



Contaminated Land Inspection Report

Closed Landfill,
Dersingham Pit
King's Lynn

June 2018

Reference no. CL11

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Executive Summary

The Borough Council of King's Lynn and West Norfolk (BCKLWN) has a statutory duty to inspect its district for potentially contaminated land under Part 2A of the Environmental Protection Act 1990. The contaminated land inspection strategy has identified the potential landfill at Dersingham as a site which requires detailed inspection.

This site is a former landfill which forms part of a wooded area adjacent to Dersingham Fen which is classified as a Site of Special Scientific Interest (SSSI) and a National Nature Reserve (NNR), situated within the district of King's Lynn. An initial assessment of the site was undertaken to assess the potential for harm to human health, the environment, controlled waters and property under Part 2A.

To gather information of the site's history a desk study and preliminary risk assessment were carried out by the Environmental Quality Team. From the evidence gathered during the desk study of the site history and a site walkover, the following can be stated:

- The site was a former landfill operated by Docking Rural District Council (DRDC).
- The site is understood to have been filled with inert and commercial waste.
- The site abuts a SSSI and NNR.
- A hydrological risk assessment has been carried out by Mott MacDonald on behalf of Norfolk County Council. This indicates that the fen is being affected by contamination originating from the landfill and the surrounding area.
- The level of contamination detected impacting Dersingham Fen from the landfill would be considered sufficient to determine the site as 'Contaminated Land' under Part 2A of the Environmental Protection Act 1990.
- Norfolk County Council is working with Natural England to mitigate the impact of the landfill on the fen.

As such the Potential Hazard and the Risk associated with the site has been reassessed. The site has been reassessed as having a Highly Likely Potential Hazard Score for ecological receptors, Likely for groundwater and Unlikely for human health. These equate to Very High Risk Rating in relation to Environmental receptors.

Therefore the site is considered to represent a risk to the environment under Part 2A of the Environmental Protection Act 1990. However, the site is being managed by Natural England with the assistance of Norfolk County Council. Contact was made with Mr A Murray of Natural England and Mr C Wright of Norfolk County Council who both indicated that the contamination was being jointly managed. As such no further action is considered necessary at this time. The BCKLWN have requested to be updated as to any further developments at this site which could change the status of the site.

1. Introduction

This report details a review of information and written statement about a closed landfill at Dersingham, King's Lynn and provides a conclusion on the risk to human health, property, groundwater and the wider environment.

The Contaminated Land Statutory Guidance (DEFRA, 2012) suggests that where the authority has ceased its inspection and assessment of land as there is little or no evidence to suggest that it is contaminated land the authority should issue a written statement to that effect. This document provides that written statement.

2. Desk Study Information

Location

The site's location is shown in Appendix B. The grid reference for the centre of the site is 568000, 329470 and the nearest postcode is PE31 6LB.

Initial Prioritisation Score

The site was initially assessed as having a 'Very High' Potential Hazard Rating due to the risk to Ecological receptors.

Previous Site Usage

The site (drawing CL11/101) was a mineral extraction, which has been used as a landfill.

Present Site Usage

Its present use comprises a public open space adjacent to Dersingham Fen which is classified as a Site of Special Scientific Interest (SSSI) and a National Nature Reserve (NNR). A residential property is 220m east of the site. Dersingham Fen is to the north, west and south.

Ownership

Land Registry enquiries showed that the land is owned by The Crown Estate and is operated as part of a nature reserve by Natural England. This report will be made available to the site owners, Natural England and the former landfill operators (Norfolk County Council).

Environmental Setting

Geology

The Solid and Drift Geology Sheet 160, 1:50,000, 1999 and Regional Hydrological Characteristics Sheet 1 1:125 000 shows the site surface is approximately 20 meters above ordnance datum (maOD).

The bedrock geology is the Leziate Member – Sand.

The superficial geology is the Lowestoft Formation – Head Deposits (Clay, silt, sand and gravel).¹

Hydrogeology

The site is on land classified as a principle aquifer but not within a Source Protection Zone (SPZ) (Environment Agency Website).

The Principle Aquifer comprises the Leziate Sand Member, which has a very high permeability allowing it transmit pollutant very easily. The superficial deposits are classified as ‘Secondary (undifferentiated)’.

Hydrology

Dersingham Fen is adjacent to the site and Boathouse Creek is approximately 800m north and west of the site.

There are no surface water abstraction points within 1000m. No private water or Environment Agency licenced abstractions exists on site or within 500m.

Local Authority Pollution Prevention and Control Regulations

No LAPPC processes are on site or within 500m of the site.

The Environment Agency Web site records

The Environment Agency Web site records the following:

- The site is in an area where the Environment Agency issue flood warnings.
- The site is indicated as a Priority Waters (Groundwater) under the Farmers Assessment Tool.
- The site is classified as a priority Water under Nitrate Vulnerable Zone 2013.
- The site is covered by a Designation Notice (Tranche 2).
- The superficial deposits beneath the site are classified as being a Secondary Aquifer (undifferentiated).
- The bedrock beneath the site is a Principal Aquifer.
- The groundwater has a high vulnerability at this location.
- The site is recorded as being a landfill.
 - Name: East of A149, Dersingham, First Received waste 31st December 1948, Last received waste 7th June 1982. Operated by Norfolk County Council. Inert and commercial waste landfilled.

MAGIC website records

MAGIC website records the following

- The site is part of an area covered by the Countryside and Rights of Way Act 2000 (England).

¹ BGS website: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

- The site is covered by the MMO Marine Areas (England).
- The site is part of a RAMSAR Site.
- The site is part of a Site of Special Scientific Interest.
- The site is part of a Special Area of Conservation.
- Part of the site is covered by the Woodland Priority Habitat Network (High and Lower Spatial Priority).
- Part of the site is covered by Woodland Improvement (High Spatial Priority).
- Part of the site and Dersingham Fen is covered by the Priority Habitat Inventory – Lowland heathland (England).
- Part of the site is covered by the National Forest Inventory (Broadleaf).
- The site is a Farm Wildlife Package Area (England).
- The site is part of the Woodland Bird Assemblage.
- The site is designated as a Priority Catchment under the Former Catchment Sensitive farming Priority Areas 2011-2015 (England).
- The site is a National Nature Reserve (England).
- The site is part of a Nitrate Vulnerable Zone (Groundwater).
- The site is designated as part of a Higher Level Stewardship Target (England).

