

Consultants Brief

Sidlesham Landfill Site, Pagham Harbour Nature Reserve, Sidlesham

The South East England Development Agency (SEEDA) and West Sussex County Council (WSCC) wish to appoint consultants to provide environmental engineering services in respect of the former Sidlesham Landfill Site, West Sussex.

This brief outlines a short background to the site, the project objectives and services required. Please find attached a location plan (appendix 1), detailed site plan (appendix 2), Visitor Centre Specification Brief (appendix 3), Services & Utilities Summary Report (appendix 4), and Conceptual Model (appendix 5).

Confidentiality

All the information provided in this brief, including the appendices, is for the purpose of assisting the consultant to put together their proposal and should not be used for any other purpose.

Background

In partnership with West Sussex County Council (WSCC) and the Environment Agency (EA), the Royal Society for the Protection of Birds (RSPB), SEEDA and WSCC are investigating the former landfill site in Sidlesham to establish the potential options of remediating the site with a view to redevelop the visitor centre at the nature reserve and extend public access to the land.

The site was used as a civic amenity landfill tip during the 1960s and 1970s, there are limited records on the site activity and it is believed to be uncapped. In order to develop a feasibility plan for the improvement of the site, a visual inspection and intrusive investigations are required to gather information on the topography, soil, waste and geotechnical properties of the landfill. This information should be used for identifying the most appropriate location for the new centre and a car park, and provide a detailed design and construction plan for the most appropriate location(s).

Client

The EA own the freehold of the site and lease the property to WSCC who have exclusive possession and full responsibility and liability for the site. The RSPB will be leading the project in partnership with the EA, WSCC and SEEDA.

SEEDA and WSCC are looking to jointly instruct consultants to advise on the detail of the required site investigations and to manage and appoint contractors on their behalf in accordance with CDM regulations as appropriate.

Location

The subject site is located at National Grid Reference 485790 096590 on the western shore of Pagham Harbour, West Sussex (see appendix 1). Surrounding land uses are predominantly natural wetlands or agricultural. The village of Sidlesham and several nurseries lie to the north of the site.

An option paper for locating the new visitor centre and car park within the subject site has been produced by WSCC/RSPB which identifies 6 potential locations (see appendix 2). However, the most appropriate location will also need to be technically and financially viable and this will be determined by further site investigations. The attached outline specification (appendix 3) for the Visitor Centre provides an indicative guide as to the preferred size and construction requirements that should assist in determining the extent and level of potential remediation that may be required.

Environmental Setting

The site overlies a minor aquifer and there are surface waters, including a main river, within 50m of the site. The site itself and the land to the east and west is part of the Pagham Harbour Local Nature Reserve, which is also a SSSI, a Ramsar Site and a Special Protection Area.

The site is located in a rural area. There is a landfill to the north of the subject site (formerly licensed for inert material). Otherwise there are no activities in the immediate vicinity that would be likely to have adverse effects on the subject site.

Conceptual Model

A Conceptual Model has been developed by Casella Stranger on behalf of the EA which has identified a possibility of 33 pollutant linkages being present. There is a reasonable possibility that some of these linkages exist on the land, while others are considered unlikely to exist or can only be assessed on the basis of further data. Casella Stranger have made recommendations for further site inspection/assessment which are specified in the technical brief.

The full Conceptual Model is discussed in Section 7.0 of the Sidlesham Ferry Assessment report (appendix 5).

Technical Brief

In order to establish the most technically and financially viable location for the visitor centre and car park, consultants are required to provide technical advice and undertake site survey and investigations and analysis.

The inspection and reporting should be in 2 parts;

1. Visual Inspection and limited sampling
2. Intrusive investigations and analysis

Stage 1

Consultants are required to undertake a visual inspection of the site and limited sampling and provide a detailed outline of methodology, locations and quantity of boreholes for each and every site identified in the option paper (appendix 2).

In addition there are four options for remediation that should be considered for the site inspection:

- o Do Nothing.
- o Remediating the preferred site only.
- o Capping the entire subject site: what would the likely cost be to cap the entire site?
- o Remediating the preferred site and additional area for habitat creation and landscaping.

The Visual Inspection and limited sampling should aim to assess:

- Layout of site and site access for Intrusive Investigation.
- Nature of site boundaries with regard to un-authorised access.
- Nature and condition of site surfaces with regard to drainage and soil contact pathways.
- Construction of buildings etc on site with regard to gas / vapour intrusion.
- Presence of any confined spaces on site.
- Surrounding land uses with regard to presence of Property (Crops and Livestock) as potential receptors.
- Any visual or olfactory evidence for ground contamination on site or on surrounding land.
- Surface water quality in the drain (running through the site) and in the Broad Rife. Samples are to be recovered on more than one occasion at upstream and downstream locations.

Stage 2

Once the stage 1 recommendations have been reported and agreed with the client, the second stage of the work should be to fully specify and obtain competitive quotes for the intrusive investigations required.

The Intrusive investigations should aim to assess:

- Thickness and chemical quality of soil cover across the site.
- Thickness and chemical quality of the landfill material and geology beneath the landfill.
- Installation of permanent monitoring boreholes.
- Groundwater quality beneath the site.
- Presence, flow rates and concentration ranges of landfill gas beneath the site.
- Geotechnical properties of the landfill.
- Flow regime of groundwater beneath the site.

Reporting

Two stages of reporting should be produced and should be issued in draft initially for review with the final report issued following inclusion of comments. The reports should detail the following:

- Findings of the Visual Inspection and limited sampling
- Findings of the intrusive investigations.
- Revision of the conceptual model
- Recommendations for further investigation and monitoring (if applicable)
- Assessment of the risks to controlled water and human health
- Recommendations for remediation

Fee Proposal

Consultants are invited to provide their fee proposals for undertaking this work to include their proposed hourly rates subject to ceilings for each of the following elements:

Stage 1 – Visual inspection, topographical survey and limited sampling and reporting to clients

Stage 2 (a) – Instructing and managing contractors on site to undertake intrusive investigations, undertaking analysis of results and reporting to clients

Stage 2 (b) – To provide planning supervisor services as required during on site works.

