DESK BASED GEOLOGICAL SITE ASSESSMENT

Site:	August 2025
References:	18-449
Date:	28 August 2025
Client:	Peel L & P Group Limited

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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

SITE DESCRIPTION AND HISTORY

Site Address	Land located north of Protos, Grinsome Road, Chester, CH2 4RB
Grid Reference	Centred on National Grid Reference SJ 467 770
Site Area	The Site is approximately 144 hectares in size.
Proposed Development	The client intends to develop the land with a series of sustainable enterprises, including energy complexes and an extensive industrial estate.
Current Site Use	The Site currently consists primarily of open undeveloped agricultural land, with a section of industrial development (Protos) present in the centre and a number of ponds across the Site.
Site History	The Ince Marsh area, and the Site of Protos, is situated in a low-lying area which has been significantly shaped by Quaternary deposition and subsequently, extensive human intervention. Deposits of organic-rich material and peat-like deposits have been identified across the site area; however, the site conditions are not indicative of a peatland habitat. The location has a history of drainage, which has known consequences of the quality of peat as a carbon sink, with degradation caused by drying up the land. Currently, a pumping station is maintained by the Environment Agency, primarily functioning to drain agricultural land within the Ince Marshes catchment and agricultural drainage is present across most of the Site.

SYNOPSIS OF GEOLOGICAL CONDITIONS

E3P has undertaken a review of the Site's geology, historical land use and previous ground investigation data, alongside published British Geological Survey records and the DEFRA England Peat Map. The Site lies within the reclaimed Stanlow Marshes, part of a wider saline estuarine system along the River Mersey, historically shaped by tidal deposition, sediment transport and land reclamation works carried out between the 17th and 19th centuries.

Subsurface conditions comprise estuarine alluvial deposits – interbedded silts, sands and clays – with deep organic-rich layers formed through the accumulation of mineral sediments and decayed salt marsh vegetation. These organic deposits have been recorded as "peat" or "peat-like" in engineering logs prepared under BS 5930 due to their high organic content; however, they differ fundamentally from recognised UK peatland habitats in origin, composition and function.

True peatland habitats in the UK (e.g. raised bogs, blanket bogs and fens) develop in freshwater, low-nutrient, acidic conditions under stable, waterlogged environments and are often dominated by *Sphagnum* mosses. The Site's saline, dynamic estuarine setting lacks these conditions and therefore does not meet the definition of a peatland habitat under Natural England's classification. The England Peat Map confirms that no significant mapped peatland habitat, or irreplaceable peat, exists within the site boundary.

While the deep organic deposits have stored carbon over time, this has occurred through estuarine processes rather than peat formation. The anaerobic groundwater regime likely limits decomposition rates, and greenhouse gas emissions from these deposits are expected to be low in a development context.

The Cheshire West and Chester peatlands report classifies the Stanlow, Frodsham, Helsby and Ince Marshes as peatland based on national soil mapping that records deep organic deposits, but this approach does not distinguish between true peat formed in freshwater mire systems and organic-rich estuarine sediments. As a result, areas of reclaimed tidal marsh with interbedded silts, sands and clays are included as "peatland" despite lacking the vegetation, hydrology and ecological processes required under Natural England's peatland habitat definitions. This broad soil-based classification differs from the DEFRA/Natural England England Peat Map, which shows no mapped irreplaceable peat habitat in these marshes, reflecting their estuarine geological origin and the absence of active peat-forming conditions.

From an engineering perspective, the deep, compressible organic soils present geotechnical challenges, but these can be addressed through standard ground improvement and foundation solutions.

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DRAWING LIST

1. INTRODUCTION

1.1. BACKGROUND

Peel L & P Group Limited have commissioned E3P to prepare a geological assessment and synopsis of ground conditions with particular focus on peat, and peat-like soils at land located to the north of Protos, Grinsome Road, Chester, CH2 4RB, centred on SJ 467 770.

This report is required to determine a high-level appraisal of the geology present below the subject site, and to summarise ground conditions and geotechnical liabilities for the proposed Site's redevelopment.

This report is intended to form part of the wider strategic planning assessment for this Site, to be considered alongside future master planning. It will assist in evaluating biodiversity and sustainability matters relating to the potential presence of peat soils.

This report includes a detailed assessment of the depths of organic soils utilising desk-based geological and soil resource mapping, a series of third-party ground investigations and a general discussion regarding the condition of geological and geomorphology and the balance of sustainable development potential at the subject Site.

1.2. PROPOSED DEVELOPMENT AREA

E3P understand that Peel L & P Group Limited intends to develop the land with a series of sustainable enterprises, including energy complexes and an extensive industrial estate.

A snapshot of the outlined development layout is indicated in Figure 1.

Figure 1 Site Location

Given the extent of the Site, sections have been categorised to split up the development, as follows:

Section A – Opportunity Area

Section B – Protos

Section C – Protos Phase 3

Section D – Opportunity Area to the south

This report provides a high-level assessment of the entire Site to establish baseline conditions, considering the development area as a whole rather than focusing on specific areas or individual development parcels, which will be reviewed in due course as the project masterplan evolves.

1.3. OBJECTIVES

The objectives of this appraisal are as follows:

- Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available to complete an assessment of geology and hydrogeological conditions.
- Consider the high-level implications of any potential environmental risks, liabilities and development constraints associated with the Site, specifically in relation to potential irreplaceable peat deposition.
- Assess the desk study information and provide a high-level opinion and discussion of geological conditions across the development opportunity area.

1.4. LOCATION & SETTING

The Ince Marsh area and the Site of Protos are situated in a low-lying area which has been significantly shaped by Quaternary deposition and, subsequently, extensive human intervention. Deposits of organic-rich material and peat-like deposits have been identified across the site area; however, the site conditions are not indicative of a peatland.

The location has a history of drainage, with a pumping station maintained by the Environment Agency that primarily functions to drain agricultural land within the Ince Marshes catchment. Agricultural drainage is also present across most of the Site.

The low-lying, historically waterlogged estuarine setting of Ince Marsh provides an environment which is conducive to an accumulation of organic matter, with a consistent mixture of organic and mineral sediments indicative of an alkaline environment.

There is no indication of historical cutting of organic materials or peat in the Ince Marshes area, based on this initial desk top review.

The site area comprises drained marshland, as shown in the land use mapping in Figure 2, with a network of drainage channels (often termed gutters or rhynes) cut across the marsh surface. These artificial drains were installed during extensive land reclamation works undertaken between the 17th and 19th centuries, transforming the original wetland environment into agricultural and industrial land. The works formed part of a wider programme of reclamation along the Mersey Estuary, including the Ince, Frodsham and Helsby marshes, which were progressively enclosed behind embankments and drained to make the land more productive and accessible.

Historical accounts and cartographic evidence indicate that prior to reclamation, this area was a tidal salt marsh and mudflat, regularly inundated by brackish water from the estuary.

The marsh surface would have been characterised by salt-tolerant vegetation, intertidal creeks, and extensive seasonal waterlogging.

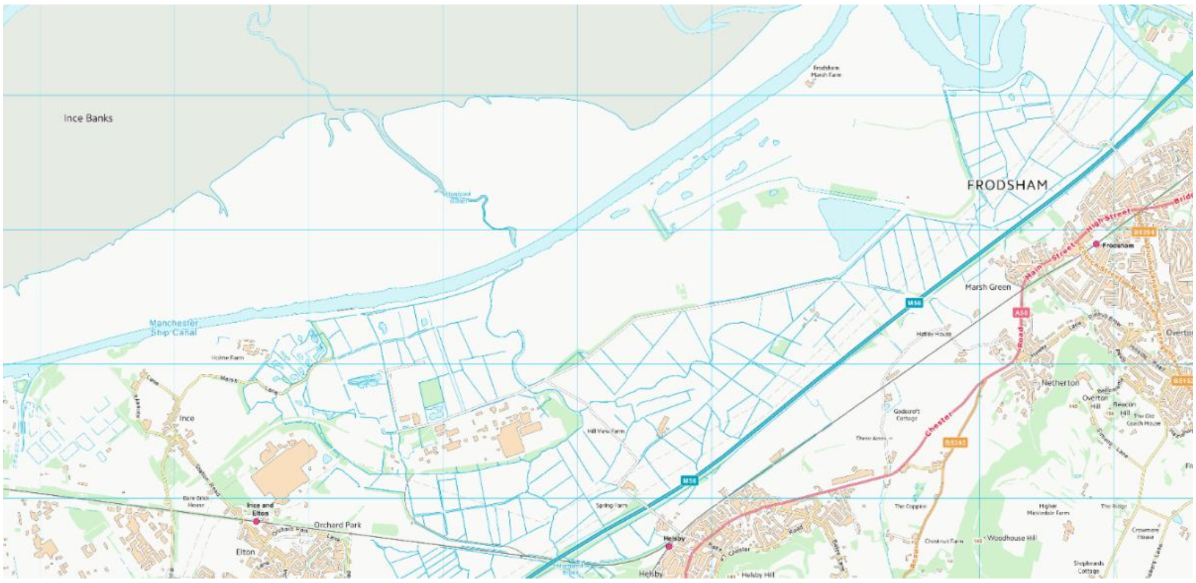
From the early modern period onwards, engineering interventions were introduced to alter this natural hydrology. Earth embankments, sluices and drainage ditches were constructed to exclude the highest tides, intercept surface water, and redirect flows into managed channels leading to the River Mersey.

By the mid-19th century, the landscape had undergone a marked transition. The Frodsham and Helsby marshes were largely enclosed, with reclaimed parcels used for pasture, hay production and later, industrial development. The drainage network was maintained and periodically upgraded to prevent waterlogging, and the soils — once saturated and anaerobic — became more aerated. These changes effectively arrested the natural estuarine sedimentation process and prevented the long-term accumulation of partially decomposed vegetation needed for peat development.

This historical shift from an active marsh within a tidal estuary to drained and reclaimed land is critical to understanding the Site's current baseline condition. While the original marsh surface may have contained localised organic-rich deposits formed in low-energy, sheltered zones, the extensive and prolonged drainage regime has greatly reduced the likelihood of intact, active peat being present today. Any organic layers that do remain are likely to be degraded, reworked or overlain by estuarine silts and clays deposited prior to enclosure.

Accordingly, the Site represents a cultural wetland landscape — a product of historical engineering — rather than a naturally functioning peatland. This context will be central to our assessment of whether peat or peatland habitat is present in any part of the development area and, if so, the extent to which it retains ecological and carbon storage value.

Figure 2 – Current Land Use Mapping



1.5. THE IMPORTANCE OF PEAT – NATIONAL OVERVIEW & LOCAL CONTEXT

This report provides a high-level assessment of the entire Site to establish baseline conditions, considering the development area as a whole rather than focusing on specific parcels, which will be reviewed in detail as the project masterplan evolves.

A key aspect of our assessment is the consideration of peat and peatland habitats, given their recognised environmental significance in the UK. Peat is a soil material composed of partially decomposed organic matter, primarily derived from plant remains, which accumulates in waterlogged conditions. The England Peat Action Plan defines peatland as “areas of land with a naturally accumulated layer of peat, formed from carbon-rich dead and decaying plant material under waterlogged conditions.”

Peatlands are of particular importance due to their role in:

- Carbon storage – Peat soils hold the largest carbon stores of any UK habitat.
- Carbon sequestration – Active peat removes and stores atmospheric carbon.
- Water management – Acting as a natural sponge, peat moderates runoff and reduces downstream flood risk.
- Biodiversity – Providing habitat for rare and specialist flora and fauna.

The distinction between peat and peaty soils is important in ecological and geotechnical assessments. According to Natural England guidance, substrates that are primarily plant remains, whether fibrous or amorphous, with an organic matter content exceeding 30% by weight, should be classified as peat. Identification can be challenging, and the degree of decomposition, texture, pH, and drainage characteristics must all be considered, as these determine whether the peat is active (accumulating) or inactive (degrading).

It is important to note that the Stanlow Marshes in Ellesmere Port, within the saline estuarine environment of the River Mersey, are formed through coastal and tidal processes rather than terrestrial peat accumulation. The superficial deposits here comprise estuarine silts, clays, and sands deposited under tidal influence. While peat typically forms in low-energy freshwater settings such as raised bogs or blanket bogs, the dynamic, brackish, and periodically inundated conditions of a saline estuary inhibit the sustained build-up of partially decomposed vegetation needed for true peatland development.

This baseline review, therefore, considers whether peat or peatland habitats could be present within the study area, noting that such features would be of high ecological and climate relevance and would influence both design and construction considerations. Detailed ground investigation and habitat surveys will be required to confirm presence or absence as the master plan progresses.

1.6. THE ENGLAND PEAT ACTION PLAN

The Government's Peat Action Plan aims to protect and restore peatlands across the UK, recognising their importance for carbon storage, biodiversity, and water management. The Plan aimed to restore at least 35,000 hectares of peatland by 2025, and other Key objectives include:

- Ending the sale of peat for horticulture by 2024 (for amateur use) and exploring further restrictions.
- Restoring degraded peatlands, particularly in protected areas and upland blanket bogs.
- Reducing peat extraction, but with no outright ban on development where peat is present.
- Encouraging sustainable land management to prevent further degradation.
- While the plan prioritises conservation and restoration, it does not prohibit all development on peatland, particularly where peat is already degraded or under agricultural use and allows for managed re-use and mitigation measures where necessary.

1.6.1. ENGLAND PEAT MAPPING

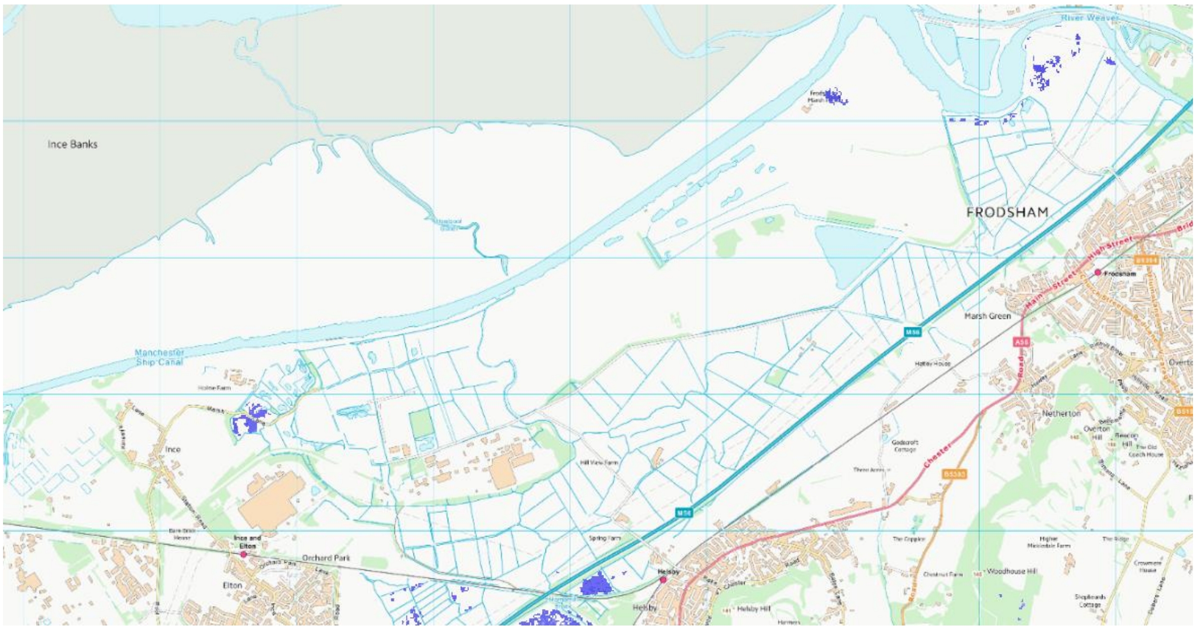
E3P has reviewed the DEFRA England Peat Map Portal, which incorporates updated peat distribution data compiled under the Natural Capital and Ecosystem Assessment (NCEA) programme.

