adjoining the Theddlethorpe Terminal, to reach nominated access points along the pipeline "Spread" as shown as a purple line.

Location(s) for site compound and pipe dumps.



Northern Pipe Dump and Project Compound

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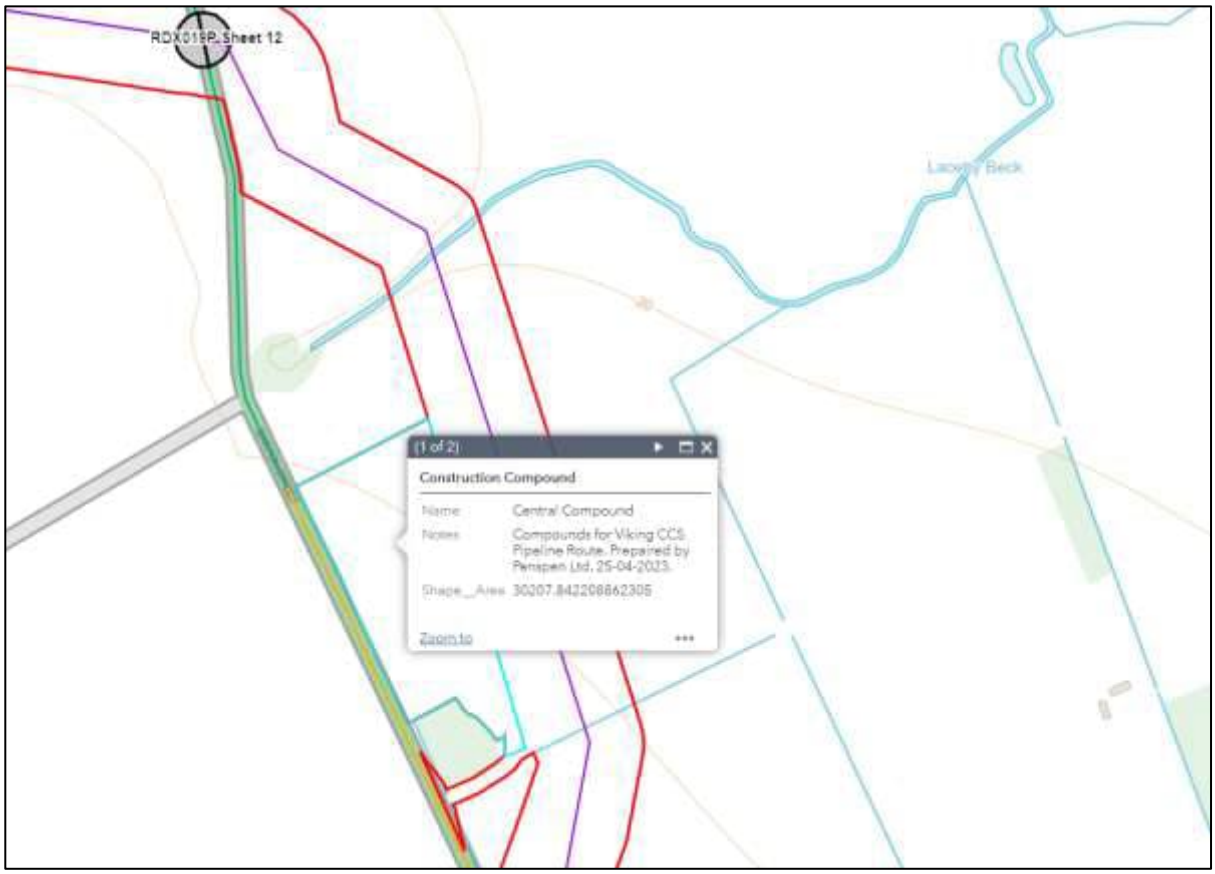
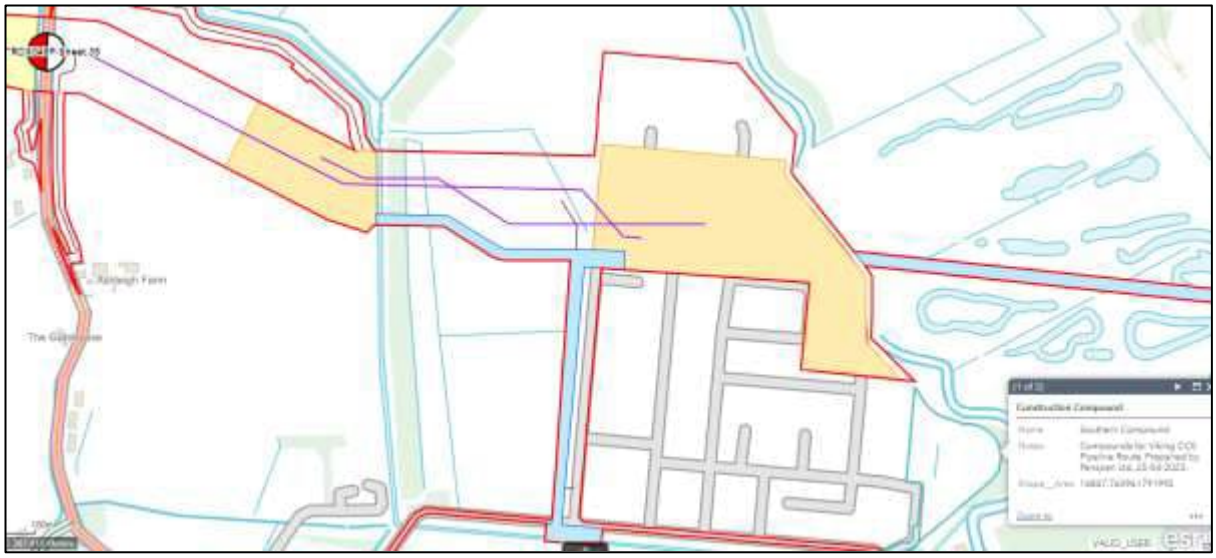