A budget estimate should also be provided for the intrusive investigations based upon the current information available.

Awarding Criteria

The work will be awarded to the most economically advantageous offer. SEEDA and WSCC are seeking at least three written quotations for the work.

Supplier selection will be made against the following criteria and the quote should provide statements as to how the company meets these criteria. Fee quotations should be provided showing all hourly fees for all members of staff who are likely to be involved in the work, subject to the individual ceilings detailed above.

- Value for money
- Quality of previous experience and success
- Appropriateness of previous experience to project objectives
- Capacity of the supplier to undertake the work within the timescale

Your proposal should also include a methodology for undertaking Stage 1 works and details of other relevant experience.

Public Liability Insurance & Professional Indemnity

Consultants should provide details of their public liability insurance which should provide cover to a minimum value of £10 million for each and every claim together with details of their professional indemnity cover which should provide a minimum cover of £2 million for each and every claim.

Consultants failing to provide this information cannot be considered for this work.

Timetable

Your proposal should be sent to [REDACTED], Cross Lanes, Guildford, GU1 1YA by midday on the 1st March 2007.

It is anticipated that the selected consultant will be appointed by 5th March, with the draft Stage 1 report and recommendations required by 23rd March 2007.

Contacts

Should you have any queries relating to the work required please direct them to [REDACTED] SEEDA: [REDACTED] or [REDACTED].

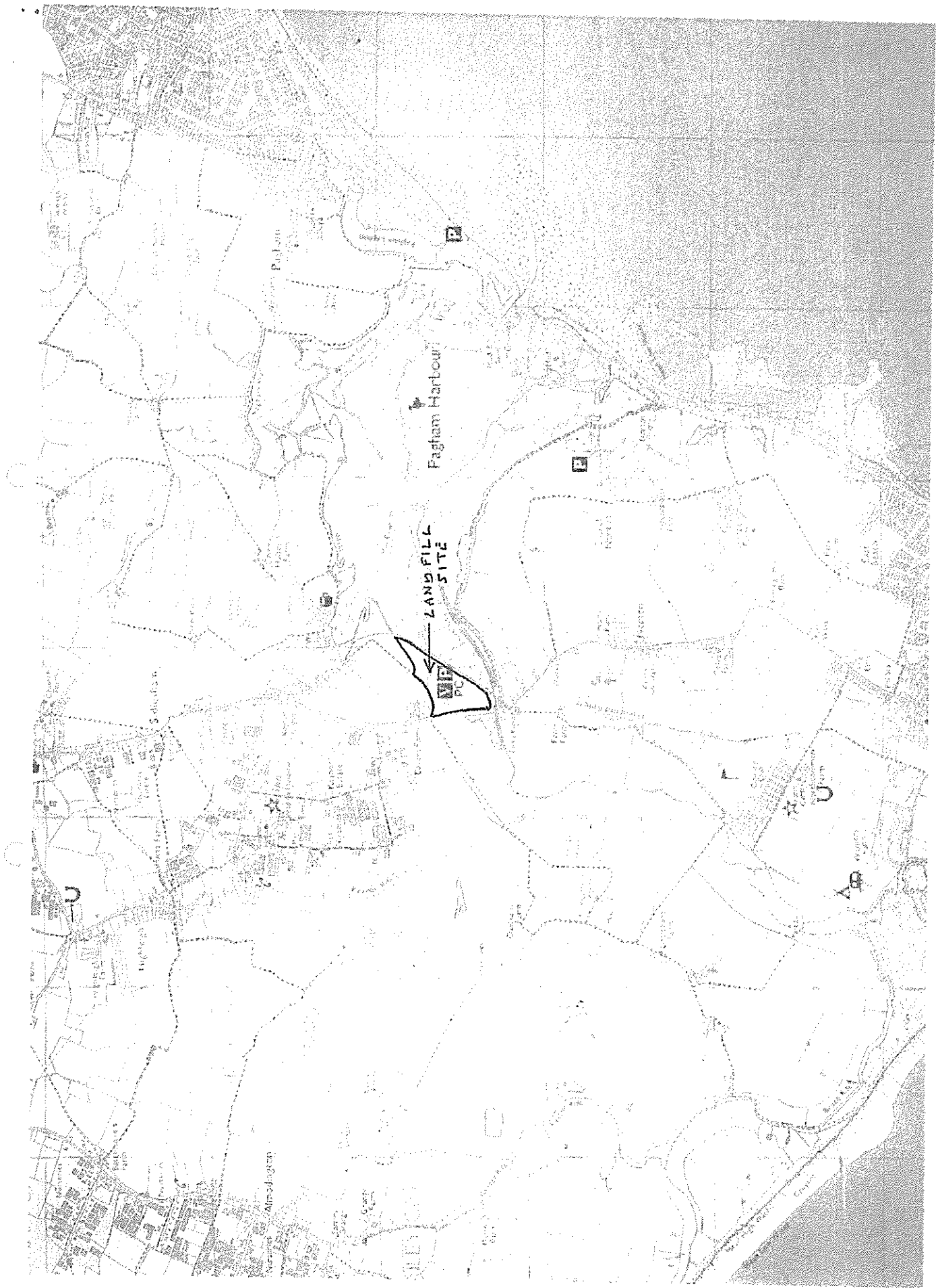
References

Assessment of Environment Agency Landholdings Anglian and Southern Regions Priority 2-4 Sites, Siddlesham Ferry, Siddlesham, West Sussex, Report no. C03583/29/ Project no. LD318157 by Casella Stanger (now Bureau Veritas) January 2004.

