DONG Energy

Westermost Rough Offshore Wind Farm

Geophysical Assessment Report

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MARITIME ARCHAEOLOGY LTD

Westermost Rough Offshore Wind Farm Development:

Geophysical Assessment Report

Prepared
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1 Non- Technical Summary

In 2008, Maritime Archaeology Ltd (MA Ltd) was commissioned by Westermost Rough Ltd (WMR Ltd) to undertake an archaeological impact assessment in advance of a proposed Westermost Rough Wind Farm (The Project) near Tunstall and Withernsea in the East Riding of Yorkshire (**Figure 1**). The assessment consisted of a review of the existing historic environment baseline, including both primary and secondary sources, upon which subsequent impact assessments and mitigation proposals can be determined (Maritime Archaeology Ltd, 2009).

WMR Ltd and English Heritage (EH) later agreed that a further magnetometer survey should be carried out *post-determination* and assessed and reported as an addendum the Environmental Statement (DONG Energy, 2009). This assessment report comprises the results of the archaeological review of magnetometer data collected by Gardline Geosurvey Limited and incudes correlation with previously identified geophysical data by MA Ltd in 2009.

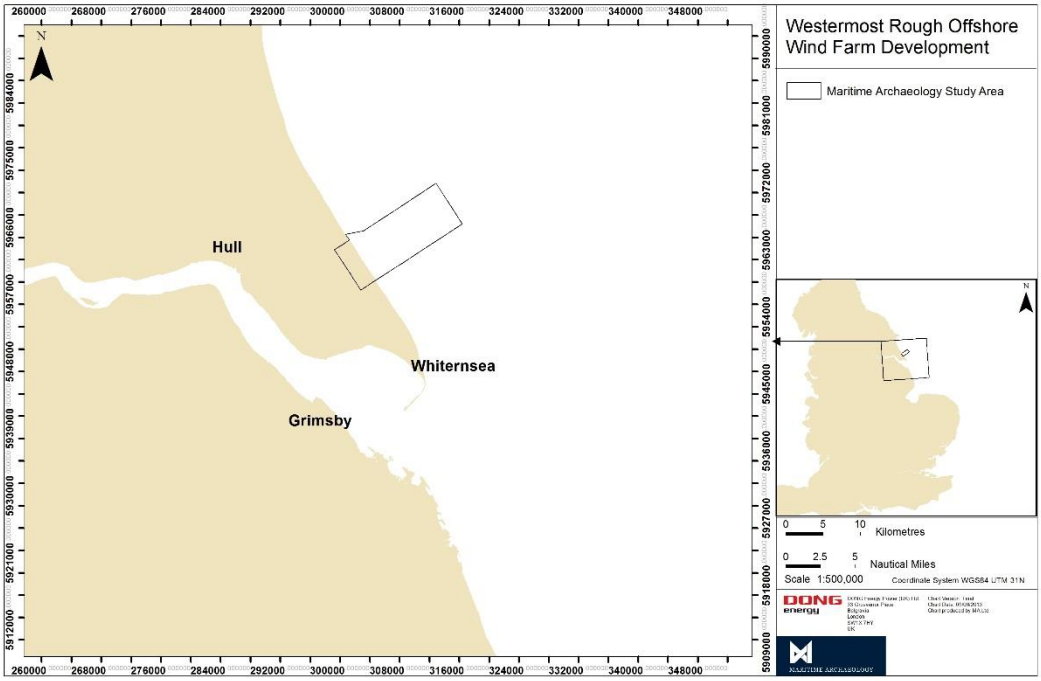

Figure 1 – Westermost Rough Offshore Wind Farm study area

1.1 Interpretation of Geophysical Data

The amalgamation of the several types of geophysical data interpretation derived from previous work undertaken for the offshore development into one GIS platform for visualisation has enabled a full assessment of the archaeological potential of the survey area. Subsequently a secure level of archaeological significance has been applied to each anomaly.

1.1.1 *Magnetometer Survey*

The magnetometer data were assessed on the basis of anomalies where the amplitude was higher than 5 nT may be representative of ferrous archaeological material, distinguishable from signal noise. The magnetometer data were compared to the existing geophysical data (side scan and swath bathymetry) from 2009 and were also analysed independently. The results from the magnetometer assessment resulted in one *medium* potential feature being elevated to *high* potential and three *low* potential features were elevated to *medium* potential **(Table 1)**. Additionally five new *medium* potential anomalies were identified due to their high magnetic amplitude.

1.1.2 *Side Scan Sonar*

In 2009, 61 anomalies were identified by side scan sonar interpretation (Maritime Archaeology Ltd, 2009). Five of these were identified as *high*, 14 as *medium*, and 44 as *low* archaeological potential (**Table 1**).

When re-analysing the side scan data with the acquired magnetometer survey data and complementing side scan sonar and bathymetry data provided by the client in February 2013, one anomaly initially interpreted as having *medium* archaeological potential **(MAL-444)**, has been re-classified as *high* potential. One anomaly initially interpreted as the site of *Celtic* (**MAL-311**), based on the recorded position of the wreck, and subsequently ascribed *high* potential has been removed in favour of a more likely candidate identified through the magnetometer assessment. Three anomalies initially interpreted as having *low* archaeological potential (**MAL-415, MAL-432, MAL-443**) have been re-classified as *medium* potential after the re-assessment as they correlated strongly with anomalies with an amplitude of more than 5 nT. Furthermore five magnetometer anomalies have been identified as of *medium* archaeological potential due to their high amplitude (≈ 100 nT) (**Table 1**).

Table 1 - Summary of proposed exclusions zones 2009 and 2013

Archaeological potential	Exclusion zones 2009	Exclusion zones 2013
High (75m)	5	5
Medium (25m/50m)	14	21
Low (no exclusion)	44	41

1.2 Impact and Mitigation Recommendations

The analysis and interpretation of magnetometer data in relation to previously assessed side scan and swath bathymetry has enabled a re-assessment of the impact on sites of archaeological potential to be made.

Though secondary impacts of operations in the study area are deemed likely to be *negligible*, the direct impact on archaeological features or deposits is likely to be *moderate to severe*.

Suggested mitigation has been achieved through the implementation of archaeological exclusion zones (AEZs) centred on each feature with a view to avoidance of such features through minor alterations of the cable route and the turbine placement area in accordance with the *Written Scheme of Investigation* (DONG Energy, 2013).

After re-assessing the data, five features have been interpreted as holding *high* potential and are proscribed a 75 m exclusion zone. Twenty-one features have been described as holding *medium* archaeological potential and are proscribed 50 m or 25 m exclusion zones depending on the spread of material. No further mitigation is applied to *low* potential anomalies.

Where no correlation between the datasets was identified it is recommended that the exclusion zones suggested in the 2009 report remain unaltered following this assessment (**Table 1**). A summary of all mitigation proposals is presented in **Section 6**.

2 Introduction

Maritime Archaeology Ltd (MA Ltd) was commissioned by Westermost Rough Ltd (WMR Ltd) to provide an archaeological assessment of geophysical data including magnetometer, side scan sonar and bathymetry data collected for the Westermost Rough Offshore Wind Farm development (the Project) near Tunstall and Withernsea in the East Riding of Yorkshire (**Figure 1**).

This report provides the results for the development area, which includes an assessment of previously identified sources, geophysical anomalies of archaeological interest and additional data collected during geophysical surveys between 2010 and 2012.

This assessment is concerned with the offshore component of the Project only. The report considers the impact of the development during the following phases:

- Impacts during construction
- Impacts during operation
- Impacts during decommissioning

All relevant data has been collected in accordance with the Institute for Archaeologists (IfA) *Standard and Guidance for Historic Environment Desk-based Assessment* (2011) within both terrestrial and marine environments, to inform the historic environment assessment report.

For the purposes of this study, the 'historic environment' is defined as including '*both the natural and human-made environments (often overlapping) and heritage above- and below-ground, as well as under the sea, that has cultural value and significance worthy of sustainable management and conservation*' (Embree and Stevens 2005: 3).

2.1 Aims

The aim of this report is to update previously identified maritime archaeological resources with information gained from the magnetometer, side scan sonar and bathymetric geophysical surveys within the proposed Project area.

2.1.1 Objectives

- Undertake an archaeological assessment of magnetometer survey data – resolution better than 0.0001nT;
- Undertake an archaeological assessment of side scan sonar and bathymetry data in areas where supporting data is deemed necessary;
- Integrate the archaeological assessment report including comparison of magnetometer data with previously acquired side scan data and bathymetry data (2009), and;
- Update mitigation recommendations and the archaeological WSI accordingly.

2.2 Area of study

The study area is located in the East Riding of Yorkshire (TA 344277) (**Figure 2**) and covers an area of approximately 105 km². The survey area stretches 6.5 km along the coast from Tunstall at the northern most point, in a south-easterly direction to the resort town of Withernsea. The furthest offshore limit of the area is located approximately 14 km out to sea. The area itself comprises parts of the onshore, intertidal and offshore zones.

The study area coverage was designed to ensure that data was analysed allowing an appropriate level of assessment for the following potential areas of impact (**Figure 2**):

- The cable corridor, including a 100 m buffer either side, to allow for double cable placement, stretching from the foreshore to approximately 14 km offshore*;*
- The landfall area of the potential export cable trenches on the foreshore;
- Offshore wind turbine placement; and
- Offshore substation placement.

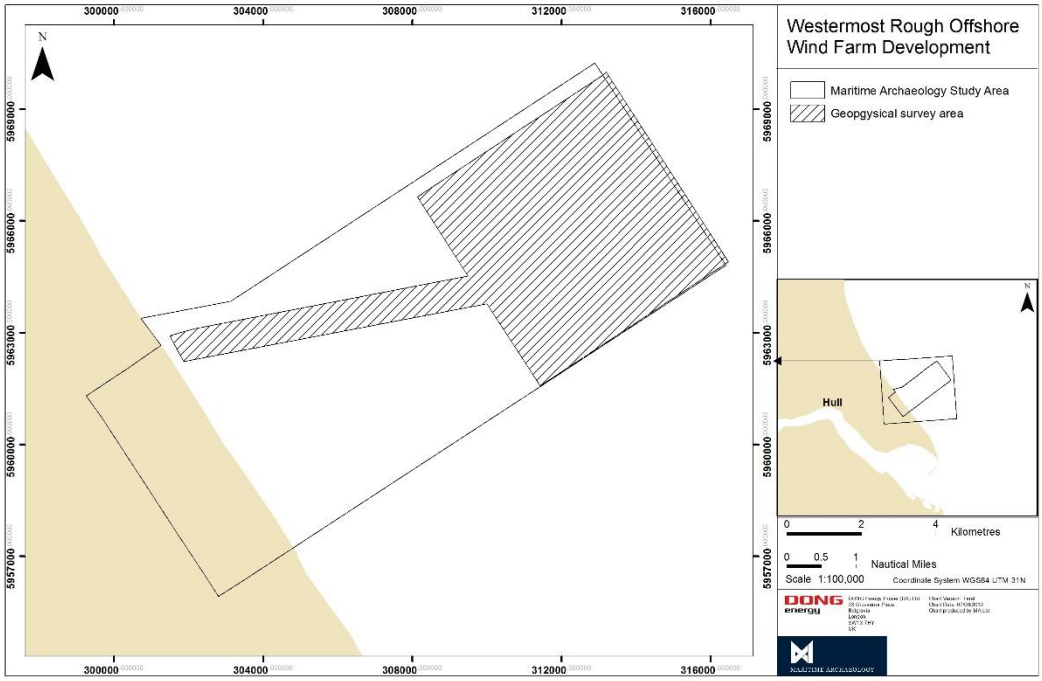

Figure 2 - Plan showing overall study area and area of geophysical survey.

The geophysical survey area covers an area of approximately 43.3 square km and comprises solely the marine zone. Coverage of the geophysical survey was designed to ensure that an appropriate level of data was collected for the proposed northern cable route, the proposed offshore turbine locations and the proposed area for the offshore substation (**Figure 2**).

2.3 Datum System and Transformations

All offshore geophysical survey data, including United Kingdom Hydrographic Office (UKHO) wrecks and obstructions information was provided in WGS84 datum UTM Zone 31N format. Admiralty chart base mapping used to display data distribution in ArcGIS 10 was georeferenced in WGS84 UTM Zone 31N.

2.4 Brief Review of Previous Archaeological Investigation

This section focuses on a brief review of the previous archaeological work undertaken in the area both on the coastal and marine zones.

Westermost Rough Offshore Wind Farm Development: Archaeological Impact Assessment was undertaken by Maritime archaeology Ltd (2009) presenting and summarising the archaeological potential for the area. The MA Ltd 2009 report proposed 75 m precautionary exclusion zones around the UKHO 'live wreck' identified as the *Upminster* (offshore), around the recorded position of the UKHO 'dead wreck' of the *Celtic* (offshore) and the UKHO 'live wreck' of the *John Creighton* (intertidal). The geophysical survey allowed the identification of further 14 medium potential anomalies in the development area and 50 m precautionary exclusion zones were proposed. This report updates the geophysical results from 2009 by reviewing them in the light of 2013 archaeological geophysical data assessment.

In 2010 Maritime Archaeology Ltd prepared the *Westermost Rough Offshore Wind Farm Development: Environmental Statement Addendum Part 1* supplementing the Westermost Rough Offshore Wind Farm Development: Archaeological Impact Assessment (2009). The addendum provided information on issues relating submerged cultural heritage, as well as clarified certain sections contained within the full Environmental Statement (ES).

Since the ES was produced a Regional Environmental Characterisation (REC) study of the Humber region has been made available. The data and final report for this is now accessible on-line (http://www.marinealsf.org.uk). Examination of this data has shown that just two sub-bottom survey lines partially intersect the Westernmost Rough Offshore Wind Farm study area.

The only potential archaeologically significant feature demonstrated by these lines was a large, shallow palaeochannel feature at the south-eastern extent of line 4A, 20 kms from the edge of the survey area. No other features of relevance to the Project were identified. Though palaeolandscapes, by their nature, are often significantly more than discreet occurrences and identification of features such as palaeochannels in proximity to the survey area may have notable implications, no significant features have been identified in the Project study area in this instance.

The Humber REC project sampled two study areas intensively for archaeological evidence. The closest to Westermost Rough Offshore Wind Farm, Area 2, lies approximately 45 km south-east of the study area and contains 16 lines of sub-bottom data. It covers an area of approximately 3 km² (**Figure 2**). Analysis of this data has revealed an environment potentially suitable for hominins.

At least one large palaeochannel can be identified running WNW and another more deeply incised cut, possibly lacustrine or fluvial, is visible on a NNE

alignment. Full interpretation of this data was released in February 2011 in the Final Humber REC report by the Marine Aggregate Levy Sustainability Fund (Tappin *et al*. 2011).

The identification of these interrelated features indicates that there is potential for the preservation of palaeolandsurfaces in this region. However, given the nature and location of these in relation to the magnitude of seabed disturbance predicted for the Project, the impact of such work upon these landscapes is considered negligible (see DONG Energy, 2009: Environmental Statement Section 6.3.6). Furthermore, the analysis of Humber REC survey lines in close proximity to the Westernmost Rough survey area supports the current interpretation that there is a low potential for the disturbance of submerged palaeolandsurfaces in this area, this was again confirmed by the geoarchaeological assessment undertaken by MA Ltd in 2013 (Maritime Archaeology Ltd, 2013)

As part of the 2009 desk based assessment, MA Ltd undertook a literature review which included:

- Archaeological assessment reports undertaken by the primary local archaeological contractor; Humber Field Archaeology (Humber Field Archaeology, 1999, 2001, 2005, 2006, 2007, 2008) were consulted to inform the archaeological potential of the coastal and foreshore areas.

- Rapid Coastal Zone Assessment for Yorkshire and Lincolnshire was reviewed informing the number of extant archaeological sites in the area and highlighting natural factors affecting their preservation, such as coastal erosion processes.

- Humber Wetlands Survey (funded by English Heritage) was assessed since it involved archaeological and palaeoenvironmental surveys of the existing and former wetland areas of Holderness.

- Additional publically available maritime archaeology research project reports relevant to the study area were also consulted. These included the following projects funded by Aggregates Levy Sustainability Fund (ALSF) and distributed by English Heritage: ‘England’s Historic Seascapes: Withernsea to Skegness Pilot Study’ project undertaken by MoLAS (2009) which provided useful historical and environmental information on Withernsea and its surrounding coastal and marine area. ‘Artefacts from the Sea’ project undertaken by Wessex Archaeology (2004) which provided further additional information to existing records. This additional information was drawn from a range of historical sources, such as local museums, individuals, the Portable Antiquities Scheme (PAS), universities and Historic Environment Records (HERs).

3 Methodology

The following section details the methodology used to produce the archaeological assessment of geophysical data collected for the Project development area. Data acquisition and processing systems specifications are outlined as well as approaches for researching baseline conditions. This includes an explanation of the criteria used to assess archaeological potential (see **Section 3.1.3**). Geophysical survey methods are detailed along with criteria for integrating the results with those of the baseline survey.

Geographic data received in OSGB36 coordinates were converted into UTM zone 31N using the OSGB_1936_To_WGS_1984_Petroleum transformation available via ArcGIS 10. This is the recommended method for transforming data from OSGB36 to UTM zone Data (Maritime Archaeology Ltd, 2010). Simple coordinates given in Latitude/Longitude were converted to a UTM zone 31N coordinate using Franson CoordTrans v2.3. All depths were reduced to below Low Water C.D. unless otherwise stated. The difference between C.D. and Ordnance Datum (OD) at Newlyn is -3.35m. All positions were loaded into a project GIS for analysis.

3.1 Geophysical Data

3.1.1 Previously Acquired Data

Data assessed by MA Ltd for incorporation in the 2009 report was used during the magnetometer assessment process. High, medium and low side scan sonar anomalies identified as having archaeological potential were analysed in GIS and post-processing software and compared with the provided geophysical data. In areas of archaeological potential where the 2009 side scan sonar data was not conclusive, more recent side scan sonar data from a 2010 survey along with complementary swath bathymetry data was provided by the Client.

3.1.2 Magnetometer 2011 Survey Specification

Gardline Geosurvey Limited was contracted by DONG Energy to survey the Westermost Rough Offshore Wind Farm area and export cable route areas between February and March 2011 (**Figure 2**). The geophysical data acquisition programme was carried out on MV *Confidante*. The data was supplied to MA Ltd as raw xyz files and an Oasis Montaj project.

The main instrumental and operating parameters are as follows:

Instrument

- Make and Model: Geometrics G882

Deployment

- Water depth 11-27m
- Cable streamed 10m and 13m back from sonar
- Ship's speed 4-4.5kts
- Towing depth 2-6m above seabed

Instrument Settings

- Regional field 49000nT
- Cycle time 4Hz

Gardline Geosurvey Limited undertook a search for magnetic anomalies using two piggy-backed magnetometers resulting in moderate to good quality data. The location of one wreck was interpreted by Gardline within the area. This was achieved using a combination of magnetic and bathymetric data.

MA Ltd used the Geometrics MagPick software to grid and analyse the raw xyx files in order to identify all targets over 5 nT (**Appendix III**) within the survey area.

Magnetic anomalies greater than 5 nT have been accepted as a standard for the smallest change in magnetic field reliably detected (Dix *et al.*, 2008). It has been argued that a minimum detectable deflection of 5 nT may be on the conservative side and that, where the data are relatively noise free, 3 or even 2 nT may be practical depending on noise levels, instrument type, data rate and purpose of investigation (Camidge *et al*., 2009).

MA Ltd has chosen to employ the > 5 nT rule for the purpose of this assessment. Objects providing a 5 nT return from a six meter distance are likely to be magnetic objects of around 100 kg (small anchor) (Camidge *et al*. 2009). Anomalies smaller than this are not likely to be discernible from signal noise unless passed over directly by the fish at extremely short range (c. 2 m). Such signals are not expected to be of archaeological interest constituting isolated debris or single instances of ferrous anthropogenic material.

This survey, like most magnetometer surveys of large areas, is of variable sensitivity (Camidge *et al*. 2009:62). At 6 m range run lines directly over targets are able to detect a target with a mass of around 100 kg, whereas the line spacing for this survey varies between 45 and 85m, with the average around 75 m.

At 75 m line spacing the slant range will be around 40 m, which means that only objects of around 10 tonnes will be discernible at 5 nT deflection (Camidge *et al*. 2009:63). As a result, only targets less than 3 m from survey lines have been identified during this assessment.

MA Ltd imported all anomalies > 5 nT into a GIS platform (ArcMap 10) and also into post-priocessing software for comaprison with side scan sonar and swath bathymetry targets identified in 2009 (See **Section 4.6** for results).

3.1.3 Ascribing Archaeological Potential

The analysis and interpretation process outlined above for geophysical data results worked within the following framework for ascribing archaeological potential (**Table 1**).

During the interpretation process the matrix presented as **Table 2** was used for anomalies and features visible on the seabed. Full details of anomalies with a high, medium, and low archaeological potential are contained within **Appendix II**. A review of the anomalies alongside known wreck and obstruction data for the area was subsequently carried out in ArcGIS in order to confirm wreck locations and associated debris fields.

Table 2 - Definition of archaeological potential in the interpretation of geophysical anomalies.

High	High potential for anthropogenic remains, often confirmed though other resources, especially interpreted signatures of buried deposits likely to preserve archaeological material. Includes known wreck, air-crash sites, and debris fields that correspond to historic anchorage sites.
Medium	Possibility of archaeological potential would require ground truthing for a definitive interpretation. Includes previously assessed wreck sites.
Low	Minimal archaeological potential, unlikely to be anthropogenic. Includes sites considered to be modern mooring or anchor related, isolated small objects with low contextual potential, geology or natural seabed features with little or no archaeological potential.

3.2 Impact Assessment

This assessment considers impacts likely to have affected the archaeological resource of the area and outlines these where appropriate. The likely impacts on any surviving archaeological resources are then considered and defined as follows.

3.2.1 *Definition of Impacts and Effects*

The definition of 'impacts' and 'effects' in relation to the marine historic environment within the Project area follows that set out in the Cowrie commissioned document *Historic Environment Guidance Note for the Offshore Renewable Energy Sector* (2007), which states:

> "'Impact' is taken here to mean the physical coincidence of a development activity and an element of the historic environment, whether it occurs through mechanical, chemical or biological processes. 'Effect' is taken to mean the consequence of the impact for the historic environment, taking account of the change in the public value of the historic environment that results from the impact, as well as the physical change." (Cowrie: Wessex Archaeology, 2007)

Analysis of information contained within the Project Design (DONG Energy, 2008b) and the techniques described therein to be employed during the delivery of the scheme has identified the following types of effects of particular relevance.

Direct Effects – disturbance of sites, finds and deposits related to cultural heritage through the dredging of seabed material. This may result in any of the following effects:

- Physical damage to a site and its related deposits;
- Physical damage or disturbance to the archaeological context of a site and its constituents;
- Destabilisation of deposits surrounding sites, and/or;
- Erosion around sites which could prompt long term damage.

The effects of direct impacts are usually adverse in relation to cultural heritage, although there are instances where beneficial effects can be gained (e.g. burial and stabilisation of sites of archaeological significance).

Indirect Effects – work resulting in direct impact can also cause 'knock on' effects on sites of archaeological potential. This can include:

- Promotion of 'draw-down' of sediments into trenches or dredged channels exposing sites, finds or deposits;
- Changes in hydrodynamic regime which induces erosion or scour, and/or;
- Introduction of chemical and biological changes to sites and deposits.

The results of indirect effects are usually adverse. An example of potential beneficial indirect effect might be the changes in a hydrodynamic regime causing siltation over a sensitive archaeological site.

Secondary Effects – effects that are not part of the development *design* but are part of the developmental *process* can also impact sites of archaeological potential. These may include:

- Construction vessel anchorages;
- Seabed disturbance by 'jack-up' vessels;
- Temporary platform installations, and/or;
- Other infrastructure required as part of the implementation of the scheme project design.

Each impact was assessed in terms of each individual component of the proposed development:

- *Construction*
- *Operation*
- *Decommissioning*

The impact assessment also includes an assessment of the cumulative effects on the marine archaeological resource of the cable route and intertidal cable landfall location areas as required by the Scope of Works (DONG Energy, 2008a - see **Section 5**). Cumulative effects are defined as those individually minor but collectively significant effects that result from a project in combination with other projects and activities. Cumulative effects are incremental changes to the environment and are likely to manifest themselves in the medium or long term (COWRIE, 2008).

The scale of an impact is classified as follows:

- Negligible: no impact. No loss or change to the historic environment;
- Minor: this would result in an indiscernible loss or change to the historic environment;
- Moderate: this would result in a noticeable but partial change or loss to the historic environment. Changes or losses may range from a localised loss of part of a site to small but regular losses over an extensive area, or;

- Major: this would result in a notable or complete loss of an archaeological site, ranging from the localised loss of a large part of a site to a substantial loss of several sites over a more extensive area.

3.2.2 *Assessing Significance*

Assessments of significance have been widely discussed within the heritage sector. Following recent policy, there is a need to understand the particular nature of the significance of an asset, the extent of the asset to which the significance relates and the level of importance of that significance (DCLG, 2010).

It is also worth clarifying that the elements of the historic environment that are worthy of consideration in planning matters are called 'heritage assets'. This term embraces all manner of features, including: buildings, parks and gardens, standing, buried and submerged remains, areas, sites and landscapes, whether designated or not and whether or not capable of designation (DCLG 2010: 7).

The significance of a heritage asset is understood as the sum of its architectural, historic, artistic or archaeological interest (DCLG 2010: 8) which are defined as follows:

- **Architectural interest**: is related to the interest of the architectural design, decoration or craftsmanship, inherent technological qualities, as well as representative quality. Consideration should also be given to both diversity of forms in which a particular type of historic asset may survive and to the diversity of surviving features.
- **Historic interest**: illustrates important aspects of the nation's social, economic, political, cultural, or military history and/or have close historical associations with nationally important people. Furthermore, the period of a historic asset will also contribute to the understanding of significant aspects of social, political, economic, cultural, maritime and technological history.
- **Artistic interest**: is related to the appearance of the asset both its intrinsic architectural merit and any group value. **Archaeological interest**: the archaeological interest of a historic asset will depend on the available data, its documentation, its rarity, quality, preservation, fragility/vulnerability, potential or representatively, technological innovation and on the degree to which the historic asset may contribute to further substantial information.

3.2.3 Significance of Effects

The significance of effects upon historic assets is assessed as follows:

- **Negligible/No Impact:** an impact that represents no loss or a limited minor loss of archaeological material. Such a loss, would not compromise the ability to understand and interpret fully and accurately surviving archaeological remains.

- **Minor:** an adverse impact resulting in a small or partial loss of archaeological material. Such a loss would allow a site to be reasonably or completely understood and accurately interpreted from the remaining components.
- **Moderate:** an adverse impact resulting in a noticeable loss or a large loss to a site. Such a loss would severely compromise the ability to understand or accurately interpret a site from its remaining components.
- **Major:** an adverse impact resulting in significant irreparable damage or loss of archaeological deposits or material. Such a loss would include total loss or the loss of enough of a site that its remaining components do not allow the original site to be adequately understood and interpreted.

The analysis of significance of effect can be represented by the following matrix (**Table 3**):

Table 3 - Analysis of significance of effect.

Scale of Impact	**Importance** (on a scale of local, regional, national or international importance)			
		Low	***Medium***	***High***
	Negligible	Neutral	Slight Adverse Effect	Slight Adverse Effect
	Minor	Minor Adverse Effect	Minor/Moderate Adverse Effect	Moderate Adverse Effect
	Moderate	Minor/Moderate Adverse Effect	Moderate Adverse Effect	Moderate/Severe Adverse Effect
	Major	Moderate Adverse Effect	Moderate/Severe Adverse Effect	Severe Adverse Effect

3.3 Mitigation Recommendations

The identification of impacts and their effects allows the recognition of aspects of the scheme that will be detrimental to the survival of archaeological remains or other elements of the historic environment. These impacts will require mitigation measures to avoid, reduce or ameliorate any negative effects on the historic environment.

Based on the archaeological potential and impact assessment, mitigation proposals have been formulated. These have been based on established practice of developing exclusion zones around known wreck sites or anomalies with high or medium archaeological potential as detailed in the *Archaeological Written Scheme of Investigation* (WSI) (Dong Energy 2013) and in *Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects* (The Crown Estate, 2010).

4 Results of Geophysical Assessment

This section presents the archaeological results gathered from the geophysical assessment. The data has been correlated with previously results gained from the desk based assessment and the geophysical data, including side scan sonar and swath-bathymetry (multibeam) (Maritime Archaeology Ltd, 2009) and have been updated accordingly.

4.1 Seabed Magnetic Anomalies

The magnetometer data was supplied by Gardline Geosurvey Limited. Gardline supplied MA Ltd with the raw data and summary of all magnetic anomalies > 5 nT. Gardline observed one wreck within the area, the SS *Upminster.*

MA Ltd re-analysed and gridded the raw magnetic data in the software package Geometrics MagPick and identified 1,622 targets over 5 nT, twelve targets over 50 nT and seven targets over 100 nT. These anomalies were cross-checked against single line profiles to determine precise maximum amplitude. They are described below and presented in **Appendix III**.

4.2 Magnetic Targets Correlating With Side Scan Anomalies (2009)

Fourteen side scan anomalies correlate with magnetometer targets over 5 nT. The identification of correlating targets was based on a 50 m buffer around each target due to the difficulty of accurately positioning magnetic material by their detectable magnetic field. The targets are summarised in **Table 4** and described in detail below.

Table 4 - Magnetometer anomalies correlating with side scan sonar anomalies

MA Ltd SSS ID	MA Ltd 2009 Potential	MAG ID	MAG nT	Distance between SS (2008) and MAG (2013)
MAL-401	Medium	186	5.39	50m
MAL-405	Low	512	6.48	30m
MAL-408	Low	386	5.98	38m
MAL-411	Low	627	6.97	48m
MAL-415	Low	1581	34.43	31m
MAL-422	Medium	564	6.68	39m
MAL-424	Low	707	7.33	50m
MAL-426	Medium	1116	10.56	15m
MAL-427	Medium	890	8.5	46m
MAL-432	Low	1205	11.46	47m
MAL-438	Low	828	8.09	28m
MAL-443	Low	1623	150.5	8m
MAL-444	Medium	89	5.14	6m
MAL-450	High	1629	135.99	25m
MAL-452	Low	229	5.5	0.5m

4.2.1 *Magnetic Targets Correlating With High Potential Side Scan Anomalies*

All high priority anomalies from 2009 assessment were compared to the magnetic anomalies from the 2012 survey, the results are presented below.

MAL-450 - The anomaly is the known wreck SS *Upminster* that sank in 1940. The di-polar magnetometer target 1629 has a calculated amplitude of 135.99 nT (See **Figure 5** for magnetometer profile) and is 25 m from the previously identified feature. **MAL-450** was identified from the side scan analysis as a wreck. The wreck measures 89.18 m x 14.92 m and protrudes 5.81 m from the seabed. Subsequent comparison with known wreck data from the UKHO, National Record of the Historic Environment (NRHE) (former NMR), and multibeam survey data has confirmed this feature as the 'Live' wreck of the *Upminster* (**Figure 3**).