Historic Maps

E-map Explorer

Tithe map circa 1840 – The site is part of a field labelled 269. To the southeast of the site is a pit labelled as 267, to the southwest of which was another it labelled 264.

Enclosure Map 1800 - 1850 – Not available.

Ordnance Survey 1st Ed. 1879-1886 – The site is described as a marsh. To the southeast the pit is shown in greater detail and is labelled as sand pits. The western section of the map is unavailable.

Historic Maps on file at the Borough Council of King's Lynn and West Norfolk

1843 – 1893: The site has not changed from that which is depicted on the 1st Ordnance Survey map. The pit to the south has disappeared.

1891 – 1912: The site was as depicted above.

1904 – 1939: The site was as depicted above.

1919 – 1943: The site was as depicted above.

1945 – 1970: The site is depicted as an area of flat ground and the former sand pit on the southern extent of the site is described as a Refuse Tip.

1970 – 1996: Not available.

Aerial Photographs

1945 – 1946 MOD Aerial Photograph – The sand pit which is depicted as a Refuse Tip in the 1945 – 1970 historic map is visible. The rest of the site does not show any distinguishing features with the exception of what might be a ditch which runs in a north-westerly direction from the sand pit.

1988 Aerial Photograph – The site is grassed over with a few trees in the eastern section of the site. There is a distinct change between the vegetation noted on the site and the surrounding area. The ditch which is thought to go in a north-westerly has disappeared but a line of denser vegetation can be seen in approximately the same location.

1999 Aerial Photograph – The site was generally as described above.

2006-09 Aerial Photograph – The site was generally the same as described above.

Planning History

One planning application exists in the Borough Council records on or adjacent to the site. This is related to the construction of a single storey open fronted hay barn for storage of feed for cattle.

Environment Agency Records

The Environment Agency were contacted and their response indicated that additional investigation is required to assess the potential risk to groundwater and that they are 'unable to comment on whether the site would meet the definition of significant pollution of controlled waters under part 2A of the Environmental Protection Act (1990) (as amended)'. A copy of the e-mail correspondence is presented in Appendix C.

Natural England

Natural England were contacted but have made no comment regarding this report.

Norfolk County Council Records

Mr C Wright of Norfolk County Council was contacted with regards to the history of the site. Mr Wright provided a report relating to the site:

- The Dersingham landfill site was used as a parish pit for the disposal of domestic waste between 1974 and 1982. The waste at the site is thought to be up to 12.3 m thick forming a gently sloping mound from the sandstone escarpment to the fen. The site is unlined and has been restored with a thin cap of topsoil and has been seeded with grass and planted with trees (NCC 2001).
- Dersingham Landfill Site, Hydrological Risk Assessment, Mott MacDonald, February 2011. This indicated that the several contaminants were detected in the leachate samples from the ditch at the toe of the landfill which required further assessment. This included the following:
 - Hazardous: 4-chloro-2-methylphenol and mercury

- Non-Hazardous: ammonia, boron, chloride, copper, iron, mecoprop, and total phenol.
- The report also indicated that the leachate had a pH varying between 6.9 and 8.3.
- 4-chloro-2-methylphenol, mercury, ammonia, copper and iron were considered to be 'non-compliant with respect to Part IIA of the Environmental Protection Act (1990)', while mecoprop was considered to require further assessment. The 'Analysis of pH indicates that whilst leachate from the landfill site falls within the range specified by EQS, it has a significant impact on the naturally acidic conditions within the surrounding mire.'
- The concentrations of copper, iron and mercury were considered to be stable and to represent background.
- The report recommended additional analysis of selected analytes to assess the long term risk to the fen and that the nutrients entering the fen should be limited and indicated that bioremediation using Common Reeds should be assessed.

3. Site Walkover

A site visit was carried out by an Environmental Quality Officer of the Borough Council of King's Lynn and West Norfolk in the presence of Mr C Wright and Mr A Murray on 26/09/2017 and the following was noted. Photographs are presented in the Appendix A.

The site comprises a mound of soil peaking at approximately 15m above the level of the fen and sloping down to the north, west and south and was mainly laid to grass with occasional trees. The site was generally used to graze cattle which were not on site at the time of visiting. The landfill projected into the fen from a raised wooded area in the east and has a ditch which bounds the landfill to the north, west and south. This ditch is used to collect any leachate which the landfill generates and is potentially being used by the cattle as a source of drinking water. Beyond the ditch to the north and northwest the fen is dominated by reeds. To the west and south the fen is exclusively dominated by flora typical of acid bogs. Mr Wright indicated that the amount of reeds in the fen appeared to have diminished since his last visit.

A trial of a remediation proposal (bioremediation using reed beds within the toe of the landfill) was ongoing on site. This comprised an area which had been excavated into the toe of the landfill adjacent to the ditch around the landfill. The excavation was filled with reeds which are being watered from the leachate in the ditch from which the outflow water is then sampled and analysed. Mr Wright indicated that the trial was about to be extended with further bio-remediation pits being constructed along the toe of the landfill.

4. Assessment of Site Use

From the assessment of the site using County Council data, historic maps, aerial photography and a site walk over it has been possible to conclude that the site has been used as a landfill and that Dersingham Fen is being impacted by the leachate from the landfill. Norfolk County Council is actively monitoring the situation and has plans in place to attempt to address the situation.

The site is part of a National Nature Reserve and is open to the public but it is expected that the public's occupation of the site would be transient and intermittent. Ecological receptors and controlled water receptors are on site and directly adjacent to the site.