Appendix 1 – Location Plan

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LAND FILL SITE



Fagham Harbour

Pagan

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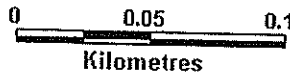
Almsdington

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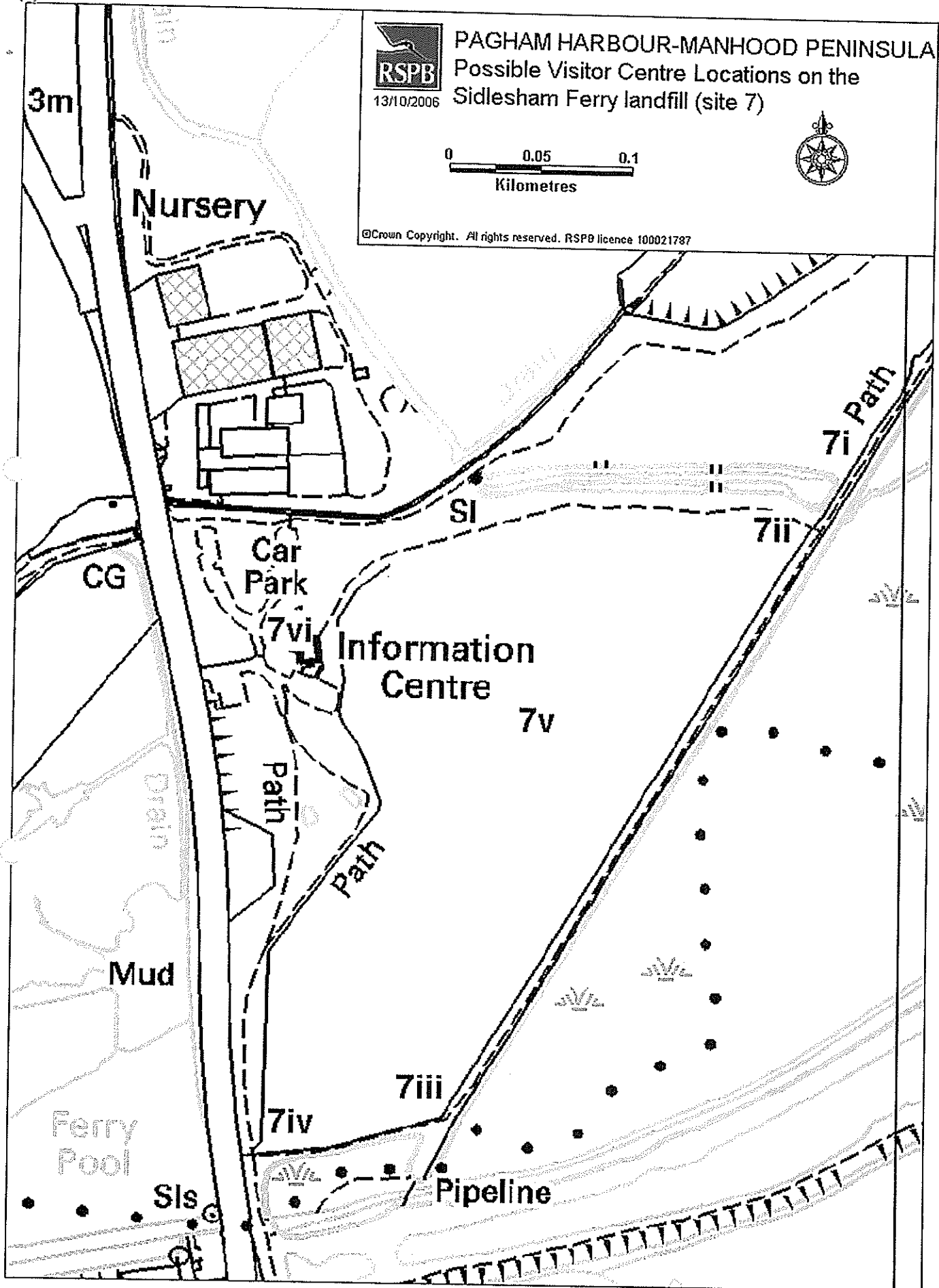
Appendix 2 – Detailed Site Plan



PAGHAM HARBOUR-MANHOOD PENINSULA
Possible Visitor Centre Locations on the
Sidlesham Ferry landfill (site 7)



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Appendix 3 – Visitor Centre Specification Brief

Pagham Harbour Nature Reserve Visitor Centre Brief

VISITOR OBJECTIVES

A reception and information building that will attract and direct visitors to appropriate areas of Pagham Harbour where they will experience the very attractive coastal and countryside landscape and wildlife with minimal adverse impact upon both the wildlife and local people.

The objective will not necessarily be to attract many more visitors to the area, (which can be modified by appropriate levels of promotion) but to raise the quality of visitor infrastructure to be acclaimed as a flagship nature conservation area with very interesting walks through a special landscape.

The creation of a safe, attractive visitor “honey pot” in this part of the harbour is likely to attract additional visitors but careful design of access trails and landscaping could accommodate such an increase without detriment to the area. This sensitive approach to planning and design may also help to reduce pressure in other parts of the harbour, where visitor numbers at peak times may have already become an issue.

BUILDING CONCEPT

A sustainable building that will meet future long term demands is likely to need to receive up to 0.25m visitors per year. However, a modular construction approach could be incorporated so that the building can grow as and when there is a sound business case together with public demand and approval. The building will need to create a pleasant, friendly, welcoming atmosphere. It will cater for both formal and informal educational use (c 7,500 formal school children visiting per year) It will serve as a meeting place for local people and harbour related interests and activities. There will also need to be sufficient space including open ground for special events, e.g. open days etc.