The mapping for the Site and its immediate surroundings identifies only very limited and highly localised areas of peat, none of which fall within the proposed development footprint.

According to the UK Government's guidance on irreplaceable habitats, peatland is considered irreplaceable where it supports an intact and functioning peat soil ecosystem capable of ongoing carbon sequestration, biodiversity support and hydrological regulation.

The mapping confirms that such peatland habitats are not present within the Site. While small pockets of organic-rich material may occur within the historical marsh deposits, these are not mapped as extensive or active peat and therefore do not meet the criteria for classification as a nationally recognised peatland or irreplaceable habitat. Consequently, the Site is not identified as an irreplaceable peat habitat under Natural England's current mapping and classification framework.

Figure 3 – DEFRA Peat England Peat Mapping



1.7. HISTORIC CONTEXT

The history of land reclamation in England dates back to at least Roman times, often involving the construction of earthen banks to enclose salt marshes and mudflats for agricultural purposes. This process inherently requires land drainage.

Across the UK, extensive areas of lowland marshes have been drained for cultivation, transforming them into productive farmland.

The successful drainage of peat has profound effects on the land surface. It leads to a significant fall in elevation due to the collapse and shrinkage of the peat soil. This occurs directly as water, which can constitute over 50% of the peat's volume, is removed. Subsequently, the lower peat layers undergo compression as the drier upper layers no longer provide flotation. This process also exposes previously waterlogged organic matter to oxygen, accelerating decomposition and compaction, which results in long-term subsidence and sustained releases of carbon dioxide (CO_2) into the atmosphere.

The extensive history of drainage at Ince Marsh provides a link to the likely degraded state of its organic deposits, directly influencing their current properties and classification. The fact that Ince Marshes is "reclaimed land" and relies on a pumping station for agricultural drainage is a critical piece of information. Historical land reclamation in the UK consistently involved the extensive drainage of wetlands.

This drainage introduces oxygen into what were previously anaerobic peat environments, significantly accelerating the decomposition of organic matter and leading to the release of stored carbon as CO_2. This process, known as degradation, means that even if the material originally formed as true peat, its current organic content, degree of decomposition, and physical properties (e.g., density, water retention) are almost certainly altered. Therefore, any "peat" identified at Ince Marsh is highly likely to be "degraded peat", which possesses different characteristics and implications (e.g., acting as a carbon emitter rather than a carbon sink) compared to active, pristine peat. This degraded state is a direct consequence of historical anthropogenic intervention.

2. SITE HISTORY

2.1. ON-SITE HISTORICAL DEVELOPMENT

MAP EDITION	DISCUSSION	MAP EXCERPT
1945 (AERIAL IMAGERY)	The Site is indicated to consist of open agricultural land, with several drainage channels present towards the canal.	
2005 (AERIAL IMAGERY)	A small compound is present in the northwest of the Site, with several tracks across the fields in the north.	

MAP EDITION	DISCUSSION	MAP EXCERPT
2016 (AERIAL IMAGERY)	A series of spine roads has been developed in the south.	
2018 (AERIAL IMAGERY)	The central portion of the Site has undergone development, with several stockpiles present in the area. A number of ponds are indicated in the northwest of the Site.	

MAP EDITION	DISCUSSION	MAP EXCERPT
2025 (AERIAL IMAGERY)	The compound is no longer in use and appears to be in a deleterious condition. Ponds are now indicated in the southeast of the Site.	

3. PREVIOUS GROUND INVESTIGATION REPORTS

The following previous site investigation reports have been provided to E3P for review:

Table 2: Previous Reports

AUTHOR	TITLE/REFERENCE	CLIENT	DATE
WSP (i)	Ground Investigation Report Resource Recovery Park, Ince Marshes	Peel	April 2010
WSP (ii)	Resource Recovery Park, Ince Marshes Report on Kemira Road Site Investigation	Peel	May 2010
RSK ENSR (iii)	Ince Resource Recovery Park, Site Investigation Report for PPC Application	Peel	November 2005
WSP (iv)	Outline Peat Management Plan	Liverpool Bay CCs Ltd	March 2025

WSP, April 2010(i)

- The report provides a series of geological logs for site investigations across the western vicinity of the Site, including 13 no. Cable Percussive Boreholes, six Window Sample boreholes and twenty no. trial pits.
- Section B and Section E – Peat-like soils were encountered at depths ranging from 3.30 to 13.20 m bgl, with thicknesses ranging from 0.80 to 2.70 m bgl.
- The soils were generally interbedded with alluvial soils and were generally encountered in a poor condition.

WSP, May 2010 (ii)

- The report provides a series of geological logs for site investigations across the western vicinity of the Site, including 31 holes in Section B, and six no. holes in the southwest of Section E.
- Section B – Pseudo-fibrous peat-like deposits were encountered in thirteen locations, at depths ranging from 0.30 to 11.50 m bgl, with a minimum thickness of < 0.30 m bgl (declassifying the soils as peat) and a maximum thickness of > 2.0 m. The average thickness of the soils was found to be approximately 1.30 m; however, all of the deposits were within interbedded alluvial deposits of silt/gravel.
- Section E – Pseudo-fibrous peat-like deposits were encountered in three locations, at depths ranging from 1.30 to 5.80 m bgl, with an average thickness of approximately 3.50 m. All of the deposits were overlain and underlain by alluvial deposits of silt/gravel,
- Where alluvial soils are present surrounding the peat-like deposits. The presence of these soils suggests probable compression and increased decomposition, indicating that the highly organic deposits are in poor condition, consistent with a fens.

RSK ENSR (iii)

- The report provides a scope of the site use and identified that most of the entire site area consists of land used for farming. There is a mixed use of grazing fields, croplands and woodland areas, with areas to the west developed during the 20th century, including the Ince Power Station.
- A series of drainage ditches were identified across the agricultural areas of the Site, with a pumping station located within the area which has contributed significantly to the degradation of the Site and the drying of the Ince Marsh area.

ENI (iv)

- This document entails a review of peat-like deposits below the subject site, including a review of 44 exploratory holes.
- The peat-like deposits were encountered from 0.30 to 11.90 m bgl, with thicknesses ranging from 0.07 to 4.35 m, indicative of some organic deposits, given the minimal thickness in some cases.
- The soils, interbedded with alluvial soils, are indicative of poor generative conditions of peat, characterised by compression and reduced moisture content, which has been increased by agriculture within the area.

3.1.1. E3P DISCUSSION OF GROUND INVESTIGATION DATA

Several prior ground investigations have been undertaken across the Site and its immediate vicinity, comprising a combination of cable percussive boreholes, window sample boreholes and trial pits. These investigations have consistently identified deposits of highly organic, “peat-like” soils at depth, typically interbedded with alluvial silts, sands and gravels, as would be expected in a low-lying reclaimed marsh environment.

Logs prepared in accordance with BS 5930 correctly describe these soils in terms of their engineering and geotechnical characteristics, with classifications based on visual and tactile assessment. Across the various investigations, organic-rich layers were encountered at depths ranging from near-surface to over 13 m below ground level, with individual thicknesses from a few centimetres to more than 4 m. In all cases, these deposits were associated with alluvial sequences, often showing evidence of decomposition, compression, and reduced moisture content. Such conditions are consistent with historic reclamation, artificial drainage and agricultural use, which have altered the original hydrology and accelerated degradation of the organic material.

It is important to emphasise that the term “peat” in a BS 5930 logging context does not directly equate to the definition of a peatland habitat under Natural England’s classification framework. The Natural England definition of peatland is habitat-based and relates to intact, functioning peat-forming systems that support characteristic vegetation, hydrological regimes and ongoing carbon accumulation. The “peat-like” deposits recorded in the site investigations represent degraded, inactive organic soils formed in an estuarine marsh setting, lacking the ecological and hydrological functions of active peatland.

In addition, DEFRA’s England Peat Map identifies only very small, isolated areas of mapped peat within the wider land use dataset for this location, none of which are classified as irreplaceable peat habitat. This mapping evidence, when considered alongside the site investigation data, supports the conclusion that while deep deposits of organic material are present, the Site does not contain a recognised peatland habitat under national definitions.

3.2. PEATLAND OF CHESHIRE WEST AND CHESTER

E3P has completed a detailed review of the "Peatlands of Cheshire West and Chester" report, focusing on how it identifies the Stanlow/Frodsham/Helsby/Ince Marshes as peatlands and suggesting restoration potential, alongside an assessment of the basis for those statements.

3.2.1. WHERE THE REPORT IDENTIFIES FRODSHAM, HELSBY AND INCE MARSHES AS PEATLANDS

The report clearly includes the Frodsham, Helsby and Ince Marshes within its definition of Cheshire West peatlands:

- **Extent Mapping** – Section *Results: Extent* states that "The majority of CW's lowland peatland is located at Frodsham Marshes…", and Figure 1 maps the marshes as part of the borough's *rich fen* or *wasted fen* peatland resource.
- **Designation** – In Table 6 and Figure 5, "Frodsham, Helsby and Ince Marshes" is listed as a Local Wildlife Site (LWS) covering 1,104.45 ha, representing 36% of all CW's peatlands and 42% of the borough's entire peatland area.
- **Case Study 2** – The marshes are a specific case study. The text describes them as having "priority habitat 'floodplain grazing marsh'… classified as peatland under extensive grassland". It suggests the condition of the peat could be improved by rewetting and blocking ditches.

In each of these references, the marshes are grouped under the "peatland" heading because the underlying soils are classed in the national NE257 dataset as *deep peaty soils* (>40 cm organic layer) of fen origin, even where surface habitat is not an active peatland community.

3.2.2. HOW THE REPORT FRAMES THESE MARSHES AS "PEATLANDS CAPABLE OF RESTORATION"

The report repeatedly refers to restoration potential:

- **Executive Summary & Conclusion** – It recommends that "targeted restoration of drained deep peat… can have significant benefits in terms of reducing emissions and improving biodiversity value" and calls for stopping development on peatlands across CW.
- **Case Study 2** – While it acknowledges biodiversity conflicts (importance of floodplain grazing marsh to bird populations), it still frames the marshes as "peatland" and suggests that, absent such conflicts, ditch blocking and rewetting could improve the "condition of the peat".
- **Discussion: Restoration and Management** – Positions drained fen peats (including those under grazing marsh) as degraded peatland with potential to be rewetted, thereby reducing GHG emissions and improving habitat condition.

By applying the NE257 soil dataset classification of "deep peat" to these areas, the authors treat them as part of the borough's peatland resource irrespective of their saline/brackish estuarine history.

3.2.3. ASSESSMENT OF THE BASIS FOR THE PEATLAND CLASSIFICATION

Methodological reliance on NE257 dataset

The classification is not based on site-specific coring or ecological survey of active peatland vegetation, but on national soil mapping (NE257), which:

- Identifies soils with an organic layer >40 cm as "deep peat".
- Does not distinguish between peat formed in freshwater mires versus organic-rich estuarine sediments.
- Treats all deep organic deposits as "peat" for emissions accounting purposes.

This means any deep organic alluvial deposit — even if formed in a saline marsh environment and now lacking peat-forming vegetation — is counted as "peatland" in the inventory.

3.2.4. LACK OF DISTINCTION BETWEEN PEAT-FORMING AABITAT AND ORGANIC SUBSTRATE

The report's own definitions (Section Background) describe peatlands as ecosystems where organic matter accumulates under waterlogged conditions, but it does not explicitly exclude estuarine marsh origins.

This contrasts with Natural England's habitat-based definitions, which require:

- Presence of an accumulated peat layer.
- Hydrological and ecological conditions capable of sustaining peat formation.
- Associated plant communities (e.g., *Sphagnum* for bogs, sedge/brown moss assemblages for fens).

The Stanlow/Frodsham/Helsby/Ince Marshes do not meet these ecological criteria — they are reclaimed saltmarshes, historically tidally influenced, with vegetation and hydrology incompatible with ongoing peat formation.

3.2.5. THE REPORT'S CONCLUSIONS MAY OVERSTATE RESTORATION POTENTIAL

- **Ecological feasibility** – The marshes are underlain by organic-rich estuarine alluvium, not ombrotrophic or minerotrophic peat. The saline/brackish history, modified hydrology, and current land use (floodplain grazing marsh, industrial/reclaimed land) mean true peat-forming conditions cannot be recreated without wholesale landscape re-engineering.
- **Biodiversity conflicts** – The report itself concedes that restoring "peatland" here could conflict with the ecological value of existing habitats (notably grazing marsh for waders and wildfowl).
- **Greenhouse Gas dynamics** – While the organic soils store carbon, their GHG fluxes in an anaerobic estuarine substrate differ from degraded freshwater peats. Literature suggests that methane and CO_2 profiles are different and the "restoration" benefits may be minimal compared to freshwater peatlands.

3.2.6. E3P OBSERVATIONS AND COMMENT

These marshes are estuarine in origin, comprising tidal alluvial sediments with interbedded organic layers, rather than peat formed through mire succession in freshwater settings. Under Natural England's peatland habitat definitions, the area does not qualify as a peatland because it lacks the characteristic vegetation, hydrology, and ongoing peat accumulation processes associated with active peat-forming systems.

The "peatland" label applied here is the result of soil mapping methodology rather than ecological reality. It should not be interpreted as evidence of restoration potential to a functional peatland.

Significant hydrological barriers, saline influence, existing habitat value, and altered soil chemistry mean that restoration to active peat-forming fens or bogs is unlikely to be feasible.

Although the deep organic deposits have stored carbon, the anaerobic and waterlogged nature of these estuarine sediments means ongoing greenhouse gas emissions are likely to be low. As such, large-scale restoration for carbon benefit may be unjustified when weighed against the cost and potential ecological risks.

Key points:

- Formed from estuarine tidal alluvium with organic layers, not freshwater peat.
- Does not meet Natural England's peatland habitat definition.
- "Peatland" label is a mapping artefact, not a reflection of ecological function.
- Restoration to active peatland is not feasible due to hydrology, salinity, and soil chemistry.
- GHG emissions from these deposits are likely low in the current anaerobic state.
- Large-scale restoration may not deliver significant carbon benefit relative to cost and ecological risk.

In summary, the difference between the two assessments arises from the distinction between a soil classification of "deep peat" and the ecological/geological definition of a peatland habitat.

- The Cheshire Wildlife Trust report applies a broad soil-based definition from NE257, which captures any deep organic substrate, including those formed in estuarine marshes.
- Our assessment — consistent with the DEFRA/Natural England England Peat Map — recognises that the Stanlow/Frodsham/Helsby/Ince Marshes are not peatland habitats, but rather deep organic estuarine deposits with a different formation history, hydrology, and ecological potential.
- As such, they are not irreplaceable peatland habitat under national definitions (NPPF), and large-scale peatland restoration is neither technically feasible nor ecologically appropriate in this setting.

4. ENVIRONMENTAL SETTING

4.1. SITE PUBLISHED GEOLOGY

The British Geological Survey (BGS) map (Sheet 97) for the Site (1:50,000, Solid and Drift editions) and online records indicate the area is underlain by the geological sequence presented in Table 3.