Assessment of probability of a contamination event

The site was a quarry, which was then used as a, dilute and disperse landfill which was capped in accordance with its permission. As the site was capped it is considered that the probability of a contamination event effecting human health (via direct contact or inhalation) and property is considered UNLIKELY.

The leachate from the landfill is recorded as having impacted Dersingham Fen and as such is considered to have a probability of affecting the environment and Controlled Waters is HIGH.

Assessment of Hazard

The risks posed by the site have been assessed under the statutory guidance, the Contaminated Land Statutory Guidance. This is discussed further below:

Human Health and Property

The site has been used as a landfill which accepted inert and commercial waste. Given the type of waste deposited it is considered that some hazardous material would have been deposited in the landfill. Therefore it is considered that the hazard to human health (via direct contact or inhalation) and property (Cattle) is considered MEDIUM.

Environment

The site is adjacent to Dersingham Fen which is classified as a SSSI and NNR which are on the list of designated receptors stipulated in Table 1 of the Statutory Guidance. The report by Mott MacDonald indicates that the leachate leaving the landfill is considered to be hazardous to the fen. Therefore the hazard is considered to be HIGH.

Controlled Water

Groundwater

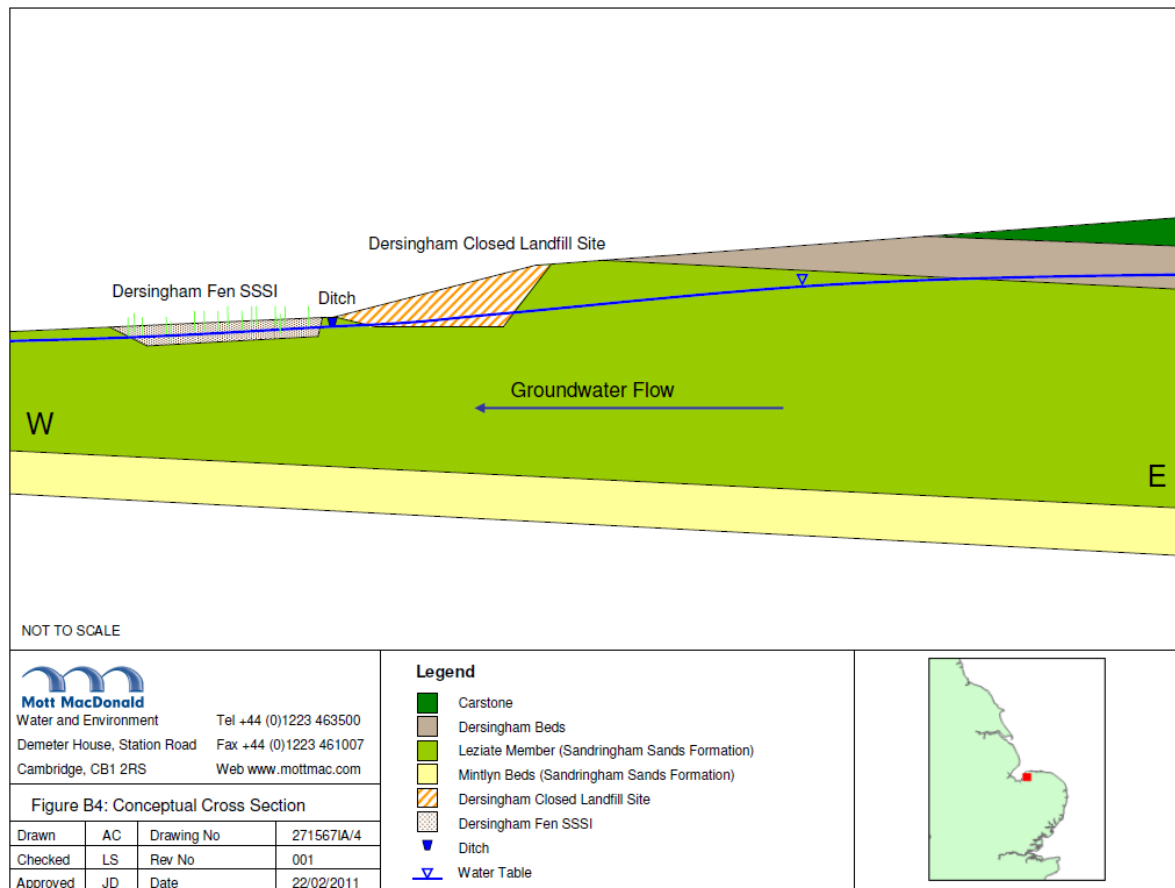
The report from Mott MacDonald indicates that the groundwater upwells beneath the toe of the landfill and is incorporated into the water flow of the fen. As the groundwater is flowing upward at this location it is considered that the identified contamination will not be able to migrate into the groundwater. Therefore the hazard is LOW.

Surface waters

From the Mott MacDonald report the leachate from the landfill enters the water of the fen from the western edge of the landfill and disperses across the fen in a north-westerly direction. This can be seen in the change of vegetation across the fen. As such the hazard to surface water is considered to be HIGH.

Conceptual site model

The conceptual site model (Table 1) shows the sources, pathways and receptors identified and the subsequent risk classification.



Conceptual Cross Section from Dersingham Landfill Site, Hydrogeological Risk Assessment, February 2011, Mott MacDonald

Table 1: Preliminary conceptual site model

Source	Pathway	Receptor	Probability	Hazard	Risk
Metals and metalloids within waste material	Direct contact	Humans	Unlikely	Low	Very Low
	Inhalation				
Metals and metalloids within waste material	Direct Contact	Property	Unlikely	Low	Very Low
	Inhalation				
Metals and metalloids within waste material	Direct contact	Environment	High Probability	High	Very High Risk
Metals and metalloids within waste material	Direct contact	Controlled water	High Probability	High	Very High Risk

Outcome of Preliminary Risk Assessment

A plausible source pathway receptor linkage was identified as a source of contamination has been identified. Therefore further investigation would normally be considered necessary. However, as the site has been investigated and continues to be monitored and remediated by Norfolk County Council no further site investigation is considered necessary at this time.