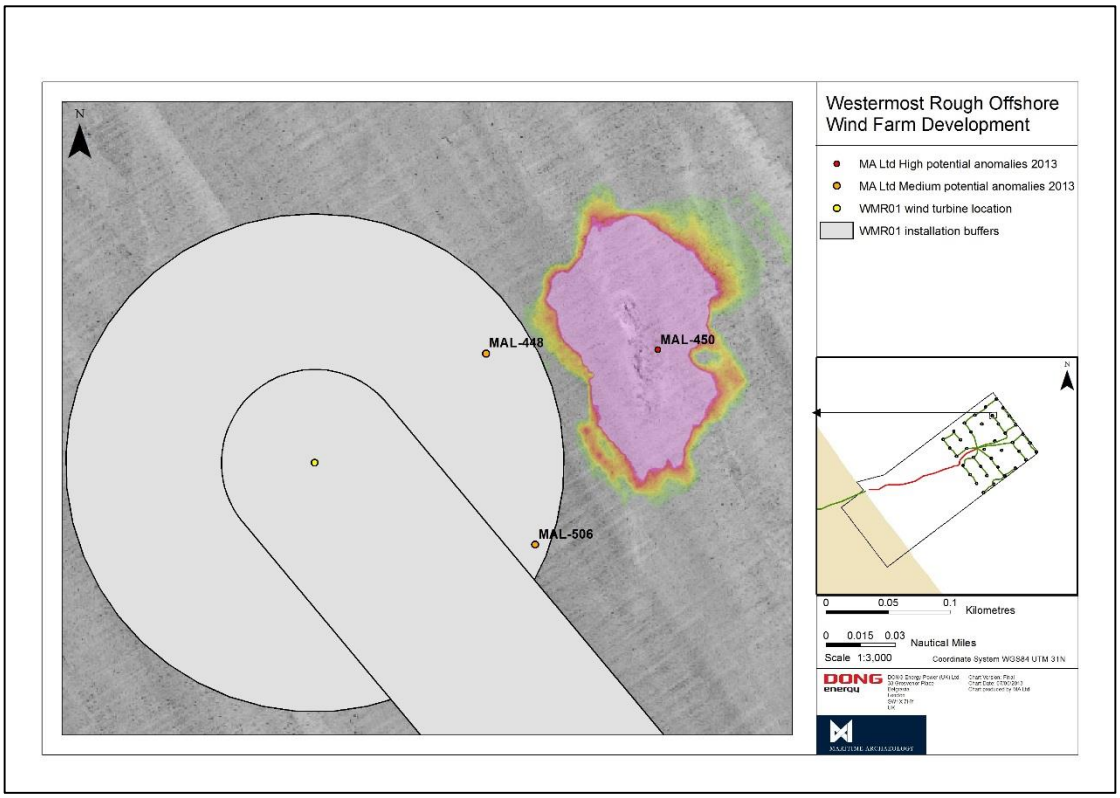

Figure 3 - Magnetometer anomalies MAL-448 and MAL-506 and Side Scan Sonar target MAL-450 referencing the position of the known wreck SS Upminster.

MAL-407 (MAL-313) was interpreted in 2009 as a high priority target 22 m long and 5 m wide. The closest magnetometer anomaly is 76 m away (**ID 250**). The measured nT is 5.55. It is anticipated that the magnetometer targets is not directly linked to the side scan anomaly.

MAL-445 (MAL-314) was interpreted in 2009 as a high priority target. The closest magnetometer anomaly is 134 m away (**ID 903**). The measured nT is 8.58. It is anticipated that the magnetometer targets is not directly linked to the side scan anomaly (**Figure 4**).

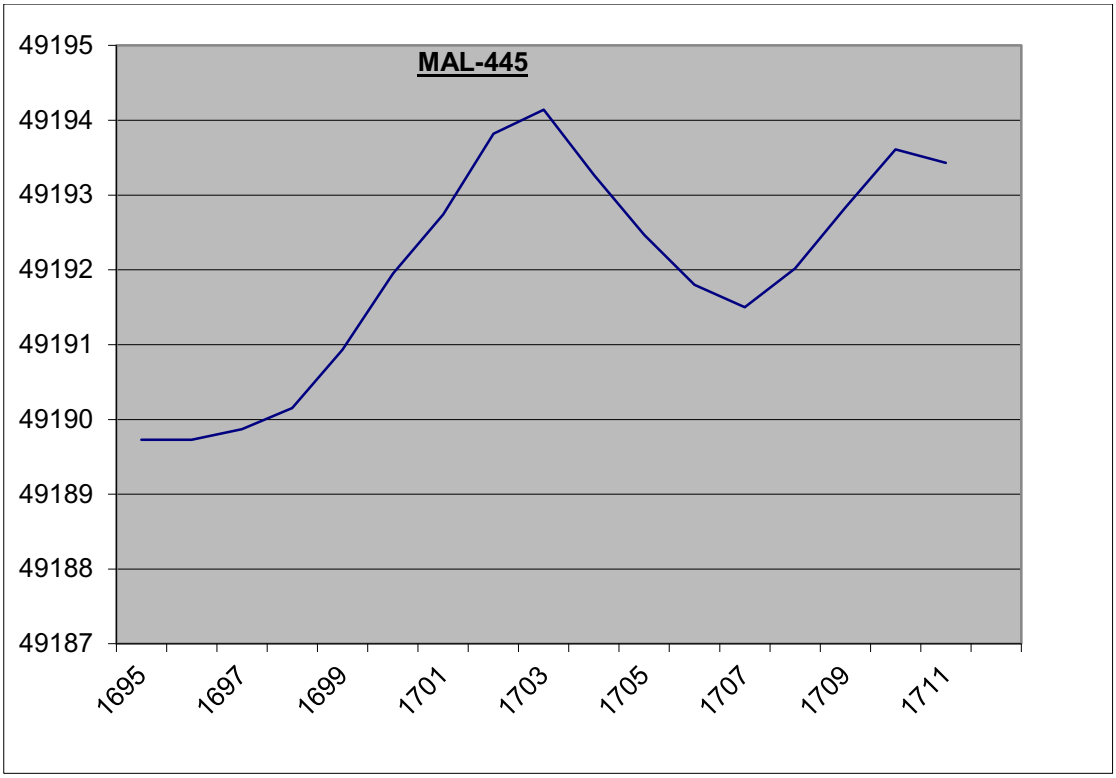

Figure 4 - Magnetometer profile showing anomaly 445

4.2.2 *Correlation with Medium Potential Side Scan Anomalies*

In 2009, fourteen anomalies were considered to be of medium archaeological potential within the geophysical survey area. Twelve of the fourteen were located in the proposed turbine placement area and two along the cable route. The table below presents the relationships between the medium potential side scan anomalies and the anomalies identified in the magnetometer assessment.

Table 5 - Medium potential anomalies 2009 and their relationship to magnetometer targets.

MA Ltd SSS ID	Description 2009	Magnetic ID	Distance between targets	Mag nT	Comments
MAL-401	Largely buried cylindrical feature 53.9m x 9.5m	186	50m	186	Associated with SSS anomaly
MAL-412	Distribution of reflectors and associated scour over a 45m x 15m area	578	115m	6.76	Associated with SSS anomaly
MAL-421	Linear distribution of discrete reflectors 36.5m in length	906 777 1416	All within 90m	8.6 7.74 17.26	Three targets associated with SSS anoamly

MA Ltd SSS ID	Description 2009	Magnetic ID	Distance between targets	Mag nT	Comments
MAL-422	Semi-circular outline of attenuating material in proximity to linear reflectors 5.31m x 10.78m in extent	564	39m	6.68	Associated with SSS anomaly
MAL-426	Tight cluster of discrete reflectors	1116	15m	10.56	Associated with SSS anomaly
MAL-427	Series of linear reflectors 35.3m in length with shadow	890	46	8.5	Associated with SSS anomaly
MAL-437	Semi-circular formation of discrete reflectors showing signs of scour.	555	165m	6.65	No SSS correlation
MAL-439	Series of reflectors associated with MAL-437	555	165m	6.65	No SSS correlation
MAL-441	Scatter of reflectors in a semi-linear formation, 54m in length.	358	227m	5.92	No SSS correlation
MAL-442	Pronounced cluster of discrete reflectors and shadows	89	154m	5.14	No SSS correlation
MAL-444	Cluster of reflectors Part of Upminster (MAL-450) debris field	89	6m	5.14	Associated with SSS anomaly
MAL-448	Cluster of linear reflectors 9.55m x 5.61m, protruding 0.73m from the seabed	1629	113m	135.00	No direct SSS correlation
MAL-453	Discrete area of attenuating material 19.11m x 4.51m	5	387m	9.02	No SSS correlation
MAL-459	Linear attenuating feature	1628	433m	10.92	No SSS correlation

It is recommended that one of the fourteen anomalies (**MAL-444**) described above should be elevated to *high* potential targets due to its association with **MAL-450**.

4.2.3 *Correlation with Low Potential Side Scan Anomalies*

Forty-four anomalies were classed as *low* potential (2009) since they were considered to be geological features or isolated debris with little archaeological interest. Following the comparison of these 44 targets with the magnetometer data, eight of them correlate with > 5 nT anomalies (**Table 6**).

MA Ltd SS ID	MAG ID	MAG nT	Distance between SSS (2009) and MAG (2013)
MAL-405	512	6.48	30m
MAL-408	386	5.98	38m
MAL-411	627	6.97	48m
MAL-424	707	7.33	50m
MAL-432	1205	11.46	47m
MAL-438	828	8.09	28m
MAL-443	1623	150.5	8m
MAL-452	229	5.5	0.5m

Table 6 - Magnetometer targets correlation with low potential anomalies 2009

It is recommended that the three of the eight anomalies **(MAL-415, MAL-432** and **MAL-443**) described above should be elevated to *medium* potential targets.

4.3 Correlation with Multibeam Anomalies (2009)

In the 2009 report the results from the side scan survey were cross-referenced with the multibeam survey data in GIS. The position of the wreck of the *Upminste*r and its associated debris (**MAL-450, MAL-448**), recorded in the UKHO, NRHE (former NMR), and on side scan imagery, was confirmed. The magnetometer survey also identified a feature correlating with the position and mass of the wreck site of SS *Upminster* (**ID 1629**). No additional features of archaeological interest were identified from the review of the multibeam data in 2009.

4.4 Correlation with Known Wrecks

As discussed in the 2009 report, the shipping traffic in the study area was greater from post medieval times onwards when the rapid development of the shipping industry and trade took place. Therefore, the potential of wreckage in the development area could be considered as relatively high and some of the wrecks and anomalies mentioned in this section may be a material expression of this shipping traffic. The recorded losses in the area are detailed in **Appendix IV.**

Five known wrecks and their possible associated debris were recorded within the study area in the 2009 report (**Appendix I**). The locations of these wrecks were compared to the magnetometer survey data.

The SS *John Creighton* (**MAL-310**) located in the intertidal zone is classed as 'Live' in the UKHO dataset. Magnetometer data for the intertidal area was not collected and so no correlation can be established following this review.

The location of the SS *Upminster* (**MAL-450**), also classed as 'Live' in the UKHO dataset was confirmed through the magnetometer survey results (**ID 1629**) **Figure 5.** UKHO records state that it was also recorded by echo-sounder survey in 1981 after its original detection in 1929 (Larn & Larn, 1997). The recorded vessel length is 85.3 m x 12.5 m (beam) x 5.8 m (draught). The vessel sank on 2nd May, 1928. It was built in Sunderland in 1917 by Osborne Graham & Co. and was owned by the Hudson Steamship Co. London at the

time of sinking (Larn & Larn, 1997). The circumstances of its loss were due to a collision with another vessel, the SS *Lanrick*, 15 m south of Flamborough Head. Its present condition is recorded as upright with collapsed bows and funnel.

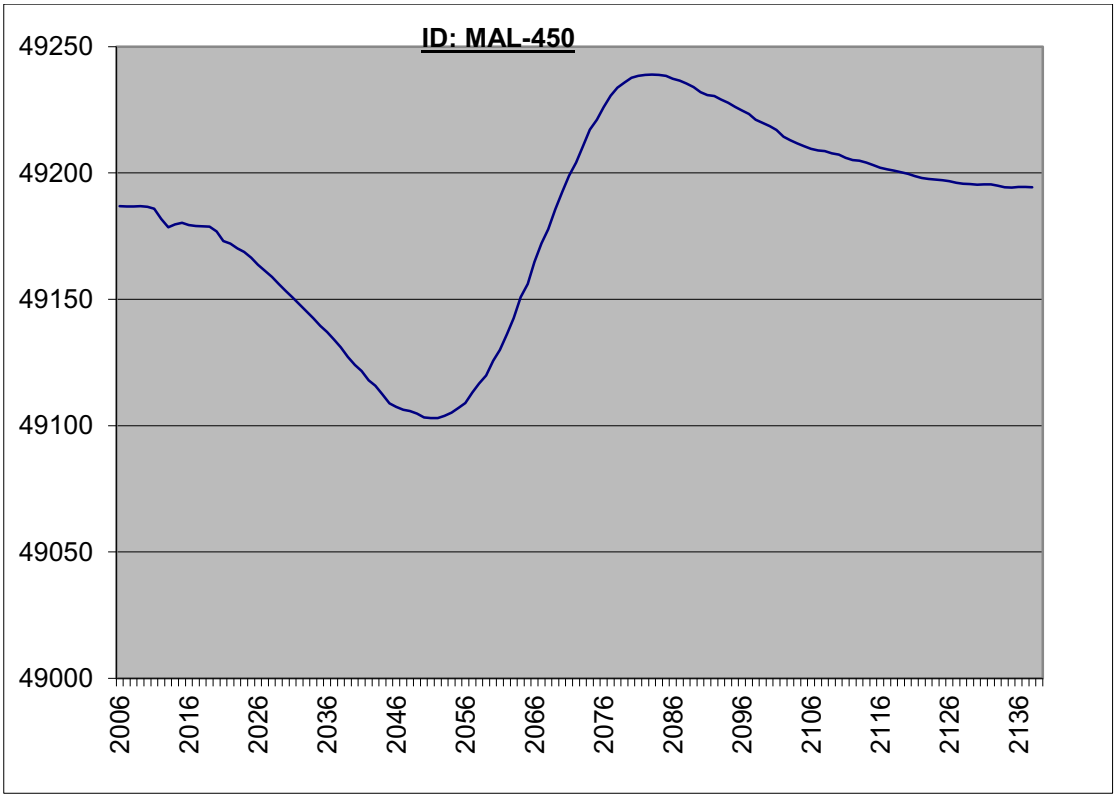

Figure 5 - Magnetometer profile showing the known wreck Upminster (MAL-450)

The iron built fishing vessel *Celtic* **(MAL-311)** was built in 1899 and owned at the time of loss by the Grimsby Steam Fishing Co. Ltd. It left Grimsby port towards fishing grounds but sank c. 1905 after a collision with SS *Jagersboro* (Larn & Larn, 1997). The wreck is classed as 'Dead' in the UKHO dataset. As this wreck could not be identified in the side scan sonar dataset, it was assumed that it could be buried or dispersed due to sediment dynamics. The magnetometer survey identified small anomaly (9.27 nT) 59 m from the co-ordinates recorded in the UKHO records. The geophysical data collected is not yet sufficient to proof the correct position of *Celtic.* There are however several large magnetic anomalies in the survey area indicating that the position of *Celtic* might be associated to any of them (**Section 4.5**).

4.5 Magnetometer Anomalies c. 100 nT

There are seven magnetometer anomalies recorded in the dataset where the measured amplitude is close to 100 nT (**Table 7, Figure 6**).

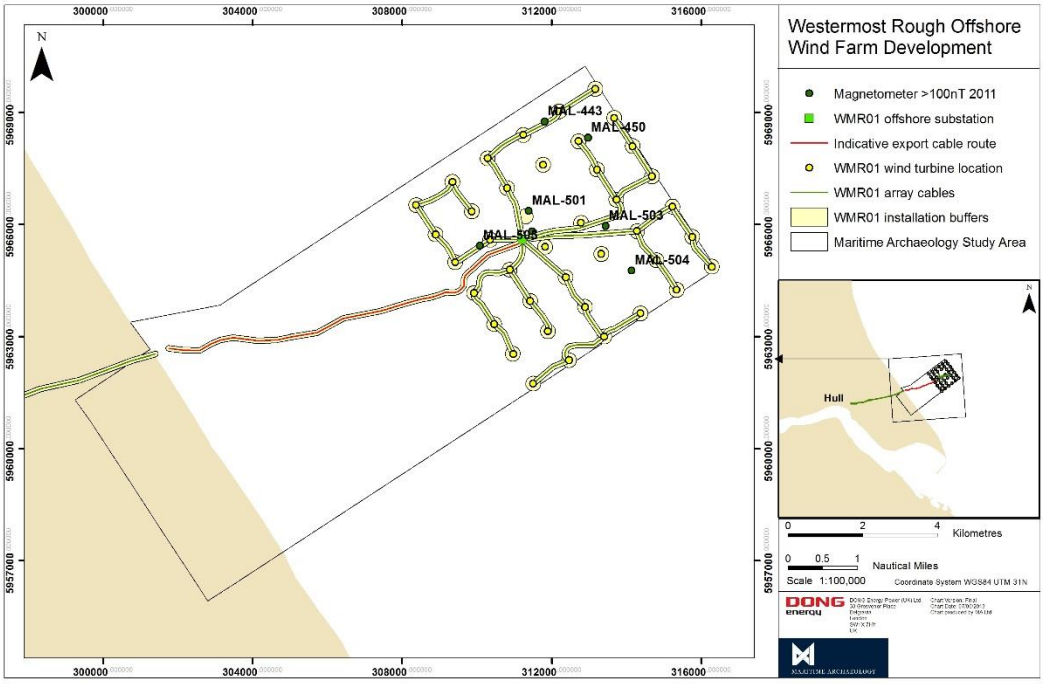

Figure 6 - Magnetometer targets c. 100 nT

Two anomalies **(MAL-443 and MAL-450)** have been assessed in **Sections 4.2.3** and **4.4**. One anomaly (**MAL-502**) is a part of a geological feature and therefore not assigned archaeological potential. The other four magnetometer anomalies do not correlate to any previously identified targets but due to their high amplitude they are assessed as of medium archaeological potential, and may potentially relate to some of the ship losses recorded in the area (**Appendix IV**).

Table 7 - Magnetometer anomalies c. 100 nT

MAL-ID	MAG-ID	X	Y	Amplitude nT
MAL-501	1620	311384.5	5966363	99.11
MAL-502	1621	311477.5	5965819	106.34
MAL-504	1622	314135.5	5964764	122.36
MAL-443	1623	311806	5968753	150.5
MAL-503	1624	313442.5	5965960	345.79
MAL-505	1625	310079.5	5965433	567.46
MAL-450	1629	312967	5968318	135.99

4.6 Magnetometer Anomalies > 5 nT

All anomalies where the amplitude is higher than 5 nT can be found in **Appendix III**. The anomalies were assessed and compared to the results from the 2009 report. For this report MA Ltd has adopted 5 nT as the minimum deflection where targets of potential archaeological interest can be recognised against background noise during a magnetometer survey (**Section 3.1.2**). All targets of > 5 nT may relate to material of archaeological interest

(**Figure 7**), though without corroborating data no further interpretation can be given at this time.

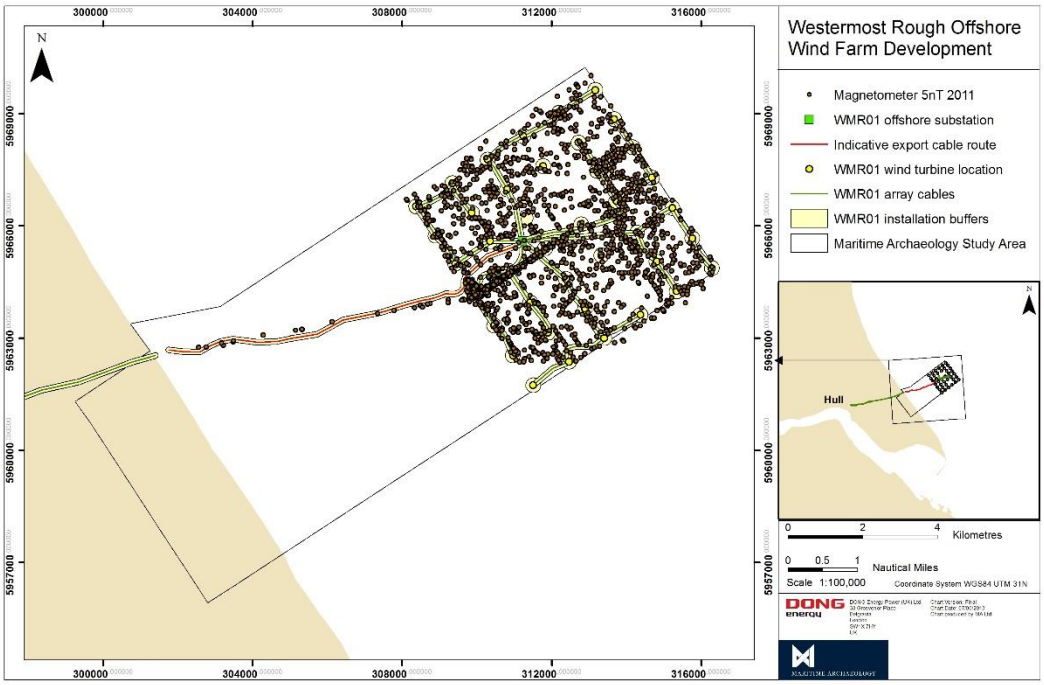

Figure 7 - Magnetometer targets in the study area over 5 nT

4.7 Summary of Archaeological Features

Following the 2013 assessment changes to the anomalies with archaeological potential are as follows;

- One target was upgraded from medium to high potential (**MAL-444)**;
- Five new targets have been added to the anomaly dataset (**MAL-501, MAL-503, MAL-504, MAL-505** and **MAL-506**) as medium potential targets;
- Three targets were upgraded from low to medium archaeological potential (**MAL-415, MAL-432** and **MAL-443**).
- The target previously associated with the known wreck *Celtic* (**MAL-311**) is no longer retained due to a lack of correlation with any magnetic anomaly identified in this assessment. Mitigation for this and other features discussed here is revised accordingly (**Section 6.2**).

All targets are described in detail below.

4.7.1 *High Potential*

Five high potential anomalies were identified in the 2013 assessment (**Table 8; Figure 8)**:

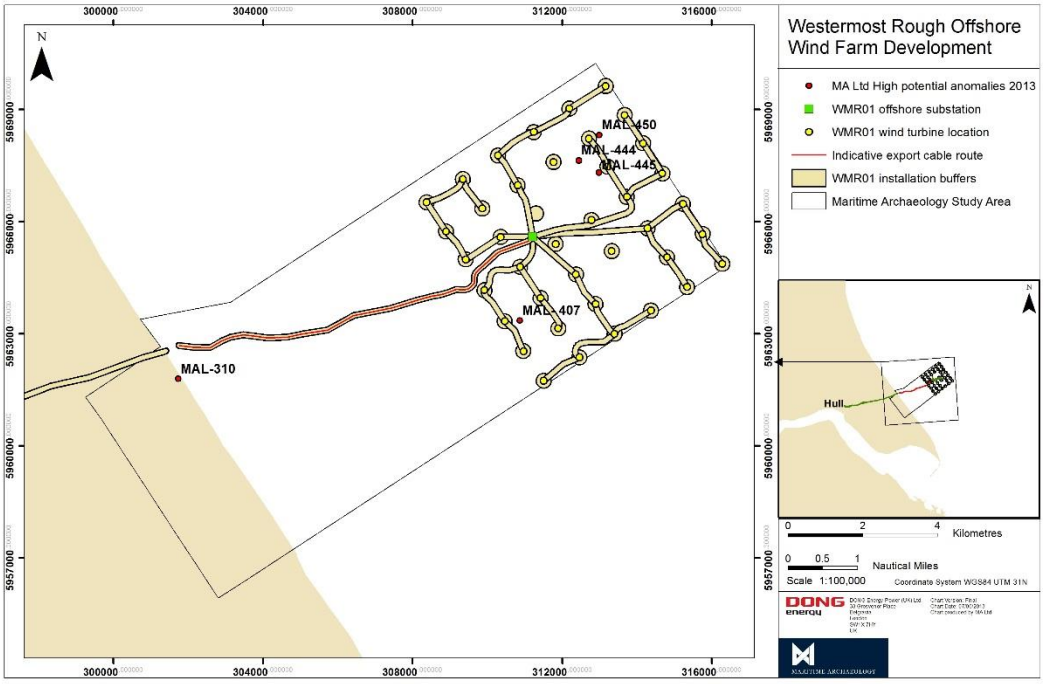

Figure 8 - High Potential Anomalies 2013

MAL-310 Wreckage after the known wreck *John Creighton*. Located in the intertidal zone and not assessed further in this report;

MAL-407 (MAL-313) Unknown wreck identified in side scan sonar data (2009) and confirmed amplitude of 4.56 nT in magnetometer survey data (2013);

MAL-444 Unknown anomaly identified in side scan sonar data and possible associated with the known wreck *Celtic* (**MAL-311**) (2009). Confirmed amplitude of 5.14 nT in magnetometer survey data (2013);

MAL-445 (MAL-314) Unknown wreck identified on the side scan sonar (2009) and confirmed amplitude of 4.41 nT in magnetometer survey data (2013);

MAL-450 Wreckage after the known wreck SS *Upminster*. Identified in the NRHE (former NMR), UKHO, on side scan sonar and multibeam (2009). Re-assessed in 2010 and identified in magnetometer data (2013).

MAL ID	Name	Dataset Identified	WGS84 UTM 31N Easting/ Nothing
MAL-310	*John Creighton*	UKHO	301729 5961792
MAL-407	Unknown wreck	Side scan sonar/ Magnetometer	310868 5963353
MAL-444	Unknown anomaly	Side scan sonar/ Magnetometer	312440 5967640
MAL-445	Unknown wreck	Side scan sonar/ Magnetometer	312982 5967311
MAL-450	SS *Upminster*	Side scan sonar/ Magnetometer/ NRHE/ UKHO/ Multibeam	313006 5968319

Table 8 - High Potential Anomalies 2013 summary

4.7.2 *Medium Potential*

Twenty- one medium potential anomalies where identified in the 2013 assessment (**Figure 9** and **Table 9**).

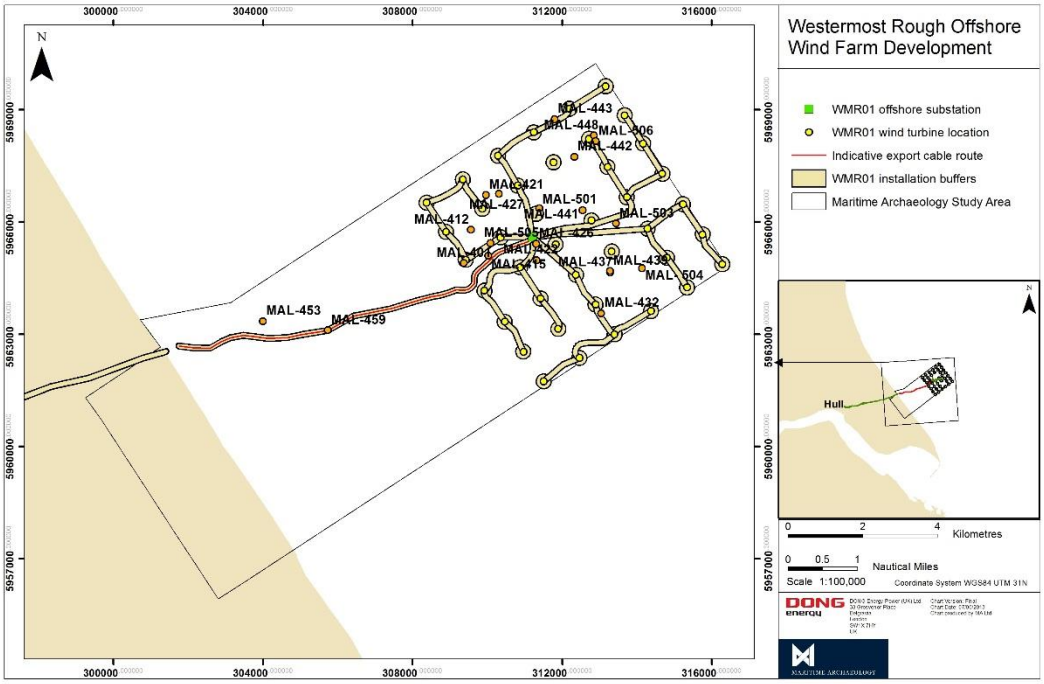

Figure 9 - Medium Potential Anomalies 2013

Table 9 - Medium potential anomalies 2013

MA Ltd ID	Type	Dataset Identified	Mag nT	WGS 84 UTM 31N Easting/ Northing
MAL-401	Medium potential anomaly	Side scan sonar		309369 5964901
MAL-412	Medium potential anomaly	Side scan sonar		309554 5965790
MAL-415	Medium potential anomaly	Side scan sonar/ Magnetometer	34.43	310022 5965097
MAL-421	Medium Potential Anomaly	Side scan sonar/ Magnetometer	8.6, 7.74, 17.26	309964 5966721
MAL-422	Medium potential anomaly	Side scan sonar		311315 5964981
MAL-426	Medium potential anomaly	Side scan sonar/ Magnetometer		311300 5965420
MAL-427	Medium potential anomaly	Side scan sonar		310314 5966752
MAL-432	Medium potential anomaly	Side scan sonar/ Magnetometer	11.46	313043.5 5963556.5
MAL-437	Medium potential anomaly	Side scan sonar		313286 5964651
MAL-439	Medium potential anomaly	Side scan sonar		313280 5964689
MAL-441	Medium potential anomaly	Side scan sonar		312543 5966319
MAL-442	Medium potential anomaly	Side scan sonar		312323 5967740
MAL-443	Medium potential anomaly	Side scan sonar/ Magnetometer	150.5	311800 5968746
MAL-448	Medium potential anomaly	Side scan sonar		312854 5968312
MAL-453	Medium potential anomaly	Side scan sonar		303998 5963346
MAL-459	Medium potential anomaly	Side scan sonar		305732 5963104
MAL-501	Medium potential anomaly	Magnetometer	99.11	311384.5 5966363
MAL-503	Medium potential anomaly	Magnetometer	345.79	313442.5 5965960
MAL-504	Medium potential anomaly	Magnetometer	122.36	314135.5 5964764
MAL-505	Medium potential anomaly	Magnetometer	567.46	310079.5 5965433
MAL-506	Medium potential anomaly	Magnetometer	51.55	312893.5 5968158.5

4.7.3 *Low Potential*

The re-assessment of the geophysical data resulted in 41 low potential anomalies. Details of all low potential targets are included in **Appendix II.**

5 Archaeological Impact Assessment

The following impact assessment is an updated and revised version of that provided during the previous assessment of Westermost Rough Offshore Wind Farm (Maritime Archaeology, 2009). This revision incorporates the results of the 2013 magnetometer assessment as discussed above. As such, these findings and recommendations should supersede those presented previously. For geophysical targets where no updated impact assessment has been provided in this report the recommendations stated in the 2009 report are adequate.

All of the results gained from this assessment to date have been incorporated within the archaeological WSI (DONG Energy, February 2013).

5.1 Scheme Impacts

To effectively assess any adverse effect of offshore development on any known and potential archaeology within the intertidal and marine areas, the planned impacts have been categorised into three phases:

- Construction
- Operation
- Decommissioning

The significance of the effect of each development impact has been assessed, taking into account the type of effect and the local, regional, national or international importance of the receptor. The isolated and cumulative effect on each identified archaeological feature or site has therefore been appraised in terms of its significance using the methodology detailed in (**Section 3.2**).

5.2 Impacts During Construction

A comparison between the geophysical survey datasets and anomalies previously detected has enabled an assessment of the impact of the Project development on the historic assets of its immediate vicinity.

5.2.1 Offshore Export Cable Route

The laying of the export cable on the seabed will connect the offshore substation to the onshore substation near Salt End. A trench to accommodate the cable is planned as part of the scheme proposals. This will extend to a maximum of 8.8 km offshore from the mean high water level to connect to the offshore substation. The export cable trench would need to be excavated to a maximum of 3 m below the seabed surface and, at present, the exact method of subsea trenching is unknown (DONG Energy, 2008b).

The final export cable route has not yet been confirmed, however the final cable trench and associated areas of impact will be designed to avoid all archaeological exclusions zones. **MAL-453** and **MAL-459** positions adjacent to the proposed export cable route trench indicates that they may be affected indirectly by trenching operations, either by slumping, or later scouring around the pipeline (**Figure 10)**. They will be avoided by micro-siting the export cable.