Central Pipe Dump



Southern Pipe Dump

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Refineries
North Killingholme
Hotel
Westfield Fm
South Killingholme
Holton Fm
A1077
A160
Hill Fm
Pelham Ho
Habrough
Immingham Grange
The Grange
New Fm
Roxton Fm
Cemy
CH
Luxmore Fm
Immingham
Mus
Maushall Fm
A1173
B1210
Hotel
Little London
Imming Dock
17
16
15
14
13
12

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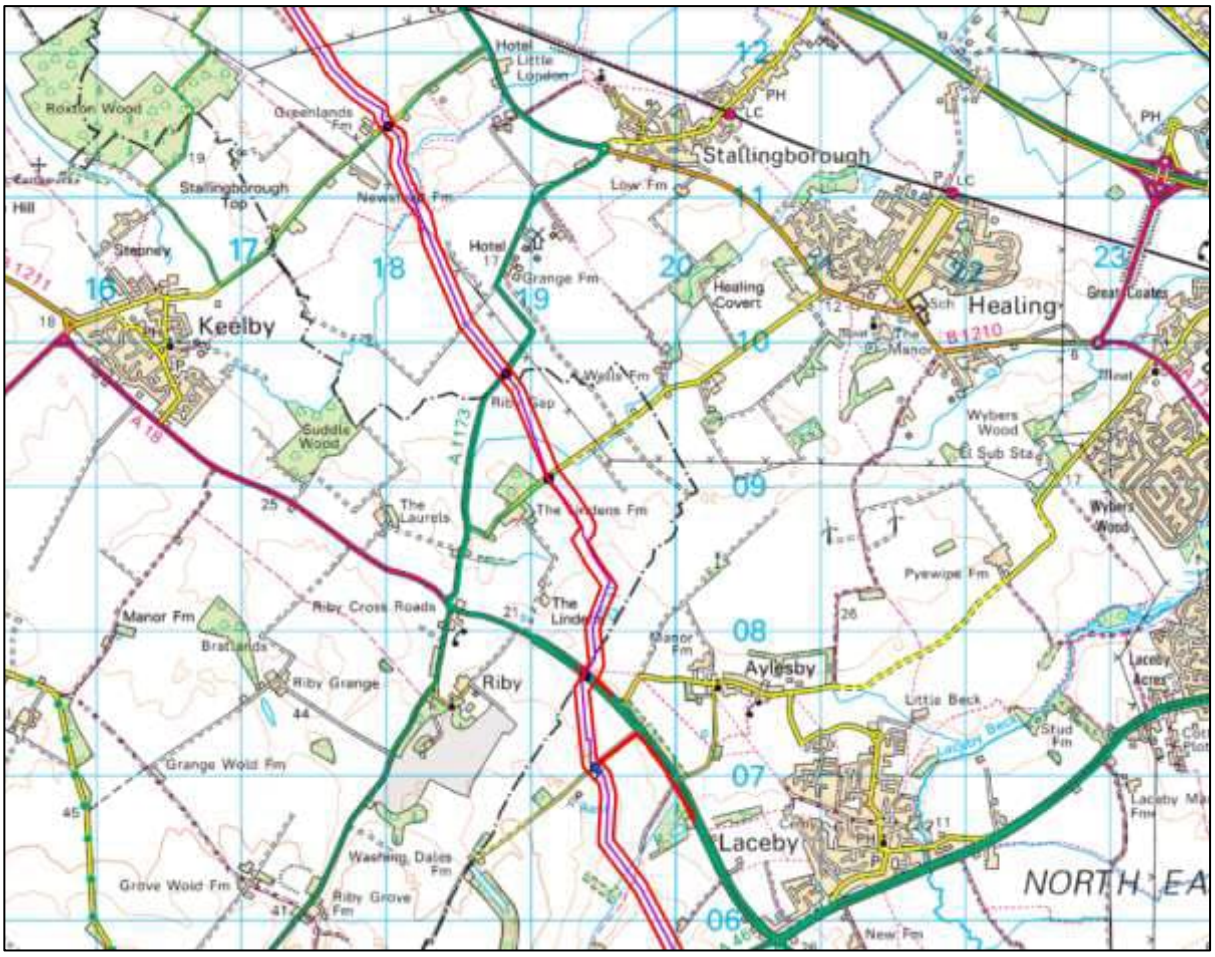
Roxton Wood
Queenlands Fm
Hotel
Little London
Stallingborough
Stallingborough Top
Low Fm
Newstead Fm
Hill
Stepney
Keelby
Hotel
Grange Fm
Healing Covert
Healing
Great Coates
B1210
Wells Fm
Ribby Sap
A1173
A18
Suddle Wood
Wybers Wood
El Sub Sta
The Laurels
The Lodens Fm
Pyewipe Fm
Riby Cross Roads
Manor Fm
Bratlands
Riby Grange
Riby
The Linden
Aylesby
Little Beck
Grange Wold Fm
Stud Fm
Laceby
Washing Dales Fm
Grove Wold Fm
Riby Grove Fm
New Fm
NORTH EA