Table 3 Summary of Underlying Geology

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Superficial	Majority of Site - Tidal Deposits	Clay, silt, sand, peat-like deposits and GRAVEL.	Secondary Undifferentiated
	Southwest of Site - Glacial Till	Sand, clay and GRAVEL	Secondary Undifferentiated
Solid	West of Site - Chester	SANDSTONE	Principal
	East of Site - Kinnerton	SANDSTONE	Principal

4.2. GEOLOGICAL FORMATION OF TIDAL FLAT DEPOSITS IN THE UK

Tidal flats, also referred to as mudflats or intertidal flats, are low-gradient coastal or estuarine landforms that are alternately exposed and submerged by the tides. In the UK, they are widely developed in estuaries (e.g. the Humber, Severn, and Thames), sheltered bays, and low-energy coastal margins, where tidal currents dominate over wave action. These environments are important both ecologically and geotechnically, being composed largely of fine-grained sediments with low bearing capacities and high compressibility.

4.2.1. PROCESS OF FORMATION

SEDIMENT SUPPLY AND DEPOSITION

The formation of tidal flats relies on a sustained supply of fine-grained sediment—typically silt- and clay-sized particles (<63 μm)—derived from:

- **Fluvial inputs**: Rivers transport suspended sediments from catchments (often including glacially-derived silts and modern weathering products).
- **Marine inputs**: Re-suspension and transport of marine shelf sediments by tidal currents.
- **Erosion of adjacent coastlines**: Particularly soft, unconsolidated glacial deposits and alluvium.

These sediments are carried in suspension within the tidal prism and deposited when current velocities fall below the threshold for transport, typically during slack water at high and low tide.

4.2.2. ROLE OF TIDAL ENERGY

Tidal range and current velocity are critical controls. In macro-tidal estuaries such as the Severn (tidal range >7 m), the intertidal zone can extend for kilometres. Fine sediments settle preferentially in the upper intertidal zones where energy is lowest. Over time, deposition fills accommodation space and builds up extensive mudflat surfaces.

4.2.3. FLOCCULATION AND SETTLING

In UK estuaries, fresh river water meets saline marine water, creating brackish conditions that promote **flocculation**—the aggregation of fine clay particles into larger, faster-settling flocs due to the presence of salts. This accelerates deposition rates.

4.2.4. BIOLOGICAL INFLUENCE

Vegetation colonisation (e.g. by *Salicornia*, *Spartina anglica*) can trap additional sediments, leading to stabilisation and potential progression from tidal flat to saltmarsh. Benthic organisms (e.g. lugworms, cockles) bioturbate the sediment, altering its fabric and structure.

4.2.5. TIMESCALES OF FORMATION

Tidal flat formation is a relatively rapid Holocene process in geological terms:

- **Initial formation**: Many UK tidal flats began developing after the last glacial maximum (~20,000 years BP), as post-glacial sea level rose and drowned river valleys to form estuaries.
- **Major infilling phase**: Between ~8,000 and 4,000 years BP, sea level stabilised close to present levels, and extensive sedimentation infilled sheltered estuaries, creating wide tidal flats.
- **Modern deposition rates**: Can range from a few millimetres to several centimetres per year, depending on sediment supply and energy regime. Anthropogenic changes (dredging, reclamation, harbour works) now influence sedimentation rates significantly.

In some UK estuaries, sediment cores show sequences up to 10 m thick that have accumulated over 5,000–8,000 years.

4.2.6. NATURE OF THE SOILS

Tidal flat deposits in the UK are characteristically **fine-grained, cohesive soils** with distinctive geotechnical properties.

COMPOSITION

- **Texture**: Predominantly silty clays or clayey silts.
- **Mineralogy**: Illite, kaolinite, smectite clays with quartz and feldspar silt fractions.
- **Organic matter**: Variable; higher in upper flats due to plant colonisation, lower in lower flats due to constant tidal washing.
- **Salinity**: Porewaters can be brackish to saline, influencing consolidation and corrosion potential.

FABRIC AND STRUCTURE

- Soft, high-water-content materials: Often with natural water contents above the liquid limit.
- Laminated bedding: Alternating silt and clay layers due to tidal and seasonal variations in deposition.
- Occasional sand lenses: From storm events or channel migration.

4.2.7. GEOTECHNICAL BEHAVIOUR

- **Very low undrained shear strengths** (often <20 kPa in upper layers).
- **High compressibility**: Primary consolidation under load is rapid, followed by long-term secondary compression.
- **Low permeability**: Typically $<1\times10^{-9}$ m/s, leading to slow drainage and extended consolidation times.
- **Potential for thixotropy**: Disturbed sediments can temporarily lose all strength when remoulded.

4.2.8. SUMMARY OF FORMATION SEQUENCE

- **Sea level rise** after the last glaciation floods river valleys.
- **Suspended sediments** from rivers, marine currents, and coastal erosion enter sheltered estuaries.
- **Flocculation** in brackish water enhances the settling of fine material.
- **Deposition during slack tide** builds laminated silty clay beds.
- **Progressive infill** and stabilisation by vegetation transition flats to saltmarsh in places.
- **Continued sedimentation** maintains flats in dynamic equilibrium with tides, storms, and human intervention.

4.2.9. SUMMARY OF SOIL TYPES IN UK TIDAL FLATS

Tidal flats in the UK typically contain the following soil types:

SOIL TYPE	CHARACTERISTICS	ORIGIN & NOTES
Soft silty clay	Grey to dark grey, high plasticity, high water content, low strength.	Deposited from suspension during slack tides; most common tidal flat material.
Clayey silt	Slightly coarser, more silt fraction, marginally higher strength than pure mud.	Settled from suspension under slightly higher energy conditions, often lower tidal flat zones.
Sand lenses	Fine to medium sand, locally clean, often thin (<0.3 m).	Storm surges or tidal channel shifts deposit sand layers within otherwise fine-grained sequences.
Peaty silt / clay	Dark brown to black, high organic matter, fibrous plant remains.	Forms in upper tidal flats and transitional saltmarsh where vegetation traps sediment and organic detritus.
Organic-rich mud	Very dark grey to black, odorous, may contain shell fragments.	Accumulates in sheltered pockets with low oxygen levels; organic matter from decayed vegetation and estuarine fauna.

4.2.10. ORGANIC MATERIAL

Organic content is higher in upper tidal flats and salt marsh fringes because these areas are periodically submerged (not permanently underwater), allowing colonisation by salt-tolerant vegetation. These plants trap fine sediments, slow water flow, and contribute decaying plant matter. Anaerobic conditions in waterlogged mud slow decomposition, preserving organic content and leading to dark, humic-rich layers. In low-energy sheltered pockets, detritus from algae, phytoplankton, and benthic organisms also accumulates.

Figure 4: Summary of Underlying Superficial Geology

The yellow areas denote the areas mapped as Tidal Deposits, that are present across the majority of the Site, with an isolated area in the southwest indicated to consist of Glacial Till. The mapping for the surrounding area indicates that peat is present in isolated pockets, where brown is shown on the map in the south.

4.2.11. BGS BOREHOLE DATA

E3P has reviewed the BGS database, which identified boreholes on-site, from which to compare the published geology above.

The borehole logs are summarised in Table 3 below.

Table 3 Summary of BGS Borehole Records

LOCATION	DEPTH	TOPSOIL	PEAT-LIKE DEPOSITS	MG	DRIFT
On-site NW (ref. SJ47NE28)	3.00 m	0.00 – 0.15	0.85 – 0.95 amorphous PEAT	n/a	0.15 – 0.85 Gravelly clayey SAND 0.95 – 3.00 gravelly silty CLAY
On-site NE (ref. SJ47NE22)	10.00 m	0.00 – 0.50	2.90 – 4.10 fibrous clayey PEAT 9.80 – 10.00 fibrous PEAT		0.50 – 1.90 sandy gravelly silty CLAY 1.90 – 2.20 silty GRAVEL 2.20 – 2.90 silty organic CLAY 4.10 – 9.80 silty peaty CLAY
On-site E (ref. SJ47NE79)	8.70 m		1.85 – 2.07 PEAT 2.22 – 3.07 PEAT 3.33 – 3.40 PEAT 8.36 – 8.70 PEAT	0.00 – 0.17 Disturbed ground	0.17 – 0.45 silty CLAY 0.65 – 0.80 SILT 0.80 – 0.92 silty CLAY 0.92 – 1.04 CLAY 1.04 – 1.07 (n/a) 1.07 – 1.16 CLAY 1.16 – 1.57 clayey SILT 1.57 – 1.75 CLAY 1.75 – 1.85 organic silty CLAY 2.07 – 2.22 peaty CLAY 3.07 – 3.33 peaty CLAY 3.40 – 3.51 silty CLAY 3.51 – 4.07 clayey SILT

					4.07 – 4.15 peaty CLAY
					4.15 – 5.07 silty CLAY
					5.09 – 5.43 SILT
					5.43 – 8.32 silty CLAY
					8.32 – 8.36 organic CLAY

Figure 5 – BGS Borehole Locations

The E3P review of BGS-published borehole records within the site boundary confirms the presence of localised, thin to moderately thick organic-rich layers described as “peat” or “peat-like” deposits, typically interbedded with alluvial silts, clays, and sands.

Depths to these organic layers range from approximately 0.85 m to over 9.80 m below ground level, with individual thicknesses generally less than 2.0 m.

The deposits are often amorphous or fibrous but occur within sequences dominated by mineral alluvium, indicating a marsh or estuarine depositional setting rather than a continuous peatland body.

While these organic horizons are logged as “peat” in accordance with BS 5930 soil description conventions, they represent isolated and degraded organic layers formed under historical tidal and marsh conditions, lacking the intact hydrology, vegetation community, and carbon accumulation functions required to meet Natural England’s definition of a peatland habitat.

4.3. HYDROGEOLOGY

The Ince Marshes site is located immediately south of the Mersey Estuary in a low-lying estuarine setting. The hydrogeological regime is expected to be strongly influenced by proximity to the estuary, the composition of the superficial deposits, and the presence of regionally significant aquifers at depth.

The superficial sequence is anticipated to comprise soft, cohesive tidal flat deposits, typically silty clay, clayey silt, and organic-rich muds, which have accumulated in this intertidal environment throughout the Holocene. Interbedded within this sequence are known to be deep organic deposits, in places several metres thick, with a structure and composition similar to peat soils.

These deposits are likely to have developed in former marsh or lagoonal environments where waterlogged, anaerobic conditions inhibited decomposition, allowing plant material to accumulate over time.

These tidal flat and organic deposits are expected to overlie estuarine sands and gravels or glacial till, with bedrock beneath belonging to the Permo–Triassic Sherwood Sandstone Group. The Sherwood Sandstone forms a Principal Aquifer of regional importance, although in this location it is expected to be confined beneath a thick sequence of low-permeability estuarine clays, organic beds, and, in places, glacial till.

From a hydro stratigraphic perspective, the Site is expected to exhibit three main water-bearing characteristics. The uppermost unit is a laterally extensive aquitard formed by estuarine silty clays, organic muds, and peat-like deposits with very low permeability, likely in the order of 1×10^{-9} m/s or lower. The organic layers, while fibrous and compressible, are highly saturated and effectively act as water-retaining layers, contributing to the high and stable shallow groundwater table. Within this upper sequence, occasional sand or silt lenses may be present, creating shallow perched water horizons. These horizons can be tidally influenced, particularly within a few hundred metres of the estuary's tidal channels. Beneath these, a more permeable unit of estuarine or glaciofluvial sands and gravels is anticipated, which may be in partial hydraulic continuity with the deeper bedrock aquifer, depending on the continuity and thickness of the overlying low-permeability deposits.

The shallow groundwater regime is expected to be dominated by a high water table, typically within 1.0 m below ground level, due to the low-lying nature of the land, the low permeability of the near-surface materials, and the influence of estuarine tidal cycles. These shallow horizons are likely to exhibit brackish to saline porewater chemistry, with elevated chloride and sulphate concentrations that may present aggressive ground conditions for buried concrete and steel.

In the lower tidal flat zones, and particularly where sand lenses occur, groundwater levels are likely to respond to the semi-diurnal tidal cycle, with observable fluctuations that could extend inland depending on the transmissivity of the permeable layers.

At greater depth, the Sherwood Sandstone Principal Aquifer is expected to be confined and hydraulically separated from the shallow estuarine sequence. Groundwater within the sandstone at this location is likely to be of variable salinity, with fresher water occurring further inland and more brackish conditions nearer to the estuary. In some locations along the Mersey Estuary, the confined aquifer exhibits upward hydraulic gradients, although the overlying clay and organic-rich sequence typically prevents significant upward seepage.

Recharge to the shallow horizons is anticipated to be very limited, as the cohesive estuarine clays and organic deposits significantly restrict infiltration. Rainfall is likely to contribute little to groundwater recharge, with most precipitation lost through surface runoff or evapotranspiration. Instead, the shallow groundwater regime is dominated by lateral flow towards the estuary, with tidal fluctuations periodically reversing local gradients in the intertidal zone. Recharge to the deeper Sherwood Sandstone aquifer is not expected to occur at the Site itself but rather in inland outcrop or subcrop areas where the sandstone is overlain by more permeable superficial deposits.

The hydrogeological conceptual model for the Site comprises a shallow, tidally influenced groundwater regime within low-permeability estuarine deposits, including thick, waterlogged organic layers with peat-like structure, containing occasional permeable interbeds. These overlie a confined and regionally important Sherwood Sandstone Principal Aquifer. The near-surface environment is dominated by brackish to saline conditions, minimal recharge, and strong hydraulic control by the estuarine tidal cycle, while the deeper aquifer is largely isolated but requires protection from any potential vertical connectivity during intrusive works.

4.4. HYDROLOGY

The Manchester Ship Canal is located immediately north of the Site, and the Site has historically been flooded by the River Mersey and the Irish Sea. Additionally, a number of ponds are present across the Site. These ponds form part of the SUDs system (and ecology areas) and reduce the potential of flooding across the site.

The Site is predominantly located within a currently defined "Flood Risk Zone 3", defined as land assessed as having a significantly high annual probability of river or sea flooding (1.00%) and, as such, is considered to be significantly affected by river flooding. It should be noted, however, that the EA has a series of pumps that also form part of flood alleviation measures that are set to operate when water levels reach 2.8 m AOD. The existing pre-development ground levels are circa 4-4.5 mAOD.

5. DETAILED GEOLOGICAL ASSESSMENT

5.1. CONTEXT

Available geological records indicate that the Site is underlain by drift deposits of alluvium, which is typically found to consist of soft to firm consolidated, compressible silty clays, but can contain layers of silt, sand, peat-like soils and basal gravels. The generic condition of the alluvial soils is found to consist of > 10.0 m thick of deposits in the east, with deposits found to consist of 1.00 to 2.00 m thickness in the west towards the estuary and the canal. The majority of the Site is indicated to consist of superficial tidal flat deposits, which are normally comprised of silt, clay, fine sands and lenses of gravel. Devensian Till soils are encountered locally in the southwest and may consist of sand, clay, peat-like deposits and gravel.

The soils present at the Site have undergone alteration and been reworked through the development of extensive drainage installations and the alteration of the water regime. Subsequently, the soils are well-drained and generally become waterlogged for short periods in winter during flashier events, which has supported an extensive agricultural use across the land historically.