A good standard of catering will be provided for the comfort of visitors and to limit the pressure that any increase in the number of visitors may put upon local catering establishments. A sizable retail outlet will be required to generate sufficient income to pay for the cost of maintaining the centre and its staff.

VISITOR FLOW

The building will not be a dedicated gateway to a controlled access area (which makes design much easier). It will promote access onto the public rights of way and onto probable future permissive paths which will radiate out to the surrounding countryside. Care will be needed to promote this access so that visitors will find areas which are not only interesting and attractive but also where there is sufficient space and carrying capacity for the likely increase in their numbers.

VISITOR NUMBERS

Based upon RSPB experience we would estimate the likely projected visitor numbers within 5 to 10 years to range from 150,000 to 250,000 per year.

INDICATIVE GROSS AREA REQUIREMENTS

<u>FUNCTION</u>	<u>AREA SQ M</u>
Reception	70
Display and Circulation Space	60
Toilets	60
Retail	120
Catering 60 cover	
Inc. kitchen and store	150
Double Classroom (split option)	130
Meeting Room	65
Offices and Admin inc. rest room	70
Storage	80
Plant and Equipment	20
Total internal area	825 sq m

External Requirements

Road access

Parking, 3 Coaches,
200 spaces sealed (with SUDS)
100 unsealed (including capping on landfill)

N. B. This Brief has been produced by the RSPB on their previous projects to give an indicative guideline on areas required for such centres.

Queries to: 

Appendix 4 – Services & Utilities Summary Report

VISITOR CENTRE SERVICES / UTILITIES – SUMMARY REPORT

- **Gas**

Southern Gas Networks supply line to Selsey running under / along the line of the old Tramway. No gas provision to existing Centre.

- **Electricity**

National Grid / Southern Energy mains supply runs along the opposite (west) side of the road. Supply to the Centre is from a sub-station to the north via the west side of the overflow car park. Exact line of service supply to Centre unknown.

- **Water**

Southern Water – no supply / waste water services

Portsmouth Water – Mains supply runs north-south (as with electricity supply) between overflow car park and the road, following the line of the road. Exact line of service pipe to Centre unknown.

- **Telecommunications**

BT / Cable & Wireless – Main supply running north-south along the road boundary. Poles / service supply to north and west of overflow car park. Exact line to Centre unknown.

Queries to: [REDACTED]

Appendix 5 – Conceptual Model
(19 Pages)

TABLE 1: CONCEPTUAL SITE MODEL - Potential Pollutant Linkages

No.	Contaminant	Pathway	Receptor	Notes
1.	Hydrocarbons	Dermal exposure Ingestion of soil, dust and water Inhalation of particulates Inhalation of vapours	Humans On-site Reserve Staff	First 3 pathways only considered to be present where soil is exposed or in excavations. Vapour pathway only present in excavations and only applies to volatile substances (unlikely due to age of waste and repeated flushing by tides). Visual Inspection is required to evaluate the nature and condition of site surfaces and the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
2.	Hydrocarbons	Dermal exposure Ingestion of soil, dust and water Inhalation of particulates Inhalation of vapours	On-site construction and utility workers	First 3 pathways only considered to be present where soil is exposed or in excavations. Vapour pathway only present in excavations and only applies to volatile substances (unlikely due to age of waste and repeated flushing by tides). Visual Inspection is required to evaluate the nature and condition of site surfaces and the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
3.	Hydrocarbons	Dermal exposure Ingestion of soil, dust and water Inhalation of particulates Inhalation of vapours	On-site visitors	First 3 pathways only considered to be present where soil is exposed or in excavations. Vapour pathway only present in excavations and only applies to volatile substances (unlikely due to age of waste and repeated flushing by tides). Visual Inspection is required to evaluate the nature and condition of site surfaces and the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
4.	Hydrocarbons	Dermal exposure Ingestion of soil, dust and water Inhalation of particulates Inhalation of vapours	On-site trespassers	First 3 pathways only considered to be present where soil is exposed or in excavations. Vapour pathway only present in excavations and only applies to volatile substances (unlikely due to age of waste and repeated flushing by tides). Visual Inspection is required to evaluate the nature and condition of site surfaces and the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
5.	Hydrocarbons	Inhalation of airborne dust Ingestion of water from site	Site neighbours	First pathway possible though unlikely if soil is exposed on site and can give rise to significant airborne dust generation. Second pathway unlikely as surface water and groundwater are not believed to be abstracted locally for potable supply.
6.	Hydrocarbons	Inhalation of airborne dust Ingestion of water from site	The general public	First pathway possible though unlikely if soil is exposed on site and can give rise to significant airborne dust generation. Second pathway unlikely as surface water and groundwater are not believed to be abstracted locally for potable supply.
7.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of soil, dust and water Inhalation of particulates	On-site Reserve Staff	Visual Inspection is required to assess potential for airborne dust generation From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways.
8.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of soil, dust and water Inhalation of particulates	On-site construction and utility workers	Visual Inspection is required to assess potential for airborne dust generation From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.