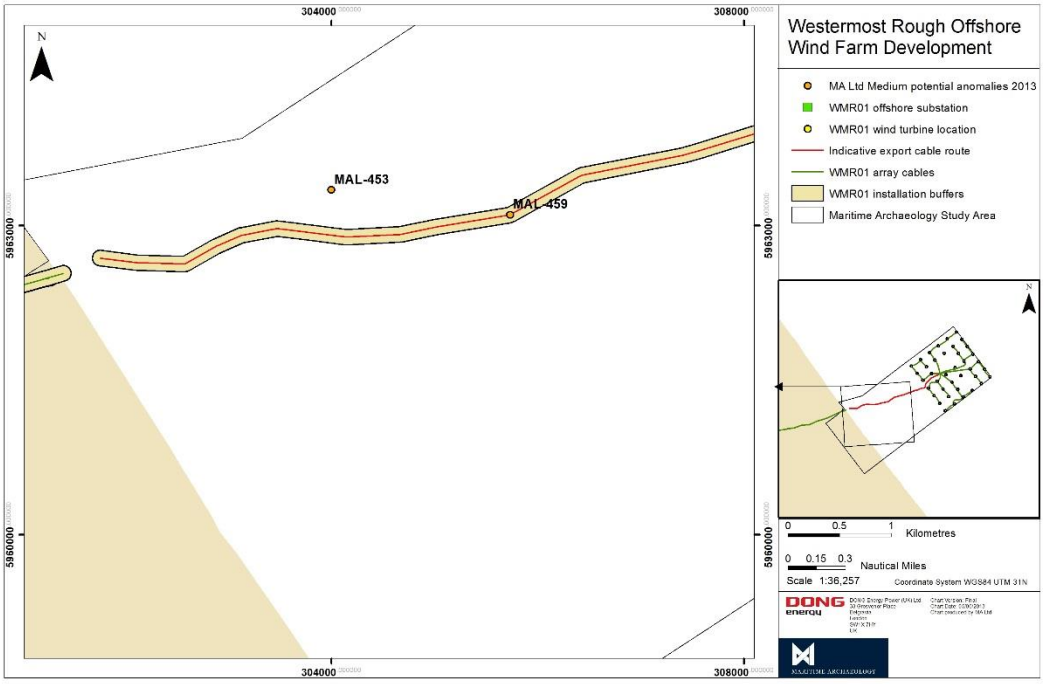

Figure 10 - Medium potential targets in the vicinity of the indicative export cable route

5.2.2 Offshore Turbine and Substation Installation

The marine component of the scheme involves the construction of 35 wind turbines and an offshore substation. The maritime area encompassed by the wind farm is 35 km^2. The indicative turbine layout is shown in Figure 8 and 9 above.

Both turbine and substation installation will require foundations which have a potential to cause damage or loss of any surface or buried archaeology, including in situ or dispersed wreck material. The turbines will be installed with monopiles up to a depth of 32.5 m and the substation will be installed with eight piles up to a depth of 40 m.

The depth range for the foundations is between 25 – 35 m – m and may require seabed preparation, including potential re removal of boulders and obstructions, which have a potential to cause damage or loss of any submerged features, wrecks, or buried archaeological deposits.

Piling to this depth, in addition to seabed preparation which would involve the removal of surface obstructions, would also cause severe damage and disturbance to any submerged features, wrecks, or buried archaeological deposits. This is relevant to both piling operations and substation installation.

Intrusion into the seabed of deep pile foundations is likely to disturb archaeological receptors, resulting in a loss of information that prevents or reduces the possibility to accurately interpret such material.

Soil dumping areas during foundation excavation are most likely to be positioned around the base of the turbines or in a licensed disposal ground. Dumping material on surviving archaeological features would disturb the integrity of these sites.

Secondary impacts from the infrastructure deployed to install the wind farm, including jack-up vessel spud legs and installation vessel anchoring, are likely to result in compression of the seabed. The effect on discrete receptors is likely to cause the modification or destruction of archaeological material, preventing the complete or partial interpretation of such material and its surrounding context.

The offshore substation will be located within the wind farm in the array of turbines closest to the shore. The marine export cables are required to supply this electrical power by connecting the offshore substation to the onshore substation at Hull.

5.3 Impacts During Operation

5.3.1 Marine Export Cable Route

Two medium potential anomalies (**MAL-453** and **MAL-459)** are located within the export cable route corridor (**Figure 10**). At the time of writing, the final export cable route has not yet been confirmed, however the final cable trench and associated areas of impact will be designed to avoid all archaeological exclusions zones and therefore there will be no impact on these two anomalies.

5.3.2 Offshore Turbine and Substation Installation

Minor to moderate secondary impacts during the operation of the turbines and substation are considered to be scouring of the seabed around the foundations and the disturbance of wreck material as a result of anchorage during repairs or on-site maintenance.

5.4 Impacts During Decommissioning

5.4.1 Offshore Export Cable Route

There is the potential for survival of foreshore deposits, especially prehistoric peats. Removal of the marine export cable may cause damage to these deposits due to the fragility of peat and associated structures and features, including the potential human occupation evidence. Boreholes and vibrocores from the offshore area did not establish any evidence of either culturally or palaeoecologically significant material, however if such material should be located, their disturbance through decommissioning can be considered as having a minor to moderate impact on such deposits.

5.4.2 Offshore Turbine and Substation Removal

Removal of foundations from the seabed would cause the disturbance, damage or loss of surviving exposed or buried archaeological remains and further slumping of sediments. The targets identified below might be affected by planed the activity.

The known position of the ‘Live’ wreck of the *Upminster* (**MAL-450**), within the proposed turbine area has been re-confirmed by the magnetometer survey.

Previously a geophysical anomaly was detected that reflected a debris field with an approximate overall diameter of c.150 m **(MAL-448).** The initial exclusion zone from 2009 was amended in 2010 (ES Addendum 1 - Maritime

Archaeology Ltd, 2010). The 2011 magnetometer survey has confirmed the extent of the wreckage by identifying one magnetometer target (**MAL-506)**.

The previously unknown vessels identified by side scan sonar interpretation in 2009 (**MAL-407 and MAL-442**) are positioned within the turbine placement area. Their archaeological potential is considered high because they have been positively identified as a wreck but, at present, the wreck identities and status are unknown (**Appendix II**).

One other high priority target **MAL-444** is within the turbine area. The target was identified by side scan sonar and magnetometer survey. The archaeological potential for the targets has been assessed *as high* (**Appendix II**).

5.5 Significance of Effect

5.5.1 Offshore Export Cable Route

In Maritime Archaeology Ltd (2009) the potential for the existence of submerged landscape features and land surfaces within the study area was considered to be high. In the light of recently available data from the Humber REC and the subsequent report that has been published (see **Section 2.4**), the potential for such deposits is now considered to be reduced. The archaeological geotechnical assessment consisting of borehole and vibrocore sampling concluded that there is potential of such deposits in this area is low (Maritime Archaeology, 2013).

The effect of any trenching operations on surviving submerged prehistoric landscapes would have a significant adverse effect on such deposits. However, as the presence of these deposits is unlikely, the effect is not assessed further.

No definite dispersed remains of either known or unknown wrecks were highlighted in the marine export cable route as a result of the geophysical survey. However, six low potential anomalies were identified through geophysical assessment in close proximity to the cable trench (**MAL-460**, **MAL-454**, **MAL-455**, **MAL-456**, **MAL-457**, **MAL-458** – **Figure 11).** All of these are classified as potentially geological in nature and therefore they are not subject to exclusion zones. Given the low potential of these anomalies, the effect of trenching and the effects of impacts from vessel movements and other related construction activities on them are considered *negligible.*

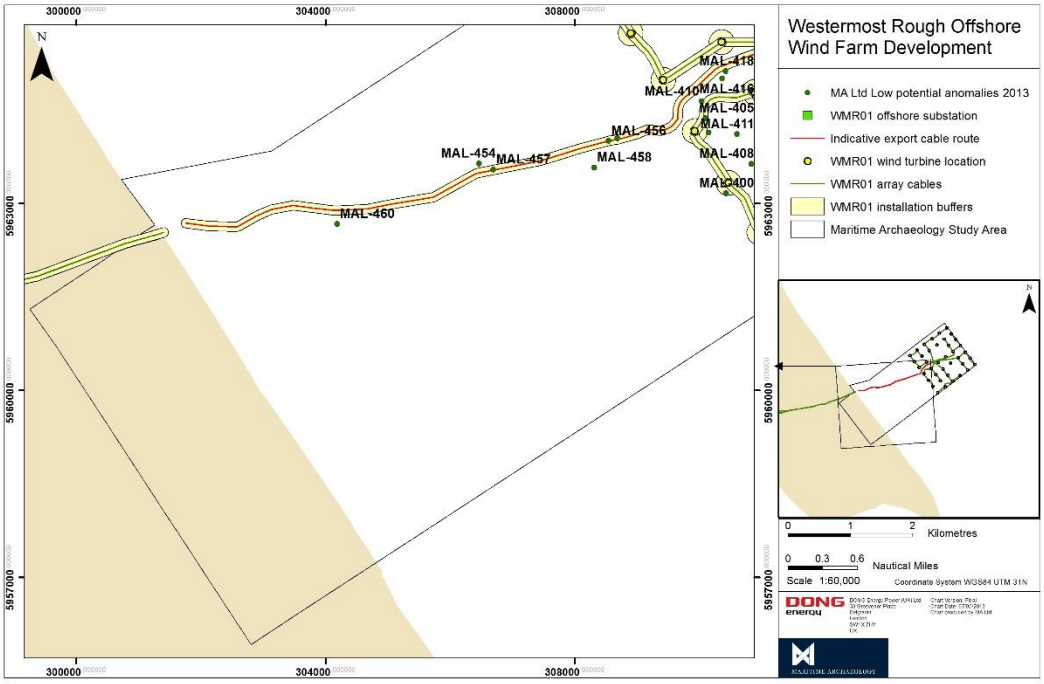

Figure 11 - Low priority targets in the vicinity of the cable export route identified in 2013

Two medium potential side scan anomalies **MAL-453** and **MAL-459** (**Appendix II**) were identified in proximity to the proposed export cable trench **Figure 10**. This material may be anthropogenic in nature and may represent exposed wreck material. Construction operations, including anchoring or the positioning of pontoons, could have a *moderate to severe adverse effect* on such remains, where these activities occur in these locations.

5.5.2 Offshore Turbine and Substation Installation

The confirmed locations of the 'Live' wreck *Upminster* (**MAL-450**) means that it is likely to be directly affected by the proposed development. While the significance of this individual vessel is not currently fully assessed then the overall effects of development should be considered *severe*. Following correspondence with English Heritage's Marine Spatial Planning team (January 28th, 2010) it was stipulated that a 75 m precautionary exclusion zone delineating the entire wreck and any associated debris should be implemented during the life of the Project.

Further four medium potential anomalies with 25 and 50 m exclusions zones lie within the turbine construction buffer placement areas (**MAL-401, MAL-448, MAL-501, MAL-506**). These anomalies have been identified in the geophysical survey data, but have not been firmly identified. Therefore, the effects of disturbance or loss of these potential wreck sites are at present considered *severe* until further data is obtained (**Figure 12**).

One medium potential anomaly (**MAL-426**) is located within the 500 m buffer surrounding the substation. The exact nature of the anomaly is not yet

confirmed. Therefore, the effects of disturbance or loss of the anomaly are at present considered *severe* until further data is obtained.

Any other construction activities in this area that may include vessel anchoring or the positioning of spud leg pontoons would have a significant adverse effect on the integrity of the existing wreck remains.

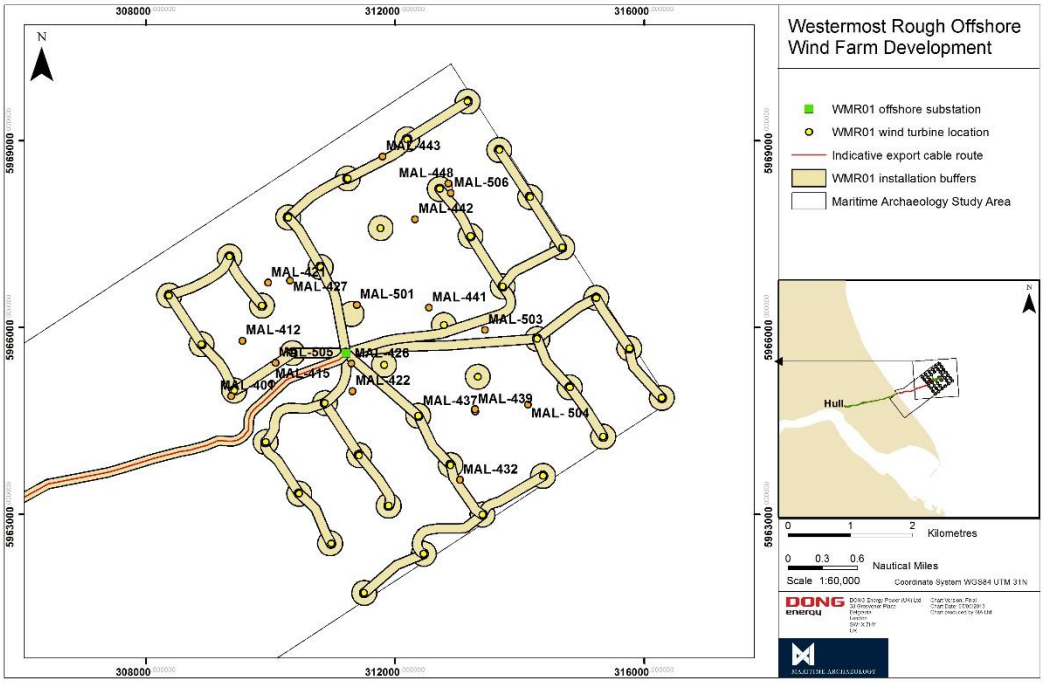

Figure 12 – Medium anomalies within turbine installation buffers

No other identifiable dispersed remains of recorded wrecks were highlighted as a result of the geophysical survey. Within the turbine placement area nineteen medium potential anomalies were identified protruding from the seabed. The targets may represent exposed wreck material relating to the many reported losses recorded on the NRHE (former NMR). Construction operations including excavation, anchoring or the positioning of pontoons is likely to have a moderate to severe adverse effect on such remains, depending on the location of these activities.

5.6 Summary

MA Ltd submitted a detailed account of potential impacts in 2009 (Maritime Archaeology Ltd, 2009). This section comprises a summary of the sites affected by the offshore development including updated information collected and analysed from the magnetometer survey undertaken in 2011. All high and medium potential targets are at risk of unmitigated during the development. **Table 10** summarises the features affected without mitigation by the development.

Following the adoption of mitigation measures described in the WSI (DONG Energy, 2013) and outlined in **Section 6**, the residual adverse effects on these features are likely to be reduced to neutral or slight.

Table 10 - Features affected by the development.

Export Cable Route					
Features Impacted	**Archaeological Potential**	**Impact Phase**	**Scale of Impact**	**Mitigation**	**Residual Effect**
MAL-453	Medium	Construction/ Decommissioning	Moderate	AEZ 50m radius from point	Slight
MAL-459	Medium	Construction/ Decommissioning	Moderate	AEZ 50m radius from point	Slight
Offshore Turbine and Substations					
Features to be impacted	**Archaeological Potential**	**Impact Phase**	**Scale of Impact**		
MAL-310	High potential anomaly	Construction	Moderate to Severe	AEZ 75m radius from point	Slight
MAL-407	High potential anomaly	Construction	Moderate to Severe	AEZ 75m radius from point	Slight
MAL-444	High potential anomaly	Construction	Moderate to Severe	AEZ 75m radius from point	Slight
MAL-445	High potential anomaly	Construction	Moderate to Severe	AEZ 75m radius from point	Slight
MAL-450	High potential anomaly	Construction	Moderate to Severe	AEZ 75m radius from rectangular perimeter of wreck and debris	Slight
MAL-401	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-412	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-415	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-422	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight

MAL-426	Medium potential anomaly	Construction	Moderate to Severe	AEZ 25m radius from point	Slight
MAL-427	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-432	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-437	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-439	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-441	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-442	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-443	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-448	Medium potential anomaly	Construction	Moderate to Severe	AEZ 25m radius from point	Slight
MAL-501	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-503	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-504	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-505	Medium potential anomaly	Construction	Moderate to Severe	AEZ 50m radius from point	Slight
MAL-506	Medium potential anomaly	Construction	Moderate to Severe	AEZ 25m radius from point	Slight

6 Mitigation Recommendations

6.1 Review of Current Mitigation Recommendations (2009-2010)

A brief review of mitigation recommendations suggested in the 2009-2010 reports is included in this section. For mitigation recommendations following the magnetometer assessment refer to **Section 6.2.**

6.1.1 High Potential Feature (2009-2010)

A precautionary exclusion zone of 75 m (rectangular area encompassing wreck and associated debris) was designed around the surveyed position of the UKHO 'live wreck' identified as SS *Upminster*. Precautionary exclusion zones (radius from a central point) were proposed around the two high potential wreck anomalies (**MAL-407** and **MAL-445**) identified in the side scan survey data (2008). Due the uncertain extent and distribution of any surviving material around the recorded position of the UKHO 'dead wreck' *Celtic,* a precautionary 75m exclusion zone was proposed (Maritime Archaeology Ltd*, ES Addendum Pt 1,* 2010).

6.1.2 Medium Potential Features (2009-2010)

The following exclusion zones were established centred on medium potential features (**Table 11**):

Table 11 - High and Medium Potential Anomalies identified by side scan sonar survey and associated proposed exclusion zones 2009

MA Ltd ID	Name	Identified through	Exclusion zone
MAL-310	*John Creighton*	UKHO	75m
MAL-311	*Celtic*	UKHO	75m
MAL-312/ MAL450	SS *Upminster*	Side scan sonar	75m
MAL-313	Unknown wreck	Side scan sonar	75m
MAL-314	Unknown wreck	Side scan sonar	75m
MAL-401	Medium potential anomaly	Side scan sonar	50m
MAL-412	Medium potential anomaly	Side scan sonar	50m
MAL-421	Medium potential anomaly	Side scan sonar	50m
MAL-422	Medium potential anomaly	Side scan sonar	50m
MAL-426	Medium potential anomaly	Side scan sonar	50m
MAL-427	Medium potential anomaly	Side scan sonar	50m
MAL-437	Medium potential anomaly	Side scan sonar	50m
MAL-439	Medium potential anomaly	Side scan sonar	50m
MAL-441	Medium potential anomaly	Side scan sonar	50m
MAL-442	Medium potential anomaly	Side scan sonar	50m
MAL-444	Medium potential anomaly	Side scan sonar	50m
MAL-448	Medium potential anomaly	Side scan sonar	50m
MAL-453	Medium potential anomaly	Side scan sonar	50m
MAL-459	Medium potential anomaly	Side scan sonar	50m

6.2 Revised Mitigation Recommendation (2013)

Analysis of data from the previous archaeological assessment, the newly acquired magnetometer survey data, and the reappraisal of those sites previously identified have enabled the following mitigation proposals to be put forward. These recommendations have been designed to reduce or eliminate potential impacts on archaeological sites and features within the offshore development area. These recommendations have been presented in response to the impacts identified above, following a review of previous recommendations.

Major modifications from previously summited mitigation proposals consist of five new exclusion zones, four upgrades in archaeological potential and three reductions to previous exclusion zones due to the availability of enhanced geophysical for assessment, notably magnetometer data. These changes have all occurred due to the correlation between previously identified side scan features and magnetic anomalies and further assessment of supporting geophysical data. One 50 m exclusion zone has been upgraded to a 75 m (**MA444 – Figure 13**) exclusion zone based on the revised interpretation of archaeological potential;

- Three low potential anomalies with no previous exclusion zones have been re-assessed as medium archaeological potential anomalies and have been assigned 50 m exclusion zones;
- Five new dispersed medium archaeological potential anomalies with 50 m exclusion zones are proposed, and;
- Three discrete medium anomalies interpreted as having medium archaeological potential have been assigned 25 m exclusion zones.

All recommended exclusion zones are detailed below.

6.2.1 High Potential Features (2013)

Summary of the high potential anomalies is presented in **Table 12** and described in detail below.

Table 12 - Summary of high potential anomalies with recommended exclusion zones

MAL ID	Name	Exclusion zone	WGS84 UTM 31N Easting/ Nothing
MAL-310	*John Creighton*	75 m	301729 5961792
MAL-450	SS *Upminster*	75 m	313006 5968319
MAL-407	Unknown wreck	75 m	310868 5963353
MAL-445	Unknown wreck	75 m	312982 5967311
MAL-444	High potential anomaly	75 m	312440 5967640

MAL-310, *John Creighton* should be avoided and considered in the planning stage when finalising the export cable route. A precautionary exclusion zone

of 75 m (circular area encompassing wreck) is proposed around the position of the wreck.

MAL-407, an unidentified wreck, should be avoided and considered in the planning stage when finalising the wind turbine layout. A precautionary exclusion zone of 75 m (circular area encompassing wreck) is proposed around the position of the anomaly (**Figure 13**).

MAL-444 Unknown high potential anomaly should be avoided and considered in the planning stage when finalising the wind turbine layout. A precautionary exclusion zone of 75 m (circular area encompassing wreck) is proposed around the position of the anomaly (**Figure 13**).

MAL-445, an unidentified wreck should be avoided and considered in the planning stage when finalising the wind turbine layout. A precautionary exclusion zone of 75 m (circular area encompassing wreck) is proposed around the position of the anomaly (**Figure 13**).

MAL-450 – SS *Upminster* should be avoided and considered in the planning stage when finalising the wind turbine layout. The initial exclusion zone from 2009 was amended in 2010 (*ES Addendum Pt 1*- MA Ltd, 2010). The 2011 magnetometer survey has confirmed the extent of the wreckage and they support the amended area. The magnetometer survey has confirmed the location and extent of material relating to this wreck. Therefore, it is recommended that the precautionary exclusion zone of 75 m (rectangular area encompassing wreck and associated debris) is retained around the position of SS *Upminster*.

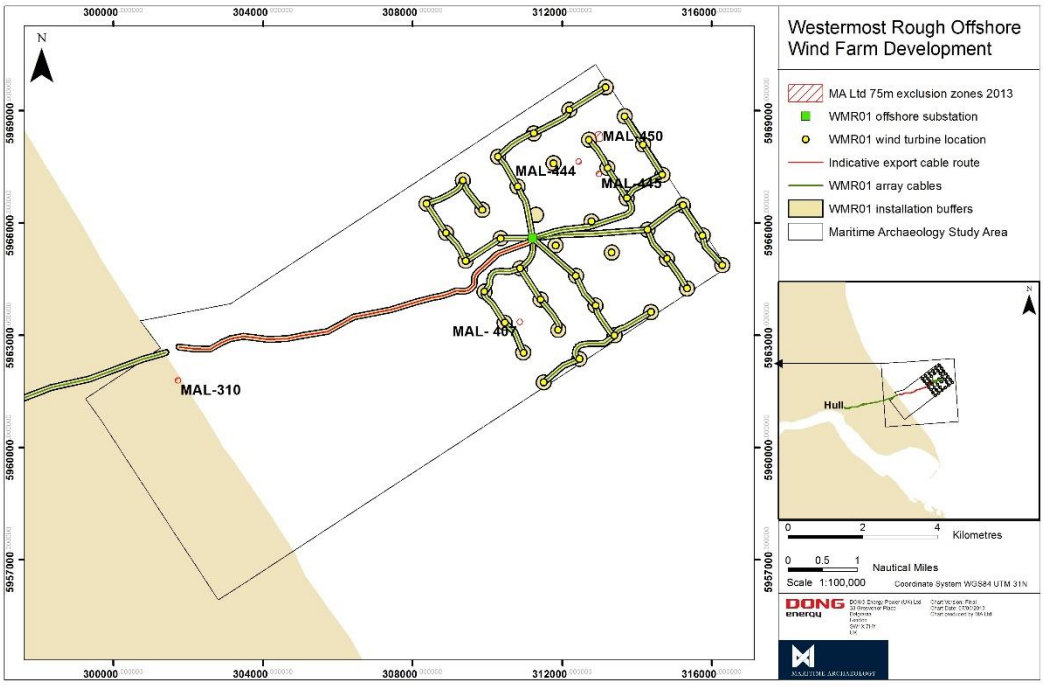

Figure 13 - High potential anomalies (2013) with associated 75m exclusion zones.

Should the proposed exclusion zones around high potential anomalies need to be amended (enlarged, reduced, moved or removed) it is recommended that further archaeological investigation of the sites are undertaken. It should be noted that such investigations are likely to require phased archaeological works (e.g. phased work could include preliminary evaluation, targeted evaluation, excavation and watching brief). The exact scope and nature of these works is detailed in the archaeological WSI (DONG Energy, 2013), agreed in advance with the relevant heritage curators and Licensing authority.

6.2.2 Medium Potential Features (2013)

For medium potential anomalies 25 m or 50 m exclusion zones, depending on their physical distribution, are proposed in accordance with the WSI. The presence of these medium potential anomalies should be considered and avoided where possible when finalising turbine foundation layout. The medium archaeological potential anomalies may represent buried or partial vessel remains, but it has not been possible to fully characterise them based on the geophysical data and other available sources such as NRHE (former NMR) and UKHO data. These sites are likely to be adversely impacted by the proposed development scheme. A summary of the medium potential anomalies is presented in **Figure 14** and **Table 13.**

If impact cannot be avoided within exclusions zones it is recommended that ground-truthing operations in the form of diving or ROV investigations on these anomalies should be undertaken to confirm the presence of archaeological remains and characterise them where possible. In cases where archaeological sites of importance may be located then further evaluation or excavation work will be required in accordance with the WSI.

Table 13 - Medium Potential Anomalies identified by side scan sonar and magnetometer survey and associated proposed exclusion zones

MA Ltd ID	Type	Exclusion zone	WGS 84 UTM 31N Easting/ Northing
MAL-401	Medium potential anomaly	50m	309369 5964901
MAL-412	Medium potential anomaly	50m	309554 5965790
MAL-415	Medium potential anomaly	50m	310022 5965097
MAL-421	Medium Potential Anomaly	25m	309964 5966721
MAL-422	Medium potential anomaly	50m	311315 5964981
MAL-426	Medium potential anomaly	25m	310051 5966741
MAL-427	Medium potential anomaly	50m	310314 5966752
MAL-432	Medium potential anomaly	50m	313043.5 5963556.5
MAL-437	Medium potential anomaly	50m	313286 5964651

MAL-439	Medium potential anomaly	50m	313280 5964689
MAL-441	Medium potential anomaly	50m	312543 5966319
MAL-442	Medium potential anomaly	50m	312323 5967740
MAL-443	Medium potential anomaly	50m	311800 5968746
MAL-448	Medium potential anomaly	25m	312854 5968312
MAL-453	Medium potential anomaly	50m	303998 5963346
MAL-459	Medium potential anomaly	50m	305732 5963104
MAL-501	Medium potential anomaly	50m	311384.5 5966363
MAL-503	Medium potential anomaly	50m	313442.5 5965960
MAL-504	Medium potential anomaly	50m	314135.5 5964764
MAL-505	Medium potential anomaly	50m	310079.5 5965433
MAL-506	Medium potential anomaly	25m	312893.5 5968158.5

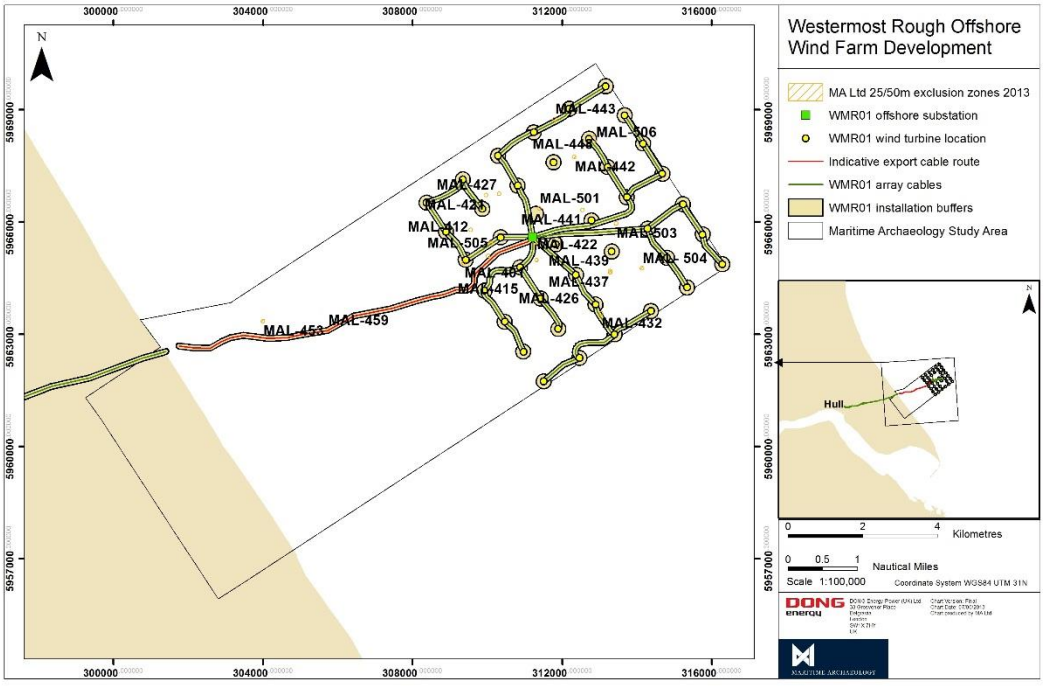

Figure 14 - Medium potential anomalies (2013) with associated 25m/50m exclusion zones.

6.2.3 Low Potential Features (2013)

Archaeological exclusion zones are not considered necessary for the thirty-nine low potential side scan anomalies located within the offshore area (**Appendix II**).

6.2.4 *Magnetometer Anomalies > 5 nT* (2013)

Archaeological exclusion zones are not considered necessary for the isolated and low amplitude magnetometer anomalies located within the offshore area where not specified (**Appendix III and IV**). However, the possibility that they may represent items of unexploded ordnance is noted here, though this is the remit of specialist contractors. At present these anomalies should be considered by a suitably qualified ordnance specialist in advance of pipeline or removal prior to foundation excavation.

6.3 Mitigation for Unexpected Discoveries

Where unexpected discoveries are encountered during activities associated with the proposed scheme, including sites and discoveries of possible archaeological importance, these should be reported according to the guidance contained in *Protocol for Archaeological Discoveries: Offshore Renewables Projects* (The Crown Estate, 2010). A site champion should be nominated who will be responsible for reporting such discoveries to a Nominated Contact, who in turn will liaise with an Implementation Service and Retained Archaeologist to further investigate and record features and material of archaeological significance. These aspects are described and provisioned within a Protocol provided as an appendix to the archaeological WSI (DONG Energy, 2013).

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8 Appendices

8.1 Appendix I Gazetteer of Known Wrecks identified within the study area.

MAL ID	Source	Source ID	Name	Description	WGS 84 UTM 31N: Easting	WGS 84 UTM 31N: Northing	Period	Status	Condition
MAL-310	UKHO	UKHO-WO-8575	*John Creighton*	Had gearbox failure while on passage R Humber for Whitby and was put ashore. Refloating attempt failed and wreck was broken up by swell. (II). Possible debris could remain onshore.	301729	5961792	Modern	Live	Known-notable debris
MAL-311	UKHO,	UKHO-WO-8927	*Celtic*	Owned at time of loss by Grimsby Steam Fishing Co Ltd. Screw. compound engines. Passage grimsby for fishing grounds and return. Sank after collision with SS 'Jagersboro'.	312373	5967450	Post Medieval	Dead	Known-within area
MAL-450	UKHO & side scan sonar, magneto meter.	UKHO-WO-9046 & Side scan MAL-450 & MAL-448. Magnetometer: 1621 NRHE;MAL-312	*Upminster*	Remains of Steamer. Possibly British. 1928. 12-MAY-1928 Upminster - Sunk in collision with SS Lanrick. 15 miles S of Flamborough Head. En route London to Methil (LL 03-MAY-1928). 24-AUG-1960 Unsuccessfully searched for. A spar was located and recovered. Eventually recorded 1978 on Side scan sonar.	313006	5968319	20th Century	Live	Known & located by side scan sonar 1978.