Conclusion

From the information gathered and the site walkover it is apparent that the site was excavated for minerals and was then backfilled with commercial and inert waste by Docking Rural District Council and Norfolk County Council.

A report produced by Mott MacDonald indicated that contamination leaching from the landfill is having an adverse effect on Dersingham Fen, mainly due to the elevated level of nutrients and neutral pH in the groundwater although other contaminants were identified.

No evidence was noted of significant harm to Humans (via direct contact, ingestion and inhalation) and Property. Therefore there is not a strong case to consider that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm to Humans (via direct contact, ingestion and inhalation) and Property as defined in the statutory guidance. CIRIA C552 states that on a site with a very low risk classification 'There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.'²

From the evidence gathered significant harm has been identified affecting Environmental Receptors and Controlled Water (Surface Waters). This is known by the site operators (Natural England) and the organisation which filled the landfill

² Contaminated land risk assessment. A guide to good practice. CIRIA C552, ISBN 0860175529.

(Norfolk County Council) who are cooperating in efforts to mitigate the effects on Dersingham Fen.

Human Health

Following the above assessment the site is assessed as Category 4: Human Health³ as set out in the Statutory Guidance, as such no further assessment is considered necessary with regards to the risk to human health.

Controlled Waters

Groundwater

No further inspection is considered to be required with regards to groundwater as it is considered that there is no reasonable possibility that a significant contaminant linkage exists as set out in the Statutory Guidance⁴. This assessment applies to the site's current use.

Surface waters

Contamination is considered to be entering the surface waters of Dersingham Fen as demonstrated in the Mott MacDonald report. The Environment Agency have indicated that additional site investigation is required before it can be established if the site poses a significant risk of significant pollution of controlled waters.

Environment

It is known that contaminants are entering Dersingham Fen from the landfill which are altering the ecology to such a level that 'significant harm' is considered to be occurring.

Property

Cattle are being grazed at varying times on the landfill. But as their occupation of the landfill is transient the overall risk to property is considered to be low and no further assessment is considered necessary with regards the risk to property.

Part 2A status of the site

The site could be considered to be contaminated land under Part 2A of the Environmental Protection Act 1990 due to the impact on the environment and potentially contaminated land due to the impact on controlled waters. However as the situation is being managed in a cooperative effort by Natural England and Norfolk County Council determination is not considered to be warranted at this time. However, this situation should be monitored on a regular basis to assess the progress of the mitigation scheme and the continued impact on Dersingham Fen.

³ Appendix E sets out the categories of land in the Contaminated Land Statutory Guidance.

⁴ (Contaminated Land Statutory Guidance April 2016)

2.13. If at any stage the local authority considers, on the basis of information obtained from inspection activities, that there is no longer a reasonable possibility that a significant contaminant linkage exists on the land, the authority should not carry out any further inspection in relation to that linkage.

Appendices

Appendix A Site Photographs



Photograph 1.



Photograph 2.



Photograph 3



Photograph 4



Photograph 5.



Photograph 6.



Photograph 7.



Photograph 8.

Appendix B Drawings

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Borough Council of
**King's Lynn &
West Norfolk**