9.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of soil, dust and water Inhalation of particulates	On-site visitors	From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
10.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of soil, dust and water Inhalation of particulates	On-site trespassers	From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site. First pathway possible though unlikely if soil is exposed on site and can give rise to significant airborne dust generation. Second pathway unlikely as surface water and groundwater are not believed to be abstracted locally for potable supply. Visual Inspection is required to assess potential for airborne dust generation
11.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Inhalation of airborne dust Ingestion of water from site	Site neighbours	From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site. First pathway possible though unlikely if soil is exposed on site and can give rise to significant airborne dust generation. Second pathway unlikely as surface water and groundwater are not believed to be abstracted locally for potable supply. Visual Inspection is required to assess potential for airborne dust generation
12.	Metals - human health (e.g. As, Cd, Cr, Pb, Ni, Se)	Inhalation of airborne dust Ingestion of water from site	The general public	From waste or in topsoil. This linkage is only considered to be present where soil or waste is exposed on the site surface or in excavations. Visual Inspection is required to evaluate the nature and condition of site surfaces and their likely impact on these exposure pathways. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site. First pathway possible though unlikely if soil is exposed on site and can give rise to significant airborne dust generation. Second pathway unlikely as surface water and groundwater are not believed to be abstracted locally for potable supply. Visual Inspection is required to assess potential for airborne dust generation
13.	Flammable Landfill Gases (methane)	Inhalation of gases Fire and Explosion	On-site Reserve Staff	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
14.	Flammable Landfill Gases (methane)	Inhalation of gases Fire and Explosion	On-site construction and utility workers	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
15.	Flammable Landfill Gases (methane)	Inhalation of gases Fire and Explosion	On-site visitors	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
16.	Flammable Landfill Gases (methane)	Inhalation of gases Fire and Explosion	On-site trespassers	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
17.	Flammable Landfill Gases (methane)	Inhalation of gases Fire and Explosion	Site neighbours	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.

18.	Toxic Landfill Gases (carbon dioxide)	Inhalation of gases	On-site Reserve Staff	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
19.	Toxic Landfill Gases (carbon dioxide)	Inhalation of gases	On-site construction and utility workers	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
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21.	Toxic Landfill Gases (carbon dioxide)	Inhalation of gases	On-site trespassers	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on these exposure pathways. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
22.	Toxic Landfill Gases (carbon dioxide)	Inhalation of gases	Site neighbours	Reasonable possibility due to old landfill. This linkage is only considered to be present in excavations, buildings, or confined spaces. Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
23.	Hydrocarbons	Leaching from unsaturated zone of soil and waste	Controlled Waters	Intrusive Investigation is required to assess the actual presence and concentrations of landfill gases on the site.
24.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Leaching from unsaturated zone of soil and waste	Groundwater	There is a reasonable possibility that this linkage is present. An Intrusive Investigation is required to allow assessment of the groundwater quality and flow regime beneath the site.
25.	Hydrocarbons	Leaching from unsaturated zone of soil	Drain (running through site)	There is a reasonable possibility that this linkage is present. Limited Sampling is required to allow assessment of the groundwater quality and flow regime beneath the site.
26.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Leaching from unsaturated zone of soil	Drain (running through site)	There is a reasonable possibility that this linkage is present. Limited Sampling is required to allow a comparative assessment of water quality upstream and down stream from the site.
27.	Hydrocarbons	Migration within aquifer	Broad Rife (30 m to south)	Theoretical possibility. Considered unlikely due to age of landfill and dilution within river. Dependent upon actual presence of contamination in groundwater; groundwater flow regime and flow state of river.
28.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Migration within aquifer	Broad Rife (30 m to south)	Theoretical possibility. Considered unlikely due to age of landfill and dilution within river. Dependent upon actual presence of contamination in groundwater; groundwater flow regime and flow state of river. Limited Sampling is required to allow a comparative assessment of water quality upstream and down stream from the site

29.	Hydrocarbons	Leaching from unsaturated zone of soil Migration within aquifer Discharges from surface waters	Pagham Harbour (to east of site)	Theoretical possibility. Considered unlikely due to age of landfill and dilution within receiving waters. Dependent upon groundwater flow regime and actual presence of contamination in groundwater. An Intrusive Investigation is required to allow assessment of the groundwater quality and flow regime beneath the site.
30.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Leaching from unsaturated zone of soil Migration within aquifer Discharges from surface waters	Pagham Harbour (to east of site)	Theoretical possibility. Considered unlikely due to age of landfill and dilution within receiving waters. Dependent upon groundwater flow regime and actual presence of contamination in groundwater. An Intrusive Investigation is required to allow assessment of the groundwater quality and flow regime beneath the site.
31.	Hydrocarbons	Dermal exposure Ingestion of soil, dust and water Inhalation of particulates Ingestion of food	Protected Ecosystems Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site	This linkage refers to wildlife on-site (which is part of the Nature Reserve). The first three pathways are considered to be active in outside areas where soil or waste is exposed. The fourth pathway refers to food sources (eg worms) that come from soil on-site. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
32.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of soil, dust and water Inhalation of particulates Ingestion of food	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site	This linkage refers to wildlife on-site (which is part of the Nature Reserve). The first three pathways are considered to be active in outside areas where soil or waste is exposed. The fourth pathway refers to food sources (eg worms) that come from soil on-site. An Intrusive Investigation is required to assess the thickness and quality of topsoil cover over the waste on site.
33.	Hydrocarbons	Dermal exposure Ingestion of silt and water Ingestion of food	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) off-site	This linkage refers to wildlife off-site (but within the Nature Reserve). It assumes contamination of the mud flats and / or waters bordering the subject site has occurred. The third pathway refers to food sources (eg worms) that are found within the mud or harbour waters. Dust inhalation is not considered to be an active pathway as the mud flats are permanently wet. An Intrusive Investigation on site is required to allow assessment of the groundwater quality and groundwater flow regime beneath the site.
34.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Ingestion of silt and water Ingestion of food	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) off-site	This linkage refers to wildlife off-site (but within the Nature Reserve). It assumes contamination of the mud flats and / or waters bordering the subject site has occurred. The third pathway refers to food sources (eg worms) that are found within the mud or harbour waters. Dust inhalation is not considered to be an active pathway as the mud flats are permanently wet. An Intrusive Investigation on site is required to allow assessment of the groundwater quality and groundwater flow regime beneath the site.
35.	Hydrocarbons	Direct contact and uptake by plant root zone.	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site	This linkage is reasonably possible on the subject site. An Intrusive Investigation is required to assess the quality and thickness of soil cover on the site.
36.	Metals - (e.g. As, Cd, Cr, Pb, Ni, Se)	Direct contact and uptake by plant root zone.	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site	This linkage is reasonably possible on the subject site. An Intrusive Investigation is required to assess the quality and thickness of soil cover on the site.
37.	Flammable Landfill Gases (methane)	Direct contact and uptake by plant root zone.	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site	This linkage is reasonably possible on the subject site. It is, however considered to be unlikely, given the age of the landfill. An Intrusive Investigation is required to assess the actual presence of landfill gases on the site.
38.	Toxic Landfill Gases (carbon dioxide)	Direct contact and uptake by plant root zone.	Pagham Harbour Local Nature Reserve (also SSSI; Ramsar site; SPA) on-site Property (Buildings)	This linkage is reasonably possible on the subject site. It is, however considered to be unlikely, given the age of the landfill. An Intrusive Investigation is required to assess the actual presence of landfill gases on the site.
39.	Hydrocarbons	Direct contact	Buried services on-site	Reasonable possibility, but only likely if service runs have been laid through waste. A Visual Inspection is required to evaluate the presence of buried water pipes on site.