8.2 Appendix II Gazetteer of Anomalies identified during the geophysical assessments 2009-2011

High Potential Anomalies

MAL ID	Other ID	Description	Archaeological Potential	Length (m)	Width (m)	Height (m)	Type	UTM WGS 84 31N: Easting	UTM WGS 84 31N: Northing
MAL- 407	MAL-313 known wreck	Unknown identify. Probable anthropogenic structure protruding from sea-bed	High	21.69	4.73	1.74	Unidentified Anomaly	310868	5963353
MAL-445	MAL-314 Known wreck	Ovate are of reflectors and attenuating material suggesting wreck debris	High	0	0	0	Unidentified Anomaly	312982	5967311
MAL-450	MAL-312-Known wreck	100m+ shipwreck of the Upminster	High	89.18	14.92	5.81	Upminster	312992	5968315
MAL-444	Associated with MAL-311 Known wreck	Cluster of reflectors – possible wreck debris of the Celtic	High	0	0	0	Identified on Magnetometer survey	312440	5967640
MAL-310	UKHO	John Creighton	High	.			Modern	301729	5961792

Medium Potential Anomalies

MAL ID	Other ID	Description	Archaeological Potential	Length (m)	Width (m)	Height (m)	Type	Easting	Northing
MAL-401	None	Largely buried cylindrical feature with protruding reflectors in c	Medium	53.93	9.51	2.74	Unidentified Anomaly	309369	5964901
MAL-412	None	Partially buried object - probable anthropogenic material,	Medium	2.34	1.81	0.65	Unidentified Anomaly	309554	5965790
MAL-415	None	Three discreet linear reflectors - possible anthropogenic material	Medium	9.71	1.19	0.77	Unidentified Anomaly	310022	5965097
MAL-421	None	Linear distribution of discrete reflectors 36.5m in length	Medium	37	0	0	Unidentified Anomaly	309964	5966721
MAL-422	None	Unusual outline of attenuating material in proximity to linear ref	Medium	5.31	10.78	0.14	Unidentified Anomaly	311315	5964981
MAL-426	Magnetometer 1116	Tight cluster of discrete reflectors - possible debris area.	High	0	0	0	Identified on Magnetometer survey	311300	5965420
MAL-427	None	Area of linear reflectors at various orientations, with shadow, p	Medium	35.54	0	0	Unidentified Anomaly	310314	5966752
MAL-432	MAG ID 1205	Several reflectors	Medium	4.13	2.7		Unidentified anomaly	313043.5	5963556.5
MAL-437	None	Crescent of discrete reflectors with scour, plus outlying linear h	Medium	0	0	0	Unidentified Anomaly	313286	5964651
MAL-439	None	Poss anthropogenic material relating to Contact 72	Medium	0	0	0	Unidentified Anomaly	313280	5964689
MAL-441	None	Scatter of reflectors in a semi-linear formation - possible debris	Medium	54.06	0	0	Unidentified Anomaly	312543	5966319

MAL-442	Associated with MAL-311 Known wreck	Pronounced cluster of discrete reflectors and shadowing – possible wreck debris of the Celtic	Medium	0	0	0	Part of the Celtic?	312323	5967740
MAL-443	None	Small mound - possible section of piping or anchor stock	Medium	9.62	3.51	1.02	Unidentified Anomaly	311800	5968746
MAL-448	Associated with MAL-450 Known wreck	Cluster of linear reflectors - probable wreck debris related to the Upminster	Medium	9.55	5.61	0.73	Part of the Upminster?	312854	5968312
MAL-453	None	Discrete area of attenuating material - possibly anthropogenic in n	Medium	19.11	4.51	0	Unidentified Anomaly	303998	5963346
MAL-459	None	Linear attenuating feature perpendicular to general orientation of	Medium	0	0	0	Unidentified Anomaly	305732	5963104
MAL-501	MAG ID 1620	Amplitude (nT) 99.11	Medium	0	0	0	Identified on Magnetometer survey	311384.5	5966363
MAL-503	MAG ID 1624	Amplitude (nT) 345.79	Medium	0	0	0	Identified on Magnetometer survey	313442.5	5965960
MAL- 504	MAG ID 1622	Amplitude (nT) 122.36	Medium	0	0	0	Identified on Magnetometer survey	314135.5	5964764
MAL-505	MAG ID 1625	Amplitude (nT) 567.46	Medium	0	0	0	Identified on Magnetometer survey	310079.5	5965433
MAL-506	MAG ID 1610	Amplitude (nT) 51.55	Medium	0	0	0	Identified on Magnetometer survey. Associated with MAL-450	312893.5	5968158

Low Potential Anomalies

MAL ID	Other ID	Description	Archaeological Potential	Length (m)	Width (m)	Height (m)	Type	Easting	Northing
MAL-400	None	Cluster of reflectors and shadow - probable natural seabed feature	Low	13.98	0	0.89	Unidentified Anomaly	310421	5963165
MAL-402	None	Scatter of reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	308328	5966598
MAL-403	None	Upstanding reflector in area of small scattered surface objects	Low	3.23	1.3	0.95	Unidentified Anomaly	310145	5964138
MAL-404	None	Scatter of reflectors at the end of a sand wave	Low	19.92	2.56	0	Unidentified Anomaly	311380	5962397
MAL-405	None	Tight cluster of reflectors - possible buried protruding structure	Low	0	0	0	Unidentified Anomaly	310091	5964370
MAL-406	None	Cross-ref'd with contact 16 - tight cluster of reflectors	Low	0	0	0	Unidentified Anomaly	309047	5966051
MAL-408	None	Linear feature - probable modern debris	Low	4.81	0.53	0.17	Unidentified Anomaly	310831	5963638
MAL-409	None	Cluster of reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	308689	5966659
MAL-410	None	Cluster of reflectors - possible debris scatter	Low	0	0	0	Unidentified Anomaly	310032	5964641
MAL-411	None	General area of linear reflectors - probable geology or natural , b	Low	0	0	0	Unidentified Anomaly	310599	5964114
MAL-413	None	Similar object to Contact 42 - possibly part of debris scatter	Low	5.22	1.39	0.52	Unidentified Anomaly	309236	5966487
MAL-414	None	Small backscatter refection from loosely clustered objects	Low	0	0	0	Unidentified Anomaly	310997	5963917
MAL-416	None	Scatter of boulder like objects over 45 m long area, probable natural feature	Low	43.34	0	0	Unidentified Anomaly	310360	5965006
MAL-417	None	Unusual cluster of reflectors and shadow - possible debris	Low	3.76	3.45	0	Unidentified Anomaly	309230	5966709
MAL-418	None	Isolated irregular reflector with shadow and second reflective surface	Low	5.63	2.34	0.78	Unidentified Anomaly	310419	5965124
MAL-419	None	Tightly clustered linear and curvilinear reflectors with shadow an	Low	2.4	0.79	0.65	Unidentified Anomaly	309676	5966535
MAL-420	None	Pair of linear reflectors with shadow and limited scour- possible	Low	5.36	0.9	0.32	Unidentified Anomaly	312307	5963287

MAL-423	None	Rectilinear outline of object, probable modern debris	Low	5.1	2.35	1.42	Unidentified Anomaly	309781	5967279
MAL-424	None	Linear reflector, low profile - probably pipe section	Low	6.09	1.51	0.25	Unidentified Anomaly	312883	5962533
MAL-425	None	30m long oblong area of se-bed with some scattered reflectors - pro	Low	30.53	5.68	0	Unidentified Anomaly	312800	5962921
MAL-428	None	Group of linear reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	311995	5964468
MAL-429	None	Discrete cluster of reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	309969	5967743
MAL-430	None	Cluster of discrete reflectors - probably boulders	Low	0	0	0	Unidentified Anomaly	312409	5964102
MAL-431	None	Rectilinear reflector and shadow - probable barrel	Low	3	1.15	0.56	Unidentified Anomaly	309970	5967987
MAL-433	None	Cluster or discrete reflectors in crescent formation with reflect	Low	0	0	0	Unidentified Anomaly	313603	5963342
MAL-434	None	Cluster of linear reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	311218	5966850
MAL-435	None	Linear reflectors with shadow - probable modern debris	Low	7.74	3.29	0.37	Unidentified Anomaly	313236	5964076
MAL-436	None	Small cluster of reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	313016	5964913
MAL-438	None	Discrete mound - possibly accumulated over anthropogenic feature s	Low	27.45	8.8	1.7	Unidentified Anomaly	312834	5965406
MAL-440	None	Scatter of reflectors and shadowing -	Low	7.81	2.45	0.81	Unidentified Anomaly	313266	5965267
MAL-446	None	50m area of boulder like reflectors - probable natural geological	Low	50.48	0	0	Unidentified Anomaly	314576	5965090
MAL-447	None	Cluster of reflective points - possible boulders or debris	Low	0	0	0	Unidentified Anomaly	314810	5964979
MAL-449	None	Discrete area of acoustic attenuation - possible buried structure	Low	0	0	0	Unidentified Anomaly	314628	5965523
MAL-451	None	Loose group of reflectors - possible debris	Low	0	0	0	Unidentified Anomaly	315041	5966407
MAL-452	None	Cluster of reflectors - possible debris	Low	0	0	0	Unidentified Anomaly	313147	5969307
MAL-454	None	Series of reflectors - probable geology but possibly anthropogenic	Low	36.38	0	0	Unidentified Anomaly	306463	5963642

MAL-455	None	Ovate area of reflectors with crescent shaped cluster - probable geology	Low	0	0	0	Unidentified Anomaly	308679	5964048
MAL-456	None	Linear outline in single point reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	308537	5964006
MAL-457	None	Linear reflective feature - probable geological	Low	0	0	0	Unidentified Anomaly	306688	5963546
MAL-458	None	Linear reflector outline - probable geology but possible anthropogenic	Low	0	0	0	Unidentified Anomaly	308309	5963578
MAL-460	None	Scatter of reflectors - probable geology	Low	0	0	0	Unidentified Anomaly	304187	5962672

8.3 Appendix III Gazetteer of Magnetometer anomalies >5 nT

ID	X	Y	Z	Amplitude 1	Amplitude 2	Difference (nT)
3	303169.8	5962875.3	4.5	49176.90	49167.90	9.00
4	302551.8	5962748.0	6.8	49179.27	49173.80	5.47
5	304277.5	5963077.3	6.1	49185.45	49176.43	9.02
7	307342.8	5963659.3	6.8	49191.00	49182.74	8.26
8	307777.0	5963741.8	16.9	49188.91	49183.39	5.52
9	308490.3	5963878.3	3.8	49191.34	49185.21	6.13
10	308755.8	5963925.5	6.9	49188.65	49181.52	7.13
11	309231.3	5964016.3	8.6	49204.98	49184.18	20.80
12	302758.0	5962760.0	6.2	49186.34	49177.32	9.02
13	303476.5	5962896.5	12.1	49186.81	49181.07	5.74
15	305150.5	5963209.3	7.5	49189.81	49176.51	13.30
16	308331.3	5963805.5	22.2	49193.10	49187.92	5.18
17	309634.0	5964040.3	4.6	49215.95	49179.36	36.59
18	305318.9	5963235.0	4.1	49167.41	41522.64	7644.77
19	303211.0	5962808.0	6.0	49190.80	49170.31	20.49
21	309989.9	5964084.0	5.7	49206.45	49182.43	24.02
22	309237.6	5963942.0	5.1	49211.19	49181.03	30.16
23	309673.0	5964022.3	7.5	49190.80	49184.55	6.25
24	309589.8	5964010.3	7.1	49189.18	49184.04	5.14
25	309151.0	5965197.5	17.1	49194.98	49182.75	12.23
26	308817.6	5965703.5	4.0	49194.62	49184.96	9.66
27	308327.7	5966843.5	1.8	49196.94	49190.54	6.40
28	315095.5	5963867.0	7.5	49190.96	49185.96	5.00
29	314728.0	5966622.5	16.2	49193.78	49188.78	5.00
30	311191.0	5964479.0	4.2	49184.87	49179.87	5.00
31	309070.0	5965853.0	9.5	49195.32	49190.32	5.00
32	311773.0	5963714.0	13.4	49199.01	49194.00	5.01
33	310247.5	5964156.5	17.1	49191.86	49186.86	5.00
34	312446.5	5963658.5	8.8	49195.61	49190.60	5.01
35	313066.0	5964084.5	5.4	49187.15	49182.14	5.01
36	314266.0	5966634.5	9.6	49197.39	49192.38	5.01
37	310253.5	5964389.0	18.1	49191.05	49186.04	5.01
38	311597.5	5965356.5	18.1	49189.72	49184.71	5.01
39	312475.0	5969187.5	9.6	49190.82	49185.81	5.01
40	310726.0	5966003.0	4.2	49186.91	49181.90	5.01
41	311689.0	5963837.0	6.7	49199.36	49194.34	5.02
42	312880.0	5966549.0	19.2	49184.39	49179.38	5.01
43	310480.0	5963274.5	12.1	49194.60	49189.58	5.02
44	311768.5	5965509.5	12.9	49195.21	49190.19	5.02
45	309788.5	5965263.5	17.1	49192.20	49187.16	5.04
46	310802.5	5964083.0	7.5	49196.67	49191.64	5.03

47	308741.5	5966684.0	7.5	49191.81	49186.78	5.03
48	314905.0	5964693.5	18.8	49199.30	49194.27	5.03
49	310652.5	5966111.0	7.5	49191.05	49186.01	5.04
50	313190.5	5963768.0	16.0	49194.43	49189.39	5.04
51	310577.5	5964783.5	6.4	49190.29	49185.25	5.04
52	309628.0	5966717.0	15.0	49191.29	49186.25	5.04
53	311078.5	5963811.5	19.6	49180.09	49175.05	5.04
54	309632.5	5967662.0	3.4	49186.88	49181.84	5.04
55	312116.5	5963192.0	12.8	49197.95	49192.89	5.06
56	310202.5	5966114.0	18.3	49193.16	49188.11	5.05
57	313669.0	5963279.0	17.5	49179.77	49174.71	5.06
58	311107.0	5964839.0	15.0	49189.96	49184.91	5.05
59	312643.0	5962947.5	1.5	49191.18	49186.12	5.06
60	311560.0	5965824.5	16.2	49192.87	49187.80	5.07
61	309839.5	5964248.0	3.4	49192.80	49187.73	5.07
62	313396.0	5964264.5	16.2	49193.94	49188.87	5.07
63	311927.5	5968940.0	10.1	49191.99	49186.91	5.08
64	313261.0	5967464.0	19.2	49190.19	49185.11	5.08
65	311315.5	5963897.0	11.7	49188.85	49183.77	5.08
66	310885.0	5967689.0	4.2	49195.53	49190.45	5.08
67	314392.0	5967128.0	6.7	49197.40	49192.32	5.08
68	311725.0	5964621.5	16.2	49195.05	49189.96	5.09
69	311114.5	5964719.0	10.1	49198.39	49193.30	5.09
70	309889.0	5966460.5	16.2	49184.43	49179.34	5.09
71	311203.0	5963531.0	19.2	49192.63	49187.53	5.10
72	313391.5	5967672.5	19.1	49193.68	49188.59	5.09
73	313909.0	5967309.5	12.1	49199.50	49194.41	5.09
74	314033.5	5968086.5	15.4	49182.82	49177.73	5.09
75	314720.5	5966784.5	15.4	49194.88	49189.77	5.11
76	314558.5	5964119.0	10.1	49200.28	49195.18	5.10
77	310274.5	5964135.5	12.9	49190.77	49185.66	5.11
78	309800.5	5966211.5	12.9	49193.37	49188.26	5.11
79	313208.5	5963048.0	3.4	49188.06	49182.95	5.11
80	312479.5	5965257.5	12.9	49199.55	49194.43	5.12
81	309710.5	5967687.5	17.1	49192.83	49187.71	5.12
82	313535.5	5967882.5	4.7	49197.33	49192.20	5.13
83	314504.5	5967618.5	19.6	49192.08	49186.95	5.13
84	310133.5	5967585.5	6.4	49187.06	49181.93	5.13
85	310714.0	5965725.5	14.8	49191.68	49186.55	5.13
86	315643.0	5964363.5	16.2	49194.41	49189.27	5.14
87	313825.0	5968652.0	6.7	49191.56	49186.43	5.13
88	316262.5	5964686.0	11.7	49185.81	49180.67	5.14
89	312436.0	5967635.0	3.0	49181.02	49175.88	5.14
90	310834.0	5963489.0	10.8	49191.40	49186.26	5.14
91	311801.5	5966706.5	2.1	49190.88	49185.74	5.14

92	314998.0	5966609.0	15.0	49184.81	49179.67	5.14
93	310397.5	5967861.5	19.6	49177.88	49172.73	5.15
94	313639.0	5967288.5	16.2	49191.47	49186.31	5.16
95	312329.5	5963840.0	14.2	49194.58	49189.42	5.16
96	314393.5	5965067.0	7.5	49192.43	49187.28	5.15
97	311618.5	5967513.5	4.7	49198.09	49192.93	5.16
98	312226.0	5962341.5	5.4	49200.50	49195.34	5.16
99	311390.5	5962505.0	14.2	49195.48	49190.32	5.16
100	313364.5	5963633.0	3.4	49190.11	49184.94	5.17
101	313304.5	5969450.0	14.2	49189.28	49184.12	5.16
102	314738.5	5966046.5	15.4	49200.48	49195.31	5.17
103	314219.5	5965323.5	8.8	49196.10	49190.93	5.17
104	315554.5	5964377.0	10.1	49194.56	49189.39	5.17
105	311114.5	5965551.5	8.8	49195.23	49190.06	5.17
106	312641.5	5968542.5	8.8	49199.68	49194.50	5.18
107	311272.0	5962677.5	9.6	49195.05	49189.88	5.17
108	314750.5	5966309.0	16.0	49190.32	49185.14	5.18
109	314162.5	5965407.5	12.9	49200.55	49195.37	5.18
110	314353.0	5965808.0	10.8	49192.85	49187.67	5.18
111	310228.0	5963861.0	3.0	49201.53	49196.35	5.18
112	313913.5	5963883.5	15.4	49189.05	49183.86	5.19
113	316265.5	5965098.5	12.9	49191.45	49186.26	5.19
114	311902.0	5968983.5	12.1	49192.18	49186.98	5.20
115	309286.0	5965188.5	8.1	49184.58	49179.38	5.20
116	315133.0	5965437.5	12.1	49200.47	49195.27	5.20
117	309809.5	5967105.5	19.6	49187.01	49181.81	5.20
118	310534.0	5964489.5	9.6	49195.27	49190.06	5.21
119	313955.5	5966265.5	6.4	49202.09	49196.88	5.21
120	313064.5	5963402.0	3.4	49187.83	49182.62	5.21
121	313258.0	5967600.5	9.6	49198.33	49193.13	5.20
122	310678.0	5966072.0	4.2	49190.49	49185.28	5.21
123	310063.0	5967435.5	13.8	49191.90	49186.69	5.21
124	310715.5	5966583.5	19.6	49187.52	49182.30	5.22
125	314827.0	5966618.0	8.5	49195.53	49190.30	5.23
126	310517.5	5963760.5	19.6	49188.52	49183.30	5.22
127	309826.0	5967806.0	10.8	49192.19	49186.96	5.23
128	315266.5	5965365.5	19.6	49200.85	49195.62	5.23
129	315755.5	5964783.5	12.9	49191.18	49185.95	5.23
130	314377.0	5965331.0	17.5	49194.34	49189.11	5.23
131	313460.5	5967858.5	19.6	49186.46	49181.23	5.23
132	311807.5	5962973.0	7.5	49199.39	49194.15	5.24
133	312770.5	5969040.5	19.6	49201.41	49196.16	5.25
134	314735.5	5966451.5	17.1	49192.44	49187.19	5.25
135	312773.5	5964648.5	8.8	49179.39	49174.14	5.25
136	314422.0	5966651.0	17.5	49198.46	49193.20	5.26

137	310399.0	5963594.0	9.0	49198.41	49193.15	5.26
138	312686.5	5963697.5	19.6	49189.66	49184.39	5.27
139	312862.0	5965484.0	10.8	49186.79	49181.52	5.27
140	312814.0	5968004.0	8.5	49200.26	49194.98	5.28
141	310783.0	5968263.5	16.2	49190.13	49184.85	5.28
142	314951.5	5965286.0	12.8	49194.38	49189.10	5.28
143	311270.5	5962442.0	14.2	49176.39	49171.11	5.28
144	314788.0	5967362.0	4.2	49187.80	49182.52	5.28
145	312616.0	5962989.5	8.1	49191.90	49186.61	5.29
146	313616.5	5968046.0	10.1	49189.23	49183.94	5.29
147	314204.5	5963319.5	8.8	49183.05	49177.76	5.29
148	314825.5	5966034.5	12.9	49199.02	49193.73	5.29
149	312782.5	5962479.5	15.4	49197.19	49191.89	5.30
150	310993.0	5966021.0	15.0	49194.61	49189.31	5.30
151	314431.0	5967212.0	19.2	49192.23	49186.93	5.30
152	315250.0	5965676.0	10.8	49192.35	49187.05	5.30
153	312278.5	5966790.5	12.9	49193.00	49187.70	5.30
154	314344.0	5968040.0	17.5	49187.88	49182.57	5.31
155	313184.5	5964861.5	15.4	49182.44	49177.13	5.31
156	315575.5	5963948.0	18.3	49192.29	49186.97	5.32
157	311243.5	5967399.5	2.1	49193.38	49188.05	5.33
158	311147.5	5966717.0	3.4	49179.45	49174.13	5.32
159	312487.0	5964416.0	17.5	49195.67	49190.35	5.32
160	313039.0	5966567.0	4.2	49197.54	49192.21	5.33
161	312449.5	5963238.5	2.1	49190.39	49185.06	5.33
162	312694.0	5964765.5	12.1	49180.11	49174.79	5.32
163	310207.0	5963784.5	12.1	49192.79	49187.45	5.34
164	310774.0	5967285.5	12.1	49181.46	49176.12	5.34
165	310390.0	5964374.0	17.5	49190.48	49185.13	5.35
166	312824.5	5963631.5	12.9	49189.96	49184.61	5.35
167	311081.5	5967798.5	6.4	49191.59	49186.25	5.34
168	312044.5	5963306.0	7.5	49201.14	49195.79	5.35
169	312292.0	5968940.0	13.4	49190.45	49185.09	5.36
170	312148.0	5962460.0	17.5	49199.96	49194.61	5.35
171	314783.5	5966807.0	7.5	49196.17	49190.81	5.36
172	313753.0	5965347.5	16.2	49197.09	49191.73	5.36
173	311936.5	5968683.5	19.6	49188.09	49182.73	5.36
174	312053.5	5962605.5	8.8	49201.16	49195.80	5.36
175	310825.0	5965160.0	4.2	49198.26	49192.89	5.37
176	312764.5	5969342.0	7.5	49189.31	49183.94	5.37
177	315712.0	5965529.0	10.8	49183.71	49178.34	5.37
178	312038.5	5966184.5	19.6	49190.70	49185.32	5.38
179	312388.0	5968926.5	16.2	49200.67	49195.29	5.38
180	309958.0	5965797.5	5.4	49196.70	49191.32	5.38
181	310694.5	5964408.5	2.1	49182.73	49177.35	5.38

182	310282.0	5964341.0	13.4	49191.40	49186.02	5.38
183	314897.5	5966498.0	7.5	49197.66	49192.27	5.39
184	311810.5	5965374.5	19.1	49184.52	49179.14	5.38
185	314750.5	5966993.0	7.5	49184.89	49179.50	5.39
186	309329.5	5964870.5	8.8	49174.66	49169.27	5.39
187	309857.5	5964225.5	19.1	49194.63	49189.24	5.39
188	310880.5	5964689.0	16.2	49189.01	49183.62	5.39
189	314849.5	5966582.0	16.8	49193.45	49188.05	5.40
190	313892.5	5965137.5	15.4	49201.80	49196.40	5.40
191	313208.5	5964956.0	11.7	49189.28	49183.88	5.40
192	312034.0	5963319.5	16.2	49198.17	49192.77	5.40
193	310865.5	5965242.5	12.9	49199.18	49193.77	5.41
194	311410.0	5965047.5	14.2	49186.96	49181.55	5.41
195	308417.5	5966517.5	15.4	49182.74	49177.32	5.42
196	313157.5	5963390.0	10.1	49196.43	49191.01	5.42
197	312224.5	5964389.0	11.7	49187.67	49182.25	5.42
198	310304.5	5963741.0	6.2	49197.36	49191.94	5.42
199	313630.0	5967729.5	5.4	49196.95	49191.52	5.43
200	312572.5	5965536.5	12.9	49193.89	49188.46	5.43
201	312104.5	5962782.5	6.4	49194.90	49189.47	5.43
202	315971.5	5964449.0	12.8	49191.88	49186.45	5.43
203	313346.5	5965040.0	3.4	49183.59	49178.15	5.44
204	312844.0	5964704.0	10.8	49200.89	49195.46	5.43
205	313645.0	5966735.0	6.7	49200.47	49195.04	5.43
206	310730.5	5967522.5	8.8	49193.11	49187.66	5.45
207	311581.0	5965142.0	12.4	49192.22	49186.78	5.44
208	309337.0	5966745.5	9.6	49196.80	49191.36	5.44
209	311068.0	5967008.0	3.0	49193.77	49188.32	5.45
210	310148.5	5964209.0	10.1	49192.51	49187.06	5.45
211	312020.5	5964993.5	17.1	49183.95	49178.50	5.45
212	312182.5	5965968.5	12.9	49194.99	49189.54	5.45
213	309980.5	5966178.5	17.1	49193.40	49187.95	5.45
214	311348.5	5965064.0	15.7	49188.18	49182.72	5.46
215	313859.5	5965650.5	11.4	49199.80	49194.35	5.45
216	312619.0	5969402.0	4.2	49198.07	49192.61	5.46
217	310900.0	5967671.0	10.8	49194.55	49189.08	5.47
218	312625.0	5969552.0	15.0	49188.55	49183.07	5.48
219	310522.0	5964432.5	18.1	49190.93	49185.46	5.47
220	314215.0	5964914.0	17.5	49180.79	49175.32	5.47
221	312196.0	5968950.5	14.8	49199.08	49193.60	5.48
222	312719.5	5965572.5	19.6	49182.14	49176.66	5.48
223	313655.5	5967563.0	18.3	49191.30	49185.82	5.48
224	311506.0	5963172.5	18.8	49178.66	49173.17	5.49
225	309716.5	5964278.0	7.5	49176.50	49171.02	5.48
226	314242.0	5967359.0	13.4	49193.79	49188.29	5.50

227	312403.0	5964398.0	15.0	49186.02	49180.52	5.50
228	310747.0	5964324.5	16.2	49181.56	49176.06	5.50
229	313147.0	5969307.5	16.2	49194.89	49189.39	5.50
230	310672.0	5967606.5	12.1	49190.11	49184.61	5.50
231	312653.5	5969778.5	2.1	49189.04	49183.54	5.50
232	308668.0	5966318.0	17.0	49190.37	49184.86	5.51
233	309701.5	5964554.0	10.1	49186.63	49181.11	5.52
234	310690.0	5964609.5	14.8	49188.52	49183.00	5.52
235	312442.0	5968160.0	6.7	49192.48	49186.96	5.52
236	314141.5	5967237.5	2.1	49189.73	49184.21	5.52
237	314558.5	5964812.0	6.2	49196.73	49191.21	5.52
238	312448.0	5963658.5	16.2	49196.02	49190.50	5.52
239	312826.0	5965142.0	10.8	49192.80	49187.27	5.53
240	310321.0	5964270.5	5.4	49190.55	49185.02	5.53
241	313856.5	5966126.0	7.5	49191.09	49185.56	5.53
242	310490.5	5966771.0	18.3	49194.66	49189.13	5.53
243	311381.5	5963865.5	8.8	49195.18	49189.65	5.53
244	313505.5	5966955.5	12.9	49200.68	49195.14	5.54
245	312866.5	5967803.0	18.3	49195.18	49189.65	5.53
246	311987.5	5965493.0	5.4	49185.95	49180.41	5.54
247	309247.0	5965053.5	1.5	49190.21	49184.67	5.54
248	309451.0	5966574.5	16.2	49196.52	49190.98	5.54
249	311588.5	5965244.0	6.2	49187.66	49182.12	5.54
250	310804.0	5963394.5	8.1	49193.99	49188.44	5.55
251	310208.5	5966105.0	18.3	49194.61	49189.06	5.55
252	314263.0	5967735.5	9.6	49183.34	49177.79	5.55
253	310228.0	5964185.0	10.8	49190.69	49185.13	5.56
254	312425.5	5968871.0	11.7	49198.45	49192.89	5.56
255	312773.5	5968203.5	17.1	49187.43	49181.87	5.56
256	311485.0	5966375.0	10.8	49196.70	49191.13	5.57
257	312923.5	5962797.5	17.1	49195.57	49190.00	5.57
258	311510.5	5965107.5	12.9	49190.87	49185.29	5.58
259	314735.5	5965509.5	2.1	49196.20	49190.63	5.57
260	315442.0	5965524.5	9.6	49192.46	49186.88	5.58
261	312148.0	5969459.0	6.7	49197.13	49191.54	5.59
262	309854.5	5964498.5	2.1	49197.25	49191.67	5.58
263	310807.0	5964714.5	12.1	49185.61	49180.02	5.59
264	309743.5	5964236.0	7.5	49175.29	49169.70	5.59
265	311939.5	5963196.5	17.1	49196.68	49191.09	5.59
266	313643.5	5964815.0	14.2	49191.45	49185.86	5.59
267	313498.0	5966543.0	15.0	49197.55	49191.96	5.59
268	313034.5	5963853.5	4.7	49183.73	49178.14	5.59
269	310562.5	5964806.0	11.7	49190.65	49185.05	5.60
270	310934.5	5964723.5	10.6	49190.06	49184.46	5.60
271	311765.5	5962967.0	3.4	49192.93	49187.33	5.60

272	313468.0	5966345.0	10.8	49194.16	49188.55	5.61
273	312409.0	5965506.5	12.1	49193.87	49188.26	5.61
274	313471.0	5966583.5	18.8	49193.34	49187.73	5.61
275	315287.5	5965076.0	5.4	49193.50	49187.87	5.63
276	310355.5	5965884.5	12.9	49195.67	49190.04	5.63
277	315335.5	5964597.5	17.1	49199.96	49194.34	5.62
278	313531.0	5966250.5	5.4	49194.24	49188.61	5.63
279	311785.0	5963271.5	13.8	49195.19	49189.56	5.63
280	310121.5	5963915.0	18.3	49187.62	49181.99	5.63
281	310058.5	5966210.0	10.1	49182.37	49176.73	5.64
282	312160.0	5969003.0	10.8	49200.49	49194.86	5.63
283	309763.0	5964738.5	18.8	49171.34	49165.71	5.63
284	310582.0	5967587.0	17.5	49178.89	49173.26	5.63
285	310934.5	5967333.5	6.4	49186.92	49181.29	5.63
286	309266.5	5966775.5	17.1	49188.55	49182.91	5.64
287	313582.0	5965322.0	15.0	49190.51	49184.86	5.65
288	313301.5	5965350.5	15.4	49193.62	49187.96	5.66
289	313267.0	5967315.5	8.1	49201.37	49195.71	5.66
290	314035.0	5968332.5	4.5	49189.80	49184.14	5.66
291	313718.5	5967297.5	19.6	49193.80	49188.14	5.66
292	312190.0	5967606.5	9.6	49185.93	49180.26	5.67
293	315271.0	5965229.0	13.4	49199.01	49193.34	5.67
294	314816.5	5964293.0	16.8	49194.34	49188.67	5.67
295	312932.5	5963463.5	2.1	49187.20	49181.53	5.67
296	314731.0	5964957.5	13.8	49201.25	49195.57	5.68
297	312358.0	5964612.5	8.1	49195.77	49190.09	5.68
298	309443.5	5966585.0	18.3	49196.22	49190.54	5.68
299	313060.0	5966972.0	13.4	49191.09	49185.41	5.68
300	308714.5	5966511.5	11.4	49187.08	49181.39	5.69
301	310970.5	5967818.0	18.3	49194.55	49188.86	5.69
302	311732.5	5965262.0	18.1	49189.15	49183.46	5.69
303	311516.5	5963154.5	19.6	49179.09	49173.39	5.70
304	314741.5	5965908.5	15.4	49190.62	49184.91	5.71
305	309851.5	5965524.5	12.9	49194.51	49188.80	5.71
306	313148.5	5969436.5	4.7	49185.54	49179.82	5.72
307	315866.5	5965298.0	18.3	49184.51	49178.79	5.72
308	313768.0	5966135.0	17.5	49192.92	49187.20	5.72
309	314090.5	5965523.0	14.2	49195.61	49189.89	5.72
310	313201.0	5967552.5	18.8	49193.44	49187.71	5.73
311	313550.5	5964435.5	12.9	49189.64	49183.91	5.73
312	308717.5	5966160.5	10.6	49199.17	49193.43	5.74
313	312335.5	5969010.5	12.9	49200.35	49194.61	5.74
314	310376.5	5965851.5	17.1	49200.16	49194.41	5.75
315	310379.5	5965082.0	7.5	49190.69	49184.94	5.75
316	314704.0	5965797.5	9.6	49195.12	49189.37	5.75