Title
Site plan

Project / Details

Dersingham Pit, Dersingham

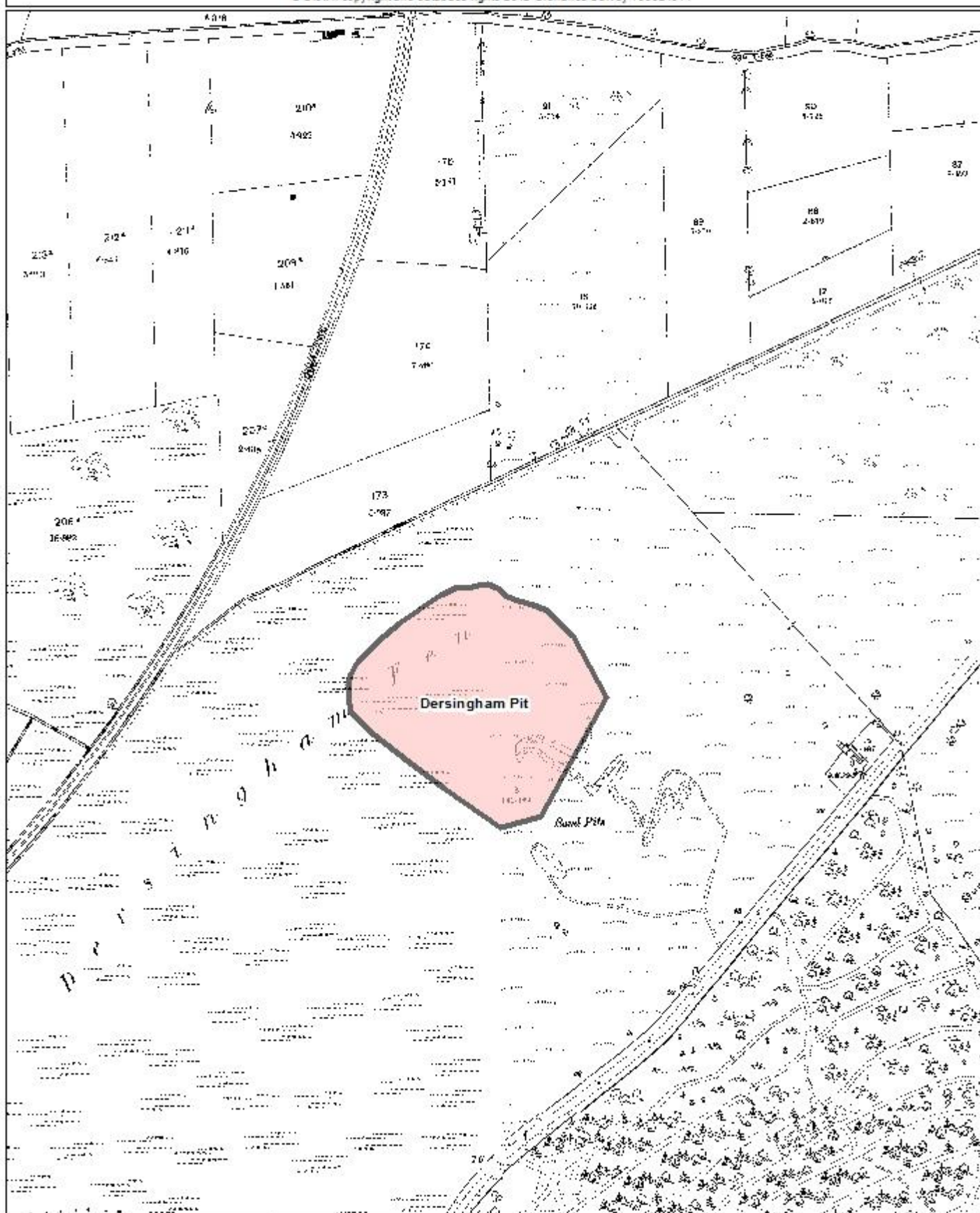


Scale
1:5,000

Date
October 2017

Drawn by
EH&H

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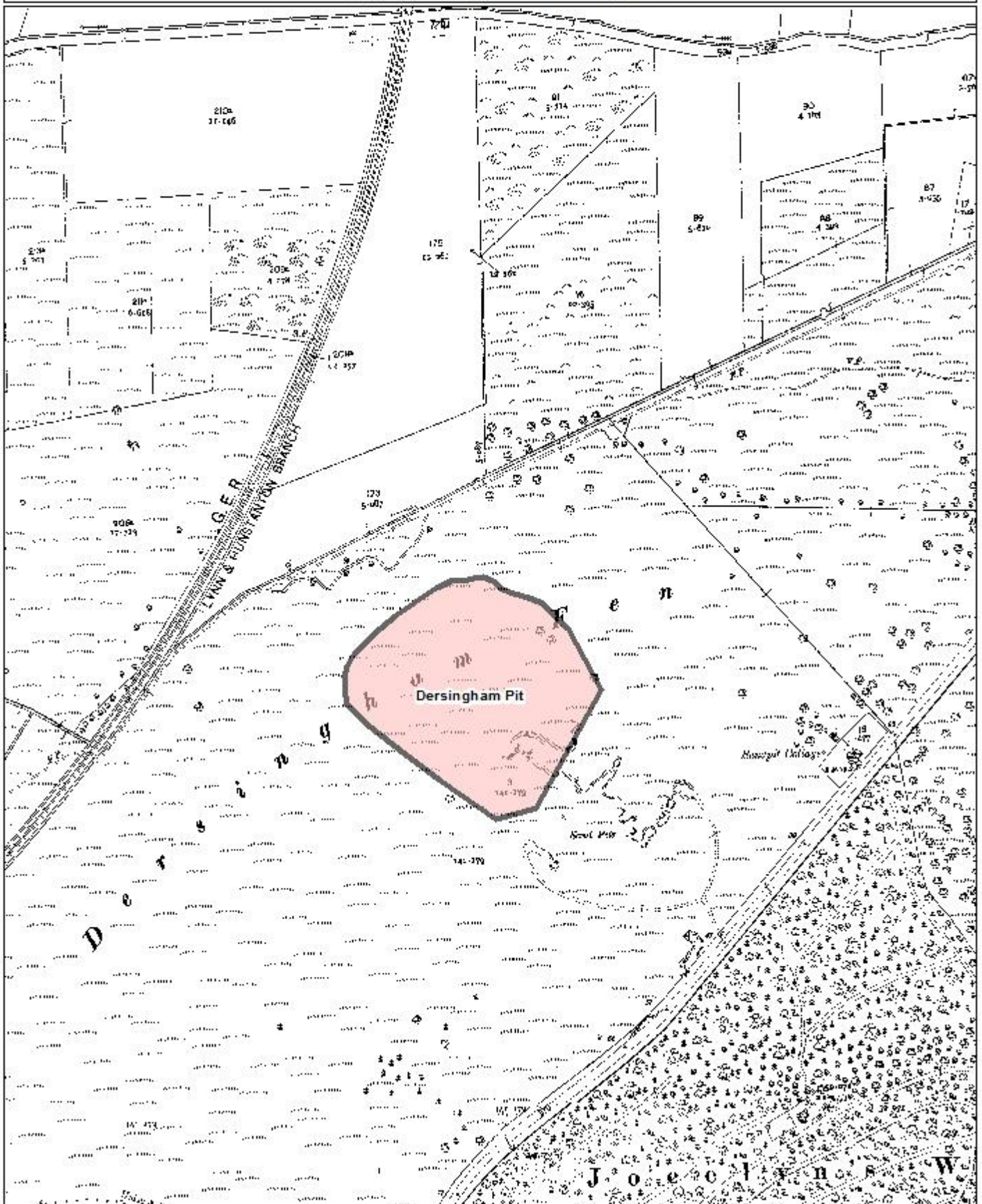
Title
Historic Map 1843-1893