40.	Flammable Landfill Gases (methane)	Fire / explosion	Buildings on the site	Reasonable possibility due to landfilling on site. This linkage is only considered to be present where there is potential for flammable gases to accumulate. A Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on this exposure pathway. An Intrusive Investigation is required to assess the actual presence of landfill gases on the site.
41.	Flammable Landfill Gases (methane)	Fire / explosion	Buildings to north of site	Reasonable possibility due to landfilling on site. This linkage is only considered to be present where there is potential for flammable gases to accumulate. A Visual Inspection is required to evaluate the construction of buildings / presence of confined spaces with respect to their likely impact on this exposure pathway. An Intrusive Investigation is required to assess the actual presence of landfill gases on the site.
42.	Hydrocarbons	Migration within aquifer	Property (Crops, Livestock and Game)	
43.	Flammable Landfill Gases (methane)	Lateral migration through unsaturated zone of soil. Direct contact with plant root zone.	Fish in Broad Rife (if subject to fishing rights) Crops on adjacent land.	This pollutant linkage is not likely to exist. It does not appear that there are any receptors in this category on the subject site or surrounding land. A Visual Inspection is required to examine more fully the surrounding uses for the presence or other wise of any relevant receptors. This pollutant linkage is not likely to exist. It does not appear that there are any receptors in this category on the subject site or surrounding land. A Visual Inspection is required to examine more fully the surrounding uses for the presence or other wise of any relevant receptors.
44.	Toxic Landfill Gases (carbon dioxide)	Lateral migration through unsaturated zone of soil. Direct contact with plant root zone.	Crops on adjacent land.	This pollutant linkage is not likely to exist. It does not appear that there are any receptors in this category on the subject site or surrounding land. A Visual Inspection is required to examine more fully the surrounding uses for the presence or other wise of any relevant receptors.

Report: Assessment of Environment Agency Landholdings – Anglian & Southern Region Priority 2 – 4 sites
 Site ID: Siddlesham Ferry
 Client: Environment Agency
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TABLE 2A.1: POTENTIAL CONTAMINANT SOURCES

CONCEPTUAL MODEL UNCERTAINTY EVALUATION		Former Civic Amenity site and landfill (HYDROCARBONS)	Data To Be Obtained Via Detailed Inspection
CONTAMINANT SOURCE			
Parameters Considered	Contaminant Types	Summary Of Existing Data	
Contaminant Properties		Hydrocarbon Fuels and oils	
Solubility		See Table 3.	
Density			
Viscosity			
Henrys Law			
Log Octanol/Water			
Biodegradation			
Contaminant Form		No data available but it is likely that hydrocarbons will be sorbed. Possible vapour phase at depth within waste (hazard in excavations or confined spaces only)	
Solid			
Sorbed			
Free Phase Liquid			
Dissolved			
Vapour			
Contaminant Distribution		Hydrocarbon contamination could be located anywhere on the site.	
Location			
Extent			
Depth			
Other			

Report of Stanger Environmental Policy Ltd. on behalf of the Environment Agency
 Site ID: Siddleham Ferry
 Client: Environment Agency
 Report: C03583/29

TABLE 2B.1: POTENTIAL RECEPTORS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION		Data To Be Obtained Via Detailed Inspection
CONTAMINANT SOURCE		Summary Of Existing Data
Parameters Considered		
Humans	Site used as Nature Reserve with Information Centre and car park	
Land Use	Adult worker	
Critical Receptor Type	No data	
Exposure Averaging Areas	Reserve staff daily	
Occupiers	Visitors daily	
Visitors	Trespassers may be able to access the site	
Trespassers	Possible but unlikely.	
Off-site receptors	Unlikely but possible occasionally	
Maintenance workers		
Ecological receptors	The site itself and the land to the east and west are designated as a Local Nature Reserve, a Ramsar Site, a SSSI and a Special Protection Area	
	National Nature Reserves	
	Marine Nature Reserves	
	Special Areas of Conservation	
	Special Protection Areas	
	Candidate SACs	
	Candidate SPAs	
	PPG9 sites & Ramsars	
	Nature Reserves	
Property	None present on site, possible on surrounding land.	Visual inspection to assess surrounding land uses and existence of fishing rights areas.
	Crops	
	Domestic produce	
	Livestock	
	Owned/domesticated animals	
	Wild animals subject to shooting/fishing rights	
Property	Hunted services may be a receptor	Visual inspection to assess location of on-site service runs.
	Buildings	
	Ancient monuments	
Controlled waters	None present on site or within 500 metres	
	Lakes	Visual inspection to assess presence of ponds on site
	Ponds	
	Rivers	
	Other watercourses	
	Groundwater	Minor aquifer beneath the site - groundwater vulnerability map.