The regional hydrogeology indicates that groundwater in the underlying Permo-Triassic sandstone aquifer flows north-north-east, discharging towards the Mersey estuary and the low-lying Ince Marshes. This aquifer exhibits zoned salinity and redox conditions, with oxic waters typically found near the surface, which encourages the deterioration of organic matter and increases the alkalinity of water.

5.2. RELATION TO PRIOR INVESTIGATIONS

Throughout the previous site investigations, the ground conditions indicate that the peat-like soils are interbedded by other soils, including sands, silt and alluvium, which would cause the compression of the organic deposits and increase the deterioration of any peat present. The historical context of Ince Marshes as extensively reclaimed and drained agricultural land is indicative that long-term, active management has inevitably led to the degradation of any peat-like soils originally present. Degraded peat typically undergoes desiccation, oxidation, and compaction due to the introduction of oxygen into previously anaerobic environments. Consequently, it may no longer be actively forming peat and can become a net emitter of greenhouse gases, particularly CO_2 instead of emitting CH_4.

The nature of the ground observed during investigations at Ince Marsh is characteristic of degraded organic soils, which exhibit high compressibility and low shear strength. Given the estuarine and reclaimed nature of Ince Marsh, it is plausible to consider its organic deposits within the framework of an alkaline flat marsh or a saline wetland. Alkaline flats are typically flat-bottomed depressions found in arid or semi-arid regions, often adjacent to coasts or large bodies of water, characterised by periodic inundation and the deposition of salts, sand, and mud as water evaporates or infiltrates.

Ince Marsh's low-lying, reclaimed status and proximity to the Mersey Estuary mean it experiences tidal influences and managed drainage (from the agricultural history and extensive drainage associated with the canal and EA pump), which can lead to the accumulation of mineral sediments (silt, clay, sand) alongside organic matter. The presence of "tidal flat deposits and alluvium" containing "lenses of organic-rich muds" supports this mixed composition.

The pH of estuarine marshes can vary significantly, and the soils encountered typically have a higher pH than those found in peatlands. As such, the Site is considered to have similar properties to a fens landscape, commonly characterised by neutral pH due to its connection to mineral-rich groundwater. As such, the underlying Permo-Triassic sandstone bedrock could influence the groundwater chemistry, potentially contributing to alkaline conditions.

5.3. ECOLOGICAL & BIODIVERSITY PROCESSES

Peatlands and alkaline flat marshes (i.e. tidal flats, fens) are wetlands where organic matter may accumulate due to waterlogged conditions, the formation process is fundamentally different, and are shaped by the environment, geochemistry and local biology.

Peatlands are wetlands that have a significant accumulation of peat, with classification within the UK regarded as deposits greater than 30 cm thick. The formation is a long-term process and requires persistently high and stable water tables, which contribute to the preservation of organic material and encourage slow decomposition under compressive conditions, which encourage decomposition. Peatlands are ombrotrophic, meaning that they receive water and nutrients from the atmosphere, and are isolated from mineral-rich groundwater sources.

Peatland is additionally associated with specific vegetative species which are present in the matrix of the soil. In lowland bogs, sphagnum mosses are the primary peat-formers, given the ability to maintain a significant concentration of water and generate an acidic environment.

Deep peat provides a unique habitat which supports a wide range of ecological communities. Additionally, the critical feature of deep peat deposits is their carbon storage potential. Provided the organic-rich soil, the process of peatland development results in a carbon store which is considered the largest terrestrial sequester of carbon globally. Common thicknesses of deep peat are considered to be 9.00 m, with little to no variation in the composition or structure of the deposits, given that alluvial or glacial deposition can cause the composition of organic deposits and encourage decomposition, resulting in an organic-rich peat-like soil which does not possess the properties of a carbon sink similar to peat.

Alkaline flat marshes are minetrophic, receiving water and nutrients from groundwater and surface runoff from surrounding mineral soils, e.g. alluvium. The conditions mean that peat-like soils form, which are interbedded, with compression of organic soils caused by mineral deposits from hydrological deposition processes. Peat-like deposits in these landscapes are indicative of organic deposits which represent non-Lutetian peat composed of vascular plants, which represent a distinct difference to acidic boreal environments, that characterise peat.

The peat-like deposits in these marshes are not the purely organic peat found in bogs. Instead, they are a unique mixture of partially decomposed organic matter and inorganic marl. The accumulation is still driven by waterlogging and low oxygen, which slows decomposition, but the presence of the mineral-rich groundwater (i.e. calcareous sandstone) means the organic matter is less acidic and can be interspersed with layers of silt, sand, gravel and clay as encountered in the prior investigations' logs. The resulting deposits possess a different texture and composition than the organic-rich peat of a bog and cannot be described as peatland.

Critically for peaty soil accumulation, flat topography is essential to provide efficient waterlogged and anaerobic conditions, which decrease the oxygen concentration and inhibit decomposition. True peat, especially in bogs, is a highly organic, acidic material composed almost entirely of partially decomposed plant matter, primarily *Sphagnum* moss. It is formed in environments isolated from mineral-rich groundwater. In contrast, the deposits at Ince Marsh contain a significant inorganic component in the form of marl. This mixture of organic and inorganic material makes it distinct from the pure, organic-rich peat of a bog.

The formation of true peat is a process of organic accumulation under acidic to neutral conditions. The deposits at Ince Marsh, however, form under alkaline conditions where the presence of calcareous bedrock generates acidic conditions through the calcification of the soils. Furthermore, extensive and historic drainage of the peatland has been undertaken that has increased the bioavailability of oxygen for microorganisms within the peat soils and encouraged the decomposition of peat-like soils.

At Ince Marsh, boreholes have shown a significant depth of these peat and silt deposits, with deposits in excess of 3.0 m thickness encountered locally. This demonstrates a long history of waterlogged conditions and plant growth; the underlying geology reveals a history of estuarine and tidal influence. The deposits are not simply accumulating from the slow growth and decay of bog plants; they are a complex layering of organic material, marine and alluvial silts, and the precipitated marl, all influenced by the dynamic coastal environment of the Mersey Estuary and the regional groundwater system.

5.3.1. LIKELIHOOD OF *SPHAGNUM* MOSSES IN THE STANLOW MARSHES ENVIRONMENT

The Stanlow Marshes, along with the adjacent Ince, Frodsham and Helsby marshes, are not naturally occurring raised bogs or blanket bogs. They form part of a saline estuarine system along the River Mersey, historically dominated by tidal flats, saltmarsh vegetation, and intertidal muds. Several key factors mean that *Sphagnum* mosses are highly unlikely to occur here:

1. Salinity – *Sphagnum* mosses are adapted to freshwater, low-nutrient environments. Even moderate salinity severely inhibits their growth, damaging their cell structure and disrupting their ability to absorb water. The Stanlow Marshes are subject to periodic inundation by brackish tidal waters from the River Mersey, creating conditions wholly unsuitable for *Sphagnum* colonisation.
2. Hydrological regime – Peat-forming *Sphagnum* communities require consistently high water tables fed by rainfall or baseflow, without regular tidal flushing. The marshes here experience fluctuating water levels driven by tidal cycles, storm surges, and engineered drainage systems installed during 17th–19th century land reclamation. These fluctuations prevent the stable waterlogged surface conditions needed for *Sphagnum* establishment.
3. pH and nutrient status – *Sphagnum* prefers acidic, nutrient-poor waters. Estuarine sediments are often more neutral to slightly alkaline and enriched in nutrients from tidal inputs, sediment transport, and upstream agricultural runoff. This nutrient-rich, non-acidic environment favours saltmarsh plants such as *Spartina*, *Salicornia*, and *Atriplex*, not bog mosses.
4. Sediment dynamics – The marshes lie in a high-sediment, dynamic environment where mineral deposition (silts, sands, clays) from tidal flows and river discharge constantly reworks the surface. This mineral input dilutes organic accumulation and physically disrupts any *Sphagnum* growth, which requires stable, organic-rich surfaces.
5. Historical land reclamation – The drainage channels, embankments, and pumping infrastructure constructed between the 17th and 19th centuries have further altered hydrology, reducing natural waterlogging and facilitating agricultural use. This would have eliminated any pre-existing freshwater bog-forming vegetation long before modern ecological records began.

While *Sphagnum* mosses are central to the function and persistence of active UK peatland habitats, their specific ecological requirements – constant freshwater saturation, acidic nutrient-poor conditions, and absence of tidal influence – are incompatible with the hydrological and chemical conditions of the Stanlow Marshes. The Site's estuarine setting, saline influence, dynamic sediment regime, and history of drainage and reclamation preclude the development of *Sphagnum*-dominated vegetation.

Any organic-rich soils present in the area result from estuarine marsh sedimentation and plant decay under brackish conditions, rather than the sustained bog moss activity seen in true peat-forming systems. Therefore, the absence of *Sphagnum* further supports the conclusion that the Stanlow Marshes do not constitute an active peatland habitat under Natural England's definition.

5.4. ARTIFICIAL ALTERATION

The landscape of Ince Marsh has been heavily modified by human activity, particularly the reclamation of marshland for agriculture. This has involved extensive drainage, which leads to the drying, compaction, and degradation of any existing peat. This process can change the character of the soil, making it a mixture of original peat and other organic and mineral deposits.

Archaeological findings in the area indicate that the Ince Marsh area has undergone alteration historically, with the marsh itself predating the ordnance datum. Roman fortlets have been encountered locally, and the presence of Roman structures is indicative of agriculture and drainage networks across the landscape. This would have minimised the waterlogging of the landscape and subsequently resulted in the degradation of organic-rich soils, increasing the emission of greenhouse gases.

Furthermore, extensive anthropogenic alteration followed in the wake of the Industrial Revolution. Whilst extensive drainage channels associated with agriculture are known to be present through historic investigation, further drainage networks were introduced following the construction of the Manchester Ship Canal. The project involved the significant alteration of the landscape which necessitated an extensive drainage network to reclaim the tidal mudflats of the landscape.

As a result, the landscape is characterised by a dense network of interconnected drainage channels and ditches with pumping stations present locally, which control the water levels below the level of the landscape. Consequently, the soils present are not waterlogged and do not represent the formative landscape of a peatland due to the excessive degradation that would be caused.

5.5. CARBON-SINK ASSESSMENT

After reviewing environmentally pertinent information and the potential of the Site as a peatland, the following assessment has been made:

While natural peatlands can be globally recognised as a sequester of carbon and can be classified as carbon stores, degraded soils consisting of organic material can become net emitters of greenhouse gases. When the peat-like organic soils are exposed to aerobic conditions, decomposition of the intrinsic organic matter is encouraged, and as such result in CO_2 emission.

The historic deposits' poor condition, with interbedded alluvial and marine deposits, is indicative of a poorly stored organic material which has organic-rich properties. However, given the extensive drainage and agricultural use across the Site, it must be noted that there is no realistic possibility of wetland restoration, and as such there is no conceivable potential for the cessation of the deterioration of the Ince landscape.

The limited and sporadic ground investigation across the sites has highlighted that peat-like soils are present within the soil matrix and deposits across the Site, however, the soils are indicated to be in a poor condition.

The presence of alluvial and marine soils above and below the horizons of peat are indicative of conditions which exacerbate peat deterioration.

The loading of sediment can increase the compression of organic deposits, and can also alter the water table, which may alter drainage and deposition rates, as well as acting as a source of erosion on the organic soil's surface. Additionally, as a tidal mudflat, the Site exhibits flooding from marine transgression, and this can perturb the deterioration of peat. This can occur through increased salinity that inhibits typical peat-forming plants and alters the vegetative composition, chemical imbalances can occur, which promote decomposition and the release of CO_2 and erosion through tidal action can remove organic matter.

6. CONCLUSION AND ASSESSMENT

A review of prior ground investigations, British Geological Survey records, and historical land use mapping confirms that the Site is underlain by estuarine alluvial deposits comprising interbedded silts, sands, clays and significant depths of organic-rich soils. These organic layers, locally several metres thick, have formed over centuries through tidal deposition of mineral sediments and the decay of saltmarsh and brackish marsh vegetation. This formation process is a direct product of coastal and estuarine geomorphology, involving periodic inundation, sediment transport, and tidal channel migration.

While these deposits have been described as "peat" or "peat-like" in accordance with BS 5930 soil description conventions due to their high organic content, their origin, composition, and environmental function are materially different from recognised UK peatland habitats. True peatland habitats – such as blanket bogs, raised bogs, and fens – form in freshwater, low-nutrient, acidic environments under permanently waterlogged conditions, often dominated by Sphagnum mosses and other peat-forming vegetation. In contrast, the Site's organic deposits formed in a saline, dynamic, mineral-rich setting, without the ecological community, hydrology or chemical conditions necessary for active peat formation.

This fundamental geological and geomorphological difference means that, under Natural England's habitat definitions and the DEFRA England Peat Map, the Site is not classified as peatland. The England Peat Map identifies only very minor, isolated pockets of peat within the wider area and none within the site boundary. No areas are designated as irreplaceable peatland habitat, confirming there is no existing or historical peatland capable of restoration.

Although the deep organic deposits have stored carbon over time, this has occurred through estuarine sedimentation and vegetation accumulation rather than through ombrotrophic or minerotrophic peat-forming processes. The current groundwater regime, maintained by tidal influence and low-permeability sediments, is likely to create largely anaerobic conditions within deeper horizons, limiting decomposition rates. However, historical drainage and land reclamation will have released some greenhouse gases.

Expert studies on similar degraded estuarine organic deposits indicate that ongoing greenhouse gas emissions in a development context are generally low, due to the absence of active biological peat accumulation and the relatively stable anaerobic conditions at depth.

The Cheshire Wildlife Trust report classifies the Stanlow, Frodsham, Helsby and Ince Marshes as peatland on the basis of soil mapping, our geological assessment and the DEFRA/Natural England England Peat Map confirm that these areas are estuarine in origin, consisting of tidal alluvial sediments with interbedded organic layers rather than peat formed through freshwater mire processes. They do not meet the national habitat definition of peatland, lack the vegetation, hydrology and ecological function of active peat-forming systems, and therefore have no realistic potential for restoration to a functioning peatland. As such, large-scale peatland creation here would be unlikely to deliver significant climate benefits and would face substantial hydrological, chemical and ecological constraints, while existing habitats such as floodplain grazing marsh hold their own biodiversity value.

From an engineering perspective, these deep organic deposits present potential challenges in terms of settlement, bearing capacity and construction stability, but such constraints can be addressed through established ground improvement, piling, or soil replacement methods.

This review suggests that the Site does not contain a peatland habitat under recognised UK definitions, has no potential for peatland restoration, and does not present an environmental constraint that would preclude development. With appropriate geotechnical design and environmental management, the Site can be considered suitable for development within the wider planning and sustainability context.

END OF REPORT

Appendix I: Limitations

GENERAL

This report and any associated works (together comprising the "Services") were compiled and carried out by E3P for the client (as present in Section 1) under the E3P "Terms of Business" or with those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.

Unless explicitly agreed otherwise, in writing, this report has been prepared under E3P Standard Terms and Business as included within our proposal to the Client.

Project-specific appointment documents may be agreed upon at our discretion and a charge may be levied for both the time to review and finalise appointment documents and also for associated changes to the appointment terms. E3P reserves the right to amend the fee should any changes to the appointment terms create an increased risk to E3P.

The report needs to be considered in light of the proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEOENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

Coverage: This section covers reports with the following titles or combination of titles: Phase 1; Desktop Study; Geoenvironmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Baseline Environmental Assessment; Project Scope Summary Report (PSSR), Program Environmental Impact Report (PEIR), Geotechnical Development Risk Register; Agricultural Land Assessment; Mineral Safeguarding Assessment; Desk Top Coal Mining Risk Assessment; Hydrogeological Appraisal; Construction Environmental Management Plan; and Site Water Management Plan.