317	311999.5	5968706.0	14.2	49194.93	49189.18	5.75
318	312521.5	5964627.5	12.9	49180.09	49174.34	5.75
319	310322.5	5964611.0	3.4	49180.69	49174.93	5.76
320	310915.0	5963222.0	10.8	49193.73	49187.96	5.77
321	310952.5	5964842.0	12.1	49186.55	49180.78	5.77
322	310858.0	5966472.5	14.8	49190.73	49184.95	5.78
323	312371.5	5965673.0	5.4	49191.72	49185.94	5.78
324	316232.5	5964735.5	8.8	49186.49	49180.70	5.79
325	313937.5	5967978.5	19.6	49194.83	49189.04	5.79
326	314672.5	5963535.5	2.1	49196.12	49190.33	5.79
327	313886.5	5968056.5	15.4	49193.14	49187.34	5.80
328	312556.0	5964978.5	16.2	49180.20	49174.40	5.80
329	313067.5	5966961.5	15.4	49191.67	49185.86	5.81
330	311272.0	5965995.5	16.2	49187.66	49181.85	5.81
331	312320.5	5968893.5	8.8	49192.87	49187.05	5.82
332	313235.5	5963709.5	8.8	49198.34	49192.52	5.82
333	314321.5	5964962.0	14.2	49201.33	49195.51	5.82
334	310301.5	5964311.0	16.0	49191.35	49185.53	5.82
335	311075.5	5962565.0	9.6	49198.46	49192.64	5.82
336	315781.0	5965008.5	9.6	49197.86	49192.03	5.83
337	311941.0	5965499.0	15.0	49182.85	49177.00	5.85
338	310591.0	5965398.5	13.8	49185.97	49180.11	5.86
339	311056.0	5963850.5	8.1	49182.21	49176.35	5.86
340	310504.0	5965383.5	18.8	49192.16	49186.30	5.86
341	312746.5	5964573.5	15.4	49189.20	49183.34	5.86
342	314618.5	5965694.0	11.7	49198.74	49192.87	5.87
343	314042.5	5967104.0	11.7	49198.96	49193.09	5.87
344	309704.5	5964731.0	6.2	49194.90	49189.03	5.87
345	311542.0	5967368.0	4.2	49180.79	49174.91	5.88
346	310129.0	5963808.5	12.1	49197.04	49191.16	5.88
347	310693.0	5964567.5	13.8	49190.88	49185.00	5.88
348	310031.5	5963955.5	4.7	49191.11	49185.24	5.87
349	313502.5	5965866.5	12.9	49198.91	49193.03	5.88
350	310672.0	5964644.0	6.7	49186.87	49180.98	5.89
351	309916.0	5964123.5	7.5	49187.61	49181.73	5.88
352	311711.5	5969021.0	16.8	49189.32	49183.43	5.89
353	309868.0	5966190.5	14.8	49200.39	49194.50	5.89
354	310622.5	5964590.0	10.1	49185.16	49179.27	5.89
355	310652.5	5968182.5	8.8	49192.53	49186.63	5.90
356	315470.5	5964926.0	3.4	49201.29	49195.39	5.90
357	311107.0	5967758.0	17.5	49196.04	49190.12	5.92
358	312338.5	5966418.5	2.1	49198.40	49192.48	5.92
359	311644.0	5965265.0	6.0	49186.57	49180.65	5.92
360	313511.5	5964366.5	15.4	49183.00	49177.07	5.93
361	314336.5	5966942.0	14.2	49190.59	49184.67	5.92

362	313972.0	5965581.5	16.2	49192.11	49186.18	5.93
363	314959.0	5964452.0	10.8	49196.06	49190.14	5.92
364	313837.0	5965359.5	16.2	49197.88	49191.95	5.93
365	313613.5	5967327.5	12.9	49191.98	49186.05	5.93
366	310754.5	5964681.5	7.7	49184.39	49178.46	5.93
367	312380.5	5965751.0	9.1	49187.42	49181.48	5.94
368	311372.5	5965086.5	15.4	49188.48	49182.54	5.94
369	310114.0	5964387.5	16.2	49188.32	49182.38	5.94
370	312961.0	5965467.5	12.1	49198.08	49192.14	5.94
371	311701.0	5965200.5	9.6	49190.54	49184.59	5.95
372	315226.0	5965001.0	3.0	49194.53	49188.58	5.95
373	308617.0	5966204.0	6.7	49184.10	49178.15	5.95
374	309074.5	5967071.0	7.5	49189.11	49183.16	5.95
375	311027.5	5965406.0	3.4	49190.07	49184.11	5.96
376	310919.5	5964761.0	15.7	49190.71	49184.76	5.95
377	314335.0	5964456.5	16.2	49196.78	49190.82	5.96
378	313627.0	5968146.5	12.1	49191.60	49185.64	5.96
379	310165.0	5966049.5	9.6	49190.46	49184.50	5.96
380	310193.5	5964240.5	14.2	49189.29	49183.32	5.97
381	310643.5	5966549.0	14.2	49192.90	49186.93	5.97
382	313981.0	5965137.5	5.4	49199.90	49193.93	5.97
383	310459.0	5963508.5	14.2	49196.97	49191.00	5.97
384	311443.0	5967525.5	9.6	49182.42	49176.44	5.98
385	312950.5	5963856.5	2.1	49196.78	49190.80	5.98
386	310835.5	5963676.5	4.7	49194.79	49188.81	5.98
387	312059.5	5968733.0	7.5	49193.51	49187.53	5.98
388	311399.5	5967431.0	3.4	49186.58	49180.60	5.98
389	309842.5	5967774.5	15.4	49194.54	49188.55	5.99
390	314353.0	5966633.0	10.8	49197.21	49191.22	5.99
391	312265.0	5966810.0	3.0	49194.42	49188.42	6.00
392	309376.0	5966258.0	10.8	49196.55	49190.55	6.00
393	315551.5	5964267.5	15.4	49198.29	49192.28	6.01
394	312313.0	5964261.5	18.8	49191.45	49185.44	6.01
395	315121.0	5964924.5	12.1	49198.23	49192.23	6.00
396	313781.5	5967791.0	7.5	49187.77	49181.75	6.02
397	314302.0	5966996.0	13.4	49189.23	49183.21	6.02
398	309271.0	5965736.0	6.7	49194.17	49188.14	6.03
399	312719.5	5964326.0	14.2	49179.75	49173.71	6.04
400	310807.0	5963532.5	8.1	49189.26	49183.22	6.04
401	313481.5	5967830.0	7.5	49191.41	49185.36	6.05
402	312604.0	5964230.0	15.0	49199.27	49193.21	6.06
403	309848.5	5964330.5	15.4	49186.89	49180.84	6.05
404	312322.0	5965104.5	12.1	49195.62	49189.56	6.06
405	313021.0	5964845.0	15.0	49194.23	49188.17	6.06
406	312409.0	5967963.5	16.2	49191.09	49185.02	6.07

407	312757.0	5965940.0	19.2	49184.57	49178.50	6.07
408	312326.5	5965646.0	6.2	49189.99	49183.91	6.08
409	310288.0	5963762.0	9.5	49200.23	49194.16	6.07
410	311888.5	5968472.0	7.5	49180.23	49174.15	6.08
411	312388.0	5968113.5	12.1	49198.00	49191.91	6.09
412	313016.5	5963883.5	8.8	49179.36	49173.27	6.09
413	310879.0	5964666.5	14.8	49189.56	49183.47	6.09
414	313256.5	5969142.5	8.8	49195.79	49189.70	6.09
415	313075.0	5965460.0	13.4	49184.80	49178.71	6.09
416	312304.0	5962907.0	3.0	49200.87	49194.78	6.09
417	313609.0	5964480.5	9.6	49197.62	49191.53	6.09
418	314032.0	5964927.5	12.1	49196.29	49190.20	6.09
419	314960.5	5963769.5	4.7	49181.82	49175.71	6.11
420	312737.5	5969501.0	11.7	49191.42	49185.31	6.11
421	310873.0	5965770.5	18.8	49190.50	49184.39	6.11
422	314228.5	5966390.0	10.1	49194.07	49187.95	6.12
423	313982.5	5965565.0	14.2	49192.73	49186.61	6.12
424	312515.5	5965449.5	2.1	49196.84	49190.70	6.14
425	310072.0	5963897.0	17.5	49192.09	49185.95	6.14
426	315445.0	5966193.5	18.1	49192.99	49186.85	6.14
427	311378.5	5968040.0	3.4	49185.77	49179.63	6.14
428	309545.5	5966979.5	17.1	49184.39	49178.24	6.15
429	311168.5	5968481.0	14.2	49196.39	49190.23	6.16
430	313610.5	5965577.0	10.1	49199.28	49193.12	6.16
431	310751.5	5964318.5	17.1	49182.34	49176.17	6.17
432	310792.0	5964708.5	9.6	49186.01	49179.84	6.17
433	310967.5	5967819.5	4.7	49194.59	49188.43	6.16
434	315850.0	5965181.0	10.8	49199.50	49193.32	6.18
435	315322.0	5965439.0	13.4	49192.41	49186.23	6.18
436	310549.0	5967798.5	18.1	49193.13	49186.94	6.19
437	310573.0	5967987.5	9.6	49177.21	49171.02	6.19
438	313699.0	5968025.0	6.7	49193.39	49187.20	6.19
439	311261.5	5965601.0	16.8	49197.88	49191.68	6.20
440	309640.0	5966970.5	13.8	49195.01	49188.80	6.21
441	313895.5	5966069.0	11.7	49195.36	49189.14	6.22
442	313835.5	5965493.0	7.5	49182.03	49175.81	6.22
443	309967.0	5964078.5	11.7	49188.43	49182.21	6.22
444	311516.5	5962701.5	2.1	49207.71	49201.48	6.23
445	311701.0	5965301.0	10.8	49186.45	49180.21	6.24
446	314218.0	5965581.5	12.1	49192.63	49186.39	6.24
447	313774.0	5966247.5	5.4	49193.99	49187.74	6.25
448	309128.5	5965430.0	18.3	49181.45	49175.19	6.26
449	311915.5	5966534.0	3.4	49189.27	49183.01	6.26
450	313763.5	5968242.5	12.9	49196.18	49189.92	6.26
451	315703.0	5964440.0	13.4	49193.39	49187.13	6.26

452	314474.5	5966855.0	11.7	49193.40	49187.14	6.26
453	314939.5	5966142.5	19.6	49193.96	49187.70	6.26
454	314977.0	5965679.0	17.5	49200.36	49194.09	6.27
455	309281.5	5965712.0	10.1	49198.30	49192.02	6.28
456	313207.0	5963865.5	5.4	49190.03	49183.75	6.28
457	312502.0	5962607.0	3.0	49197.00	49190.71	6.29
458	313892.5	5968551.5	8.8	49192.09	49185.80	6.29
459	311606.5	5965233.5	11.4	49186.65	49180.36	6.29
460	310510.0	5963226.5	16.2	49201.21	49194.92	6.29
461	313070.5	5965691.0	3.4	49193.83	49187.52	6.31
462	311284.0	5965016.0	15.0	49186.60	49180.29	6.31
463	311584.0	5969112.5	5.4	49205.87	49199.55	6.32
464	312814.0	5966090.0	10.8	49192.81	49186.50	6.31
465	311326.0	5963198.0	3.0	49198.02	49191.70	6.32
466	310996.0	5964779.0	13.4	49189.13	49182.82	6.31
467	309617.5	5966046.5	8.8	49175.11	49168.79	6.32
468	314795.5	5965425.5	15.4	49200.95	49194.62	6.33
469	309941.5	5964192.5	2.1	49191.87	49185.54	6.33
470	310943.5	5965670.0	18.3	49189.39	49183.06	6.33
471	315872.5	5964867.5	17.1	49197.95	49191.62	6.33
472	311435.5	5965880.0	6.2	49180.56	49174.23	6.33
473	312686.5	5969732.0	16.0	49189.46	49183.13	6.33
474	313436.5	5967321.5	8.8	49200.82	49194.49	6.33
475	314660.5	5964659.0	11.7	49196.95	49190.61	6.34
476	310687.0	5964857.0	15.0	49190.83	49184.49	6.34
477	310151.5	5964327.5	8.8	49190.47	49184.13	6.34
478	313418.5	5966543.0	14.2	49198.41	49192.07	6.34
479	313015.0	5965937.0	8.5	49179.09	49172.73	6.36
480	311719.0	5965851.5	16.2	49182.00	49175.63	6.37
481	309737.5	5967377.0	18.3	49190.84	49184.47	6.37
482	310243.0	5965370.0	13.4	49198.95	49192.56	6.39
483	312214.0	5967570.5	12.1	49186.25	49179.86	6.39
484	312557.5	5963082.5	15.4	49194.59	49188.19	6.40
485	309839.5	5965263.5	12.9	49194.34	49187.95	6.39
486	311099.5	5963781.5	4.7	49182.47	49176.07	6.40
487	312121.0	5964293.0	17.5	49197.97	49191.57	6.40
488	314350.0	5965004.0	13.4	49193.54	49187.12	6.42
489	314996.5	5963715.5	7.7	49189.25	49182.84	6.41
490	311096.5	5967359.0	3.4	49198.20	49191.77	6.43
491	312458.5	5964455.0	11.7	49197.92	49191.50	6.42
492	312388.0	5965652.0	13.4	49194.06	49187.64	6.42
493	310625.5	5963994.5	8.8	49194.03	49187.60	6.43
494	308419.0	5966622.5	14.8	49193.09	49186.66	6.43
495	314792.5	5965656.5	10.6	49193.84	49187.41	6.43
496	314867.5	5964342.5	19.6	49196.27	49189.84	6.43

497	310315.0	5967590.0	15.0	49182.85	49176.42	6.43
498	315688.0	5965823.0	6.7	49191.90	49185.46	6.44
499	314152.0	5964614.0	15.0	49190.50	49184.05	6.45
500	311849.5	5963600.0	14.2	49197.26	49190.81	6.45
501	312253.0	5968568.0	15.0	49192.82	49186.37	6.45
502	314282.5	5968128.5	18.1	49182.64	49176.17	6.47
503	314552.5	5965500.5	12.9	49192.85	49186.38	6.47
504	313333.0	5968748.0	19.2	49194.24	49187.77	6.47
505	312523.0	5965335.5	18.8	49197.55	49191.07	6.48
506	308707.0	5966744.0	12.7	49190.41	49183.94	6.47
507	315067.0	5963907.5	16.2	49192.89	49186.41	6.48
508	309632.5	5966297.0	18.3	49193.95	49187.47	6.48
509	311747.5	5963061.5	8.8	49201.31	49194.84	6.47
510	313373.5	5967155.0	14.2	49201.05	49194.57	6.48
511	312551.5	5965397.0	18.3	49195.79	49189.32	6.47
512	310120.0	5964378.5	16.2	49188.90	49182.42	6.48
513	313604.5	5965275.5	17.1	49193.14	49186.66	6.48
514	314687.5	5964617.0	10.1	49196.07	49189.59	6.48
515	309548.5	5967108.5	8.8	49195.64	49189.16	6.48
516	311902.0	5966394.5	5.4	49193.69	49187.20	6.49
517	312841.0	5965655.0	10.8	49200.20	49193.70	6.50
518	311272.0	5968194.5	18.8	49185.46	49178.96	6.50
519	310801.0	5964701.0	18.3	49186.31	49179.82	6.49
520	315086.5	5964003.5	17.1	49195.39	49188.89	6.50
521	310675.0	5963261.0	6.0	49194.61	49188.11	6.50
522	310973.5	5963144.0	14.2	49194.76	49188.25	6.51
523	312242.5	5963006.0	14.2	49197.31	49190.80	6.51
524	309757.0	5964381.5	16.2	49197.79	49191.27	6.52
525	314182.0	5966064.5	9.6	49192.75	49186.23	6.52
526	314882.5	5964186.5	17.1	49192.82	49186.30	6.52
527	313037.5	5965908.5	12.9	49178.97	49172.45	6.52
528	309962.5	5963906.0	3.4	49175.73	49169.20	6.53
529	313790.5	5966787.5	2.1	49197.63	49191.09	6.54
530	310666.0	5962989.5	12.1	49195.48	49188.94	6.54
531	309535.0	5966445.5	13.8	49199.27	49192.73	6.54
532	311177.5	5964888.5	4.7	49189.54	49182.99	6.55
533	314486.5	5965335.5	8.8	49201.06	49194.50	6.56
534	311053.0	5962671.5	8.1	49199.52	49192.96	6.56
535	308833.0	5966157.5	1.5	49166.39	49159.83	6.56
536	310511.5	5967012.5	10.6	49188.90	49182.33	6.57
537	313763.5	5965752.5	8.8	49197.51	49190.94	6.57
538	314759.5	5965316.0	10.1	49207.47	49200.89	6.58
539	314947.0	5965847.0	17.5	49200.07	49193.50	6.57
540	312622.0	5963105.0	3.0	49194.29	49187.71	6.58
541	312359.5	5968157.0	14.2	49198.71	49192.13	6.58

542	311639.5	5963924.0	14.2	49198.68	49192.10	6.58
543	310813.0	5967225.5	18.8	49181.32	49174.73	6.59
544	313321.0	5965194.5	12.1	49197.51	49190.92	6.59
545	314452.0	5967698.0	15.0	49195.71	49189.12	6.59
546	309956.5	5964284.0	18.3	49196.59	49189.99	6.60
547	309124.0	5965545.5	10.5	49194.61	49188.01	6.60
548	310864.0	5965784.0	17.5	49190.04	49183.44	6.60
549	314153.5	5965299.5	12.9	49194.19	49187.58	6.61
550	313891.0	5962943.0	19.2	49182.70	49176.07	6.63
551	308951.5	5965881.5	6.4	49194.97	49188.34	6.63
552	313562.5	5967528.5	12.9	49194.48	49187.85	6.63
553	308494.0	5966393.0	3.0	49186.23	49179.60	6.63
554	313741.0	5965832.0	10.8	49194.59	49187.95	6.64
555	313123.0	5964681.5	12.1	49194.61	49187.96	6.65
556	310273.0	5966406.5	18.1	49190.84	49184.19	6.65
557	314741.5	5963538.5	19.6	49195.13	49188.47	6.66
558	313460.5	5967693.5	2.1	49197.10	49190.44	6.66
559	313177.0	5964339.5	13.8	49198.39	49191.72	6.67
560	313387.0	5964824.0	19.2	49194.23	49187.55	6.68
561	312508.0	5965892.0	13.4	49183.77	49177.10	6.67
562	311518.0	5962629.5	12.1	49196.38	49189.70	6.68
563	309082.0	5966859.5	16.2	49172.09	49165.41	6.68
564	311285.5	5964954.5	17.1	49186.95	49180.27	6.68
565	310765.0	5966079.5	16.2	49194.57	49187.88	6.69
566	310772.5	5968115.0	18.3	49192.59	49185.89	6.70
567	313855.0	5965194.5	18.8	49200.13	49193.43	6.70
568	309872.5	5964204.5	12.9	49196.42	49189.71	6.71
569	313892.5	5966244.5	8.8	49199.90	49193.19	6.71
570	313814.5	5966622.5	12.9	49193.13	49186.41	6.72
571	313484.5	5963448.5	2.1	49190.76	49184.05	6.71
572	313670.5	5963703.5	6.4	49192.72	49186.01	6.71
573	310015.0	5965958.0	19.2	49192.29	49185.55	6.74
574	311348.5	5966975.0	11.7	49197.83	49191.09	6.74
575	311452.0	5965059.5	16.8	49192.80	49186.05	6.75
576	310483.0	5963639.0	9.5	49177.63	49170.88	6.75
577	310759.0	5967707.0	10.8	49180.30	49173.55	6.75
578	309439.0	5965794.5	16.2	49192.60	49185.84	6.76
579	311570.5	5965146.5	4.7	49192.52	49185.76	6.76
580	313922.5	5967842.0	14.2	49194.08	49187.30	6.78
581	310924.0	5967461.0	10.8	49181.21	49174.44	6.77
582	312586.0	5964255.5	9.6	49196.60	49189.82	6.78
583	310538.5	5964287.0	5.4	49177.63	49170.85	6.78
584	314815.0	5963730.5	16.2	49201.95	49195.17	6.78
585	312076.0	5964366.5	9.6	49196.68	49189.90	6.78
586	313493.5	5963969.0	16.0	49196.84	49190.05	6.79

587	306128.5	5963433.5	10.6	49186.56	49179.78	6.78
588	315940.0	5965185.5	1.5	49184.05	49177.27	6.78
589	313054.0	5965067.0	3.0	49184.13	49177.34	6.79
590	309935.5	5967486.5	12.9	49189.86	49183.07	6.79
591	314267.5	5967165.5	17.1	49194.36	49187.56	6.80
592	312965.5	5963678.0	18.3	49199.59	49192.79	6.80
593	309113.5	5965565.0	7.5	49196.32	49189.52	6.80
594	310556.5	5964263.0	14.2	49180.34	49173.53	6.81
595	311512.0	5964678.5	16.2	49187.65	49180.83	6.82
596	315209.5	5965194.5	19.6	49192.14	49185.32	6.82
597	312961.0	5966016.5	12.1	49178.13	49171.30	6.83
598	309728.5	5964419.0	18.3	49193.71	49186.88	6.83
599	310567.0	5966109.5	12.1	49191.09	49184.26	6.83
600	310375.0	5965725.5	18.8	49186.77	49179.93	6.84
601	314164.0	5966381.0	15.0	49198.68	49191.83	6.85
602	312100.0	5966514.5	1.5	49182.39	49175.55	6.84
603	309523.0	5966466.5	4.5	49198.14	49191.28	6.86
604	314179.0	5966195.0	10.8	49201.64	49194.78	6.86
605	314020.0	5966444.0	10.8	49203.39	49196.53	6.86
606	310741.0	5964155.0	8.5	49196.54	49189.68	6.86
607	311771.5	5965350.5	14.2	49185.45	49178.59	6.86
608	311401.0	5963769.5	5.4	49192.48	49185.61	6.87
609	313667.5	5967675.5	6.4	49198.09	49191.20	6.89
610	312344.5	5968056.5	17.1	49191.75	49184.86	6.89
611	311260.0	5965182.5	5.4	49191.42	49184.53	6.89
612	312307.0	5969049.5	5.4	49200.63	49193.74	6.89
613	308911.0	5966990.0	17.5	49191.05	49184.15	6.90
614	313771.0	5968355.0	10.8	49197.00	49190.09	6.91
615	312776.5	5965911.5	8.8	49184.38	49177.48	6.90
616	313538.5	5967047.0	11.7	49193.18	49186.27	6.91
617	314015.5	5967272.0	7.5	49200.11	49193.19	6.92
618	315758.5	5965874.0	16.0	49191.43	49184.52	6.91
619	316286.5	5964905.0	18.3	49189.84	49182.92	6.92
620	312071.5	5968851.5	12.9	49192.36	49185.44	6.92
621	310637.5	5965751.0	11.7	49194.12	49187.20	6.92
622	312784.0	5965323.5	16.2	49189.91	49182.98	6.93
623	311105.5	5963144.0	14.2	49203.68	49196.73	6.95
624	314506.0	5964768.5	18.8	49194.08	49187.13	6.95
625	314279.5	5967305.0	7.5	49198.51	49191.55	6.96
626	311864.5	5967927.5	2.1	49189.27	49182.30	6.97
627	310627.0	5964153.5	5.4	49183.86	49176.89	6.97
628	311707.0	5962959.5	16.2	49192.93	49185.96	6.97
629	311711.5	5968046.0	11.7	49191.30	49184.33	6.97
630	313715.5	5966093.0	14.2	49196.68	49189.71	6.97
631	314308.0	5964974.0	17.0	49200.46	49193.48	6.98

632	312938.5	5964393.5	2.1	49181.20	49174.22	6.98
633	313339.0	5966663.0	13.4	49195.86	49188.87	6.99
634	313973.5	5965703.0	11.7	49193.28	49186.29	6.99
635	313049.5	5970015.5	12.9	49186.93	49179.94	6.99
636	309467.5	5967227.0	18.3	49196.51	49189.52	6.99
637	313300.0	5968794.5	9.6	49192.76	49185.76	7.00
638	309272.5	5966847.5	17.1	49196.84	49189.84	7.00
639	311281.0	5968313.0	15.0	49189.02	49182.00	7.02
640	311974.0	5967938.0	17.5	49187.00	49179.98	7.02
641	312670.0	5964798.5	16.2	49180.62	49173.60	7.02
642	310454.5	5963526.5	17.1	49197.50	49190.45	7.05
643	313082.5	5967474.5	12.9	49200.59	49193.54	7.05
644	312260.5	5965605.5	8.8	49192.82	49185.76	7.06
645	311626.0	5963942.0	3.0	49200.27	49193.21	7.06
646	312548.5	5964876.5	19.6	49188.63	49181.56	7.07
647	313714.0	5966912.0	17.5	49202.98	49195.91	7.07
648	308863.0	5967039.5	13.8	49193.10	49186.03	7.07
649	308143.0	5966672.0	4.2	49179.41	49172.34	7.07
650	310900.0	5962833.5	11.7	49198.79	49191.71	7.08
651	312026.5	5965452.5	17.1	49191.63	49184.55	7.08
652	312176.5	5963100.5	2.1	49199.31	49192.23	7.08
653	312700.0	5965739.0	10.8	49189.82	49182.73	7.09
654	311366.5	5968698.5	8.8	49191.04	49183.95	7.09
655	311599.0	5965259.0	4.2	49187.88	49180.78	7.10
656	313916.5	5965914.5	15.4	49196.64	49189.54	7.10
657	311521.0	5964665.0	17.5	49188.11	49181.01	7.10
658	312121.0	5962922.0	3.0	49195.39	49188.29	7.10
659	312179.5	5962413.5	4.7	49202.79	49195.68	7.11
660	313163.5	5965712.0	7.5	49180.38	49173.27	7.11
661	313549.0	5966469.5	9.6	49197.24	49190.12	7.12
662	312052.0	5969039.0	15.0	49197.21	49190.08	7.13
663	312023.5	5965514.0	10.1	49187.86	49180.73	7.13
664	311275.0	5964351.5	9.6	49190.04	49182.91	7.13
665	310583.5	5964837.5	2.1	49200.51	49193.38	7.13
666	311728.0	5964473.0	19.2	49191.34	49184.21	7.13
667	315604.0	5964189.5	12.1	49201.45	49194.32	7.13
668	309862.0	5964216.5	18.1	49196.15	49189.01	7.14
669	313454.5	5967462.5	12.9	49199.81	49192.67	7.14
670	312220.0	5967558.5	12.1	49186.95	49179.81	7.14
671	311125.0	5963294.0	10.8	49199.47	49192.32	7.15
672	311819.5	5962515.5	12.9	49196.88	49189.72	7.16
673	312658.0	5967819.5	9.6	49195.66	49188.49	7.17
674	309980.5	5965137.5	8.8	49179.82	49172.66	7.16
675	313454.5	5965509.5	8.8	49191.58	49184.41	7.17
676	314347.0	5967051.5	12.1	49194.96	49187.77	7.19

677	312362.5	5968836.5	6.4	49193.00	49185.81	7.19
678	310429.0	5964368.0	13.4	49195.68	49188.49	7.19
679	315050.5	5964873.5	19.6	49202.03	49194.84	7.19
680	311290.0	5968299.5	9.6	49190.38	49183.18	7.20
681	312610.0	5964222.5	16.2	49200.15	49192.95	7.20
682	314182.0	5964837.5	12.1	49200.46	49193.26	7.20
683	311441.5	5962752.5	6.4	49194.92	49187.72	7.20
684	310334.5	5964783.5	4.7	49193.68	49186.48	7.20
685	313612.0	5967056.0	19.2	49201.75	49194.54	7.21
686	310675.0	5964437.0	6.7	49181.59	49174.37	7.22
687	310645.0	5964587.0	19.0	49185.87	49178.65	7.22
688	313885.0	5965286.0	3.0	49201.57	49194.35	7.22
689	312571.0	5964152.0	10.8	49190.71	49183.48	7.23
690	312049.0	5964134.0	3.0	49198.09	49190.86	7.23
691	313673.5	5966265.5	17.1	49193.59	49186.36	7.23
692	313813.0	5967747.5	5.4	49191.46	49184.21	7.25
693	310246.0	5963633.0	4.2	49194.89	49187.63	7.26
694	313280.5	5967567.5	19.6	49198.47	49191.22	7.25
695	314495.5	5964665.0	16.8	49204.06	49196.80	7.26
696	314230.0	5965565.0	17.5	49195.14	49187.88	7.26
697	310393.0	5964866.0	17.5	49181.40	49174.14	7.26
698	315934.0	5964923.0	17.5	49199.73	49192.46	7.27
699	313444.0	5966925.5	12.1	49201.04	49193.77	7.27
700	314656.0	5965739.0	15.0	49194.88	49187.60	7.28
701	311206.0	5964894.5	10.9	49190.45	49183.16	7.29
702	314347.0	5967860.0	17.5	49194.55	49187.26	7.29
703	313573.0	5964536.0	6.7	49201.06	49193.77	7.29
704	310981.0	5965757.0	19.2	49201.05	49193.75	7.30
705	312293.5	5963759.0	7.5	49198.03	49190.72	7.31
706	308461.0	5966630.0	15.0	49193.72	49186.40	7.32
707	312881.5	5962583.0	7.5	49193.42	49186.09	7.33
708	308779.0	5966147.0	15.0	49189.80	49182.47	7.33
709	316016.5	5965071.5	12.9	49188.01	49180.66	7.35
710	310790.5	5964947.0	14.2	49194.77	49187.42	7.35
711	313658.5	5968095.5	17.1	49191.55	49184.21	7.34
712	309775.0	5967590.0	10.8	49196.40	49189.04	7.36
713	309269.5	5966855.0	18.3	49197.14	49189.77	7.37
714	315541.0	5964945.5	16.2	49202.50	49195.14	7.36
715	314660.5	5965335.5	19.6	49194.31	49186.94	7.37
716	314906.5	5964018.5	2.1	49206.82	49199.43	7.39
717	310843.0	5964453.5	5.4	49201.04	49193.65	7.39
718	315884.5	5965005.5	12.9	49198.38	49190.98	7.40
719	310394.5	5965965.5	19.6	49197.58	49190.18	7.40
720	311138.5	5962359.5	2.1	49192.83	49185.43	7.40
721	314749.0	5965899.5	18.8	49192.22	49184.82	7.40

722	309130.0	5966631.5	12.1	49195.08	49187.68	7.40
723	312505.0	5963568.5	5.4	49197.85	49190.44	7.41
724	313415.5	5963840.0	3.4	49203.03	49195.61	7.42
725	310094.5	5964621.5	17.1	49190.36	49182.94	7.42
726	312736.0	5969091.5	18.8	49196.17	49188.74	7.43
727	313484.5	5967254.0	10.1	49201.57	49194.13	7.44
728	315211.0	5964081.5	8.1	49198.42	49190.97	7.45
729	313648.0	5967276.5	16.2	49195.10	49187.65	7.45
730	313316.5	5963420.0	3.4	49182.92	49175.47	7.45
731	315421.0	5966396.0	6.7	49187.44	49179.98	7.46
732	310360.0	5967522.5	16.2	49182.81	49175.35	7.46
733	312259.0	5965601.0	6.7	49193.21	49185.74	7.47
734	311786.5	5962571.0	16.8	49201.10	49193.63	7.47
735	312241.0	5968881.5	8.1	49202.52	49195.05	7.47
736	313868.5	5965314.5	8.8	49201.68	49194.19	7.49
737	311042.5	5962418.0	3.4	49196.28	49188.79	7.49
738	311884.0	5965347.5	14.8	49193.51	49186.01	7.50
739	312799.0	5965995.5	9.6	49196.86	49189.36	7.50
740	314911.0	5964149.0	15.0	49198.03	49190.53	7.50
741	314411.5	5963799.5	12.9	49178.38	49170.87	7.51
742	313364.5	5966213.0	18.3	49184.14	49176.62	7.52
743	310571.5	5963228.0	18.3	49193.31	49185.77	7.54
744	310024.0	5965949.0	12.7	49193.18	49185.64	7.54
745	310240.0	5966607.5	18.8	49190.07	49182.52	7.55
746	311794.0	5963829.5	12.1	49201.99	49194.44	7.55
747	311641.0	5966789.0	10.8	49197.83	49190.27	7.56
748	311093.5	5962614.5	4.7	49198.78	49191.21	7.57
749	312530.5	5965994.0	14.2	49187.88	49180.31	7.57
750	312302.5	5964020.0	3.4	49199.00	49191.43	7.57
751	312965.5	5964660.5	2.1	49196.59	49189.02	7.57
752	314605.0	5966651.0	15.0	49193.10	49185.52	7.58
753	310849.0	5967458.0	13.4	49189.82	49182.22	7.60
754	312667.0	5969486.0	17.5	49191.70	49184.09	7.61
755	310537.0	5966864.0	15.0	49193.14	49185.52	7.62
756	314960.5	5966255.0	18.3	49198.18	49190.55	7.63
757	313576.0	5969202.5	12.1	49188.79	49181.16	7.63
758	310202.5	5964255.5	14.9	49190.50	49182.86	7.64
759	310189.0	5966966.0	19.2	49196.55	49188.91	7.64
760	311264.5	5964893.0	7.5	49193.82	49186.17	7.65
761	314401.0	5965731.5	5.4	49193.70	49186.04	7.66
762	312839.5	5968113.5	2.1	49190.89	49183.23	7.66
763	310511.5	5963226.5	4.7	49201.26	49193.59	7.67
764	312493.0	5966729.0	6.7	49178.72	49171.05	7.67
765	308657.5	5966144.0	10.1	49187.00	49179.32	7.68
766	310984.0	5962707.5	5.4	49199.38	49191.69	7.69