Scale
1:5,000
Date
October 2017

Project / Details
Dersingham Pit, Dersingham

Drawn by
EH&H



Borough Council of
King's Lynn &
West Norfolk



Title
Historic Map 1891-1912

Project / Details

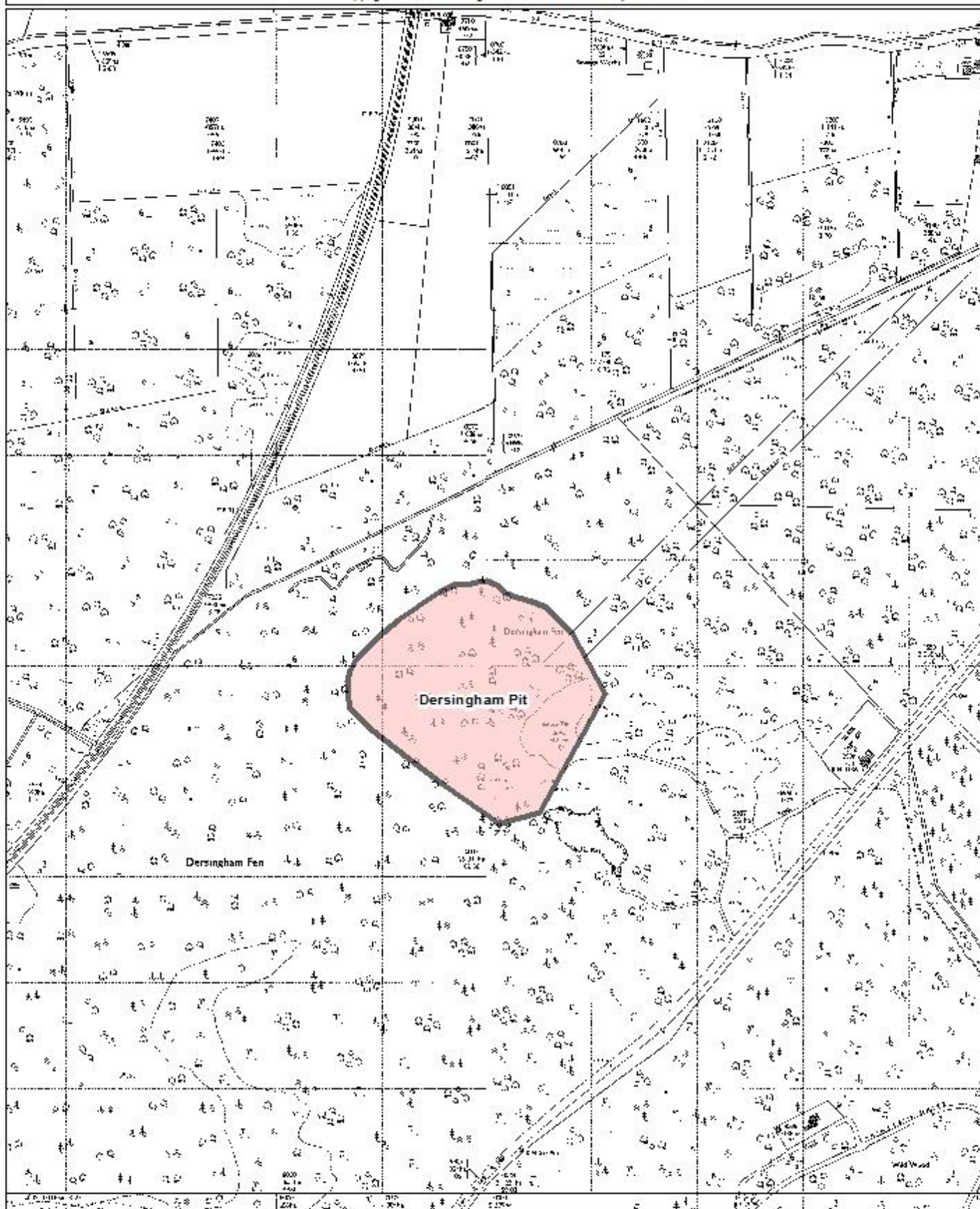
Dersingham Pit, Dersingham



Scale
1:5,000

Date
October 2017

Drawn by
EH&H



Borough Council of
**King's Lynn &
West Norfolk**



Title
Historic Map 1945-1970

Project / Details
Dersingham Pit, Dersingham



Scale
1:5,000

Date
October 2017

Drawn by
EH&H





Borough Council of
**King's Lynn &
West Norfolk**



Title
Aerial Photograph 1999

Project / Details
Dersingham Pit, Dersingham



Scale
1:5,000

Date
October 2017

Drawn by
EH&H

Drawing / Reference Number



Appendix C. Environment Agency Correspondence

Alex Grimmer

From: [REDACTED]
Sent: 01 February 2018 15:12
To: Alex Grimmer
Subject: Dersingham Landfill

Follow Up Flag: Follow up
Flag Status: Flagged

Alex,

We have reviewed the Mott MacDonald's Hydrogeological Impact Assessment for Dersingham Landfill Site, Rev. A, dated February 2011, and have the following queries and make the comments below:

With reference to the final paragraph on page 4, the Ledaie Member of the Sandringham Sands Formation (understood to be underlying the site) is designated as a principal aquifer. The overlying superficial head deposits are classified as secondary (undifferentiated) aquifer.

With reference to Table 2.2 (p.5) and Section 2.5 (p.7), it should be confirmed what the estimate of the maximum thickness of waste is based on. What is the thickness of waste at individual locations? Borehole logs should be provided where available.

Borehole BH02 is understood to have been drilled through waste into the Sandringham Sands Formation. Depending on the details of the well installations, the results may indicate that groundwater at this location has been impacted rather than the results being interpreted as representing leachate alone.

With reference to the statement on page 8 of the report: <<No leachate level management is necessary as the site operates as "dilute and disperse">> it is not clear what this assessment is based on. It should be elaborated further.

We understand that Natural England have indicated that the landfill is affecting the ecology of the Dersingham Fen Site of Special Scientific Interest (SSSI), but no further information has been provided.

The groundwater flow direction beneath the site has been inferred based on the measured groundwater elevations in the available boreholes and piezometers. The groundwater contours as shown on Figure B3 indicate that groundwater from beneath the landfill may flow towards the southwest through west, northwest to north. The lateral extent of groundwater that has been impacted should be considered in the conceptual model for the site. It may be beneficial to map the extent of the impact of the native ecology within the Dersingham Fen SSSI as this may provide an indication of the extent of groundwater impacts. This could then inform further groundwater and/or surface water sampling.

Other than BH02, the highest contaminant concentrations have been measured in groundwater sampled from BH01 and BH05 as well as surface water sampled from the catchment ditch. However, it is noted that groundwater in the other groundwater monitoring wells has also been impacted.

The location of the surface water sampling point should be confirmed. Has the extent of the impact in surface water been evaluated? What is the length of the surface waterbody impacted by the contaminants originating from the landfill? Have other surface waters located further hydraulically down-gradient of the landfill been impacted? Has the ecology of the ditch or other surface waters in the vicinity of the site has been impacted? Further surface water sampling should be undertaken.