The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walkover inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects' responses may not have been received from all parties. E3P cannot be held responsible for any disclosures that are provided post-production of our report and will not automatically update our report.

The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, E3P reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the Site.

Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and does not constitute or replace full and proper surveys completed by suitably qualified and experienced specialists in these fields.

E3P does not warrant work/data undertaken/provided by others.

INTRUSIVE INVESTIGATION REPORTS

Coverage: The following report titles (or combination) may cover this category of work: Geoenvironmental Site Investigation; Geotechnical Assessment; GIR (Ground Investigation Reports); Preliminary Environmental And Geotechnical Risk Assessment; Preliminary Summary; Coal Mining Risk Assessment, Ground Gas Addendum; and, Geotechnical Risk Register.

The investigation has been undertaken to provide information concerning either:

- The type and degree of contamination present at the Site in order to allow a generic quantitative risk assessment to be undertaken; or
- Information on the soil properties present at the Site to allow for geotechnical development constraints to be considered.

The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.

Unless otherwise specified in the scope of works, any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the Site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.

For geotechnical investigations, the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the Site within the context of the proposed future or continued use of the Site, as stated within the report.

The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.

The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the Site which have not been disclosed by this investigation and which have therefore not been taken into account in this report

The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, E3P has used reasonable skill and care to extrapolate conditions between these points based on assumptions to develop our interpretation and conclusions.

The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation and at the time of the investigation.

Conditions can change between investigation points both spatially and over time and these interpretations should therefore be considered indicative. The assessment of extreme weather events and their impact on ground conditions is not within the scope of E3P's work

The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the risk assessment process have been outlined within the body or associated appendix of the report.

Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.

Where soil contamination concentrations recorded as part of this investigation are used for commentary on the potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed and the waste classification and any subsequent disposal option agreed upon with licenced subcontractors and/or the relevant regulators.

The results of the asbestos testing are factually reported and interpretation is given as to how this relates to the previous use of the Site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the Site.

If costs have been included in relation to additional Site works, and/or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

EUROCODE 7: GEOTECHNICAL DESIGN

On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.

In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIATION AND ENABLING WORK STRATEGY REPORTS

These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected based on the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.

The outputs of the Detailed Quantitative Risk Assessments are based upon the manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.

Before adoption on-site, assessment criteria will need to be discussed and agreed upon with the Regulatory Authorities prior to adoption on Site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatoy Authority engagement are not within the control of E3P. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

E3P does not accept liability for any subcontract work that has not been completed in strict accordance with an approved E3P Remediation and Enabling Works Strategy.

GEOTECHNICAL DESIGN REPORT (GDR)

The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.

MONITORING (INCLUDING REMEDIATION MONITORING REPORTS AND BUILD PHASE MITIGATION)

These reports are factual and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of earthworks or remedial works.

The data is presented and will be compared with assessment criteria.

Appendix II: Glossary

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
MRA	Mining Remediation Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns

LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m 3	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m^2	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWI R	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection
PFAS	Per- and Poly-Fluorinated Substances	PFOA	Perfluorooctanoic Acid

Appendix III: Drawings

DRAWING 18-449-R1-1 – SITE LOCATION MAP

Key

Tidal Flat Deposits - Clay, Silt And Sand

Notes:

Phase	Issue	Date	Drawn	Checked	PM
P1	REVA	19.06.2025	TG	MD	MD

Client: Cheshire West

Job No: 18-449

Date: 19.06.2025

Drawing No: 031

Scale: NTS

Job Title: Protos Extension Land

Drawing Title: Superficial Geology Plan

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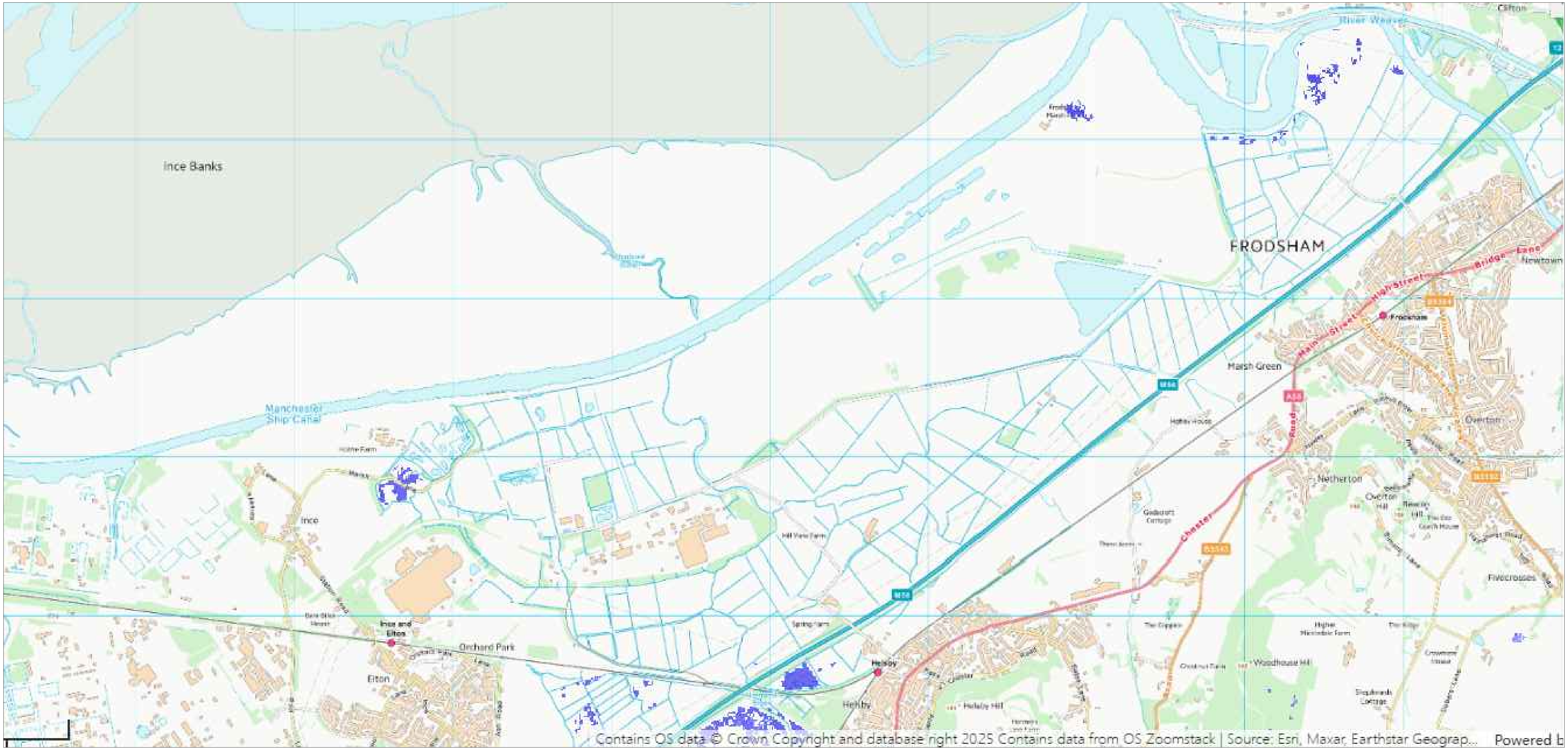
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



N

Notes:	Client:	Job No:	Date:
	Cheshire West	18-449	15.08.2025
		Drawing No:	Scale:
		032	NTS

P1	REVA	15.08.2025	TG	MD	MD
Phase	Issue	Date	Drawn	Checked	PM

Job Title: Protos Extension Land

Drawing Title: England Peat Map Plan

e3p
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Taylor Road, Trafford Park
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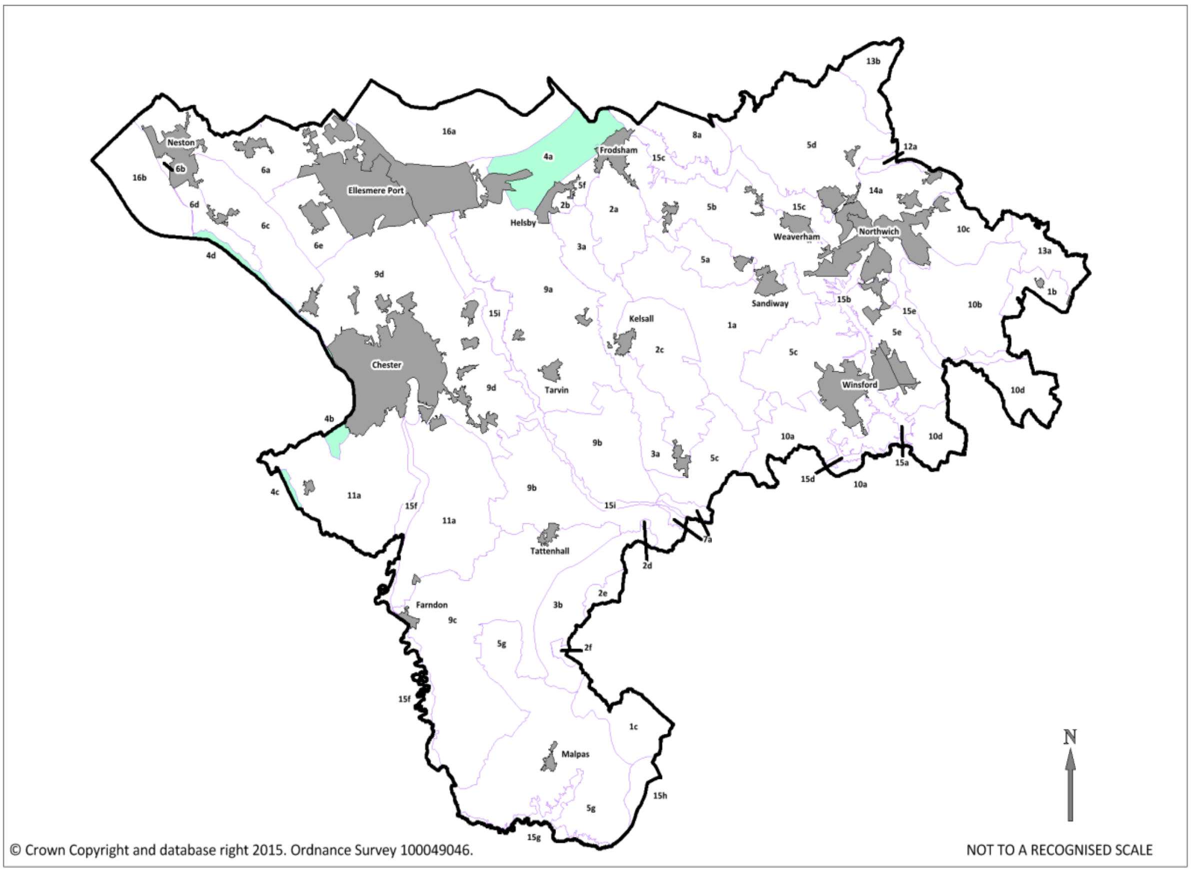
Appendix IV: LCT4 Drained Marshes

LCT 4: DRAINED MARSH



General Description

This landscape character type is located on former saltmarsh or mudflats adjacent to the Dee and Mersey estuaries. It is drained by inter-connecting networks of drainage channels arranged in a regular, often linear pattern, and this gives the impression of an open unenclosed landscape. This character type is significantly reduced in size; it formerly covered a much greater area. Today the reclaimed land is mainly used as grazing land, with some arable crops.

The flat, open nature of this landscape often provides expansive views of the surrounding area including the Dee and Mersey estuaries, which are intrinsic to its existence and character. The close proximity to industrial sites and the open views of these areas also has a significant impact.

Visual Character

This landscape type appears as a very flat, open and large scale landscape. The combination of flat topography and low field boundaries such as drainage ditches or post and wire fences allows extensive panoramic views out to the surrounding character areas. Within this landscape the general absence of development or higher ground means that visually dominant elements, such as upland areas or large structures, are located in the surrounding character areas and this exerts a strong influence upon landscape character.

Major transport corridors can be visually prominent. For example, the M56 and main railway transport corridors traverse the *Frodsham, Helsby and Lordship Marshes* character area on embankments. This slight elevation combined with the scarcity of high hedges or hedgerow trees can lead to a high level of visual disruption from moving traffic. Artificial embankments along the northern boundary of the *Frodsham, Helsby and Lordship Marshes* character area, separating it from the Manchester Ship Canal and the open Mersey Estuary, and around the canal deposit dumps, are prominent, highly visible features in the landscape. Similarly, a number of large scale overhead power lines running parallel with the M56 and railway are dominant features.

Physical Influences

This character type occurs on very low-lying flat topography with an elevation of between 0-13m AOD. The former marsh resulted from the marine and alluvial deposits of clay, salt and silt deposited under tidal and estuarine influence. This overlies Kinnerton Sandstone, Chester Pebble Beds and Wilmslow Sandstone. Soils comprise humic and alluvial gleys on the improved reclaimed coastal floodplain.

Small patches of scrub are common, with few trees. Where there are hedgerows they are mostly grown out and in poor condition. Reeds and other aquatic or emergent plants are mainly restricted to ditches. The drained marsh has ornithological interest as a wintering ground for wading birds and wildfowl as well as birds of prey.

Cultural Influences

This is marginal land that has been created through reclaiming former estuarine marshland and manually digging drainage ditches and installing pumps in more recent periods. This was undertaken to increase the available land for agriculture and to improve food production. For example, the *Frodsham, Helsby and Lordship Marshes* area was reclaimed in 1894 as part of the opening of the Manchester Ship Canal, with further extensive drainage undertaken in the Second World War. The reclaimed sediments are amongst the best in the county and potentially very fertile, able to sustain crops of barley, winter wheat and potatoes.