767	311983.0	5966270.0	12.7	49191.73	49184.05	7.68
768	310030.0	5964155.0	12.7	49193.75	49186.06	7.69
769	309796.0	5964321.5	12.1	49196.59	49188.89	7.70
770	309814.0	5964566.0	8.5	49196.36	49188.66	7.70
771	313039.0	5968503.5	1.5	49195.36	49187.65	7.71
772	310645.0	5964602.0	13.4	49185.84	49178.13	7.71
773	313135.0	5969198.0	3.0	49194.93	49187.22	7.71
774	313915.0	5962907.0	17.5	49186.59	49178.88	7.71
775	310138.0	5963799.5	16.2	49199.34	49191.62	7.72
776	311438.5	5965056.5	8.8	49193.73	49186.01	7.72
777	309889.0	5966733.5	16.2	49195.97	49188.23	7.74
778	311276.5	5968596.5	12.9	49178.29	49170.53	7.76
779	313208.5	5968377.5	8.8	49197.66	49189.89	7.77
780	311395.0	5967596.0	10.8	49185.82	49178.04	7.78
781	311449.0	5965052.0	16.2	49193.77	49185.99	7.78
782	313952.5	5965983.5	15.4	49196.71	49188.93	7.78
783	310679.5	5964624.5	10.6	49186.50	49178.71	7.79
784	311842.0	5962925.0	6.7	49200.95	49193.16	7.79
785	314707.0	5964710.0	15.0	49196.65	49188.85	7.80
786	310774.0	5965796.0	6.7	49193.44	49185.63	7.81
787	314648.5	5966180.0	11.7	49198.28	49190.45	7.83
788	311026.0	5964170.0	15.0	49191.22	49183.39	7.83
789	313604.5	5966948.0	14.2	49194.16	49186.32	7.84
790	311246.5	5962367.0	13.8	49197.67	49189.84	7.83
791	311659.0	5965676.0	17.5	49197.18	49189.34	7.84
792	310441.0	5964791.0	10.8	49182.52	49174.64	7.88
793	310912.0	5964783.5	16.5	49188.89	49181.01	7.88
794	312152.5	5967401.0	3.4	49188.00	49180.13	7.87
795	311317.0	5967165.5	5.4	49199.96	49192.08	7.88
796	309595.0	5966609.0	19.2	49192.80	49184.92	7.88
797	312077.5	5969003.0	11.7	49198.78	49190.89	7.89
798	314893.0	5964552.5	12.1	49199.29	49191.40	7.89
799	310262.5	5966016.5	19.6	49196.07	49188.18	7.89
800	313646.5	5967707.0	7.5	49201.80	49193.90	7.90
801	311467.0	5965137.5	18.3	49191.23	49183.33	7.90
802	310424.5	5966889.5	15.4	49196.60	49188.68	7.92
803	311216.5	5964986.0	11.7	49187.48	49179.57	7.91
804	311552.5	5963102.0	7.5	49182.39	49174.47	7.92
805	312619.0	5967882.5	12.1	49195.91	49187.98	7.93
806	312644.5	5968704.5	17.1	49198.52	49190.56	7.96
807	310855.0	5963463.5	13.8	49190.52	49182.55	7.97
808	309863.5	5967590.0	3.4	49206.72	49198.74	7.98
809	313027.0	5963582.0	6.7	49194.89	49186.89	8.00
810	314177.5	5963630.0	7.5	49202.81	49194.81	8.00
811	309997.0	5967390.5	12.1	49193.19	49185.18	8.01

812	311684.5	5962905.5	19.6	49184.12	49176.11	8.01
813	311473.0	5965172.0	17.0	49190.87	49182.86	8.01
814	314815.0	5965496.0	15.0	49197.65	49189.64	8.01
815	311537.5	5968392.5	4.7	49200.48	49192.47	8.01
816	312254.5	5963289.5	2.1	49193.23	49185.21	8.02
817	309688.0	5966628.5	16.2	49193.54	49185.52	8.02
818	310531.0	5964551.0	3.0	49189.34	49181.31	8.03
819	309382.0	5966940.5	5.4	49192.69	49184.66	8.03
820	303488.5	5962925.0	5.4	49185.55	49177.51	8.04
821	310262.5	5964372.5	6.4	49191.94	49183.89	8.05
822	310243.0	5968262.0	15.0	49194.61	49186.56	8.05
823	314087.5	5963498.0	3.4	49185.98	49177.93	8.05
824	316225.0	5965164.5	12.1	49192.78	49184.72	8.06
825	310565.5	5964593.0	12.8	49180.96	49172.89	8.07
826	315943.0	5964495.5	16.2	49197.73	49189.64	8.09
827	315629.5	5964249.5	12.9	49196.93	49188.84	8.09
828	312818.5	5965430.0	14.2	49186.10	49178.01	8.09
829	309046.0	5966403.5	16.2	49193.46	49185.36	8.10
830	310610.5	5966322.5	2.1	49195.67	49187.57	8.10
831	310564.0	5964554.0	17.5	49187.46	49179.36	8.10
832	315620.5	5964167.0	3.4	49200.03	49191.93	8.10
833	309668.5	5967477.5	2.1	49198.20	49190.09	8.11
834	311014.0	5964117.5	4.5	49205.45	49197.34	8.11
835	312797.5	5968176.5	2.1	49190.18	49182.07	8.11
836	313687.0	5967771.5	14.8	49199.92	49191.79	8.13
837	310408.0	5967062.0	19.2	49189.63	49181.50	8.13
838	313495.0	5967939.5	9.6	49200.55	49192.39	8.16
839	313127.5	5963301.5	2.1	49189.95	49181.80	8.15
840	309515.5	5966199.5	8.8	49177.36	49169.20	8.16
841	310673.5	5964626.0	5.4	49186.71	49178.55	8.16
842	309163.0	5966499.5	16.2	49197.96	49189.80	8.16
843	313648.0	5965389.5	18.8	49188.46	49180.29	8.17
844	309599.5	5965374.5	8.8	49191.45	49183.28	8.17
845	312377.5	5966909.0	12.8	49178.97	49170.80	8.17
846	309331.0	5967171.5	12.1	49194.60	49186.42	8.18
847	311057.5	5964807.5	2.1	49192.69	49184.50	8.19
848	308692.0	5966280.5	7.5	49190.53	49182.34	8.19
849	313871.5	5967923.0	18.3	49195.05	49186.86	8.19
850	313658.5	5966985.5	12.9	49201.32	49193.13	8.19
851	310511.5	5967851.0	16.8	49193.87	49185.68	8.19
852	312386.5	5965001.0	11.7	49197.61	49189.41	8.20
853	314440.0	5967591.5	9.6	49208.03	49199.82	8.21
854	311389.0	5965404.5	12.1	49207.82	49199.60	8.22
855	309695.5	5964465.5	17.1	49197.94	49189.71	8.23
856	313841.5	5966585.0	10.1	49195.54	49187.30	8.24

857	312820.0	5964450.5	12.1	49191.20	49182.96	8.24
858	314396.5	5966964.5	8.8	49194.69	49186.46	8.23
859	309724.0	5966714.0	17.5	49181.21	49172.96	8.25
860	313201.0	5963757.5	13.8	49199.25	49191.00	8.25
861	315206.5	5964797.0	3.4	49199.95	49191.69	8.26
862	313339.0	5965688.0	15.0	49192.71	49184.45	8.26
863	311282.5	5966804.0	18.3	49190.39	49182.09	8.30
864	310898.5	5965734.5	8.8	49192.45	49184.16	8.29
865	314975.5	5965803.5	17.1	49206.33	49198.03	8.30
866	310964.5	5965779.5	4.7	49195.59	49187.29	8.30
867	311506.0	5967420.5	8.1	49185.30	49177.00	8.30
868	310388.5	5967200.0	7.5	49191.15	49182.84	8.31
869	314089.0	5965406.0	10.8	49195.58	49187.27	8.31
870	314482.0	5965998.5	12.1	49194.29	49185.97	8.32
871	313933.0	5966294.0	4.2	49205.69	49197.38	8.31
872	312205.0	5963064.5	1.5	49200.32	49191.96	8.36
873	314849.5	5964779.0	7.5	49203.09	49194.72	8.37
874	313559.5	5963213.0	3.4	49200.57	49192.20	8.37
875	313036.0	5967014.0	6.7	49194.16	49185.79	8.37
876	310568.5	5966525.0	14.2	49194.99	49186.62	8.37
877	310453.0	5964503.0	10.8	49190.80	49182.42	8.38
878	311797.0	5966555.0	4.2	49196.15	49187.77	8.38
879	312722.5	5962824.5	19.6	49192.46	49184.07	8.39
880	313186.0	5964447.5	9.6	49195.71	49187.30	8.41
881	313600.0	5966957.0	10.8	49194.56	49186.14	8.42
882	310315.0	5966085.5	16.2	49197.96	49189.51	8.45
883	309131.5	5966784.5	15.4	49177.24	49168.79	8.45
884	312017.5	5966217.5	15.4	49194.25	49185.80	8.45
885	312335.5	5965743.5	4.7	49190.83	49182.37	8.46
886	313475.5	5964842.0	7.5	49186.79	49178.32	8.47
887	309223.0	5966838.5	16.2	49190.55	49182.09	8.46
888	310724.5	5964357.5	2.1	49180.89	49172.41	8.48
889	309457.0	5964932.0	6.7	49190.16	49181.67	8.49
890	310349.5	5966721.5	19.6	49196.07	49187.57	8.50
891	313069.0	5962707.5	9.6	49203.09	49194.59	8.50
892	311899.0	5962571.0	10.8	49180.71	49172.20	8.51
893	312289.0	5965710.5	16.0	49190.80	49182.27	8.53
894	311450.5	5962404.5	6.4	49191.48	49182.95	8.53
895	310792.0	5967830.0	17.5	49197.28	49188.74	8.54
896	315265.0	5965106.0	19.2	49193.68	49185.14	8.54
897	309163.0	5966927.0	19.2	49188.45	49179.91	8.54
898	312977.5	5966529.5	15.4	49202.29	49193.74	8.55
899	312896.5	5969808.5	2.1	49185.67	49177.12	8.55
900	312419.5	5965778.0	11.7	49190.19	49181.63	8.56
901	312490.0	5968938.5	9.6	49196.93	49188.36	8.57

902	312709.0	5969702.0	17.5	49197.56	49188.99	8.57
903	312848.5	5967294.5	15.4	49193.55	49184.97	8.58
904	313649.5	5967831.5	15.4	49200.21	49191.62	8.59
905	311206.0	5963462.0	15.0	49203.46	49194.87	8.59
906	309959.5	5966781.5	18.1	49195.50	49186.90	8.60
907	312434.5	5963957.0	10.1	49191.48	49182.87	8.61
908	310480.0	5964428.0	17.0	49193.00	49184.39	8.61
909	311510.5	5966447.0	14.2	49186.70	49178.08	8.62
910	314282.5	5965110.5	19.6	49196.11	49187.49	8.62
911	313865.5	5967933.5	17.1	49195.33	49186.71	8.62
912	314794.0	5964332.0	4.2	49193.98	49185.36	8.62
913	310205.5	5965980.5	12.9	49189.27	49180.63	8.64
914	311074.0	5964812.0	19.2	49192.63	49183.99	8.64
915	309814.0	5964504.5	16.2	49195.81	49187.17	8.64
916	310616.5	5965364.0	10.1	49189.90	49181.25	8.65
917	312124.0	5965623.5	17.6	49183.55	49174.90	8.65
918	311723.5	5962934.0	18.3	49194.09	49185.43	8.66
919	313157.5	5966940.5	8.8	49197.17	49188.51	8.66
920	310082.5	5964165.5	4.7	49193.26	49184.60	8.66
921	308116.0	5966708.0	17.5	49178.26	49169.59	8.67
922	314093.5	5968424.0	7.5	49188.43	49179.76	8.67
923	311680.0	5969066.0	4.2	49192.02	49183.34	8.68
924	313582.0	5968517.0	6.7	49194.38	49185.68	8.70
925	311729.5	5967888.5	15.4	49177.90	49169.20	8.70
926	310565.5	5964464.0	15.1	49192.29	49183.57	8.72
927	315091.0	5965791.5	16.2	49192.85	49184.10	8.75
928	314291.5	5966721.5	2.1	49206.00	49197.24	8.76
929	310984.0	5967791.0	4.2	49198.25	49189.49	8.76
930	311990.5	5966814.5	6.4	49187.95	49179.17	8.78
931	309277.0	5965388.0	17.0	49193.97	49185.18	8.79
932	309850.0	5964507.5	18.1	49198.81	49190.01	8.80
933	311519.5	5963982.5	17.1	49189.18	49180.37	8.81
934	311641.0	5968700.0	3.0	49199.65	49190.84	8.81
935	314599.0	5966951.0	9.5	49199.73	49190.92	8.81
936	313961.5	5966400.5	6.4	49196.00	49187.18	8.82
937	313390.0	5969067.5	12.1	49186.02	49177.20	8.82
938	310564.0	5964480.5	18.8	49192.20	49183.37	8.83
939	314707.0	5965962.5	12.1	49194.48	49185.66	8.82
940	312389.5	5962656.5	2.1	49195.16	49186.33	8.83
941	311963.5	5969016.5	12.9	49187.46	49178.61	8.85
942	313118.5	5966753.0	11.7	49206.09	49197.23	8.86
943	311833.0	5967467.0	6.7	49216.30	49207.45	8.85
944	314093.5	5966892.5	8.8	49193.84	49184.98	8.86
945	309656.5	5964809.0	18.1	49193.54	49184.68	8.86
946	311405.5	5964665.0	3.4	49190.30	49181.41	8.89

947	311003.5	5968185.5	15.4	49185.39	49176.50	8.89
948	309320.5	5966501.0	16.0	49178.20	49169.31	8.89
949	308941.0	5965715.0	10.8	49187.27	49178.39	8.88
950	311915.5	5965430.0	18.1	49190.42	49181.52	8.90
951	312263.5	5965022.0	7.5	49185.26	49176.35	8.91
952	314363.5	5963330.0	3.4	49200.34	49191.41	8.93
953	309862.0	5967459.5	5.4	49196.66	49187.72	8.94
954	310960.0	5962748.0	12.7	49200.15	49191.20	8.95
955	309839.5	5964533.0	5.4	49197.89	49188.94	8.95
956	311972.5	5966288.0	11.7	49195.55	49186.59	8.96
957	311060.5	5964792.5	14.9	49192.84	49183.88	8.96
958	313271.5	5967747.5	15.4	49193.47	49184.52	8.95
959	310502.5	5964513.5	7.7	49195.81	49186.84	8.97
960	312056.5	5965538.0	18.1	49188.93	49179.95	8.98
961	311600.5	5963124.5	8.8	49193.48	49184.50	8.98
962	314132.5	5966964.5	17.1	49200.85	49191.86	8.99
963	312505.0	5964116.0	15.0	49191.23	49182.22	9.01
964	308386.0	5966736.5	10.9	49195.62	49186.60	9.02
965	308719.0	5966157.5	14.2	49202.19	49193.17	9.02
966	311402.5	5966619.5	15.4	49191.57	49182.55	9.02
967	310099.0	5965500.5	16.2	49193.81	49184.79	9.02
968	310900.0	5964779.0	4.2	49189.02	49179.98	9.04
969	310172.5	5964224.0	14.2	49192.72	49183.67	9.05
970	313772.5	5965047.5	6.4	49195.21	49186.15	9.06
971	310745.5	5964587.0	16.2	49194.52	49185.46	9.06
972	309955.0	5966216.0	17.5	49189.69	49180.61	9.08
973	314315.5	5967386.0	11.7	49198.78	49189.70	9.08
974	313114.0	5966024.0	13.4	49194.10	49185.01	9.09
975	313576.0	5968781.0	4.2	49183.68	49174.57	9.11
976	310558.0	5967905.0	10.8	49188.96	49179.84	9.12
977	312725.5	5964722.0	11.7	49181.61	49172.47	9.14
978	310762.0	5966223.5	16.2	49194.21	49185.07	9.14
979	312464.5	5965964.0	14.2	49185.14	49175.96	9.18
980	310996.0	5962575.5	1.5	49195.38	49186.20	9.18
981	312367.0	5963648.0	4.2	49197.55	49188.37	9.18
982	308495.5	5966507.0	18.3	49193.39	49184.20	9.19
983	309802.0	5963979.5	18.1	49194.54	49185.34	9.20
984	311839.0	5965412.0	6.0	49190.52	49181.32	9.20
985	314069.5	5964999.5	12.9	49200.34	49191.14	9.20
986	310570.0	5964599.0	17.0	49181.63	49172.42	9.21
987	313174.0	5963520.5	8.1	49197.42	49188.19	9.23
988	312407.5	5967401.0	3.4	49203.56	49194.29	9.27
989	310247.5	5963904.5	2.1	49197.91	49188.64	9.27
990	315140.5	5963925.5	4.7	49192.76	49183.49	9.27
991	313268.5	5967453.5	19.6	49192.36	49183.08	9.28

992	311168.5	5963879.0	7.5	49193.64	49184.36	9.28
993	311077.0	5963817.5	8.1	49182.49	49173.20	9.29
994	313118.5	5968374.5	6.4	49184.79	49175.47	9.32
995	314738.5	5964411.5	15.4	49195.73	49186.41	9.32
996	309755.5	5964572.0	9.1	49197.86	49188.55	9.31
997	310742.5	5964597.5	6.4	49194.81	49185.49	9.32
998	310961.5	5968517.0	3.4	49201.33	49191.97	9.36
999	313868.5	5963828.0	7.5	49183.29	49173.92	9.37
1000	311639.5	5962868.0	18.3	49196.72	49187.31	9.41
1001	309071.5	5965623.5	6.4	49195.57	49186.16	9.41
1002	310130.5	5966603.0	16.8	49191.24	49181.82	9.42
1003	312589.0	5965229.0	15.0	49199.52	49190.09	9.43
1004	313936.0	5966969.0	15.0	49199.26	49189.83	9.43
1005	314015.5	5966177.0	7.5	49205.13	49195.69	9.44
1006	312815.5	5968148.0	14.2	49188.16	49178.70	9.46
1007	316013.5	5964503.0	14.2	49197.43	49187.96	9.47
1008	309691.0	5967584.0	10.8	49192.91	49183.44	9.47
1009	311102.5	5967767.0	18.3	49197.23	49187.76	9.47
1010	310357.0	5966843.0	10.8	49203.81	49194.33	9.48
1011	314626.0	5965241.0	17.5	49205.86	49196.38	9.48
1012	310829.5	5966270.0	18.3	49199.19	49189.71	9.48
1013	310088.5	5963964.5	6.4	49189.54	49180.04	9.50
1014	312512.5	5968605.5	14.9	49193.39	49183.89	9.50
1015	314123.5	5965589.0	3.4	49201.02	49191.50	9.52
1016	310736.5	5963496.5	8.8	49199.99	49190.46	9.53
1017	313153.0	5966706.5	18.8	49196.88	49187.35	9.53
1018	314068.0	5964750.5	12.1	49185.98	49176.44	9.54
1019	309712.0	5967005.0	13.4	49199.48	49189.93	9.55
1020	309860.5	5965941.5	2.1	49196.84	49187.25	9.59
1021	309916.0	5964225.5	16.2	49192.10	49182.52	9.58
1022	313945.0	5966153.0	10.8	49206.68	49197.10	9.58
1023	311296.0	5967474.5	12.1	49195.59	49185.99	9.60
1024	311474.5	5965152.5	10.6	49192.18	49182.55	9.63
1025	310421.5	5964384.5	10.6	49195.10	49185.47	9.63
1026	311711.5	5963388.5	8.8	49201.20	49191.56	9.64
1027	312049.0	5962757.0	4.2	49193.27	49183.63	9.64
1028	313274.5	5968830.5	8.8	49195.88	49186.22	9.66
1029	309380.5	5966054.0	3.4	49183.09	49173.43	9.66
1030	314771.5	5966121.5	8.8	49203.50	49193.84	9.66
1031	310946.5	5964860.0	16.0	49190.46	49180.77	9.69
1032	314074.0	5966924.0	10.8	49193.63	49183.93	9.70
1033	311515.0	5965079.0	3.0	49194.51	49184.79	9.72
1034	309881.5	5964566.0	10.1	49173.81	49164.09	9.72
1035	314917.0	5964261.5	14.8	49199.35	49189.62	9.73
1036	313009.0	5967980.0	3.0	49205.07	49195.33	9.74

1037	311488.0	5968937.0	15.0	49203.18	49193.42	9.76
1038	313378.0	5963325.5	5.4	49185.60	49175.82	9.78
1039	312232.0	5965475.0	17.5	49179.68	49169.89	9.79
1040	312052.0	5965517.0	16.2	49189.46	49179.67	9.79
1041	312205.0	5965932.5	5.4	49199.24	49189.44	9.80
1042	314723.5	5967161.0	7.5	49203.61	49193.81	9.80
1043	310538.5	5963393.0	16.0	49198.39	49188.57	9.82
1044	314860.0	5966264.0	10.8	49196.29	49186.47	9.82
1045	312746.5	5968238.0	9.6	49188.11	49178.29	9.82
1046	310295.5	5965970.0	11.7	49201.02	49191.20	9.82
1047	311348.5	5966700.5	6.4	49192.52	49182.69	9.83
1048	310529.5	5964456.5	17.1	49192.62	49182.79	9.83
1049	312310.0	5964689.0	19.2	49201.20	49191.37	9.83
1050	310907.5	5967083.0	7.5	49186.45	49176.60	9.85
1051	311033.5	5966487.5	19.6	49187.08	49177.21	9.87
1052	314525.5	5964620.0	12.8	49205.77	49195.89	9.88
1053	310270.0	5964363.5	1.5	49193.14	49183.24	9.90
1054	309826.0	5964366.5	5.4	49191.21	49181.29	9.92
1055	310873.0	5966336.0	17.5	49193.65	49183.73	9.92
1056	312142.0	5965592.0	3.0	49185.43	49175.51	9.92
1057	310354.0	5964422.0	12.7	49190.68	49180.76	9.92
1058	313609.0	5967467.0	8.5	49198.82	49188.89	9.93
1059	315748.0	5964509.0	10.8	49206.60	49196.67	9.93
1060	313979.5	5965140.5	17.1	49201.74	49191.80	9.94
1061	313576.0	5966306.0	4.2	49197.95	49187.98	9.97
1062	311192.5	5966543.0	14.2	49201.40	49191.42	9.98
1063	315979.0	5965127.0	15.0	49189.77	49179.77	10.00
1064	310754.5	5964588.5	18.1	49195.34	49185.33	10.01
1065	311480.5	5965160.0	18.1	49192.25	49182.25	10.00
1066	311417.5	5967131.0	11.7	49196.77	49186.74	10.03
1067	314468.5	5963450.0	14.2	49195.97	49185.94	10.03
1068	310211.5	5964318.5	17.1	49190.42	49180.39	10.03
1069	312325.0	5965488.5	13.8	49200.27	49190.23	10.04
1070	311606.5	5963115.5	8.8	49193.93	49183.87	10.06
1071	310256.5	5965893.5	15.4	49184.77	49174.71	10.06
1072	311074.0	5964816.5	7.5	49193.14	49183.08	10.06
1073	311567.5	5965979.0	3.4	49197.79	49187.73	10.06
1074	313886.5	5965827.5	12.9	49198.93	49188.87	10.06
1075	313895.5	5967453.5	19.6	49203.00	49192.92	10.08
1076	311033.5	5962644.5	14.9	49201.53	49191.45	10.08
1077	311431.0	5964627.5	9.6	49196.82	49186.71	10.11
1078	311540.5	5965191.5	14.2	49191.38	49181.27	10.11
1079	310057.0	5964192.5	13.8	49194.10	49183.98	10.12
1080	316051.0	5964326.0	15.0	49197.78	49187.66	10.12
1081	314513.5	5964758.0	18.3	49197.86	49187.74	10.12

1082	310043.5	5964141.5	2.1	49193.61	49183.48	10.13
1083	313333.0	5967486.5	12.1	49203.40	49193.25	10.15
1084	310090.0	5964164.0	12.4	49194.73	49184.58	10.15
1085	310633.0	5966706.5	5.4	49190.73	49180.57	10.16
1086	310708.0	5964209.0	6.7	49202.32	49192.14	10.18
1087	314929.0	5965061.0	19.2	49210.70	49200.50	10.20
1088	310396.0	5963843.0	4.2	49198.16	49187.93	10.23
1089	311089.0	5966544.5	5.4	49196.99	49186.77	10.22
1090	309971.5	5964327.5	7.7	49196.40	49186.17	10.23
1091	313411.0	5967531.5	16.2	49199.18	49188.95	10.23
1092	310100.5	5964957.5	2.1	49182.21	49171.98	10.23
1093	313141.0	5967773.0	4.2	49197.59	49187.36	10.23
1094	310150.0	5966064.5	18.1	49188.57	49178.31	10.26
1095	309971.5	5964164.0	6.2	49186.18	49175.88	10.30
1096	309946.0	5964455.0	4.2	49174.75	49164.45	10.30
1097	311797.0	5965307.0	15.3	49190.12	49179.82	10.30
1098	310421.5	5963918.0	11.7	49187.91	49177.59	10.32
1099	309088.0	5965601.0	15.3	49196.86	49186.52	10.34
1100	314920.0	5966729.0	6.7	49190.36	49180.02	10.34
1101	313019.5	5967690.5	17.1	49205.29	49194.94	10.35
1102	312346.0	5965731.5	9.6	49191.93	49181.58	10.35
1103	314146.0	5965434.5	14.8	49197.11	49186.75	10.36
1104	310687.0	5964420.5	5.4	49183.20	49172.82	10.38
1105	313856.5	5967260.0	14.2	49195.07	49184.68	10.39
1106	310841.5	5964732.5	15.4	49190.64	49180.23	10.41
1107	310543.0	5963796.5	5.4	49197.44	49187.01	10.43
1108	309940.0	5964075.5	18.3	49190.34	49179.88	10.46
1109	310820.5	5963507.0	3.4	49192.13	49181.66	10.47
1110	313985.5	5966763.5	12.9	49196.05	49185.58	10.47
1111	313714.0	5968317.5	9.6	49198.65	49188.17	10.48
1112	310516.0	5963412.5	7.5	49198.78	49188.29	10.49
1113	311770.0	5963024.0	10.8	49205.00	49194.48	10.52
1114	309839.5	5964527.0	16.0	49199.43	49188.89	10.54
1115	313471.0	5965355.0	12.7	49194.27	49183.73	10.54
1116	311300.5	5965404.5	6.4	49200.45	49189.89	10.56
1117	311473.0	5967743.0	15.0	49203.11	49192.51	10.60
1118	311624.5	5966280.5	2.1	49189.17	49178.55	10.62
1119	313424.5	5965845.5	8.8	49203.17	49192.53	10.64
1120	312257.5	5965586.0	16.0	49195.02	49184.37	10.65
1121	312200.5	5969078.0	14.2	49194.87	49184.21	10.66
1122	311678.5	5963111.0	3.4	49194.48	49183.80	10.68
1123	309910.0	5964339.5	8.1	49197.33	49186.64	10.69
1124	311131.0	5964846.5	7.5	49195.00	49184.31	10.69
1125	309139.0	5965521.5	11.7	49198.58	49187.88	10.70
1126	313568.5	5965763.0	10.1	49204.82	49194.12	10.70

1127	313706.5	5968580.0	18.3	49188.66	49177.95	10.71
1128	313876.0	5966667.5	12.1	49206.61	49195.89	10.72
1129	316292.5	5964768.5	4.7	49207.70	49196.98	10.72
1130	309497.5	5964972.5	10.6	49197.96	49187.24	10.72
1131	310130.5	5967471.5	6.4	49191.88	49181.14	10.74
1132	310858.0	5962895.0	15.3	49201.59	49190.84	10.75
1133	310424.5	5964459.5	4.7	49189.37	49178.62	10.75
1134	313138.0	5962739.0	19.2	49200.80	49190.03	10.77
1135	310582.0	5964570.5	10.9	49184.34	49173.57	10.77
1136	315232.0	5966675.0	17.5	49195.98	49185.18	10.80
1137	315302.5	5964366.5	2.1	49198.67	49187.84	10.83
1138	310346.5	5964405.5	12.9	49191.25	49180.41	10.84
1139	311002.0	5968046.0	13.4	49187.00	49176.16	10.84
1140	314234.5	5965305.5	2.1	49201.72	49190.88	10.84
1141	312109.0	5968544.0	10.8	49200.44	49189.60	10.84
1142	311846.5	5965400.0	3.4	49190.52	49179.68	10.84
1143	309725.5	5967807.5	8.8	49194.79	49183.94	10.85
1144	311105.5	5964885.5	14.2	49196.77	49185.91	10.86
1145	311560.0	5962632.5	13.8	49207.06	49196.20	10.86
1146	314576.5	5965194.5	17.1	49204.01	49193.14	10.87
1147	312041.5	5965545.5	10.6	49190.26	49179.38	10.88
1148	312268.0	5968550.0	19.2	49199.08	49188.19	10.89
1149	313843.0	5965779.5	9.6	49199.08	49188.17	10.91
1150	311531.5	5965596.5	8.8	49184.03	49173.11	10.92
1151	311657.5	5962580.0	11.7	49182.37	49171.44	10.93
1152	312602.5	5969169.5	12.9	49185.69	49174.76	10.93
1153	309778.0	5964548.0	15.0	49198.30	49187.36	10.94
1154	312766.0	5966564.0	10.8	49195.77	49184.83	10.94
1155	313649.5	5965505.0	18.3	49201.85	49190.91	10.94
1156	311537.5	5965202.0	7.5	49192.00	49181.04	10.96
1157	310913.5	5964774.5	17.1	49190.82	49179.86	10.96
1158	314102.5	5966708.0	3.4	49196.22	49185.27	10.95
1159	311345.5	5967792.5	19.6	49186.59	49175.63	10.96
1160	310013.5	5967503.0	11.7	49198.81	49187.85	10.96
1161	315665.5	5965326.5	2.1	49199.82	49188.86	10.96
1162	314740.0	5966169.5	13.8	49203.90	49192.93	10.97
1163	312694.0	5962872.5	16.2	49193.23	49182.24	10.99
1164	314203.0	5967953.0	10.8	49205.83	49194.83	11.00
1165	314743.0	5964404.0	19.2	49197.39	49186.39	11.00
1166	311335.0	5967543.5	16.2	49193.94	49182.93	11.01
1167	315433.0	5964285.5	9.6	49212.02	49201.00	11.02
1168	309533.5	5967275.0	11.7	49199.78	49188.75	11.03
1169	310229.5	5964197.0	19.5	49190.74	49179.65	11.09
1170	315794.5	5964429.5	12.9	49207.35	49196.26	11.09
1171	313787.5	5965868.0	11.7	49197.58	49186.48	11.10