TABLE 2C.1 continued: POTENTIAL CONTAMINANT PATHWAYS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION	
CONTAMINANT SOURCE	Summary of existing data
Parameters considered	Data to be obtained via detailed inspection
Property: Buildings	
Direct contact between services and contaminants in soil and water	Hydrocarbon contamination possibly present - reasonable standards of professional judgement. Contact between buried services and areas of gross contamination possible.
Property: Crops, Livestock and Game	
Migration through aquifer to fish in Broad Rife (if subject to fishing rights)	Theoretical possibility (though unlikely) if lower reach of river is subject to fishing rights.
Protected Ecosystems	
Dermal exposure	Site and land to east and west is protected ecosystem - Landmark information Exposure to site soils possible - reasonable standards of professional judgement.
Ingestion of soil, dust and water	Site and land to east and west is protected ecosystem - Landmark information Exposure to site soils possible - reasonable standards of professional judgement.
Inhalation of particulates	Site and land to east and west is protected ecosystem - Landmark information Exposure to site soils possible - reasonable standards of professional judgement.
Ingestion of food	Ingestion of food sources from contaminated soils or waters possible - reasonable standards of professional judgement.
Direct Contact with root zone	Contact with contaminated soils or waters possible - reasonable standards of professional judgement.
	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
	Intrusive Investigation to assess quality and thickness of topsoil cover on site.

TABLE 2A.2: POTENTIAL CONTAMINANT SOURCES

CONCEPTUAL MODEL UNCERTAINTY EVALUATION	
CONTAMINANT SOURCE	Former Civic Amenity site and landfill (METALS – eg As, Cd, Cr, Pb, Ni etc)
Parameters Considered	Summary Of Existing Data
Contaminant Types	Metals – Human Health
Contaminant Properties	See Table 3.
Solubility	
Density	
Viscosity	
Henrys Law	
Log Octanol/Water	
Biodegradation	
Contaminant Form	No data available but it is likely that metals will be in solid or dissolved form.
Solid	
Sorbed	
Free Phase Liquid	
Dissolved	
Vapour	
Contaminant Distribution	Could be located anywhere on the site.
Location	
Extent	
Depth	
Other	
	Data To Be Obtained Via Detailed Inspection

TABLE 2C.2: POTENTIAL CONTAMINANT PATHWAYS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION		
CONTAMINANT SOURCE	Former Civic Amenity site and landfill (METALS – eg As, Cd, Cr, Pb, Ni etc)	
Parameters considered	Summary of existing data	
Humans	Data to be obtained via demitted inspection	
Ingestion of contaminants in soil, dust and waters (outdoors) & to soil-derived dust indoors	Nature Reserve and car park – WSCC Information. Metals theoretically present – reasonable standards of professional judgement. Site potentially accessible to trespassers – Agency information	Visual Inspection to assess existing site surface conditions.
Inhalation of contaminants in soil dusts (outdoors) & to soil-derived dust indoors	Nature Reserve and car park – WSCC Information. Metals theoretically present – reasonable standards of professional judgement. Site potentially accessible to trespassers – Agency information	Visual Inspection to assess existing site surface conditions.
Controlled Waters		
Leaching from unsaturated zone of soil	Most of site bare soil with vegetation cover – WSCC information. Metallic contamination possibly present – reasonable standards of professional judgement. Leaching rate likely to be dependent upon surface cover – professional judgement.	Visual Inspection to assess existing site surface conditions. Intrusive Investigation to assess groundwater quality beneath site.
Migration within aquifer	Minor aquifer present – Groundwater vulnerability map. Metallic contamination possibly present – reasonable standards of professional judgement.	Limited sampling to assess impact of site on surface water quality. Intrusive Investigation to assess the direction of groundwater flow.
Surface water discharges	Surface waters discharge to drains and channels on site. Also direct infiltration to soil – WSCC information.	Visual Inspection to assess existing site drainage conditions. Limited sampling to assess impact of site on surface water quality.
Protected Ecosystems		
Ingestion of soil, dust and water	Site and land to east and west is protected ecosystem – Landmark information Exposure to site soils possible - reasonable standards of professional judgement.	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
Inhalation of particulates	Site and land to east and west is protected ecosystem – Landmark information Exposure to site soils possible - reasonable standards of professional judgement.	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
Ingestion of food	Ingestion of food sources from contaminated soils or waters possible - reasonable standards of professional judgement.	Intrusive Investigation to assess quality and thickness of topsoil cover and groundwater quality / flow regime.
Uptake by plant root zone	Contact between roots and contaminated soil and water possible – reasonable standard of professional judgement.	Intrusive Investigation to assess quality and thickness of topsoil cover.

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TABLE 2C.2: continued: POTENTIAL CONTAMINANT PATHWAYS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION	
CONTAMINANT SOURCE	Former Civic Amenity site and landfill (METALS - eg As, Cd, Cr, Pb, Ni etc)
Parameters considered	Summary of existing data
Property: Crops, Livestock and Game	
Migration through aquifer to fish in Broad Rife (if subject to fishing rights)	Theoretical possibility (though unlikely) if lower reach of river is subject to fishing rights. Visual Inspection to assess surrounding land uses.
	Data to be obtained via detailed inspection

TABLE 2A.3: POTENTIAL CONTAMINANT SOURCES

CONCEPTUAL MODEL UNCERTAINTY EVALUATION	
CONTAMINANT SOURCE	Former Civic Amenity site and landfill (LANDFILL GASES – methane and carbon dioxide)
Parameters Considered	<p>Summary Of Existing Data Landfill Gases – methane and carbon dioxide See Table 3.</p>
Contaminant Types	
Contaminant Properties	
Solubility	
Density	
Viscosity	
Henrys Law	
Log Octanol/Water	
Biodegradation	
Contaminant Form	
Solid	No data available but would be gaseous
Sorbed	
Free Phase Liquid	
Dissolved	
Vapour	
Contaminant Distribution	<p>Reasonable possibility; could be present anywhere on site. Accumulation only in excavations and confined spaces</p>
Location	
Extent	
Depth	
Other	
	Data To Be Obtained Via Detailed Inspection