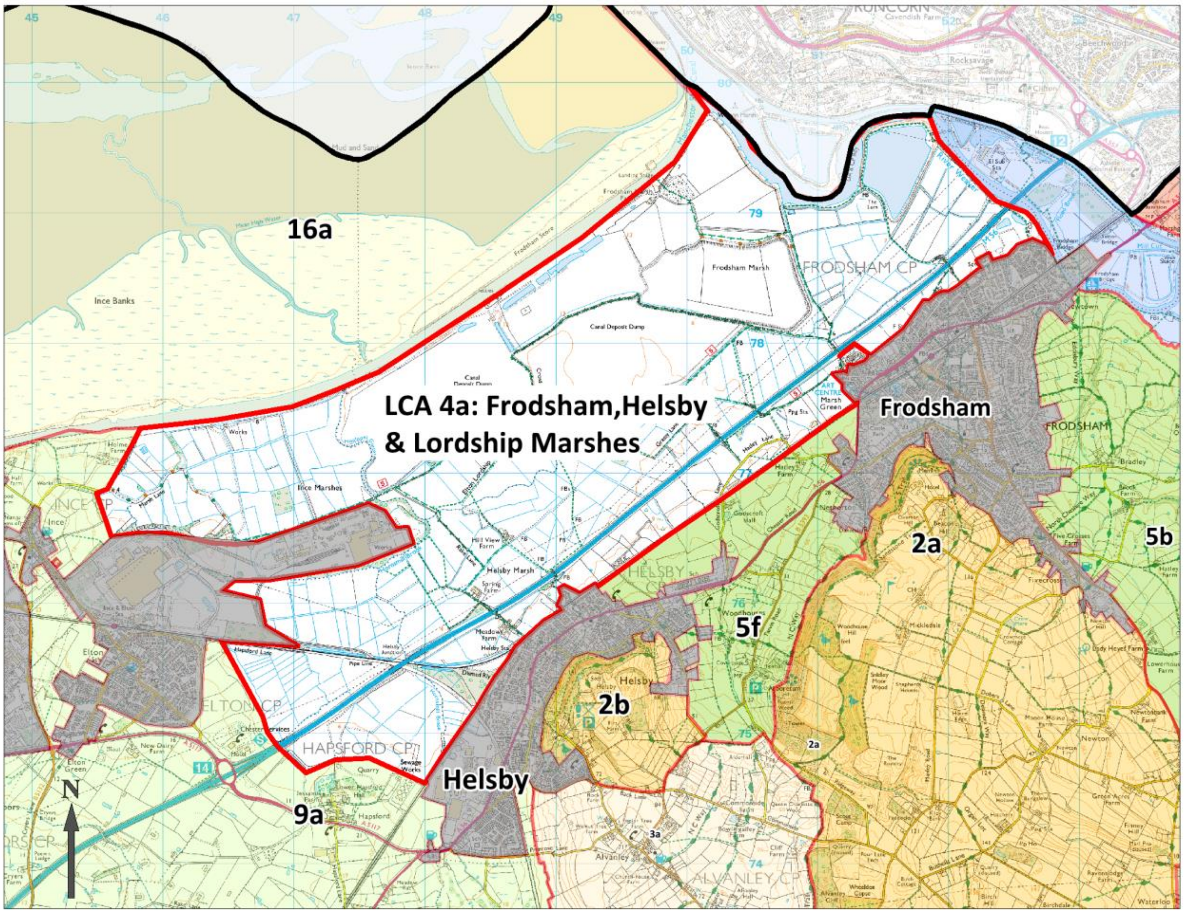
Marshland is an unappealing location for settlement and as such these areas have remained largely unsettled, restricted to a few isolated farms. However, industry has utilised similar reclaimed marshland, for example the landscape character type wraps around the GrowHow Fertiliser Plant to the west of the Frodsham and Ince Marshes, and further west is the extensive Stanlow oil refinery.

Development of the Ince Resource Recovery Park has been approved on Ince Marshes. The Frodsham Wind Farm comprising 19 wind turbines is under construction and will occupy much of the land within the northern half of the *Frodsham, Helsby and Lordship Marshes* between Lordship Lane and the Mersey Canal.

There are **four Landscape Character Areas** within LCT 4:

4a: *Frodsham, Helsby and Lordship Marshes*
4b: *The Lache Eyes*
4c: *Dodleston Drained Marsh*
4d: *Burton & Shotwick Drained Marsh*

LCA 4a: *Frodsham, Helsby and Lordship Marshes*



 Not to a recognised scale

Location and Boundaries

The northern boundary of this landscape character area is formed by an artificial bank which separates it from the Manchester Ship Canal and open *Estuary* of the Mersey Estuary beyond. The southern boundary is marked by the railway and urban edges of Frodsham and Helsby. The River Weaver lies to the east and industrial development to the west.

Key Landscape Characteristics of LCA 4a: ***Frodsham, Helsby and Lordship Marshes***

- A flat, low lying landscape (up to 13m AOD) of former mudflats and saltmarsh alongside the Mersey Estuary, contrasting with surrounding built development (previously designated as an Area of Significant Local Environmental Value – ASLEV)
- Strong interconnection and intervisibility with LCT 16 *Mudflats and Saltmarsh* to the north
- Reclaimed as part of the opening of the Manchester Ship Canal in 1894, with further drainage following the Second World War to produce productive farmland
- The flat landscape is etched with a distinctive pattern of straight drainage ditches which delineates the field pattern of planned 19th century enclosure
- There is an extensive ditch system, a stronghold for water voles in the borough
- Incomplete hedgerow boundaries provide partial enclosure along some field boundaries
- Land to the north of Lordship Lane is used as a deposit ground for dredgings from the Manchester Ship Canal and supports a range of wetland habitats
- Land to the south of Lordship Lane is in agricultural use – a mixture of pasture and arable with incomplete thorn hedgerows
- Canal dredging grounds defined by high earth embankments
- The area is of local, national and international importance for its breeding, wintering and passage birds which add movement to the landscape
- An isolated, bleak and open landscape - settlement is limited to isolated farms linked by rough tracks between ditches
- A system of surfaced tracks and bridleways serve the area, including National Cycle Route (NCR) 5
- The M56 and railway utilise the flat landscape, crossing the marsh at the base of the *Helsby to Frodsham Undulating Enclosed Farmland* that gently rises to the south
- Running parallel to the M56 area a number of large scale overhead power lines which are dominant features in this flat landscape
- The flat, open landscape provides clear views to and from the adjacent *Frodsham Sandstone Ridge* and *Helsby Hill*
- Industrial works at Ince Marshes, and at Halton and Rocksavage in Runcorn, form a backdrop in views to the west and east respectively
- Permitted windfarm will become dominant creating a 'windfarm landscape' when constructed

Key Landscape Sensitivities, Qualities and Value

Natural / Physical

- Extensive alluvial deposits of sand, silt and clay left by the Mersey River overlying a solid bedrock of Chester Pebble Beds, the erosional base of the Sherwood Sandstones;
- Once contiguous with the saltmarsh and mudflats of the Mersey Estuary, the area was embanked, ditched and drained in 1894 following the opening of the Manchester Ship Canal which lies to the north;
- Pumps and new ditches added following the Second World War to produce productive farmland that are some of the most fertile soils in the county;
- Influenced by alluvial drift deposits, clayey humic and alluvial gley soils are deep and well drained, and well suited to both pasture and arable crops;
- Field pattern delineated by the pattern of drainage ditches, with some fields also bounded by gappy hawthorn hedges;
- The extensive ditch system is a stronghold for water voles in the borough;

- Important roosting sites for wildfowl and waders at high tide from the Mersey Estuary SSSI - the whole area provides a wintering ground for waders and raptors and extensive habitat for breeding birds and is designated as a Local Wildlife Site;
- Large areas of land to the north of Lordship Lane are dredging deposit lagoons associated with the Manchester Ship Canal, exhibiting a sequence of ecologically rich habitats from bare mud to agricultural land.

Cultural / Heritage / Historic

- The field pattern characterised by straight-sided fields bounded by ditches, dating from the 19th century planned enclosure of marshland;
- Land north of Lordship Lane modified by 20th century field improvements (around Frodsham Marsh Farm) and creation of deposit dumps associated with the Manchester Ship Canal;
- Traces of human activity are indicated by the discovery of Bronze Age (c 2000 BC) spearheads on Frodsham and Ince Marshes. More recently, this marginal area was used as a WWII bomb decoy;
- The extensive network of public rights of way across the marshes, including NCR 5, which follow tracks and field boundaries and are used for passive forms of recreation such as jogging and dog walking. The Thornton-le-Moors to Frodsham Greenway crosses the area;
- Small consented developments including model aircraft strip and Hoverforce (leisure hovercraft and segways) provide recreational facilities.

Built Development and Settlement Pattern

- The absence of settlement except for scattered farms including Meadow Farm, Spring Farm, Hill View Farm, and Frodsham Marsh Farm, linked by a network of rough tracks that follow field boundaries and drainage ditches;
- The M56 and railway transport corridor that utilise the flat land;
- A number of large scale overhead power lines run parallel with the M56;
- Industrial works at Ince Marshes, and at Halton and Rocksavage in Runcorn, form a backdrop in views to the west and east respectively;
- Development of the Ince Resource Recovery Park has been approved on Ince Marshes;
- The consented Frodsham Wind Farm comprising 19 wind turbines will occupy much of the land within the northern half of the *Frodsham, Helsby and Lordship Marshes* between Lordship Lane and the Mersey Canal.

Perceptual / Visual

- The flat landform and long views contribute to the perception of a large scale, exposed landscape;
- Presence of man-made embankments foreshorten views to the north across the Mersey Estuary;
- Important views to and from the *Frodsham Sandstone Ridge* and *Helsby Hill*;
- The consistent field pattern through planned enclosure gives the perception of a reclaimed, tamed landscape;
- Vegetation-fringed ditches and rough ground and lagoons provide texture in the landscape;
- Parts of the marsh are remote, but the presence of traffic on the M56 motorway brings noise and movement to the area; the presence of birds and proximity to John Lennon Airport also contribute to noise and movement;
- Sense of naturalness of the marsh is diluted by man-made features and development;
- No prominent skyline, but embankments, pylons and industrial development are visually prominent;
- The open character means there is little opportunity for screening any large scale elements or for mitigating visual impact without the mitigation measures in themselves being highly visible -

making it a visually sensitive landscape. There are relatively few sensitive visual receptors in the area, limited to a few residential properties and users of the PRoW network, but in adjacent areas overlooking the marsh there are views from Frodsham and Helsby as well as visitors to the viewpoints at the top of Helsby Hill and the War Memorial above Frodsham.

Landscape Condition

Although much of the area is actively farmed, the degraded hedgerows and broken fencing shows this to be a landscape in need of improved management. Some land to north of Lordship Lane remains in use for canal dredgings and has undergone change as a result of the preliminary works for the permitted windfarm. Wet grassland species have been lost and ditches are eutrophic as a result of the intensive agricultural use of the land.

CWaC Local Plan policies with an influence on the character of LCA 4a: *Frodsham, Helsby and Lordship Marshes*

- Green Belt;
- Natural heritage sites of international, national, regional and/or local significance;
- Flood risk and water management.

Forces for Landscape Change

Past change

- Reduction of cultivated areas and increase in set-aside;
- Loss of wet grassland communities;
- Reduction in dredging lagoons with loss of wildlife interest;
- Increase in horse grazing around peripheral areas with associated changes to field boundaries and use of informal animal shelters, sheds etc.;
- Loss and fragmentation of hedgerows, and decline in fencing condition;
- Ditches are eutrophic as a result of nutrient run-off due to the intensive agricultural use of the land;
- Approved development of the Ince Resource Recovery Park on Ince Marshes;
- Small consented developments including model aircraft strip and Hoverforce (leisure hovercraft and segways);

Potential future change / key issues affecting LCA 4a: *Frodsham, Helsby and Lordship Marshes*

- Continued dredging and dumping is likely to continue to affect the landscape of the marshes;
- Pressure for increase in transport infrastructure / improvements;
- Encroachment by industrial development and infrastructure: pressure for expansion of industry on the marshes, including renewable energy development;
- Visual impact of prominent development and traffic could be reduced by tree planting but this would change the open character of the area;
- Cost of artificial drainage could lead to withdrawal of pumping and loss/under-management of historic drainage systems and change in water levels on farmland;
- Climate change could lead to increased flooding affecting the use and management of the land;
- Improved drainage measures could lead to local modification to hydrological characteristics of field system and may threaten paleo-environmental remains;
- When constructed the Frodsham Wind Farm will dominate the landscape, reduce the openness of the marshes and create a 'windfarm landscape'.

Overall Landscape Management Strategy for LCA 4a: Frodsham, Helsby and Lordship Marshes

The overall management strategy for this landscape should be to ***enhance and restore*** the condition of habitats and features of the marshes whilst safeguarding its open character.

Landscape Management Guidelines

1. Encourage recreational development as a means of managing some of the more derelict and degraded areas of the landscape. Encourage use of the area by walkers, cyclists, rowers and horse riders (including provision of picnic facilities and viewing opportunities) whilst safeguarding the nature conservation interest of the area, particularly its importance for birds.

2. Maintain the distinctive field pattern that reveals the planned 19th century enclosure of the marsh.

3. Seek to restore thorn hedgerows that are falling into decline.

4. Maintain and ecologically enhance the ditch system and riparian habitats and land supporting breeding, over wintering and passage birds. Seek opportunities to re-create habitats such as species rich grassland and reed beds.

5. Increase the biodiversity of intensively managed grassland and arable land – create and link buffer strips along linear features such as hedgerows and ditches to create a continuous network of wildlife corridors.

6. Improve water quality by encouraging less-intensive agricultural practices to reduce fertiliser run-off and nutrient levels in the ditches.

7. Encourage restoration of derelict industrial land including re-creation of salt-marsh and reintroduction of grazing to maintain the open character of the marsh.

8. Consider opportunities to create views across the Mersey Estuary.

9. Conserve the 'remote' character of the marshes away from the main transport corridor of the M56.

10. Retain the open character of the marsh by restricting planting to low growing scrubby species typically found in the local landscape, taking into account the importance of the area for ground nesting birds and wintering/passage birds. Woodland planting /screening using tall or ornamental species is not appropriate in the open marsh.

Built Development Guidelines

1. Conserve the remaining open, undeveloped areas of the marsh.

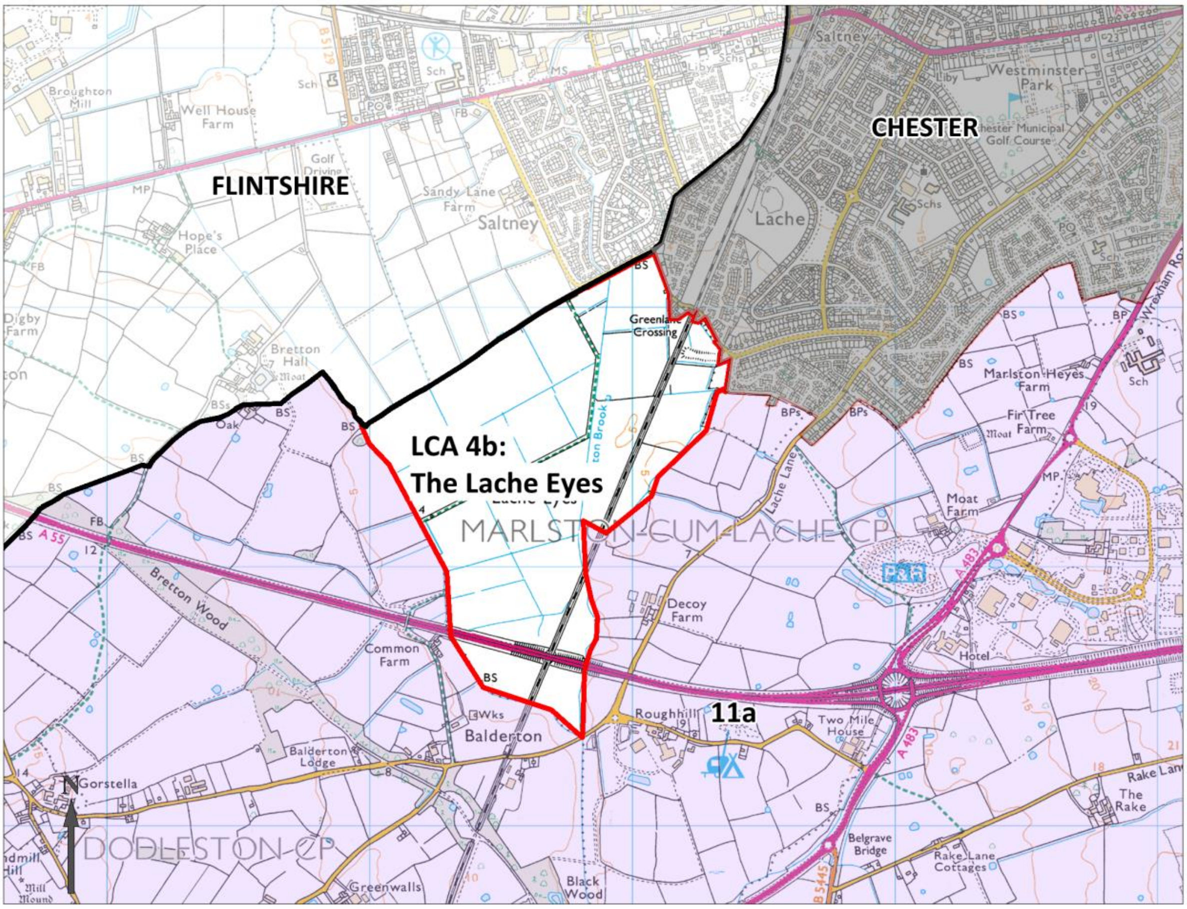
2. Consider using native scrubby vegetation to screen views of traffic on the north side of the M56 motorway (taller species may be appropriate on the southern side of the motorway adjacent to the *Helsby to Frodsham Undulating Enclosed Farmland*).