1172	313889.5	5968728.5	12.9	49190.47	49179.34	11.13
1173	311647.0	5963912.0	17.5	49201.91	49190.78	11.13
1174	313961.5	5966691.5	8.8	49206.63	49195.48	11.15
1175	313726.0	5967878.0	15.0	49192.95	49181.79	11.16
1176	311242.0	5966742.5	16.2	49198.90	49187.73	11.17
1177	309833.5	5967504.5	2.1	49194.03	49182.84	11.19
1178	314740.0	5966750.0	10.8	49203.95	49192.75	11.20
1179	312607.0	5965479.5	5.4	49197.95	49186.75	11.20
1180	313274.5	5967444.5	19.6	49196.13	49184.92	11.21
1181	311995.0	5965020.5	13.8	49192.71	49181.50	11.21
1182	309649.0	5965304.0	13.4	49191.52	49180.30	11.22
1183	311102.5	5964879.5	17.1	49196.81	49185.59	11.22
1184	312296.5	5965688.0	18.1	49191.28	49180.05	11.23
1185	310247.5	5963904.5	12.9	49198.83	49187.59	11.24
1186	310721.5	5964632.0	16.0	49194.42	49183.15	11.27
1187	314299.0	5965452.5	13.8	49191.31	49180.03	11.28
1188	312281.5	5968533.5	12.9	49201.42	49190.13	11.29
1189	311431.0	5966579.0	6.7	49192.69	49181.39	11.30
1190	311413.0	5965103.0	17.0	49193.99	49182.69	11.30
1191	312911.5	5965539.5	12.9	49201.97	49190.66	11.31
1192	311056.0	5963850.5	18.8	49185.36	49174.03	11.33
1193	311374.0	5963207.0	4.2	49204.07	49192.73	11.34
1194	313543.0	5967866.0	6.7	49194.87	49183.52	11.35
1195	312139.0	5966030.0	10.8	49197.85	49186.47	11.38
1196	312575.5	5963604.5	4.7	49200.58	49189.20	11.38
1197	313819.0	5967855.5	18.8	49193.73	49182.34	11.39
1198	309767.5	5964365.0	7.5	49205.86	49194.46	11.40
1199	310045.0	5964218.0	12.4	49192.38	49180.98	11.40
1200	310627.0	5963231.0	15.0	49199.05	49187.65	11.40
1201	314357.5	5967176.0	11.7	49199.34	49187.94	11.40
1202	309215.5	5966550.5	15.4	49194.65	49183.24	11.41
1203	310844.5	5964740.0	18.1	49191.16	49179.72	11.44
1204	311419.0	5965121.0	12.7	49194.07	49182.61	11.46
1205	313043.5	5963556.5	4.7	49202.31	49190.85	11.46
1206	313283.5	5962781.0	3.4	49196.41	49184.93	11.48
1207	313730.5	5965850.0	16.0	49202.30	49190.80	11.50
1208	311050.0	5964872.0	6.0	49190.76	49179.27	11.49
1209	312880.0	5963979.5	9.6	49199.26	49187.74	11.52
1210	313063.0	5965869.5	16.2	49182.12	49170.60	11.52
1211	314360.5	5965235.0	3.4	49197.04	49185.51	11.53
1212	311717.5	5966829.5	4.7	49190.44	49178.87	11.57
1213	310877.5	5962875.5	8.8	49200.66	49189.06	11.60
1214	308675.5	5963909.0	6.2	49196.18	49184.57	11.61
1215	313802.5	5966202.5	19.6	49197.89	49186.27	11.62
1216	310241.5	5967825.5	6.4	49201.84	49190.18	11.66

1217	309646.0	5964753.5	19.7	49197.50	49185.84	11.66
1218	310478.5	5964501.5	17.1	49192.04	49180.38	11.66
1219	311171.5	5964944.0	12.8	49191.80	49180.10	11.70
1220	311090.5	5964902.0	16.0	49195.24	49183.52	11.72
1221	311860.0	5964840.5	18.8	49196.02	49184.28	11.74
1222	311179.0	5964956.0	17.5	49191.06	49179.30	11.76
1223	313595.5	5967662.0	7.5	49192.73	49180.96	11.77
1224	310336.0	5967008.0	10.8	49217.71	49205.89	11.82
1225	312262.0	5968184.0	19.2	49196.71	49184.87	11.84
1226	314264.5	5966766.5	19.6	49206.56	49194.71	11.85
1227	312955.0	5963567.0	3.0	49193.43	49181.55	11.88
1228	311417.5	5965113.5	13.6	49194.30	49182.40	11.90
1229	311825.5	5962949.0	3.4	49203.27	49191.36	11.91
1230	310850.5	5962917.5	17.1	49199.04	49187.13	11.91
1231	310456.0	5964668.0	17.5	49198.61	49186.68	11.93
1232	310975.0	5962721.0	6.7	49201.76	49189.82	11.94
1233	310601.5	5964515.0	19.5	49185.11	49173.16	11.95
1234	312550.0	5965806.5	14.8	49188.81	49176.86	11.95
1235	314458.0	5967171.5	12.1	49200.52	49188.56	11.96
1236	308687.5	5966195.0	14.2	49195.67	49183.70	11.97
1237	310480.0	5964564.5	9.6	49201.10	49189.12	11.98
1238	310132.0	5964266.0	15.0	49189.98	49177.90	12.08
1239	309230.5	5965736.0	3.4	49193.97	49181.87	12.10
1240	310094.5	5964150.5	2.1	49196.21	49184.08	12.13
1241	311179.0	5964962.0	19.2	49191.38	49179.20	12.18
1242	314255.5	5964713.0	7.5	49206.72	49194.52	12.20
1243	313889.5	5964609.5	15.4	49184.52	49172.26	12.26
1244	315949.0	5965427.0	17.5	49195.61	49183.32	12.29
1245	310585.0	5964579.5	16.0	49185.06	49172.76	12.30
1246	310196.5	5964317.0	5.4	49191.48	49179.17	12.31
1247	310027.0	5964338.0	13.4	49177.21	49164.89	12.32
1248	310379.5	5964444.5	11.4	49196.34	49184.01	12.33
1249	313835.5	5967419.0	14.2	49206.50	49194.18	12.32
1250	311528.5	5968422.5	7.7	49193.39	49181.02	12.37
1251	315097.0	5963985.5	12.1	49197.64	49185.23	12.41
1252	310550.5	5964477.5	4.7	49195.28	49182.81	12.47
1253	310198.0	5964299.0	19.2	49191.34	49178.84	12.50
1254	313729.0	5965946.0	15.0	49196.64	49184.13	12.51
1255	313355.5	5964875.0	3.4	49203.30	49190.73	12.57
1256	312512.5	5968601.0	7.5	49195.24	49182.68	12.56
1257	311702.5	5967536.0	10.1	49188.77	49176.19	12.58
1258	313945.0	5966714.0	10.8	49201.24	49188.66	12.58
1259	310703.5	5964657.5	8.8	49193.22	49180.63	12.59
1260	310918.0	5966669.0	15.0	49190.26	49177.66	12.60
1261	310177.0	5967519.5	12.1	49193.19	49180.52	12.67

1262	314180.5	5968110.5	12.9	49195.73	49183.05	12.68
1263	315742.0	5964803.0	4.2	49198.00	49185.28	12.72
1264	310484.5	5964924.5	6.4	49195.65	49182.91	12.74
1265	310537.0	5964543.5	4.5	49191.97	49179.21	12.76
1266	312250.0	5969139.5	12.1	49205.64	49192.85	12.79
1267	313964.5	5966531.0	14.2	49208.33	49195.54	12.79
1268	309922.0	5964087.5	9.6	49195.63	49182.83	12.80
1269	314129.5	5967096.5	12.9	49204.68	49191.88	12.80
1270	315398.5	5964341.0	14.2	49208.01	49195.14	12.87
1271	311321.5	5967831.5	12.9	49193.46	49180.60	12.86
1272	313465.0	5963204.0	13.4	49176.33	49163.46	12.87
1273	312362.5	5968968.5	8.8	49208.54	49195.66	12.88
1274	309056.5	5965637.0	9.6	49197.25	49184.37	12.88
1275	309904.0	5964056.0	15.0	49199.69	49186.75	12.94
1276	313829.5	5966733.5	2.1	49200.72	49187.75	12.97
1277	312541.0	5964596.0	10.8	49190.68	49177.70	12.98
1278	314170.0	5966907.5	9.6	49205.19	49192.19	13.00
1279	313771.0	5966420.0	17.5	49208.89	49195.89	13.00
1280	310664.5	5963204.0	11.7	49199.45	49186.41	13.04
1281	313058.5	5968728.5	17.1	49207.92	49194.88	13.04
1282	313384.0	5967806.0	17.5	49196.61	49183.57	13.04
1283	312046.0	5968515.5	9.6	49194.40	49181.36	13.04
1284	311239.0	5964405.5	4.5	49195.82	49182.77	13.05
1285	310604.5	5964534.5	14.2	49185.37	49172.31	13.06
1286	310768.0	5966900.0	6.7	49188.50	49175.43	13.07
1287	312233.5	5965355.0	16.8	49192.63	49179.54	13.09
1288	310235.5	5966897.0	3.4	49201.93	49188.84	13.09
1289	310093.0	5964233.0	4.2	49183.69	49170.57	13.12
1290	312982.0	5965433.0	10.8	49207.61	49194.48	13.13
1291	314305.0	5967800.0	17.5	49210.48	49197.34	13.14
1292	311437.0	5966006.0	4.2	49201.97	49188.80	13.17
1293	314938.0	5965745.0	17.5	49208.77	49195.60	13.17
1294	311567.5	5963175.5	19.6	49196.75	49183.53	13.22
1295	313886.5	5966516.0	14.2	49199.14	49185.91	13.23
1296	314297.5	5966840.0	6.2	49204.88	49191.61	13.27
1297	309395.5	5965301.0	7.5	49177.14	49163.87	13.27
1298	313919.5	5966598.5	17.1	49208.31	49195.01	13.30
1299	308944.0	5965803.5	13.8	49196.66	49183.36	13.30
1300	315025.0	5964636.5	12.1	49208.21	49194.90	13.31
1301	312065.5	5966838.5	8.8	49204.98	49191.66	13.32
1302	311845.0	5965388.0	12.7	49192.43	49179.09	13.34
1303	312104.5	5964323.0	3.4	49199.66	49186.30	13.36
1304	311408.5	5963415.5	15.4	49198.95	49185.57	13.38
1305	311318.5	5963354.0	3.4	49196.85	49183.46	13.39
1306	310609.0	5964522.5	16.8	49186.38	49172.96	13.42

1307	309830.5	5964066.5	11.4	49192.43	49179.01	13.42
1308	313757.5	5967414.5	19.6	49195.36	49181.84	13.52
1309	310487.5	5964483.5	19.1	49192.77	49179.25	13.52
1310	311809.0	5963147.0	4.2	49196.68	49183.12	13.56
1311	313784.5	5965988.0	14.2	49200.67	49187.11	13.56
1312	310004.5	5964192.5	12.9	49194.28	49180.66	13.62
1313	311284.0	5963397.5	5.4	49196.38	49182.73	13.65
1314	313306.0	5963162.0	4.2	49205.30	49191.61	13.69
1315	314617.0	5966091.5	12.1	49195.09	49181.30	13.79
1316	311810.5	5966963.0	7.5	49188.78	49174.93	13.85
1317	313951.0	5963262.5	1.5	49200.34	49186.45	13.89
1318	309928.0	5964315.5	16.8	49200.37	49186.47	13.90
1319	310105.0	5964114.5	18.1	49194.49	49180.59	13.90
1320	309881.5	5967564.5	4.7	49200.24	49186.32	13.92
1321	309959.5	5964126.5	15.4	49195.62	49181.67	13.95
1322	312241.0	5965343.0	10.8	49195.60	49181.63	13.97
1323	313528.0	5965280.0	17.5	49201.84	49187.84	14.00
1324	311999.5	5966240.0	3.4	49192.00	49177.97	14.03
1325	314978.5	5963745.5	19.6	49191.59	49177.56	14.03
1326	310307.5	5964635.0	3.4	49189.13	49175.08	14.05
1327	311983.0	5964777.5	16.2	49198.84	49184.77	14.07
1328	311717.5	5963108.0	14.2	49207.62	49193.53	14.09
1329	313781.5	5968053.5	12.9	49202.38	49188.28	14.10
1330	313549.0	5964854.0	4.2	49200.48	49186.36	14.12
1331	312253.0	5963669.0	16.2	49200.59	49186.45	14.14
1332	310405.0	5964491.0	16.2	49189.90	49175.75	14.15
1333	310642.0	5965443.5	13.8	49206.20	49192.05	14.15
1334	311023.0	5964840.5	18.3	49193.85	49179.68	14.17
1335	313396.0	5963697.5	1.5	49180.36	49166.18	14.18
1336	309934.0	5964129.5	16.8	49191.70	49177.50	14.20
1337	312515.5	5963273.0	11.7	49196.74	49182.51	14.23
1338	312536.5	5969397.5	12.9	49205.29	49191.05	14.24
1339	309656.5	5964908.0	12.8	49172.09	49157.82	14.27
1340	310382.5	5964431.0	9.6	49195.93	49181.66	14.27
1341	310081.0	5964231.5	16.2	49184.39	49170.06	14.33
1342	308990.5	5965745.0	12.1	49199.98	49185.56	14.42
1343	313850.5	5968796.0	14.2	49192.02	49177.58	14.44
1344	314572.0	5966001.5	12.1	49199.93	49185.47	14.46
1345	310318.0	5967039.5	12.1	49214.59	49200.02	14.57
1346	313357.0	5968851.5	18.8	49202.02	49187.36	14.66
1347	311365.0	5963658.5	9.6	49197.22	49182.48	14.74
1348	313979.5	5968043.0	7.5	49204.31	49189.55	14.76
1349	309004.0	5965737.5	16.2	49200.14	49185.34	14.80
1350	310714.0	5964644.0	15.0	49194.10	49179.25	14.85
1351	310339.0	5964330.5	7.5	49200.04	49185.19	14.85

1352	310690.0	5966205.5	9.6	49202.42	49187.56	14.86
1353	310058.5	5964111.5	12.9	49193.98	49179.09	14.89
1354	310813.0	5965736.0	17.5	49196.63	49181.74	14.89
1355	312095.5	5964594.5	2.1	49197.55	49182.62	14.93
1356	315038.5	5966676.5	4.7	49210.08	49195.12	14.96
1357	310066.0	5964267.5	19.7	49181.71	49166.74	14.97
1358	312536.5	5966499.5	2.1	49195.85	49180.88	14.97
1359	314095.0	5966199.5	12.1	49195.41	49180.43	14.98
1360	311018.5	5964867.5	7.7	49196.83	49181.81	15.02
1361	310996.0	5966949.5	9.6	49190.29	49175.26	15.03
1362	315860.5	5964462.5	12.9	49204.31	49189.27	15.04
1363	308971.0	5965773.5	16.8	49202.06	49187.00	15.06
1364	313546.0	5967155.0	10.8	49208.17	49193.09	15.08
1365	310718.5	5964653.0	12.1	49194.30	49179.16	15.14
1366	312065.5	5967638.0	7.5	49196.48	49181.32	15.16
1367	310085.5	5964152.0	16.0	49198.98	49183.81	15.17
1368	310393.0	5964425.0	19.0	49196.57	49181.38	15.19
1369	311494.0	5962739.0	17.5	49209.12	49193.89	15.23
1370	315689.5	5964873.5	15.4	49201.47	49186.25	15.22
1371	313804.0	5966075.0	13.4	49203.58	49188.35	15.23
1372	312865.0	5967924.5	5.4	49208.61	49193.38	15.23
1373	313712.5	5966781.5	12.9	49195.52	49180.23	15.29
1374	311096.5	5964909.5	8.8	49195.91	49180.55	15.36
1375	310060.0	5964224.0	19.2	49192.43	49177.01	15.42
1376	309196.0	5966960.0	4.2	49202.46	49187.01	15.45
1377	312364.0	5962818.5	1.5	49198.89	49183.42	15.47
1378	309383.5	5964783.5	6.4	49179.75	49164.25	15.50
1379	314317.0	5965430.0	10.8	49206.64	49191.00	15.64
1380	312130.0	5962640.0	10.8	49197.09	49181.39	15.70
1381	311080.0	5967392.0	4.2	49207.64	49191.92	15.72
1382	312956.5	5964255.5	2.1	49198.34	49182.61	15.73
1383	314854.0	5964228.5	5.4	49204.31	49188.57	15.74
1384	312056.5	5963844.5	2.1	49200.63	49184.88	15.75
1385	310055.5	5964206.0	15.7	49193.19	49177.36	15.83
1386	315725.5	5965929.5	8.8	49198.84	49183.00	15.84
1387	310993.0	5965875.5	16.2	49197.72	49181.80	15.92
1388	310387.0	5966796.5	9.6	49202.34	49186.39	15.95
1389	309997.0	5964381.5	9.6	49171.58	49155.57	16.01
1390	312494.5	5965382.0	7.5	49201.55	49185.42	16.13
1391	310475.5	5964288.5	4.7	49210.48	49194.21	16.27
1392	312211.0	5962533.5	5.4	49198.13	49181.82	16.31
1393	312542.5	5964057.5	2.1	49197.86	49181.52	16.34
1394	309575.5	5966798.0	3.4	49189.21	49172.86	16.35
1395	310304.5	5967062.0	7.5	49202.95	49186.50	16.45
1396	309874.0	5964087.5	13.8	49195.29	49178.84	16.45

1397	311299.0	5966888.0	17.5	49186.16	49169.70	16.46
1398	314549.5	5966735.0	3.4	49201.87	49185.38	16.49
1399	312647.5	5962389.5	2.1	49206.21	49189.70	16.51
1400	310058.5	5965641.5	19.6	49206.66	49190.11	16.55
1401	313451.5	5963223.5	6.4	49191.73	49175.18	16.55
1402	312578.5	5962485.5	2.1	49205.58	49189.02	16.56
1403	310594.0	5963099.0	4.2	49206.08	49189.45	16.63
1404	309997.0	5967257.0	6.7	49200.18	49183.50	16.68
1405	310055.5	5964209.0	15.1	49194.01	49177.20	16.81
1406	311552.5	5962994.0	3.4	49203.97	49187.11	16.86
1407	310289.5	5964392.0	3.4	49199.08	49182.20	16.88
1408	313684.0	5966394.5	8.1	49202.75	49185.87	16.88
1409	312164.5	5968454.0	3.4	49201.97	49185.07	16.90
1410	315461.5	5964240.5	12.9	49213.76	49196.79	16.97
1411	309473.5	5967110.0	3.4	49192.41	49175.40	17.01
1412	311243.5	5967828.5	4.7	49191.64	49174.61	17.03
1413	310469.5	5964491.0	16.0	49194.89	49177.70	17.19
1414	311464.0	5967756.5	9.6	49203.45	49186.25	17.20
1415	314413.0	5967758.0	17.5	49199.00	49181.77	17.23
1416	310043.5	5966751.5	15.4	49198.41	49181.15	17.26
1417	311977.0	5965431.5	19.7	49192.80	49175.53	17.27
1418	315208.0	5963936.0	6.7	49203.50	49186.21	17.29
1419	310202.5	5965695.5	4.7	49199.74	49182.32	17.42
1420	309809.5	5964129.5	4.7	49186.70	49169.27	17.43
1421	310312.0	5964360.5	14.8	49201.79	49184.34	17.45
1422	311908.0	5964626.0	6.7	49192.84	49175.34	17.50
1423	310628.5	5966144.0	10.1	49197.59	49180.00	17.59
1424	312299.5	5962481.0	7.5	49202.90	49185.30	17.60
1425	309647.5	5967512.0	14.2	49202.44	49184.83	17.61
1426	312676.0	5969190.5	4.5	49211.06	49193.42	17.64
1427	313640.5	5965653.5	11.4	49195.98	49178.34	17.64
1428	311039.5	5963229.5	4.7	49209.20	49191.52	17.68
1429	309967.0	5964426.5	18.1	49181.06	49163.34	17.72
1430	313511.5	5965178.0	11.7	49188.92	49171.16	17.76
1431	312374.5	5963910.5	6.4	49202.42	49184.66	17.76
1432	309247.0	5965161.5	10.5	49190.14	49172.35	17.79
1433	315437.5	5964981.5	2.1	49207.57	49189.77	17.80
1434	310019.5	5964188.0	12.1	49194.87	49177.08	17.79
1435	311363.5	5966399.0	16.8	49191.25	49173.41	17.84
1436	312131.5	5967819.5	2.1	49204.07	49186.14	17.93
1437	308536.0	5963826.5	7.5	49195.78	49177.77	18.01
1438	313477.0	5963181.5	8.1	49191.77	49173.74	18.03
1439	309784.0	5964953.0	12.7	49199.58	49181.48	18.10
1440	312160.0	5962599.5	9.6	49202.45	49184.32	18.13
1441	310903.0	5962620.5	1.5	49208.46	49190.12	18.34

1442	310835.5	5963013.5	19.1	49205.68	49187.29	18.39
1443	311923.0	5967447.5	9.6	49203.20	49184.67	18.53
1444	313237.0	5966402.0	10.8	49189.84	49171.28	18.56
1445	312181.0	5966820.5	5.4	49192.95	49174.37	18.58
1446	308675.5	5966028.5	19.6	49190.09	49171.48	18.61
1447	313510.0	5963118.5	4.5	49189.78	49171.15	18.63
1448	313135.0	5965752.5	12.1	49182.75	49164.11	18.64
1449	310913.5	5964072.5	2.1	49184.07	49165.42	18.65
1450	313999.0	5968137.5	9.6	49197.03	49178.32	18.71
1451	311264.5	5966543.0	10.1	49190.54	49171.83	18.71
1452	310310.5	5964383.0	16.8	49198.77	49180.02	18.75
1453	312914.5	5966622.5	8.8	49206.84	49188.08	18.76
1454	310307.5	5964375.5	16.6	49199.21	49180.45	18.76
1455	309845.5	5964072.5	7.7	49192.56	49173.74	18.82
1456	313285.0	5966873.0	19.2	49206.29	49187.46	18.83
1457	314681.5	5964497.0	10.1	49200.38	49181.37	19.01
1458	308738.5	5966124.5	14.9	49205.50	49186.48	19.02
1459	310280.5	5964366.5	7.7	49197.92	49178.88	19.04
1460	313214.5	5967399.5	4.7	49208.49	49189.42	19.07
1461	310240.0	5967569.0	10.8	49198.67	49179.50	19.17
1462	311459.5	5965977.5	2.1	49201.54	49182.28	19.26
1463	309871.0	5964041.0	17.5	49190.53	49171.23	19.30
1464	310664.5	5965707.5	4.7	49201.39	49181.89	19.50
1465	311029.0	5964861.5	9.6	49198.09	49178.54	19.55
1466	313963.0	5964750.5	12.1	49199.09	49179.46	19.63
1467	308606.5	5966412.5	6.4	49192.71	49172.91	19.80
1468	314513.5	5967351.5	8.8	49193.30	49173.46	19.84
1469	310366.0	5963885.0	15.0	49205.19	49185.34	19.85
1470	313582.0	5965493.0	13.4	49197.75	49177.89	19.86
1471	311308.0	5968271.0	6.7	49205.70	49185.83	19.87
1472	309460.0	5965106.0	13.4	49210.52	49190.65	19.87
1473	310447.0	5964417.5	13.8	49197.64	49177.75	19.89
1474	309799.0	5964131.0	12.7	49189.37	49169.47	19.90
1475	310297.0	5964381.5	4.5	49199.22	49179.27	19.95
1476	314318.5	5964482.0	3.4	49203.11	49183.09	20.02
1477	310996.0	5963244.5	5.4	49201.64	49181.55	20.09
1478	312247.0	5966838.5	5.4	49201.86	49181.68	20.18
1479	313438.0	5967599.0	6.7	49203.64	49183.37	20.27
1480	312982.0	5966660.0	6.7	49210.16	49189.48	20.68
1481	314227.0	5964764.0	6.7	49205.81	49185.11	20.70
1482	313621.0	5964860.0	10.8	49202.79	49181.75	21.04
1483	312026.5	5962575.5	8.8	49208.55	49187.50	21.05
1484	312467.5	5969634.5	4.7	49194.19	49173.13	21.06
1485	310114.0	5964200.0	19.0	49189.73	49168.64	21.09
1486	310925.5	5964887.0	3.4	49195.38	49174.27	21.11

1487	311168.5	5966583.5	4.7	49195.54	49174.39	21.15
1488	313804.0	5964737.0	6.7	49186.99	49165.77	21.22
1489	311779.0	5962386.5	12.1	49197.97	49176.68	21.29
1490	309658.0	5967494.0	10.8	49203.57	49182.26	21.31
1491	313604.5	5964885.5	6.4	49202.61	49181.27	21.34
1492	309848.5	5964083.0	18.1	49195.16	49173.69	21.47
1493	312716.5	5967866.0	7.5	49206.89	49185.38	21.51
1494	310261.0	5965751.0	4.2	49206.24	49184.66	21.58
1495	309977.5	5964108.5	17.1	49204.14	49182.41	21.73
1496	310022.5	5964200.0	13.8	49195.26	49173.39	21.87
1497	312383.5	5969103.5	19.6	49202.09	49180.22	21.87
1498	309982.0	5964401.0	3.0	49174.90	49152.96	21.94
1499	312052.0	5965626.5	16.2	49202.54	49180.54	22.00
1500	311815.0	5967497.0	10.8	49224.29	49202.29	22.00
1501	312158.5	5968593.5	4.7	49205.48	49183.38	22.10
1502	314689.0	5965988.0	4.2	49198.59	49176.44	22.15
1503	313789.0	5963948.0	4.2	49198.48	49176.19	22.29
1504	310313.5	5964149.0	7.5	49203.41	49181.04	22.37
1505	315125.5	5963948.0	10.1	49206.42	49184.03	22.39
1506	314584.0	5966153.0	10.8	49202.86	49180.46	22.40
1507	313714.0	5967725.0	15.0	49217.77	49195.23	22.54
1508	315698.5	5965545.5	2.1	49196.22	49173.65	22.57
1509	310325.5	5966892.5	19.6	49205.23	49182.65	22.58
1510	311570.5	5966645.0	3.4	49213.85	49191.24	22.61
1511	310273.0	5964206.0	19.2	49209.18	49186.55	22.63
1512	313600.0	5967908.0	17.5	49210.55	49187.82	22.73
1513	312487.0	5963993.0	4.2	49194.19	49171.27	22.92
1514	313006.0	5967708.5	16.2	49201.41	49178.36	23.05
1515	312917.5	5967983.0	5.4	49214.94	49191.79	23.15
1516	311471.5	5963232.5	2.1	49190.01	49166.80	23.21
1517	312526.0	5966924.0	6.7	49204.41	49181.05	23.36
1518	313678.0	5962874.0	3.0	49196.95	49173.53	23.42
1519	309094.0	5965400.0	12.0	49191.50	49168.03	23.47
1520	312832.0	5963876.0	4.2	49198.81	49175.15	23.66
1521	313625.5	5965818.5	8.8	49195.17	49171.37	23.80
1522	315778.0	5965428.5	18.8	49186.18	49162.36	23.82
1523	314240.5	5965830.5	12.9	49196.65	49172.73	23.92
1524	311035.0	5964884.0	10.8	49206.13	49182.18	23.95
1525	311417.5	5964137.0	3.4	49204.64	49180.68	23.96
1526	311318.5	5963352.5	17.1	49207.08	49182.66	24.42
1527	312302.5	5966868.5	4.7	49207.13	49182.59	24.54
1528	308651.5	5966064.5	19.6	49192.05	49167.37	24.68
1529	315503.5	5964174.5	2.1	49219.74	49194.90	24.84
1530	310346.5	5967669.5	2.1	49202.42	49177.57	24.85
1531	310093.0	5968064.0	6.0	49212.48	49187.41	25.07

1532	314653.0	5964546.5	5.4	49194.29	49169.16	25.13
1533	312772.0	5963978.0	3.0	49197.20	49172.06	25.14
1534	309916.0	5967236.0	8.5	49217.24	49191.53	25.71
1535	310108.0	5966124.5	5.4	49184.92	49159.16	25.76
1536	309718.0	5964992.0	15.0	49203.90	49177.96	25.94
1537	311888.5	5962454.0	16.2	49211.38	49185.21	26.17
1538	315587.5	5964752.0	3.4	49218.82	49192.35	26.47
1539	313124.5	5967674.0	14.2	49189.07	49162.57	26.50
1540	308719.0	5966778.5	1.5	49200.44	49173.87	26.57
1541	312148.0	5964927.5	13.8	49218.55	49191.92	26.63
1542	309551.5	5967492.5	2.1	49203.46	49176.78	26.68
1543	313847.5	5966870.0	14.2	49211.49	49184.77	26.72
1544	312296.5	5965370.0	6.2	49189.72	49163.00	26.72
1545	311227.0	5964921.5	7.5	49208.35	49181.58	26.77
1546	311348.5	5963684.0	18.3	49220.66	49193.89	26.77
1547	314236.0	5963276.0	3.0	49202.20	49175.23	26.97
1548	309953.5	5964149.0	9.6	49201.81	49174.71	27.10
1549	303172.0	5962871.0	6.0	49182.69	49155.35	27.34
1550	310582.0	5965673.0	10.8	49208.69	49181.00	27.69
1551	311764.0	5962610.0	4.2	49214.17	49186.34	27.83
1552	311546.5	5963937.5	12.9	49201.53	49173.48	28.05
1553	310298.5	5963922.5	4.7	49184.75	49156.38	28.37
1554	314032.0	5966693.0	10.8	49205.14	49176.71	28.43
1555	312209.5	5963610.5	4.7	49197.09	49168.48	28.61
1556	309049.0	5966811.5	4.5	49212.00	49183.28	28.72
1557	309622.0	5966133.5	5.4	49210.38	49181.41	28.97
1558	313091.5	5966922.5	12.9	49216.13	49187.13	29.00
1559	313028.5	5962913.0	11.7	49221.20	49192.02	29.18
1560	312847.0	5966598.5	5.4	49200.22	49171.02	29.20
1561	313871.5	5964747.5	6.4	49208.96	49179.72	29.24
1562	311246.5	5966297.0	14.2	49206.59	49176.75	29.84
1563	313496.5	5965742.0	11.7	49220.77	49190.77	30.00
1564	310532.5	5964852.5	12.9	49206.47	49176.46	30.01
1565	309553.0	5964971.0	9.0	49209.21	49179.16	30.05
1566	314743.0	5965214.0	8.5	49187.85	49157.56	30.29
1567	310130.5	5966097.5	17.1	49208.95	49178.44	30.51
1568	312163.0	5965548.5	13.8	49202.43	49171.75	30.68
1569	311449.0	5966969.0	17.5	49193.72	49162.92	30.80
1570	312736.0	5968257.5	11.7	49209.26	49178.45	30.81
1571	312403.0	5963312.0	4.2	49215.14	49184.14	31.00
1572	309119.5	5965359.5	13.6	49201.13	49169.80	31.33
1573	311050.0	5964134.0	4.2	49213.47	49182.11	31.36
1574	312356.5	5964345.5	2.1	49199.82	49168.38	31.44
1575	313514.5	5966270.0	7.5	49207.67	49176.14	31.53
1576	313154.5	5966397.5	15.4	49218.85	49187.28	31.57

1577	311797.0	5962551.5	14.8	49228.49	49196.12	32.37
1578	310981.0	5963267.0	4.2	49204.38	49170.95	33.43
1579	314483.5	5967131.0	3.4	49213.49	49179.43	34.06
1580	313222.0	5968644.5	5.4	49212.18	49178.04	34.14
1581	310025.5	5965065.5	4.7	49207.97	49173.54	34.43
1582	310517.5	5964525.5	8.8	49203.04	49168.59	34.45
1583	310124.5	5965469.0	18.3	49188.49	49153.90	34.59
1584	311537.5	5965856.0	3.4	49212.88	49177.85	35.03
1585	315991.0	5964423.5	12.1	49190.46	49155.38	35.08
1586	310126.0	5965704.5	18.8	49211.36	49175.67	35.69
1587	310573.0	5964858.5	5.4	49215.33	49179.33	36.00
1588	310274.5	5964291.5	4.7	49218.47	49182.20	36.27
1589	310522.0	5964516.5	5.4	49197.95	49161.63	36.32
1590	315461.5	5966166.5	6.4	49188.23	49151.80	36.43
1591	309229.0	5963951.0	17.5	49211.19	49174.45	36.74
1592	311000.5	5964135.5	8.8	49213.84	49176.79	37.05
1593	309989.5	5964395.0	3.4	49174.27	49137.03	37.24
1594	313424.5	5966276.0	15.7	49217.68	49180.02	37.66
1595	311485.0	5965805.0	8.5	49197.75	49159.68	38.07
1596	310997.5	5964209.0	14.2	49226.35	49187.20	39.15
1597	314312.5	5964767.0	3.4	49210.68	49171.20	39.48
1598	310415.5	5965788.5	11.4	49218.56	49178.71	39.85
1599	309577.0	5964938.0	6.7	49213.11	49172.86	40.25
1600	312197.5	5962947.5	2.1	49216.19	49175.39	40.80
1601	313624.0	5966357.0	3.0	49222.43	49181.05	41.38
1602	312217.0	5963873.0	17.5	49223.95	49182.16	41.79
1603	309865.0	5964486.5	14.8	49222.09	49178.69	43.40
1604	309131.5	5967053.0	7.5	49225.85	49181.84	44.01
1605	313540.0	5968964.0	4.2	49210.23	49165.81	44.42
1606	312067.0	5968610.0	6.7	49225.98	49181.22	44.76
1607	310471.0	5966969.0	6.7	49192.03	49147.21	44.82
1608	315667.0	5964758.0	3.0	49231.68	49185.20	46.48
1609	309226.0	5965194.5	5.4	49212.54	49161.50	51.04
1610	312893.5	5968158.5	6.4	49250.25	49198.70	51.55
1611	312323.5	5965326.5	4.7	49182.38	49130.19	52.19
1612	310342.0	5965778.0	8.5	49215.05	49162.29	52.76
1613	310459.0	5966990.0	10.8	49233.97	49179.86	54.11
1614	309059.5	5965443.5	7.7	49220.10	49163.74	56.36
1615	313996.0	5966877.5	5.4	49237.98	49180.15	57.83
1616	313498.0	5968898.0	6.7	49240.50	49179.64	60.86
1617	314096.5	5965629.5	4.7	49231.93	49170.13	61.80
1618	314543.5	5966340.5	2.1	49234.20	49168.57	65.63
1619	309953.5	5964159.5	2.1	49209.94	49121.71	88.23
1620	311384.5	5966363.0	3.4	49224.63	49125.52	99.11
1621	311477.5	5965818.5	2.1	49210.47	49104.13	106.34

1622	314135.5	5964764.0	3.4	49275.36	49153.00	122.36
1623	311806.0	5968752.5	5.4	49319.92	49169.42	150.50
1624	313442.5	5965959.5	2.1	49378.09	49032.30	345.79
1625	310079.5	5965433.0	3.4	49402.06	48834.60	567.46
1628	305317.0	5963229.5	4.5	51283.54	40350.71	10.83
1629	312967.0	5968317.5	12.1	60317.31	43602.15	135.99

8.4 Appendix IV Ship Losses in the Area

MAL ID	Source	Source ID	Name	Description	WGS 84 UTM 31N: Easting	WGS 84 UTM 31N: Northing	Period	Potential for Wreck present in SA	Present/Likely Condition
MAL-200	NRHE	1361444	*Valiant*	Having sailed from the Tyne on 16.10. encountered a severe gale with wind conditions NW force 10. which caused her to be struck by a heavy sea. so that she lost her boats and bulwarks. and then filled before foundering. There was only one survivor.' Larn & Larn Vol 3	304742	5957582	Post Medieval	Low Potential	Foundered- probably broken up
MAL-201	NRHE	1304994	*Bellona*	1830 wreck of British craft which stranded near Tunstall during a gale. en route from London to Sunderland; a wooden sailing vessel.	304742	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up
MAL-202	NRHE	983825	*Hope*	1808 wreck of English brig which foundered after a collision 15 miles south of Flamborough Head while carrying coal; a wooden sailing vessel.	304742	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up- and located completely south of the area
MAL-203	NRHE	1340710	*Amicus*	1807 wreck of English cargo vessel which stranded 0.5 mile south of "Sister Churches" (Withernsea and Owthorne churches). En route from St. Petersburg to Kingston-upon-Hull with hemp. flax. tallow and passengers. she was a wooden sailing vessel.	304743	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up especially being so close to the shore.
MAL-204	NRHE	1363915	*Doctor Von Thunen Yellow*	Stranded whilst en route to Grimsby carrying timber.	304743	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up especially being so close to the shore.