TABLE 2B.3: POTENTIAL RECEPTORS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION		Summary Of Existing Data	Data To Be Obtained Via Detailed Inspection
CONTAMINANT SOURCE		Former Civic Amenity site and landfill (LANDFILL GASES - methane and carbon dioxide)	
Parameters Considered			
Humans	Land Use	Works depot and offices	
Critical Receptor Type	Exposure Averaging Areas	Child (assuming unauthorised access is possible) No data	
Occupiers	Visitors	Agency staff Visitors possible	
Trespassers	Off-site receptors	Trespassers may be able to access the site Possible, there are residential properties bordering the site. Likely to be present from time-to-time	
Maintenance workers			
Ecological receptors	SSSIs	The site itself and the land to the east and west are designated as a Local Nature Reserve, a Ramsar Site, a SSSI and a Special Protection Area	
	National Nature Reserves		
	Marine Nature Reserves		
	Special Areas of Conservation		
	Special Protection Areas		
	Candidate SPAs		
	PPG9 sites & Ramsars		
	Nature Reserves		
Property	Crops	None present on site, possible on surrounding land.	Visual Inspection to assess surrounding land uses.
	Domestic produce		
	Livestock		
	Owned/domesticated animals Wild animals subject to shooting/fishing rights		
Property	Buildings	Buildings present on site and on neighbouring land.	Visual Inspection to assess construction / presence of confined spaces.
	Ancient monuments	None present on the site or in the vicinity of the site	
Controlled waters	Lakes	Not applicable	
	Ponds	Not applicable	
	Rivers	Not applicable	
	Other watercourses	Not applicable	
	Groundwater	Not applicable	

TABLE 2C.3: POTENTIAL CONTAMINANT PATHWAYS

CONCEPTUAL MODEL UNCERTAINTY EVALUATION	
CONTAMINANT SOURCE	Former Civic Amenity site and landfill (LANDFILL GASES – methane and carbon dioxide)
Parameters considered	Summary of existing data
Humans	Data to be obtained via detailed inspection
Fire and explosion	Information centre and toilets present on-site – WSCC Information. Landfill gases theoretically present – reasonable standards of professional judgement. Possible Pathway to off site human receptors present
Inhalation of gases – in excavations or confined spaces	Information centre and toilets present on-site – WSCC Information. Landfill gases theoretically present – reasonable standards of professional judgement. Possible Pathway to off site human receptors present
Protected Ecosystems	Visual Inspection to assess building construction and presence of confined spaces on-site. Intrusive Investigation to assess presence and significance of landfill gas concentrations on site Visual Inspection to assess building construction and presence of confined spaces on-site. Intrusive Investigation to assess presence and significance of landfill gas concentrations on site
Direct contact with root zone	Site and land to east and west is protected ecosystem – landmark information Exposure in site soils possible - reasonable standards of professional judgement.
	Intrusive Investigation to assess actual presence of landfill gases on site.

TABLE 3: Summary of Contaminant Properties

CONCEPTUAL MODEL UNCERTAINTY EVALUATION

Contaminant	Solubility (mg/l)	Relative Density	Viscosity	Henry's Law Constant	Log Octanol/Water K_{ow}	Biodegradation Potential (Half Life - hours)
Oils, Fuels and Hydrocarbons						
Benzene	1780 (1)	0.879 (1)	Low	2.25E-01 (1)	2.13 (1)	120 - 384 (6)
Toluene	515 (1)	0.867 (1)	Low	3.74E-01 (1)	2.69 (1)	96 - 528 (6)
o-Xylene	220 (1)	0.88 (1)	Low	2.28E-01 (1)	3.15 (1)	168 - 672 (6)
p-Xylene	160 (1)	0.86 (1)	Low	2.95E-01 (1)	3.20 (1)	168 - 672 (6)
Diesel range hydrocarbons (C ₁₀)	215 (1)	0.86 (1)	Low	2.33E-01 (1)	3.18 (1)	336 - 8640 (6)
Lubricating oil (C ₂₀)	0.00005 (1)	0.77 (1)	Medium	1.57E+02 (1)	8.25 (1)	No data
Benzo(a)pyrene	No data	0.79 (1)	Medium	8.00E+01 (1)	11.27 (1)	No data
Trichloroethene	0.0038 (1)	No data	solid	1.86E-05 (1)	6.04 (1)	1368 - 12720 (6)
Metals	1000 (4)	1.46 (4)	Low	4.35E-01 (3)	2.71 (5)	4320 - 8640 (6)
Lead	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Arsenic	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Cadmium	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Chromium	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Nickel	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Mercury	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Copper	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Zinc	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Selenium	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Gases	Dependent on form	N/R	N/R	N/R	N/R	Not degradable
Methane	90 (2)	0.08 (g/l) (2)	N/R	N/R	N/R	No data
Carbon dioxide	900 (2)	1.98 (g/l) (2)	N/R	N/R	N/R	No data

Notes:

Half lives quoted are based upon the minimum to maximum time quoted for the substance in soil.

NR - Not Relevant

References

Date: January 2004

Report Ref.:LD318157/SC/R29/Rev1

Report: Assessment of Environmental Landfilling - Anglia - South East Region - Priority 2 - Sites 1 - 4
Site ID: Siddlesham Ferry
Client: Environment Agency
Report: C03583/29

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- (2) Handbook of Chemistry and Physics 36th Edition
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- (5) Soil Screening Guidance. Technical Background Guidance. EPA/540/R95/128
- (6) Handbook of Environmental Degradation Rates. P.H. Howard et al