3. Consider views to and from the *Frodsham Sandstone Ridge and Helsby Hill* when planning any change.





LCA 4b: *The Lache Eyes*



 Not to a recognised scale

Location and Boundaries

The Lache Eyes is a very small landscape character area immediately to the southwest of Chester. Formerly part of the larger Saltney Marsh in the Dee Estuary, it continues to the north beyond the Cheshire West and Chester borough boundary, west of Saltney.

Key Landscape Characteristics of LCA 4b: ***The Lache Eyes***

- A very flat, low lying landscape (up to 5m AOD) of former tidal marsh alongside the Dee Estuary, contrasting with surrounding built development
- Regular flooding occurs in the winter
- An area originally part of the tidal estuary of the River Dee before silting up after the Roman period, embanked and reclaimed during the 18^{th} & 19^{th} centuries to produce productive farmland
- Land predominantly used for grazing and horsiculture north of the main footpath crossing the LCA (land to the south has recently been sprayed off and reseeded)
- Areas of species rich grassland of nature conservation interest
- The flat landscape is etched with a distinctive pattern of straight drainage ditches and channels which delineate the regular field pattern
- Ditches and drainage channels criss-cross the area and are of important nature conservation value
- The area supports red and amber listed bird species of conservation concern including snipe and starling
- Incomplete, low cut hedgerow boundaries and post and wire and wooden fencing provide variety in field boundaries
- Lack of trees provides a very open, exposed, windswept landscape
- Absence of settlement, and lack of roads and rights of way across the area; one main footpath crosses the LCA
- The A55 cuts across the southern end of the character area, and the railway transects the eastern edge, on embankment and utilising the flat landscape
- The transport corridors add movement and noise to an otherwise remote, empty landscape
- The flat, open landscape provides clear views to the hills of north Wales to the west
- The presence of two duck decoys, used to trap wildfowl

Key Landscape Sensitivities, Qualities and Value

Natural / Physical

- The flat nature of the land was formed when Lache Eyes was originally part of the tidal estuary of the River Dee before silting up after the Roman period;
- Formerly part of the larger Saltney Marsh in the Dee Estuary, the Lache Eyes was embanked and reclaimed during the 18^{th} & 19^{th} centuries to produce productive farmland;
- Subsequent drainage and industrial development of the wider Saltney Marsh beyond the borough boundary has reduced its extent;
- Influenced by alluvial drift deposits, clayey and alluvial gley soils are deep and well drained, and well suited to both pasture and arable crops;
- Areas of species rich grassland of nature conservation interest;
- Field pattern delineated by the pattern of drainage ditches, with some fields also bounded by low cut hawthorn hedges, in some places gappy, or post and wire fences and wooden fences;
- Drainage works included straightening the Balderton Brook.

Cultural / Heritage / Historic

- The field pattern characterised by straight-sided fields bounded by ditches and drainage channels, dating from the 18^{th} and 19th century planned enclosure;
- The presence of two duck decoys, used to trap wildfowl, close to Decoy Farm although both are now only faint depressions in the ground. The one to the immediate north of the pond (known

as the 'Mermaid's Purse Decoy') is of unknown age but the main decoy to the west was known to have been constructed in 1634 and a map dated 1733 shows it located on the coastline;

- The second decoy is called Brereton's Duck Decoy and was constructed between 1631 and 1634 by Sir William Brereton and his relatives as a commercial venture. Its construction caused controversy and protests from more traditional landowners which resulted in a number of lawsuits. These indicate that Brereton was supplying the market towns of Cheshire and South Lancashire with cheaper and better quality fowl than his rivals. Although it is uncertain exactly when the decoy fell into disuse, it was definitely out of use by 1846, when the Chester-Wrexham Railway drove their line through the centre of the pond. Both are Mermaid's Purse Decoys in terms of morphology, the more northerly example is un-named;
- A public footpath follows the drainage ditches/channels and field boundaries through the character area.

Built Development and Settlement Pattern

- The absence of settlement, although a number of farmsteads are located along the character area boundary, including Decoy Farm and Common Farm which are visually prominent due to the lack of screening in the flat landscape;
- Lack of roads, although the A55 and Chester to Wrexham railway transport corridors utilise the flat land.

Perceptual / Visual

- The flat landform and long panoramic views contribute to the perception of a large scale, exposed landscape;
- Woodland within the *Eaton Estate Farmland* provides a backdrop in views to the south;
- Important views westwards to the Clwydian Hills of north Wales and south-eastwards to the *Sandstone Ridge*;
- The consistent field pattern through planned enclosure gives the perception of a reclaimed, tamed landscape;
- Vegetation-fringed ditches and rough ground provide texture in the landscape;
- Parts of the area are remote, but the presence of traffic on the A55 dual carriageway brings noise and movement to the southern part of this character area; the presence of birds and aircraft using the Hawarden (Chester) Airport also contribute to noise and movement;
- No prominent skyline, but traffic on the embanked A55 is visually prominent;
- Huge sheds and hangers of the Broughton Aircraft Factory are visually dominant in views to the northwest;
- The open character means there is little opportunity for screening any large scale elements or for mitigating visual impact without the mitigation measures in themselves being highly visible - making it a visually sensitive landscape. There are relatively few sensitive visual receptors in the area.

Landscape Condition

The degraded hedgerows and broken fencing shows this to be a landscape in need of improved management. Wet grassland species have been lost and ditches are eutrophic as a result of the intensive agricultural use of the land.

CWaC Local Plan policies with an influence on the character of LCA 4b: *The Lache Eyes*

- Green Belt;
- Flood risk and water management.

Forces for Landscape Change

Past change

- Reduction of cultivated areas and increase in set-aside;
- Loss of wet species-rich grassland communities;
- Loss and fragmentation of hedgerows, and decline in fencing condition;
- Ditches are eutrophic as a result of nutrient run-off due to the intensive agricultural use of the land.

Potential future change / key issues affecting LCA4b: *The Lache Eyes*

- Pressure for increase in transport infrastructure / improvements;
- Pressure for renewable energy; wind turbines in the open, exposed, windswept landscape, and Solar PV farms;
- Visual impact of prominent development and traffic could be reduced by tree planting but this would change the open character of the area;
- Cost of artificial drainage could lead to withdrawal of pumping and loss/under-management of historic drainage systems;
- Climate change could lead to increased flooding affecting the use and management of the land.

Overall Landscape Management Strategy for LCA 4b: The Lache Eyes

The overall management strategy for this landscape should be to ***conserve*** the open, undeveloped character and the distinctive network of drainage ditches and channels, and to ***enhance*** the condition of habitats and features of the drained marsh.

Landscape Management Guidelines

1. Encourage management of derelict and degraded areas of the landscape.

2. Maintain the distinctive field pattern that reveals the planned 18th and 19th century enclose of the former Saltney Marsh in the Dee Estuary.

3. Seek to restore and manage thorn hedgerows that are falling into decline, to maintain the age and species diversity.

4. Encourage management and maintenance of the network of drainage ditches and channels in a way that retains these as important characteristic features of the landscape and protects their ecological value.

5. Maintain and manage semi-improved species rich grassland.

6. Increase the biodiversity of intensively managed grassland and arable land – create and link buffer strips along linear features such as hedgerows and ditches to create a continuous network of wildlife corridors.

7. Improve water quality by encouraging less-intensive agricultural practices to reduce fertiliser run-off and nutrient levels in the ditches.

8. Conserve the ‘remote’ character of *The Lache Eyes* away from the main transport corridors of the A55 and railway.

9. Retain the open character of the drained marsh by restricting planting to low growing scrubby species typically found in the local landscape, taking into account the importance of the area for ground nesting birds and wintering/passage birds. Woodland planting /screening using tall or ornamental species is not appropriate in the open marsh.

10. Encourage controlled public access through the area via clear way marking to prevent people straying from the public footpath network.

Built Development Guidelines

1. Conserve the open, undeveloped character of the drained marsh. Even small scale built development is likely to be conspicuous and any attempt at screening with trees would itself be prominent and uncharacteristic.

2. Renewable energy development is likely to be prominent in the open landscape, with potential for cumulative effects which should be avoided.

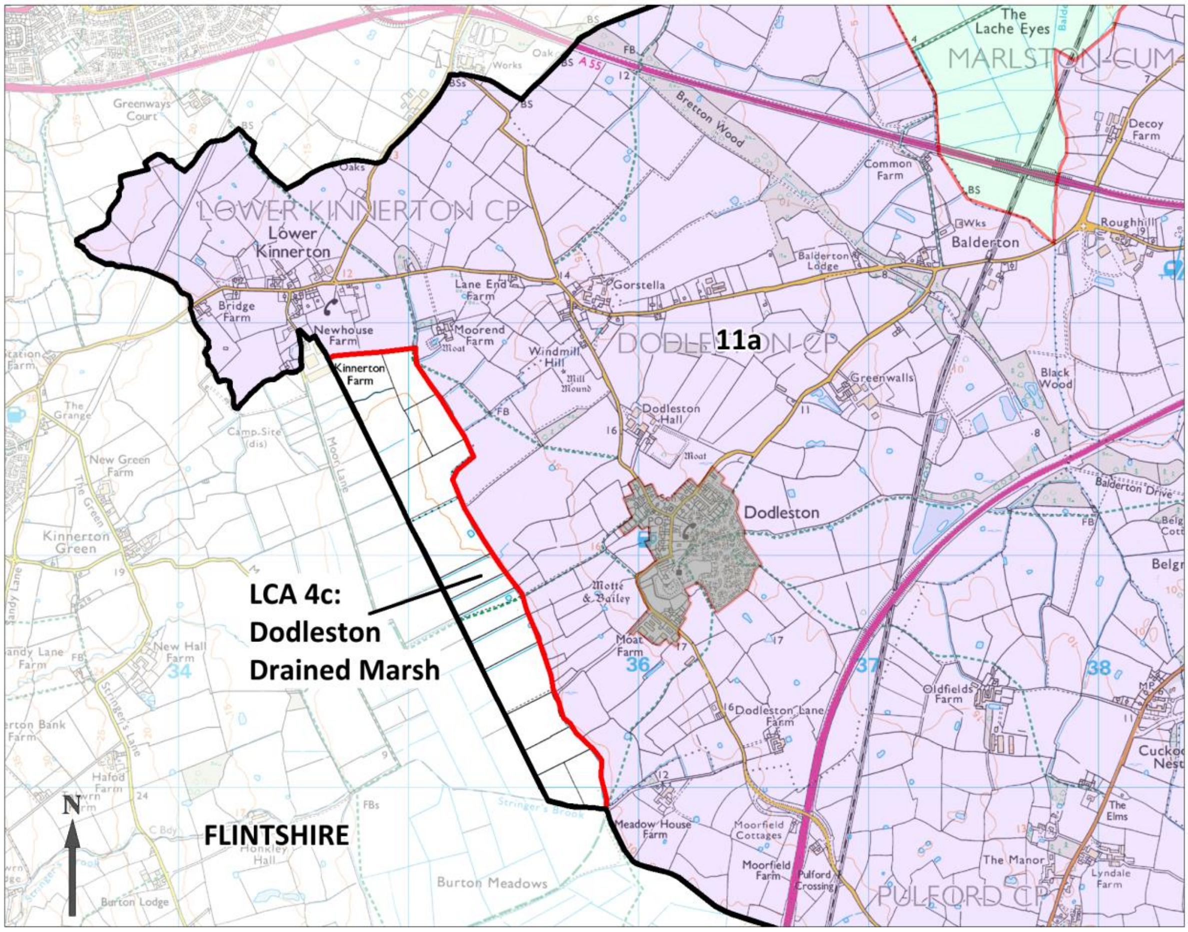
3. Consider using native scrubby vegetation to screen views of traffic alongside the A55 dual carriageway.

4. Consider views to the Welsh hills and the *Sandstone Ridge* when planning any change.





LCA 4c: *Dodleston Drained Marsh*



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Not to a recognised scale

Location and Boundaries

The *Dodleston Drained Marsh* is a narrow elongated landscape character area straddling the border with Wales to the southwest of Chester. It forms part of the wider Burton Meadows, reclaimed and artificially drained from the former Dee Estuary. It lies between Lower Kinnerton and Dodleston and continues to the west beyond the Cheshire West and Chester borough boundary.

Key Landscape Characteristics of LCA 4c: ***Dodleston Drained Marsh***

- A very flat, low lying landscape (10m AOD) of former tidal saltmarsh alongside the Dee Estuary, reclaimed during the 18th and 19th centuries to produce productive farmland
- An underlying geology of Kinnerton Sandstone and Chester Pebble Beds overlain by alluvial deposits;
- Cattle grazing is the dominant land use, although there are also fields in arable cultivation
- Areas of species rich grassland of nature conservation interest
- The flat landscape is etched with a distinctive pattern of straight drainage ditches and channels which delineate the regular, rectangular field pattern
- Ditches run perpendicular to the main drainage channel
- Ditches and drainage channels are of important nature conservation value
- Low cut hedgerow boundaries, some incomplete, and occasional post and wire fencing provide uniformity in field boundaries
- Lack of trees provides a very open, exposed, windswept landscape
- Occasional field ponds
- Absence of settlement and roads through the area provides an empty, remote landscape
- A footpath from Dodleston crosses the landscape
- The flat, open landscape provides views to the hills of north Wales to the west and to the *Sandstone Ridge* to the southeast

Key Landscape Sensitivities, Qualities and Value

Natural / Physical

- Alluvial deposits of sand, silt and clay left by the River Dee overlying a solid bedrock of Chester Pebble Beds Formation, the erosional base of the Kinnerton Sandstones;
- Once contiguous with the saltmarsh and mudflats of the tidal Dee Estuary, the area was ditched and drained during the 19th century to produce productive farmland;
- Areas of species rich grassland of nature conservation interest;
- Regular, rectangular field pattern delineated by the pattern of drainage ditches running perpendicular to the main drainage channel which runs in a northwest to southeast direction from Lower Kinnerton, along the borough boundary;
- Fields bounded by low cut hawthorn hedges, in some places gappy, with occasional post and wire fences providing uniformity in field boundaries.

Cultural / Heritage / Historic

- The regular, rectangular field pattern characterised by straight-sided fields bounded by ditches and drainage channels, dating from the 19th century;
- Field ponds along the eastern boundary of the character area are more typical of the adjacent *Estate Farmland* and *Cheshire Plain West*;
- A public footpath follows the drainage ditches/channels and field boundaries through the character area.