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Laceby
NORTH EAST LINCOLNSHIRE
Bradley
Dixon Wood
Bradley Wood
Scartho
New Fm
Hog Hill
Oaklands (Hotel)
Scrub Holt Fm
Manor Top Fm
Irby upon Humber
Netherwood Fm
Grove Fm
Grove Fm
Acad
Welbeck Hill
Walk Fm
New Fm
Barnoldby le Beck
Irby Holmes Wood
Waltham
Grange Fm
Norman Corner
Waltham Windmill
Odessa Fm
Bedlam Hill
Manor Ho
Brigsley Top
Beelsby
Brigsley
Hatcliffe Top
Old Farm
Moor Ho
Bratton House Fm
Ashby Hill
Ashby cum Fenby
Hatcliffe
Ravendale Top
A18
A1243
A16
B1203
B1219
Waithe Beck
Team Gate
110

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Holton le Clay
Brigsley
North End
Tetney
Ashby cum Fenby
Waithe
Grainsby
Ravendale
North Thoresby
Fulstow
Wold Newton
LUDBOROUGH STA
B 1203
B 1201
A 16

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LUDBOROUGH STA
Covenham Reservoir
Covenham St Bartholomew
Covenham St Mary
Yarburgh
Utterby
Fotherby
Little Grimsby
Brackenborough
Aylmingham
North End
Newholme
Austen Fen
Conisholme Fen
America Fen
Maltholme
North Cockerington
95
94
93
92
91

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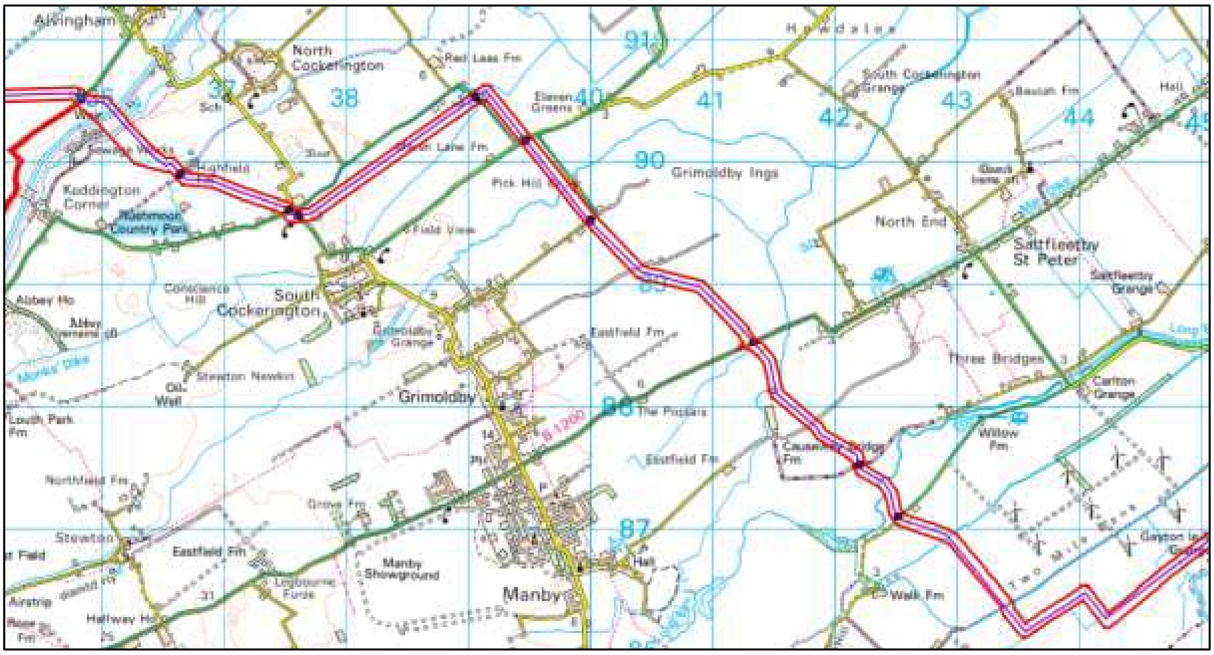
Alvingham
North Cockerington
38
Red Leas Fm
Eleven Greens
40
91
41
42
43
44
South Cockerington Grange
North End
Saltfleetby St Peter
90
Grimoldby Ings
Keddington Corner
Abbey Ho
South Cockerington
Grimoldby
Eastfield Fm
Three Bridges
Carlton Grange
Stewton Newkin
Oil Well
Louth Park Fm
B 1200
The Poplars
Willow Fm
Northfield Fm
Grove Fm
Stewton
Eastfield Fm
Manby Showground
Manby
87
Hall
Walk Fm
Airstrip
Halfway Ho