The evaluation of the significance of the contaminant impacts has been undertaken through comparison with Environmental Quality Standards (EQS). It is not clear whether the most appropriate EQS values have been adopted into the assessment. For instance the copper EQS of 28 µg/l has been selected even though it was noted that "the

hardness class 0 - 50 mg/l for the EQS is considered applicable for the groundwater beneath the site" (p.10). This may not have been the applicable EQS at the time the report was produced (2011). It should also be noted that updated EQS may be available for a number of contaminants which should be used for any future (re-)assessments.

In the assessment of iron concentrations in groundwater (p.23), reference has been made to (BGS 2005), but this does not appear to be listed in the References Section. Please provide a full reference.

With reference to the statement 'This suggests that the drainage ditch contains upwelling groundwater rather than landfill leachate.' (p.27), it is not clear whether it refers to the mechanism of contaminants entering the ditch (via groundwater rather than leachate entering the ditch directly). Please elaborate. We would support the recommendation for further evaluation of the role the ditch in the conceptual model both as a controlled waters receptor and as a pathway for further migration.

With regard to the statement 'Because there is effectively no distance between the source and receptor and the monitoring data indicate that the landfill site has already caused contamination of the receptor, it is not appropriate to carry out any Remedial Targets Worksheet analysis.' (p.29), given the uncertainty regarding the degree of interception of groundwater flow by the catchment ditch, there may be a benefit in using Remedial Targets Methodology to evaluate the impact to groundwater further.

Regarding the impact from 4-chloro-2-methylphenol (a hazardous substance), we have not been provided with laboratory certificates of analysis. As such, the frequency of detection is not clear. It is not clear whether 4-chloro-2-methylphenol has been detected in groundwater sampled from BHD2 only or whether other locations have also been impacted. It may be beneficial to undertake additional monitoring to confirm the current groundwater quality. We also note this evaluation appears to have been based on a single in waste borehole.

We have not commented specifically on the impact of the SSSI. We understand that the evaluation of ecological impacts has been undertaken by Natural England. We would, however, be happy to provide advice regarding the effectiveness of any proposed remediation.

The measured contaminant concentrations associated with the landfill have been measured above the applicable EQS in groundwater sampled from beneath the site and in boreholes and surface water located hydraulically down-gradient of the site. However, based on the information provided we are unable to comment whether the site would meet the definition of significant pollution of controlled waters under Part IIA of Environmental Protection Act (1990) (as amended). In order to assess whether the impact is significant, further information and evaluation is required as discussed above.

I hope the above advice is useful. If you would like to discuss the above further, please do not hesitate to contact me using the contact details below.

Kind regards,
Wojtek



Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else.

Appendix D. Risk Assessment Methodology

The Model Procedures for the Management of Land Contamination (CLR11⁵) provide the technical framework for applying a risk management process when dealing with contaminated land.

The Borough Council's Contaminated Land Strategy has identified priority sites based on mapping and documentary information. The Contaminated Land Inspection Report collates all the existing information on the site and develops a conceptual site model to identify and assess potential pollutant linkages and to estimate risk.

The risk assessment process focuses on whether there is an unacceptable risk, which will depend on the circumstances of the site and the context of the decision. The Council has used a process adapted from CIRIA C552, Contaminated Land Risk Assessment, a guide to good practice⁶ to produce the conceptual site model and estimate the risk of harm to defined receptors. This involves the consideration of the probability, nature and extent of exposure and the severity and extent of the effects of the contamination hazard should exposure occur.

The probability of an event can be classified as follows:

- Highly likely: The event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution;
- Likely: It is probable that an event will occur, or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term;
- Low likelihood: Circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term;
- Unlikely: Circumstances are such that it is improbable the event would occur even in the long term.

The severity of the hazard can be classified as follows:

- High: Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Contaminated Land Statutory Guidance, April 2012');
- Medium: Chronic damage to human health ('significant harm' as defined in 'Contaminated Land Statutory Guidance, April 2012'), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Contaminated Land Statutory Guidance, April 2012');

⁵ <https://www.gov.uk/guidance/land-contamination-risk-management>

⁶ <https://www.brebookshop.com/samples/142102.pdf>

- Low: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Contaminated Land Statutory Guidance, April 2012'). Damage to sensitive buildings, structures or the environment.

Once the probability of an event occurring and hazard severity has been classified, a risk category can be assigned from the table below:

		Hazard		
		High	Medium	Low
Probability	High Probability	Very High Risk	High Risk	Moderate Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk
	Low Probability	Moderate risk	Moderate/Low Risk	Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk
Very High Risk	<p>There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening</p> <p>This risk, if realised, is likely to result in a substantial liability.</p> <p>Urgent investigation (if not undertaken already) and remediation are likely to be required.</p>			
High Risk	<p>Harm is likely to arise to a designated receptor from an identified hazard.</p> <p>Realisation of the risk is likely to present a substantial liability.</p> <p>Urgent investigation (if not undertaken already) if required to clarify the risk and to determine the potential liability. Some remedial work may be required in the longer term.</p>			
Moderate risk	<p>It's possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that harm would be relatively mild.</p>			
Moderate/Low risk	<p>It is possible that harm could arise to a designated receptor from an identified hazard. However, if any harm were to occur it is more likely that harm would be relatively mild.</p>			
Low Risk	<p>It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.</p>			
Very Low Risk	<p>There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is unlikely to be severe.</p>			

Appendix E. Determination of contaminated land – Contaminated Land Statutory Guidance, April 2012