Built Development and Settlement Pattern

- Settlement and any other built development is absent from this landscape, although a number of farmsteads are located along the character area boundary, including Newhouse Farm, Kinnerton Farm, Moat Farm and Meadow House Farm which are visually prominent due to the lack of screening in the flat landscape;
- Absence of roads.

Perceptual / Visual

- The flat landform and long panoramic views contribute to the perception of a large scale, exposed landscape;
- Woodland at Hawarden, including Bilberry Wood, provides a backdrop in some views to the west, although there are more distant views westwards to the Clwydian Hills of north Wales and south-eastwards to the *Sandstone Ridge*;
- The consistent field pattern through planned enclosure gives the perception of a reclaimed, tamed landscape;
- Vegetation-fringed ditches and rough ground provide texture in the landscape;
- Field ponds and irregular field boundaries along the eastern edge of the character area are more typical of the adjacent *Estate Farmland* and *Cheshire Plain West* giving this part of the character area a more transitional feel;
- The absence of any development and roads provides a remote landscape, but the presence of birds and aircraft using the Hawarden (Chester) Airport contribute to noise and movement;
- No prominent skyline, but farm silos and the huge sheds and hangers of the Broughton Aircraft Factory are visually dominant;
- The open character means there is little opportunity for screening any large scale elements or for mitigating visual impact without the mitigation measures in themselves being highly visible - making it a visually sensitive landscape. There are relatively few sensitive visual receptors in this landscape, limited to farm workers and people using the footpath network.

Landscape Condition

The land is actively farmed and managed, although there are some degraded hedgerows and broken fencing.

CWaC Local Plan policies with an influence on the character of LCA 4c: *Dodleston Drained Marsh*

- Countryside;
- Flood risk and water management.

Forces for Landscape Change

Past change

- Loss and fragmentation of hedgerows, and decline in fencing condition;
- Loss of wet species-rich grassland communities.

Potential future change / key issues affecting LCA 4c: *Dodleston Drained Marsh*

- Loss and under management of the drainage system would affect the key characteristic feature of this landscape character area;
- There could be pressure for wind energy development in the open, exposed, windswept landscape, and Solar PV farms;
- Tree planting could reduce the visual impact of prominent structures on neighbouring farms but this would change the open character of the area;
- Climate change could lead to increased flooding affecting the use and management of the land.

Overall Landscape Management Strategy for
LCA 4c: Dodleston Drained Marsh

The overall management strategy for this landscape should be to ***conserve*** the open, undeveloped character and the distinctive network of drainage ditches and channels, and to ***enhance*** the condition of boundary hedgerows on the drained marsh.

Landscape Management Guidelines

1. Maintain the distinctive regular, rectangular field pattern that reveals the planned 18th and 19th century enclosure of the former tidal Dee Estuary.

2. Seek to restore and manage thorn hedgerows that are falling into decline, to maintain the age and species diversity.

3. Encourage continued management and maintenance of the network of drainage ditches and channels in a way that retains these as important characteristic features of the landscape and protects their ecological value.

4. Maintain and manage species rich grassland and field ponds for their nature conservation value.

5. Increase the biodiversity value of the land – create and link buffer strips along linear features such as hedgerows and ditches to create a continuous network of wildlife corridors.

6. Conserve the remote character of the *Dodleston Drained Marsh*.

7. Retain the open character of the drained marsh by restricting planting to low growing scrubby species typically found in the local landscape, taking into account the possible presence of ground nesting birds and wintering/passage birds. Woodland planting / screening using tall or ornamental species is not appropriate in the open marsh.

8. Encourage controlled public access through the area via clear way-marking to prevent people straying from the public footpath network.

Built Development Guidelines

1. Conserve the open, undeveloped character of the drained marsh. Even small scale built development is likely to be conspicuous and any attempt at screening with trees would itself be prominent and uncharacteristic.

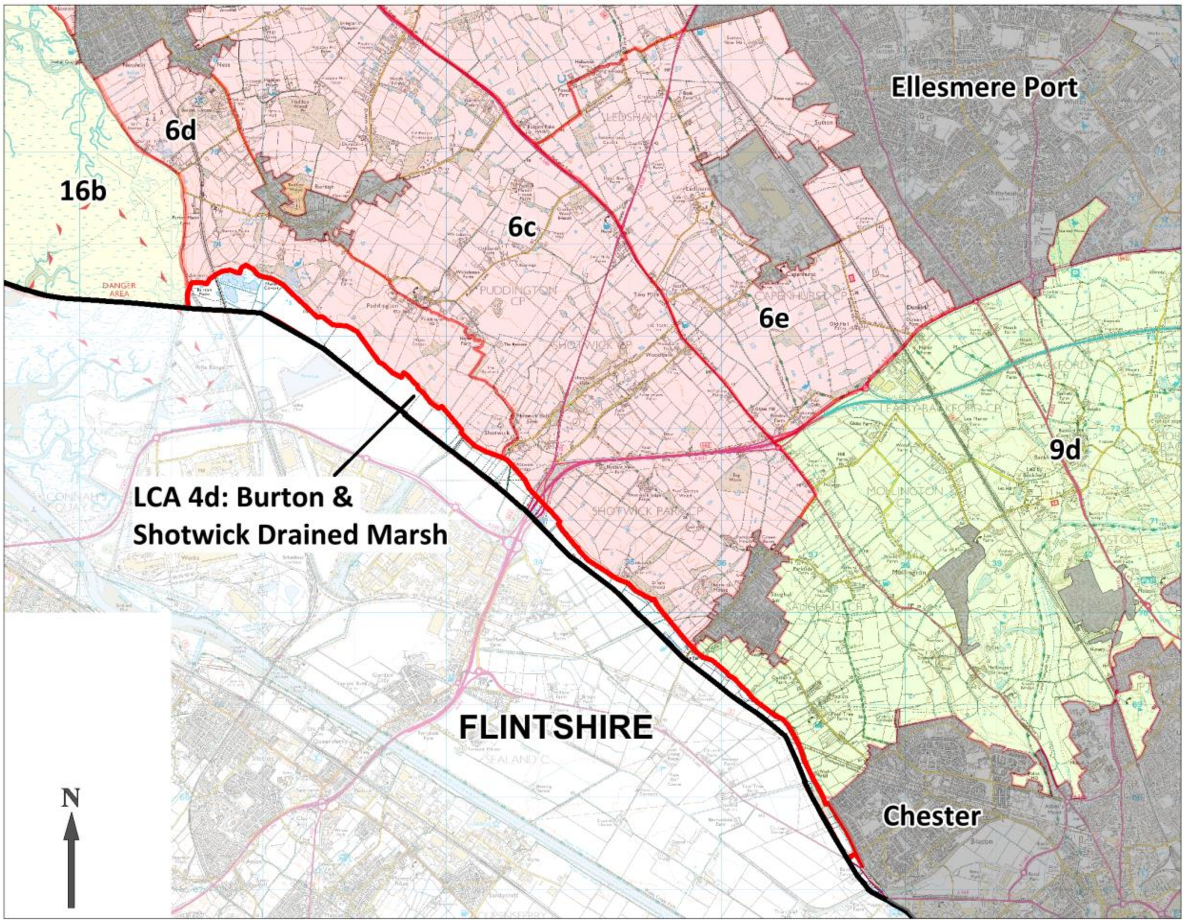
2. Renewable energy development is likely to be prominent in the open landscape, with potential for cumulative effects which should be avoided.

3. Consider views to the Welsh hills and the *Sandstone Ridge* when planning any change.





LCA 4d: *Burton & Shotwick Drained Marsh*



Not to a recognised scale

Location and Boundaries

The Burton & Shotwick Drained Marsh is a very narrow, elongated landscape character area marking the transition between the *Undulating Enclosed Farmland* and the low lying Dee levels. It straddles the national boarder, the western edge of the character area marking the English/Welsh boundary. The Burton & Shotwick Drained Marsh extends from Burton to Blacon on the outskirts of Chester.

Key Landscape Characteristics of LCA 4d: *Burton & Shotwick Drained Marsh*

- A very flat, low lying landscape (up to 5m AOD) of former tidal marsh alongside the Dee Estuary, contrasting with farmland sloping down from the east
- An area originally part of the tidal estuary of the River Dee before silting up after the Roman period, reclaimed during the 18th & 19th centuries to produce productive farmland, with further improvement at the northern end as part of the development of the Wrexham to Bidston railway
- Mixed agricultural pasture and arable land use
- Ditches and areas of species rich grassland are of nature conservation interest
- The flat landscape is etched with a distinctive pattern of straight drainage ditches and channels which delineate the regular, rectangular field pattern
- Incomplete hedgerow boundaries provide partial enclosure along some field boundaries
- Lack of trees provides an open, exposed, windswept landscape
- Absence of settlement and roads
- A number of rights of way cross the area and National Cycle Route (NCR)5 follows a disused railway (now the Chester Millennium Greenway) near the southern end
- The A550 cuts through the centre of the character area, and the Wrexham to Bidston railway passes along the eastern edge
- The transport corridors add movement and noise to an otherwise remote, empty landscape
- The flat, open landscape provides clear views across the Dee Estuary to the hills of north Wales to the west and to the Shotton industrial area where Connah's Quay power station and the Dee Bridge are visually prominent
- Recreational fishing ponds and RSPB Burton Mere Wetlands reserve with a mosaic of wetland habitats important for birds including internationally designated Ramsar site
- Iron Age promontory fort at Burton Point

Key Landscape Sensitivities, Qualities and Value

Natural / Physical

- Alluvial deposits of sand, silt and clay left by the River Dee overlying a solid bedrock of Chester Pebble Beds Formation, well suited to both pasture and arable crops;
- Once contiguous with the saltmarsh and mudflats of the tidal Dee Estuary, the area was ditched and drained during the 19th century to produce productive farmland, with further improvements at the northern end as part of the development of the Wrexham to Bidston railway ('The Borderlands Line');
- Ditches and areas of species rich grassland of nature conservation interest;
- Regular, rectangular field pattern delineated by the pattern of drainage ditches running perpendicular to the main drainage channel which runs in a northwest to southeast direction along the borough boundary from Burton Point to Blacon on the outskirts of Chester;
- Field pattern delineated by the pattern of drainage ditches, with some fields also bounded by gappy hawthorn hedges;
- Includes the 'Shotwick Fields', prone to flooding in the winter;
- RSPB Burton Mere Wetlands Reserve is internationally designated as a Ramsar site as an extension of the Dee Estuary.

Cultural / Heritage / Historic

- The regular, rectangular field pattern characterised by straight-sided fields bounded by ditches and drainage channels, dating from the 19th century;
- Iron Age promontory fort at Burton Point;
- The northern end of the LCA was the site of a bombing decoy during the Second World War;
- A number of footpaths cross the character area, linking to the network of rights of way through farmland around Burton, Puddington, Shotwick and Saughall to the east;
- The Chester Millennium Greenway provides an important recreational route along the disused railway linking Chester and Connah's Quay as part of NCR5;
- Fishing ponds provide recreational activity;
- RSPB Burton Mere Wetlands Reserve provides a mosaic of habitats including wetlands with reed beds, fenland, woodland with wildflowers and farmland, important for wildfowl and wading birds – the reserve has recently expanded and includes a visitor centre;
- Good palaeo-environmental potential.

Built Development and Settlement Pattern

- Settlement and any other built development is absent from this landscape, although a number of villages lie within the *Undulating Enclosed Farmland* to the east, namely Burton, Puddington, Shotwick and Saughall;
- Absence of roads.

Perceptual / Visual

- The flat landform and long panoramic views contribute to the perception of a large scale, exposed landscape;
- The consistent field pattern through planned enclosure gives the perception of a reclaimed, tamed landscape;
- Vegetation-fringed ditches and rough ground provide texture in the landscape;
- The absence of any development and roads provides a remote landscape, but the presence of the A550 and railway bring noise and movement to the area; birds and aircraft using the Hawarden (Chester) Airport also contribute to noise and movement;
- No prominent skyline, but the Deeside / Shotton industrial area including Connah's Quay power station, pylons and the Dee Bridge are visually dominant;
- The flat, open landscape provides clear views across the Dee Estuary to the hills of north Wales to the west;
- Topography and woodland in the *Undulating Enclosed Farmland* limit views to the east;
- The open character means there is little opportunity for screening any large scale elements or for mitigating visual impact without the mitigation measures in themselves being highly visible - making it a visually sensitive landscape. There are relatively few sensitive visual receptors in this landscape, limited to farm workers and people using the footpath network.

Landscape Condition

Although much of the area is actively farmed, the degraded hedgerows and broken fencing shows this to be a landscape in need of improved management. Some land appears to be set-a-side or is not being actively managed and the long grasses and scrub vegetation create an impression of neglect. Recreational fish ponds and the RSPB reserve are well managed.

CWaC Local Plan policies with an influence on the character of LCA 4d: *Burton & Shotwick Drained Marsh*

- Green Belt;
- Natural heritage sites of international, national, regional and/or local significance;
- Nationally designated heritage assets (on Historic England's National Heritage List for England) and locally significant heritage assets;
- Flood risk and water management.

Forces for Landscape Change

Past change

- Reduction of cultivated areas and increase in set-aside;
- Loss of wet grassland communities;
- Loss and fragmentation of hedgerows, and decline in fencing condition;
- Recently extended RSPB Burton Mere Wetlands reserve has increased visitor numbers to the area;
- Expansion of fisheries has resulted in 'suburbanisation' by signage, car parking, fencing etc.

Potential future change / key issues affecting LCA 4c: *Dodleston Drained Marsh*

- Pressure for increase in transport infrastructure / improvements across the area;
- There could be pressure for wind energy development in the open, exposed, windswept landscape, and Solar PV farms;
- Visual impact of prominent development and traffic could be reduced by tree planting but this would change the open character of the area;
- Further 'suburbanisation' of the landscape, for example signage, fencing and car parking associated with new or improved fishing ponds;
- Climate change could lead to increased flooding affecting the use and management of the land.

Overall Landscape Management Strategy for LCA 4d: Burton & Shotwick Drained Marsh

The overall management strategy for this landscape should be to ***enhance*** the condition of habitats and features of the drained marsh whilst safeguarding its open character.

Landscape Management Guidelines

1. Encourage appropriate management of the more derelict and degraded areas of the landscape to enhance the nature conservation interest of the area.

2. Maintain the distinctive field pattern that reveals the planned 19th century enclosure of the marsh.

3. Encourage management and maintenance of the network of drainage ditches and channels in a way that retains these as important characteristic features of the landscape and protects their ecological value.

4. Seek to restore thorn hedgerows that are falling into decline, to maintain the age and species diversity.

5. Maintain a range of habitats, from open water to agricultural land. Seek opportunities to re-create habitats such as species rich grassland and reed beds.

6. Increase the biodiversity of intensively managed grassland and arable land – create and link buffer strips along linear features such as hedgerows and ditches to create a continuous network of wildlife corridors.

7. Conserve the 'remote' character of the *Burton & Shotwick Drained Marsh* away from the main transport corridors of the A550 and railway.

8. Retain the open character of the marsh by restricting planting to low growing scrubby species typically found in the local landscape, taking into account the importance of the area for ground nesting birds and wintering/passage birds. Woodland planting / screening using tall or ornamental species is not appropriate in the open marsh.

Built Development Guidelines

1. Conserve the remaining open, undeveloped areas of the marsh.

2. Consider using native scrubby vegetation to screen views of traffic on the A550.

3. Ensure features associated with new development do not lead to 'suburbanisation' of the landscape, for example signage, fencing and car parking at fishing ponds.

4. Consider views to the north Wales hills when planning any change.