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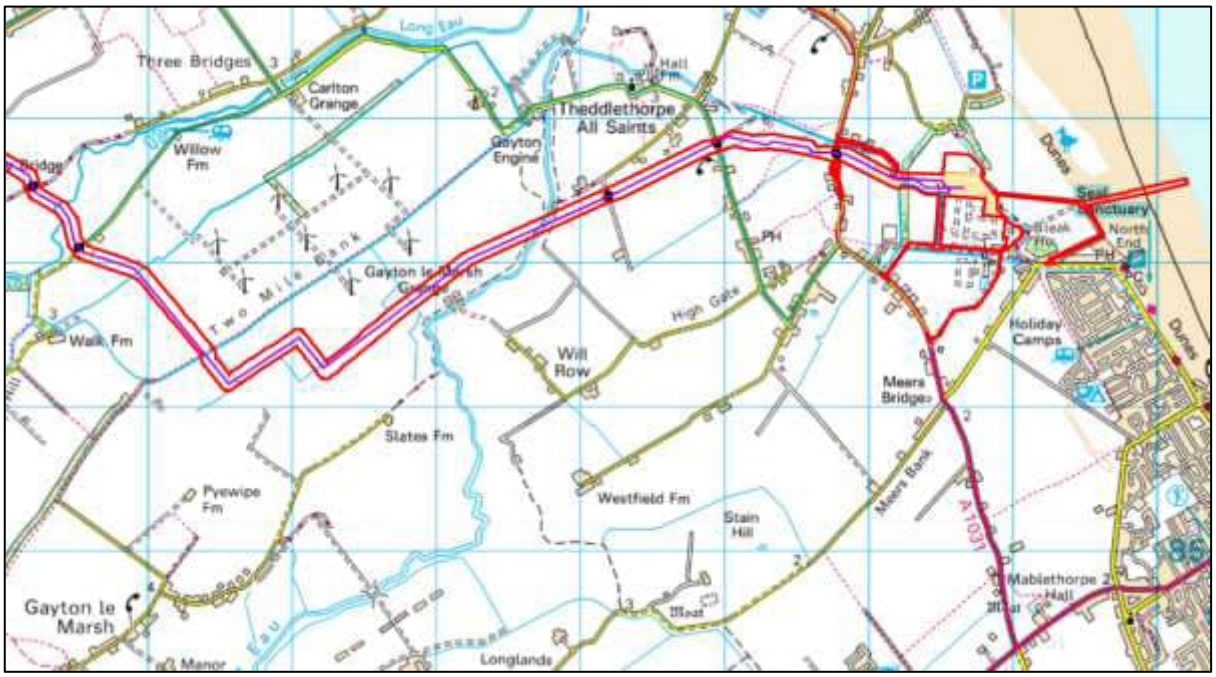
Three Bridges
Carlton Grange
Willow Fm
Theddlethorpe All Saints
Gayton Engine
Hall Fm
Dunes
Sanctuary
North End
PH
Two Mile Bank
Gayton le Marsh
Walk Fm
High Gate
Will Row
Holiday Camps
Meers Bridge
Meers Bank
A1031
States Fm
Pyewipe Fm
Westfield Fm
Stain Hill
Mablethorpe
Hall
Gayton le Marsh
Manor
Longlands

VikingCCS

Harbour Energy | AECOM