MAL-205	NRHE	983842	*Anne*	Vessel foundered and lost in wind conditions W force 8. The two passengers were the master's wife and child. both of whom were saved. (1)(2)	313450	5968729	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.
MAL-206	NRHE	1368751	*Flora*	An English dandy. stranded at Withernsea in 1879. She was a wood built sailing vessel.	304743	5957582	Post Medieval	Low Potential	Would've been broken up onshore
MAL-207	NRHE	1303453	*Acklam*	Iron Steam vessel sunk off Flamborough Head after collision with the *Emerald* of Dundee	313450	5968729	Post Medieval	Low Potential	Not likely- sank off Flamborough
MAL-208	NRHE	983827	*Capital*	Vessel stranded and lost in wind conditions SE force 11	304743	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.
MAL-209	NRHE	1372559	*Mignonette*	1900 wreck of English cargo vessel which stranded near Withernsea. This wooden steam vessel. built 1889. was en route from Middlesbrough to Kings Lynn with salt.	304743	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.
MAL-210	NRHE	1303616	*Jennie Buller*	This motor fishing vessel was stopped by a German submarine. her crew forced to abandon ship. after which she was sunk by explosive scuttling charges placed below deck.	313450	5968729	WWI	Low Potential	Scuttled wooden vessel- would've broken up off Humber
MAL-211	NRHE	983836	*Eagle*	Vessel foundered and lost in wind conditions S force 9.	313450	5968729	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.
MAL-212	NRHE	1403289	*Alexander*	1816 wreck of English cargo vessel which foundered. probably off the coast of Humberside. on her passage to Burnham with coal; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.

MAL-213	NRHE	978229	*Homer*	This steamship foundered after collision with the Russian barque HOPPET. in wind conditions W force 6. The HOPPET was bound for the USA in ballast and although a search was carried out in the dark no trace of survivors was found. The wreck lies in 26m. with her boilers and engine the highest point of the wreck standing up 4m. The wreck is orientated NE/SW with her bow to the south.	313450	5968729	Post Medieval	Medium Potential	Possible wreck or iron debris still in the area- mag survey would confirm.
MAL-214	NRHE	1403574	*Prince Regent*	1818 wreck of British craft which foundered en route from Sunderland to Woodbridge; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly. Also not clear on location
MAL-215	NRHE	1303946	*Merchiston*	Vessel foundered and lost in wind conditions NE force 3 following collision with the SS EDA of London.	313450	5968729	Post Medieval	Low Potential	Possible wreck or steel debris still in the area- however. foundering location off Spurn Head.
MAL-216	NRHE	1368678	*Marthas*	`Vessel stranded and lost in wind conditions NE force 9.'	304743	5957582	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly nr Dimlington
MAL-217	NRHE	1343448	*Flora*	1814 wreck of English cargo vessel which foundered off the Holderness coast during a gale. Laden with coal. she was a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Not likely because of wooden mat- would've broken up quickly.
MAL-218	NRHE	983851	*Victor*	UK shipwreck index includes collision as cause of sinking.	313450	5968729	Post Medieval	Low Potential	sank 13miles off Spurn Head- so little chance of broken up material being transported northwards to study area

MAL-219	NRHE	1357023	*Union*	Hull. 2nd Nov. The UNION. Robertson. from Cardiff to Leith. foundered 29th ult. Crew saved by the ALFRED. Brass. arrived here from Davis' Straits.	313450	5968729	Post Medieval	Low Potential	Sank outside the mouth of the Humber- small chance of wood debris although tidal action would prob prevent it
MAL-220	NRHE	1370371	*Orient*	Stranded at Withernsea in 1885 in wind conditions east force 8. She departed from Grimsby on a fishing and return trip. The wooden sailing vessel was built in 1848.	304743	5957582	Post Medieval	Medium Potential	Stranded at Withernsea- although prob broken up
MAL-221	NRHE	1368588	*Violet*	Vessel stranded and lost in wind conditions SSE force 5	304743	5957582	Post Medieval	Low Potential	Sank off Holmpton Gap- unlikely would've dispersed so widely
MAL-222	NRHE	984133	*Vesta*	Foundered off River Humber	313450	5968729	Post Medieval	Low Potential	Foundered off R Humber- poss around the mouth means out of search area
MAL-223	NRHE	1375536	*Hope*	1808 wreck of English brig which foundered after a collision 15 miles south of Flamborough Head while carrying coal; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Collision- 15miles off Flamborough- out of area
MAL-224	NRHE	1370402	*Emelie*	A Swedish brig which stranded 2 miles south of Withernsea pier in 1885 in wind conditions east south east force 6. She departed from Kotka for Grimsby with a cargo of wood. The wooden sailing vessel was built in 1839.	304743	5957582	Post Medieval	Medium Potential	Stranded 2 miles South of Withernsea means close to shore. so probably salvaged/broken up- poss debris though
MAL-225	NRHE	1353859	*HMS Speedy*	An ALARM class torpedo gunboat. no casualties. 124 survived. The Germans had laid extensive minefields off the Tyne and the Humber. and it was while sweeping off the Humber that SPEEDY was mined and sunk.	313450	5968729	WWI	Low Potential	Sank out of the area. Debris has been picked up 25miles e of Humber.

MAL-226	NRHE	1402769	*Heinkel HE111H-5 (3987) 5J+ZB*	1941 wreck of a German Heinkel He111 shot down and crashed on Withernsea beach. It was part of Stab I/KG4.	304743	5957582	WWII	Low Potential	Crashed on beach and was probably salvaged and/or disposed of out of the area
MAL-227	NRHE	1372656	*Emily*	1903 wreck of English brigantine which stranded 15 miles south east of Flamborough Head following collision. This wooden sailing vessel. built 1851. was en route from Queensborough to Newcastle upon Tyne with burnt ore.	313450	5968729	Post Medieval	Low Potential	Collided -off Flamborough- out of area-unlikely debris would travel intact
MAL-228	NRHE	1368785	*Georgina*	An English brig which was stranded near Withernsea in 1880 in wind conditions ENE force 10. She had departed from London for Newcastle upon Tyne in ballast. The wooden sailing vessel was built in Brockweir in 1841.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea- possiblility of wooden wreck material- prob quite broken up though.
MAL-229	NRHE	1303841	*Peebles*	A heavy explosion took place on the port quarter at 5.40pm. and the propeller and rudder were blown away. as she was torpedoed by the German submarine UB18. Abandoned 3 hours later.	313450	5968729	WWI	Low Potential	North out of area
MAL-230	NRHE	1363311	*Maria*	Vessel stranded and lost in wind conditions NNW force 9. Holmpton Beach	304743	5957582	Post Medieval	Low Potential	Stranded south of study area near Withernsea beach- prob broken up though.
MAL-231	NRHE	1319873	*Polly*	The POLLY. Wright. from Stockholm for Leith. is lost near Witheransea	304743	5957582	Post Medieval	Medium Potential	Nr Withernsea- no other location info? Prob further offshore now though as coast has eroded so much since then?

MAL-232	NRHE	983837	*Gipsey*	Vessel stranded and lost in wind conditions N force 10.	304743	5957582	Post Medieval	Medium Potential	Nr Withernsea- no other location info? Prob further offshore now though as coast has eroded so much since then?
MAL-233	NRHE	984109	*Cobden*	Foundered off River Humber	313450	5968729	Post Medieval	Low Potential	Out of Area- off River Humber
MAL-234	NRHE	1352064	*Diana*	1824 wreck of British craft which foundered 16 miles east of the Humber. possibly during a storm. En route from Southwold to Shields. she was a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Too far offshore- small poss of any mat transported within area
MAL-235	NRHE	1352028	*Delight*	1824 wreck of cargo vessel which stranded near Waxholme during a gale. En route from Archangel to London. she was a wooden sailing vessel.	304743	5957582	Post Medieval	Medium Potential	Within SA area but v. dynamic part of the coast- poss waves broken up if not salvaged. Poss position is much farther offshore now anyway due to erosion.
MAL-236	NRHE	910750	Beacons	Sites of beacons. recorded in 1588.	303687	5959241			
MAL-237	NRHE	498393	Withernsea Station	Site of railway station on the Hull and Holderness Railway opened in 1854 and closed in 1965.	304234	5957422			
MAL-238	NRHE	1368706	*Snapper*	Stranded and lost in wind conditions SE force 5.	304743	5957582	Post Medieval	Medium Potential	Position would put in area- though unlikely still intact
MAL-239	NRHE	1359284	*Ann*	Lost on the beach in wind conditions NE force 5. where she had been laid in order to take in ballast. the gale bringing on a very heavy sea. Estimated loss on the vessel was 60 pounds.	304743	5957582	Post Medieval	Medium Potential	Grounded on beach at Sand-le-Mere. any remains would by now have been eroded?

MAL-240	NRHE	1376692	*John*	1797 wreck of British craft which was scuttled by a privateer while en route from Great Yarmouth to Newcastle-upon-Tyne; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	No known position- just mid-point between two locations- would've been further offshore.
MAL-241	NRHE	1368877	*Tiber*	An English brig which stranded near Withernsea in 1880 in wind conditions ENE force 10. She departed from London for Shields in ballast. The wooden sailing vessel was built in Sunderland in 1857.	304743	5957582	Post Medieval	Medium Potential	stranded near Withernsea-although poss in area- unlikely intact
MAL-242	NRHE	983856	*Triune*	Vessel stranded and lost in wind conditions W x N force 9. 1.4miles south of Withernsea.	304743	5957582	Post Medieval	Medium Potential	stranded near Withernsea-although poss in area- unlikely intact
MAL-243	NRHE	1368902	*Shamrock*	An English dandy which stranded at Withernsea in 1881 in wind conditions south force 9. She departed from Grimsby on a fishing and return trip. The wooden sailing vessel was built in 1867.	304743	5957582	Post Medieval	Medium Potential	Stranded at Withernsea - would've been eroded by now though
MAL-244	NRHE	1368842	*Topsey*	An English brig which stranded on Withernsea beach in 1880 in wind conditions ENE force 9. She departed from Newhaven to Sunderland in ballast. The wooden sailing vessel was built in Rye in 1861.	304743	5957582	Post Medieval	Low Potential	Stranded on Withernsea beach- would've been eroded by now though
MAL-245	NRHE	1304761	*Neptune*	`The NEPTUNE. Smith. of Buckie. laden with herrings. was driven on shore near Tunstall on the Holderness coast. on Thursday. Crew saved by Capt. Manby's apparatus; cargo landed; it is expected the vessel will be got off.'	304743	5957582	Post Medieval	Medium Potential	Although grounded on Tunstall beach- if left and not 'got off' then would've been broken up and any remaining material would've eroded from beach by now.

MAL-246	NRHE	1371471	*Haabet*	1894 wreck of Norwegian barque which stranded 3.5 miles south of Withernsea. This wooden sailing vessel. built 1866. was en route from Halden to King's Lynn with timber.	304743	5957582	Post Medieval	Low Potential	Out of Area- South of Withernsea
MAL-247	NRHE	984145	*Victoria*	Foundered off River Humber	313450	5968729	Post Medieval	Low Potential	Out of Area- off River Humber
MAL-248	NRHE	983862	Unknown	Vessel foundered offshore following collision in wind conditions SSW force 6.	313450	5968729	Post Medieval	Low Potential	Off Spurn Point- too far offshore
MAL-249	NRHE	1363531	*Wanderer*	Too close to Withernsea 1/2 mile. and stranded	304743	5957582	Post Medieval	Medium Potential	Foundered at Withernsea- mostly broken up and possibly also eroded by now.
MAL-250	NRHE	1359279	*Adam Clark*	Was abandoned near Holmpton. in wind conditions NE force 7. in a sinking state following a collision with the BLANCH off Flamborough Head. Crew saved. Estimated loss on the vessel not known. but she was insured at Ipswitch for 600 pounds.	304743	5957582	Post Medieval	Low Potential	Off Holmpton/Patrington- too far offshore
MAL-251	NRHE	978190	*Fawn*	Vessel foundered and lost whilst fishing. in wind conditions ESE force 2. following collision with the SS MEDWAY. of London	313450	5968729	Post Medieval	Low Potential	Off Flmaborough- too far offshore
MAL-252	NRHE	984028	*Buckingham*	Stranded 2 miles north of Tunstall at Garton	304743	5957582	Post Medieval	Low Potential	North of area
MAL-253	NRHE	984128	*Crusader*	Foundered offshore River Humber	313450	5968729	Post Medieval	Low Potential	Out of Area- off River Humber
MAL-254	NRHE	1370562	*Alpha*	1889 wreck of English trawler which collided with another vessel and foundered 15 miles east north east of Spurn Head on a fishing and return trip out of North Shields. The iron steam vessel was built in 1885.	313450	5968729	Post Medieval	Low Potential	Too far offshore- small poss of any mat transported within area

MAL-255	NRHE	1340522		`The LADY CHARLOTTE...and two other brigs are on shore near Grimsby. A brig sunk going up the Humber...and a sloop. with corn. foundered on the coast	313450	5968729	Post Medieval	Medium Potential	Unknown location-coast Humber?
MAL-256	NRHE	1350973	*Fairy Dell*	Vessel foundered and lost in wind conditions E force 12. 12 miles east of the River Humber	313450	5968729	Post Medieval	None	Out of area
MAL-257	NRHE	1369200	*Jumbo*	An English dandy which stranded 1.5 miles south of Withernsea Pier in 1883 in wind conditions NNE force 6. She departed from Great Yarmouth on a fishing and return trip. The wooden fishing vessel was built in 1866.	304743	5957582	Post Medieval	Low Potential	Stranded on Withernsea beach. either broken up and salvaged or- would've been eroded by now
MAL-258	NRHE	1359111	*Victoria*	Vessel foundered and lost after springing a leak in wind conditions West force 6 and clear. going down at 5 a.m. Estimated loss on the vessel was 500 pounds. for which she was fully insured. Withernsea	304743	5957582	Post Medieval	Medium Potential	Sank off Withernsea-although either naturally broken up/ purposefully/ or eroded
MAL-259	NRHE	1305015	*Frau Metta*	1830 wreck of German cargo vessel which capsized and stranded near Withernsea. en route from Carolinensiel to Kingston-upon-Hull. Laden with rape seed. she was a wooden sailing vessel.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?
MAL-260	NRHE	1373795	*My Pretty Love*	1907 wreck of English dandy which stranded near Tunstall. This wooden sailing vessel. built 1886. departed from Grimsby on a fishing and return trip.	304743	5957582	Post Medieval	Medium Potential	Stranded near Tunstall-although either naturally broken up/ purposefully/ or eroded by now?
MAL-261	NRHE	978612	*Cynthia*	This Grimsby-registered steam fishing trawler No.ST133. was sunk by gunfire from a German submarine. Crew saved.	313450	5968729	WWI	Low Potential	Out of area

MAL-262	NRHE	1368705	*Excelsior*	Stranded and lost in wind conditions SE force 5. Withernsea Beach	304743	5957582	Post Medieval	Low Potential	Stranded on Withernsea beach. either broken up and salvaged or- would've been eroded by now
MAL-263	NRHE	1357599	*Blenheim MK IV V6255*	[Bristol Blenheim Mk. IV light bomber and long range fighter; 1 of a batch of 800 delivered between October 1940 and May 1941 to Contract No. 1485/39] Crashed in sea 2 miles East of Withernsea. Yorkshire. 7.8.1942. cause not known.	304743	5957582	WWII	Medium Potential	Crashed 2 miles east of Withernsea
MAL-264	NRHE	1359326		Foundered Tunstall beach	304743	5957582	Post Medieval	Medium Potential	Foundered Tunstall beach. either broken up and salvaged or- would've been eroded by now
MAL-265	NRHE	1340788	*Munificence*	`Hull. 9th. The AMICUS...and the MUNIFICENCE. -. from the Baltic. are lost...The crew of the latter drowned.'	313450	5968729	Post Medieval	Medium Potential	Location not known
MAL-266	NRHE	1337296	*Yarm*	`Bridlington. 5th Jan. The YARM. Sheriff. hence to London. foundered last night a few hours after leaving port. having been in contact with the TRAVELLER. Billing. from Lynn; crew saved.'	313450	5968729	Post Medieval	Low Potential	Out of area
MAL-267	NRHE	1351769	*Whitley MK V T4172*	British Heavy Bomber. [Armstrong Whitworth Whitley Mk V standard night bomber; 1 of a batch of 150 delivered between August and December 1940 to Contract No. 38599/39]. Ditched 4 miles South of Hornsea. Yorks.. 15.11.1940 on return from Berlin. (1)	313450	5968729	WWII	Low Potential	Out of area

MAL-268	NRHE	1315899	*William and Sarah*	1828 wreck of English sloop which stranded at Tunstall during a gale. while on her passage to King's Lynn with coal; a wooden sailing vessel.	304743	5957582	Post Medieval	Medium Potential	Foundered on Tunstall Beach. either broken up and salvaged or-would've been eroded by now
MAL-269	NRHE	1303887	*Rossini*	Vessel foundered and lost in wind conditions SE force 4. 18 miles east of Spurn Head.	313450	5968729	Post Medieval	Low Potential	Out of Area
MAL-270	NRHE	1397060	*Britannia*	1805 wreck of British brig which foundered 4 leagues from Spurn Head. after a collision on her passage from Newcastle-upon-Tyne; presumably with coal. as this wooden sailing vessel was described as a collier.	313450	5968729	Post Medieval	Low Potential	Out of Area
MAL-271	NRHE	978611	*Briton*	This Grimsby-registered steam fishing trawler was sunk by gunfire from a German submarine whilst out fishing. Crew saved.	313450	5968729	WWI	Low Potential	Northeast of area
MAL-272	NRHE	1370572	*Genesta*	An English dandy which stranded between Withernsea and Dimlington in 1890 in wind conditions north east force 6. She departed from Grimsby on a fishing and return trip. The wooden sailing vessel was built in 1885.	304743	5957582	Post Medieval	Low Potential	Southeast of area
MAL-273	NRHE	1387706	*Ann and Mary*	1780 wreck of English brigantine which foundered 4 leagues off Dimlington following a collision; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Southeast of area
MAL-274	NRHE	984030	*Aquarius*	Vessel on fishing and return trip. stranded and lost in fog with calm conditions. Near Dimlington	304743	5957582	20th Century	Low Potential	Out of Area
MAL-275	NRHE	978218	*Bessie Whineray*	Foundered 15miles east of Spurn Head Light	313450	5968729	Post Medieval	Low Potential	Out of Area

MAL-276	NRHE	1368875	*Una*	An English brigantine which stranded at Tunstall in 1880 in wind conditions NNE force 10. She departed from Dunkirk for Sunderland in ballast. The wooden sailing vessel was built in 1844.	304743	5957582	Post Medieval	Medium Potential	Foundered Tunstall. some debris possible although either broken up and salvaged or- would've been eroded by now
MAL-277	NRHE	1319343	*Fleur*	The FLEUR privateer from Dunkirk. of 2 guns. 29 men and 2 boys. was taken off Hull by the SWAN sloop of war. who. finding her very leaky. took out the crew and then sunk her.	313450	5968729	Post Medieval	Low Potential	Taken off Hull
MAL-278	NRHE	1372569	*Helen*	1900 wreck of British yacht which stranded near Hilston. This wooden steam vessel. built 1895. was en route from Bridlington to Goole.	304743	5957582	Post Medieval	Low Potential	Out of Area
MAL-279	NRHE	1392285	*Welsh Oak*	1794 wreck of English passenger vessel which foundered between Newcastle-upon-Tyne and Gainsborough during a gale; a wooden sailing vessel.	313450	5968729	Post Medieval	Medium Potential	Location not known
MAL-280	NRHE	1369046	*Ottercaps*	An English barque which stranded at Withernsea in 1882 in wind conditions SSE force 4. She departed from Rotterdam for Newcastle upon Tyne in ballast. The wooden sailing vessel was built in Sunderland in 1868.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?
MAL-281	NRHE	1341165	*Halifax MK III MZ659*	British Bomber. Abandoned low on fuel in fog returning from Alencon near Carnaby. 9.6.44; presumed crashed off Yorkshire coast	313450	5968729	WWII	High Potential	Unknown location- Yorkshire coast- also fairly recent incident- less chance of erosion
MAL-282	NRHE	1371128	*Equity*	An English ketch which stranded near Withernsea in 1893; wind conditions were north east force 9. She departed from Teignmouth for Leith with a cargo of pipe clay. The wooden sailing vessel was built in 1871.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?

MAL-283	NRHE	1359129	*Hutton*	Foundered off Withernsea	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?
MAL-284	NRHE	978187	*Secret*	Vessel foundered and lost following collision with the Middlesbrough-registered SS NORTHUMBERLAND. in wind conditions E x S force 4.	313450	5968729	Post Medieval	Low Potential	out of Area
MAL-285	NRHE	1395577		1803 wreck of part of craft which stranded four miles north of Easington during a gale; a wooden sailing vessel. `The VROW MARGARETTA...was driven on shore near Easington. on the Holderness coast...About half of another vessel was driven ashore. four miles further to the northward than the above.'	304743	5957582	Post Medieval	Low Potential	Out of Area
MAL-286	NRHE	1368931	*Ino*	An English brigantine which stranded at Withernsea in 1881 in wind conditions NE force 12. She departed from Hartlepool for Cowes with a cargo of coal. The wooden sailing vessel was built in Guernsey in 1839.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?
MAL-287	NRHE	1369016	*Harmonie*	A Norwegian brig which stranded on Tunstall Beach in 1882 in wind conditions SSW force 4. She departed from Arendal for Grimsby with a cargo of pit props. The wooden sailing vessel was built in 1815.	304743	5957582	Post Medieval	Medium Potential	Stranded on Tunstall Beach-although either naturally broken up/ purposefully/ or eroded by now?

MAL-288	NRHE	1371027	*Harry Sinclair*	An English dandy which stranded near Withernsea in 1893; wind conditions were south south east force 6. She departed from Grimsby on a fishing and return trip. The wooden sailing vessel was built in 1878.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although either naturally broken up/ purposefully/ or eroded by now?
MAL-289	NRHE	1339233	*Thomas and Hannah*	1803 wreck of English smack which foundered 10 leagues from Spurn Head following a collision; a wooden sailing vessel.	313450	5968729	Post Medieval	Low Potential	Out of Area- Spurn Head
MAL-290	NRHE	1374704	*Vivid*	1914 wreck of English brigantine which foundered 12 miles south east of Flamborough Head following collision. This wooden sailing vessel. built 1852. was en route from Seaham to Whitstable with coal.	313450	5968729	WWI	Low Potential	Out of Area- Flamborough
MAL-291	NRHE	1380766	*Catford*	1943 wreck of a British cargo vessel which foundered 11.5 miles north east of the River Humber light vessel after detonating a mine. This steel steam vessel. built in 1919. was en route from London to the River Tyne in ballast.	304743	5957582	WWII	Low Potential	Out of Area- Humber
MAL-292	NRHE	1339650	*John*	1804 wreck of English cargo vessel which was beached at Owthorne. after springing a leak on her passage from Gdansk to London. Laden with timber. deals. and oak planks. she was a wooden sailing vessel.	304743	5957582	Post Medieval	Medium Potential	Although part pulled onshore at Owthorne- would've been broken up on the beach. And the remaining wreck?
MAL-293	NRHE	1390915	*Speedwell*	1790 wreck of English sloop which foundered between Hornsea and Bridlington following a collision; a wooden sailing vessel.	313450	5968729	Post Medieval	Medium Potential	Location not known

MAL-294	NRHE	978643	*HMS Pintail*	This warship. described variously as a patrol vessel and a corvette. struck a mine and sank off the Humber. killing her captain. five other officers and forty-eight naval ratings.	313450	5968729	WWII	Low Potential	Off River Humber
MAL-295	NRHE	1374609	*Crux*	1912 wreck of English trawler which stranded at Holmpton. This steel steam vessel. built 1896. was on a fishing and return trip.	304743	5957582	20th Century	Low Potential	Stranded at Holmpton
MAL-296	NRHE	1378169	*River Don*	1931 wreck of a Scottish trawler which foundered 8 miles north east of Spurn Head light vessel following a collision. This steel steam vessel. built 1918. departed from Aberdeen on a fishing and return trip. AKA- Loch Doon	304743	5957582	20th Century	Low Potential	Out of area
MAL-297	NRHE	1341845	*Wilhelm Ludwig*	1810 wreck of German galliot which stranded near Patrington on her passage from Szczecin with timber and staves; a wooden sailing vessel. AKA *Wilhelm Livlwirg.* Cargo saved but ship not 'got off'.	304743	5957582	Post Medieval	Low Potential	Nr Patrington- south of area. Still possible could have broken up and debris remains.
MAL-298	NRHE	1377556	*John Rettig*	1918 wreck of Swedish cargo vessel which foundered 18 miles south of Flamborough Head after being torpedoed. This steel steam vessel. built 1915. was en route from Gothenburg to Kingston upon Hull with general cargo.	304743	5957582	WWI	Medium Potential	possibly inside area- steel steamship- mag hit possible- check measurement 18miles s of Flamborough Head- but debris still slight possibility
MAL-299	NRHE	984092	*Friends*	Foundered offshore SE of Spurn Head	313450	5968729	Post Medieval	Low Potential	Southeast of area
MAL-300	NRHE	987731	*Rose of June*	A Grimsby-registered fishing vessel. which was stopped by a German submarine. and her crew forced to abandon ship. after which she was sunk by explosive scuttling charges.	313450	5968729	WWI	Medium/Low Potential	10miles NE of Spurn Head- measure distance

MAL-301	NRHE	983824	*Beta*	Vessel foundered and lost in wind conditions NE force 9 and heavy rain with fog. not having been heard of since she left Newcastle.	313450	5968729	Post Medieval	Medium Potential	Off Spurn head- no known position
MAL-302	NRHE	1364623	*Thomas and Jane*	`Whereas the good ship. pink. or vessel. called the THOMAS AND JANE of Sunderland. John Reed. master. on the 27th day of September last. between the hours of 8 and 12 that night. was run down at sea by a large collier-ship. betwixt Flambrough-Head and the Spurn. upon her then intended voyage to London. loaden with coals	313450	5968729	Post Medieval	Medium Potential	Position between Flamborough and Spurn Head unknown
MAL-303	NRHE	1355031	*Wellington MK X HE915*	Vickers Wellington Mk. X. standard night bomber and maritime reconnaissance aircraft; 1 of a batch of 672 delivered between November 1942 and May 1943] Engine cut. ditched 20 miles South of Flamborough Head	304743	5957582	WWII	Medium Potential	Check measurement on GIS- possible position in SA?
MAL-304	NRHE	978182	*Milo*	Foundered and lost following collision with an unidentified barque. in wind conditions ESE force 4.	313450	5968729	Post Medieval	Low Potential	East of the SA
MAL-305	NRHE	1359213	*James Saville*	After foundering. following collision. her crew were saved by the Glance.	304743	5957582	Post Medieval	Medium Potential	Stranded near Withernsea-although probably either naturally broken up/ purposefully/ or eroded by now?
MAL-306	NRHE	1368837	*Mayville*	An English schooner which stranded at Waxholme in 1880 in wind conditions ENE force 9. She departed from Ipswich for Middlesbrough in ballast. The wooden sailing vessel was built in Leith in 1847.	304743	5957582	Post Medieval	Medium Potential	Stranded near Waxholme

MAL-307	NRHE	1449053	*Marie Knyght*	1392 wreck of cargo vessel which was wrecked "by storm" near Withernsea. on her passage from Gdansk to England. Laden with "divers goods and merchandise". she was a wooden sailing vessel.	304743	5957582	Medieval	Medium Potential	wrecked near Withernsea- but reports of salvors- so probably not much material left
MAL-308	NRHE	1473678	*Fram*	1914 wreck of Norwegian cargo vessel which disappeared after last being seen 7 miles off Spurn Head. presumed mined. en route from Kingston-upon-Hull for Dieppe with coal and coke. Constructed of iron in 1884. she was a steam-driven vessel.	313450	5968729	WWI	Low Potential	Out of Area
MAL-309	NRHE	1373615	*Urda*	1906 wreck of Norwegian schooner which stranded at Withernsea in a gale. en route from Sandefjord for Newcastle-upon-Tyne with pit props and railway sleepers. Built as URDA for her first owner in Stavanger. 1852. She was sold on a number of times. being under the German flag from 1899 to 1901. when she was sold to her final owner.	304743	5957582	Post Medieval	Low Potential	Stranded at Withernsea. However records show her wreckage was auctioned off in Withernsea. The bell was kept in the Alma Inn for many years. now located in the Lighthouse Museum