Human Health

Category	
1	<p>The local authority should assume that a significant possibility of significant harm exists in any case where it considers there is an unacceptably high probability, supported by robust science-based evidence that significant harm would occur if no action is taken to stop it. For the purposes of this Guidance, these are referred to as “Category 1: Human Health” cases.</p> <p>Land should be deemed to be a Category 1: Human Health case where:</p> <ul style="list-style-type: none"> (a) The authority is aware that similar land or situations are known, or are strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere; or (b) The authority is aware that similar degrees of exposure (via any medium) to the contaminant(s) in question are known, or strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere; (c) The authority considers that significant harm may already have been caused by contaminants in, on or under the land, and that there is an unacceptable risk that it might continue or occur again if no action is taken. Among other things, the authority may decide to determine the land on these grounds if it considers that it is likely that significant harm is being caused, but it considers either: (i) that there is insufficient evidence to be sure of meeting the “balance of probability” test for demonstrating that significant harm is being caused; or (ii) that the time needed to demonstrate such a level of probability would cause unreasonable delay, cost, or disruption and stress to affected people particularly in cases involving residential properties.
2	<p>Land should be placed into Category 2 if the authority concludes, on the basis that there is a strong case for considering that the risks from the land are of sufficient concern, that the land poses a significant possibility of significant harm, with all that this might involve and having regard to Section 1. Category 2 may include land where there is little or no direct evidence that similar land, situations or levels of exposure have caused harm before, but nonetheless the authority considers on the basis of the available evidence, including expert opinion, that there is a strong case for taking action under Part 2A on a precautionary basis.</p>
3	<p>Land should be placed into Category 3 if the authority concludes that the strong case described in 4.25(a) does not exist, and therefore the legal test for significant possibility of significant harm is not met. Category 3 may include land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted. This recognises that placing land in Category 3 would not stop others, such as the owner or occupier of the land, from taking action to reduce risks outside of the Part 2A regime if they choose. The authority should consider making available the results of its inspection and risk assessment to the owners/occupiers of Category 3 land.</p>

Category

4	<p>The local authority should consider that the following types of land should be placed into Category 4: Human Health:</p> <ul style="list-style-type: none">(a) Land where no relevant contaminant linkage has been established.(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).
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Ecological system effects

Relevant types of receptor	Significant harm	Significant possibility of significant harm
<p>Any ecological system, or living organism forming part of such a system, within a location which is:</p> <ul style="list-style-type: none"> • A site of special scientific interest (under section 28 of the Wildlife and Countryside Act 1981) • A national nature reserve (under s.35 of the 1981 Act) • A marine nature reserve (under s.36 of the 1981 Act) • An area of special protection for birds (under s.3 of the 1981 Act) • A "European site" within the meaning of regulation 8 of the Conservation of Habitats and Species Regulations 2010 • Any habitat or site afforded policy protection under paragraph 6 of Planning Policy Statement (PPS 9) on nature conservation (i.e. candidate Special Areas of Conservation, potential Special Protection Areas and listed Ramsar sites); or • Any nature reserve established under section 21 of the National Parks and Access to the Countryside Act 1949. 	<p>The following types of harm should be considered to be significant harm:</p> <ul style="list-style-type: none"> • Harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or • Harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. <p>In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010.</p>	<p>Conditions would exist for considering that a significant possibility of significant harm exists to a relevant ecological receptor where the local authority considers that:</p> <ul style="list-style-type: none"> • Significant harm of that description is more likely than not to result from the contaminant linkage in question; or • There is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration. <p>Any assessment made for these purposes should take into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.</p>

Property effects

Relevant types of receptor	Significant harm	Significant possibility of significant harm
<p>Property in the form of:</p> <ul style="list-style-type: none"> • Crops, including timber; • Produce grown domestically, or on allotments, for consumption; • Livestock; • Other owned or domesticated animals; • Wild animals which are the subject of shooting or fishing rights. 	<p>For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p> <p>The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a contaminant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss.</p> <p>In this section, this description of significant harm is referred to as an “animal or crop effect”.</p>	<p>Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question, taking into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.</p>
<p>Property in the form of buildings. For this purpose, “building” means any structure or erection, and any part of a building including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables.</p>	<p>Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended.</p> <p>In the case of a scheduled Ancient Monument, substantial damage should also be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.</p> <p>In this Section, this description of significant harm is referred to as a “building effect”.</p>	<p>Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question during the expected economic life of the building (or in the case of a scheduled Ancient Monument the foreseeable future), taking into account relevant information for that type of contaminant linkage.</p>

Controlled waters

Significant pollution of controlled waters

The following types of pollution should be considered to constitute significant pollution of controlled waters:

- (a) Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.
- (b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.
- (c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.
- (d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)5).

Significant possibility of significant pollution of controlled waters

Category

1	This covers land where the authority considers that there is a strong and compelling case for considering that a significant possibility of significant pollution of controlled waters exists. In particular this would include cases where there is robust science-based evidence for considering that it is likely that high impact pollution (such as the pollution described in paragraph 4.38) would occur if nothing were done to stop it.
2	This covers land where: (i) the authority considers that the strength of evidence to put the land into Category 1 does not exist; but (ii) nonetheless, on the basis of the available scientific evidence and expert opinion, the authority considers that the risks posed by the land are of sufficient concern that the land should be considered to pose a significant possibility of significant pollution of controlled waters on a precautionary basis, with all that this might involve (e.g. likely remediation requirements, and the benefits, costs and other impacts of regulatory intervention). Among other things, this category might include land where there is a relatively low likelihood that the most serious types of significant pollution might occur
3	This covers land where the authority concludes that the risks are such that (whilst the authority and others might prefer they did not exist) the tests set out in Categories 1 and 2 above are not met, and therefore regulatory intervention under Part 2A is not warranted. This category should include land where the authority considers that it is very unlikely that serious pollution would occur; or where there is a low likelihood that less serious types of significant pollution might occur.
4	This covers land where the authority concludes that there is no risk, or that the level of risk posed is low. In particular, the authority should consider that this is the case where: <ul style="list-style-type: none"> (a) No contaminant linkage has been established in which controlled waters are the receptor in the linkage; or (b) The possibility only relates to types of pollution described in paragraph 4.40 above (i.e. types of pollution that should not be considered to be significant pollution); or (c) The possibility of water pollution similar to that which might be caused by “background” contamination as explained in Section 3.