ENVIRONMENTAL STRATEGY PLAN

Shell Camden Town

20 July 2018

GSAP ID: 12038454

Prepared for

Shell UK Oil Products UK Ltd

Issue	Date	Details	Prepared by	Checked by	Approved by
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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken in July 2018 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

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1. INTRODUCTION

AECOM Infrastructure & Environment UK Limited (AECOM) was requested by Shell UK Oil Products Ltd. (Shell) to support the likely environmental aspects of the planning process in regard to the proposed erection of a single storey extension to the existing site shop at Shell Camden Town site located at 109-113 York Way, Camden Town, London, N7 9QE (hereafter referred to as 'the Site'). The Site location is shown on **Figure 1**.

This report has been provided to support the planning application relating to the extension of the site shop. Full planning permission was granted on 11/05/2018 by London Borough of Camden, Reference 2018/0561/P. The planning permission is provided in **Appendix A**.

The objective of this Environmental Strategy Plan is to provide a strategy for the assessment and remedial approach to be undertaken during development of the site to ensure that environmental impacts, if any are identified, are managed appropriately and risks to human health and controlled waters are assessed and appropriately mitigated. It is intended that it will form a written scheme of remediation and mitigation during construction sufficient to discharge Condition 4b of the above planning permission.

2. BACKGROUND

The site is a Shell Petrol Filling Station situated in an area of mainly residential use. It is proposed to close the site whilst improvements are made to the site services. The site is to be refurbished and re-opened for continued oil use as a fuel service station.

2.1 Previous Reports

The following environmental reports have previously been prepared for the site:

- URS, P1 Environmental Site Assessment (Ref: 46370434-001), dated September 2015
- URS, P2 Comprehensive Environmental Site Assessment (CESA) (Ref: 46370434-002), dated January 2016
- AECOM, Comprehensive Vapour Monitoring Event Report (CVME) (Ref: 60481562-12038454), dated June 2018
- AECOM, Preliminary Environmental Risk Assessment (PERA) (Ref. GB-12038454-20180713-CORext-PERA), dated 13 July 2018.

The findings of these reports have been summarised below.

2.2 Environmental Site Setting

The site is located in a mainly residential setting. Residential properties with basements are located adjacent to the south and west. The topography of the surrounding area generally slopes downwards towards the south to southwest. The site was developed as a petrol filling station (PFS) c.1977 and was previously residential housing.

Information from the Petroleum Officer report indicates that there are three (3) original tanks with five (5) compartments which were decommissioned and slurry filled in c. 1988. The tanks remain in-situ in the northern part of the site under the northern fuelling area.

In July 2015, a fuel infrastructure integrity issue was identified at Shell Camden Town along with associated odours in the site shop. Information provided by Shell's facility management company (JCI) indicated that fuel was positively identified below the drip tray for Pump 7/8. A repair was carried out, the sump below the dispenser cleaned out and ducting between the dispenser and the shop building was foam filled to prevent vapour ingress. The volume of unaccounted for loss could not be quantified by JCI.

Based on a review of the reports listed in the AECOM 2018 PERA, the development footprint (and the wider site) is directly underlain by hardstanding, further underlain by made ground. The made ground generally comprises sandy gravel/gravelly sand (maximum thickness 1.3m) underlain by gravelly clay (maximum thickness greater than 1.25m).

Available British Geological Survey (BGS) geological maps indicate that there are no superficial deposits beneath the site. The solid geology underlying the site is indicated to be the London Clay Formation. This was confirmed during an Arcadis 2002 site investigation (summarised in the URS 2015 P1 report) and in the URS 2016 ESA with the London Clay proven to be at least 4.2m thick and comprised clay and gravelly clay. No sand or gravel horizons were reported at depth. It is anticipated that the London Clay is 60-100m thick beneath the site.

The nearest surface water feature is a pond located 659m south of the site. There are no reported surface water abstractions located within 1 kilometre (km) of the site.

The Environment Agency (EA) classifies the London Clay Formation as Unproductive Strata.

Three (3) groundwater abstractions are reported to be located within 1km of the site. The abstractions are all licensed by Hanson Quarry products Europe Ltd for general use relating to "Secondary Category (High loss)" and are located 648m south of the site. From previous enquiries it is understood that the London Borough of Camden does not hold any information regarding private groundwater abstractions. The site is not located within an EA defined Source Protection Zone (SPZ).

Perched water has been encountered on site between 0.58 and 1.33m bgl. Given the significant variability in groundwater elevations, it is considered that the water is perched and discontinuous, therefore it was not possible to define a flow direction. LNAPL was not identified in any of the wells. Given the distance to the nearest surface water, and the depth of the aquifers beneath the London Clay, potential pathways to groundwater or surface water are not considered to be present.

2.3 Previous Site Investigations

The 2016 Comprehensive Environmental Site Assessment (CESA) reported a 2015 investigation of the whole PFS (Wider Site) which combined a side-wide assessment with targeted intrusive locations in

proximity of the identified human health receptors: residents in adjacent basements of neighbouring properties and on site workers. A borehole location plan is presented as **Figure 2**.

One intrusive location VP105 from the AECOM (2015) site investigation (and one aborted location VP105A) were located within the Development Area. Two further locations from the same 2015 investigation are in the immediate vicinity to the Development Area: MW102 located approximately 3m to the north and VP101 approximately 4m northwest. The approximate location of the shop extension with respect to previous site investigation locations is shown on **Figure 2**.

Site Wide Findings

Laboratory analytical data from the soil and soil vapour samples collected from the Wider Site between 2015 and 2018 were screened by AECOM against generic assessment criteria (GAC) protective of on site workers (including Shell shop staff and site users) using a continued petroleum use (CPU) end use scenario and off-site residents (in adjacent residential properties to the north, north west and south, including those with basements) using a high density residential (HDR) end use scenario. All concentrations in soil and soil vapour were below CPU and HDR GAC, and asbestos was not reported in any of the samples analysed. Monitoring of vapour wells on site did not identify vapour concentrations that were considered to be a potential risk to the site shop. The Characteristic Gas Situation is classified as 1 for the site, with a risk classification of Very Low

The 2018 Comprehensive Vapour Monitoring Event Report includes PID readings from all the wells (March 2017) and soil vapour analytical data collected from MW4 and MW105 (respectively approximately 20m northwest and 28m west from the proposed construction area) found that no COPC exceeded the HDR or CPU GAC.

Findings within Footprint of Proposed Extension (the Development Area)

VP105, located in the footprint area of the proposed extension, is a deeper well that was screened in the London Clay to assess risks from lateral migration of deep vapours in permeable horizons (if present) to neighbouring basements. VP105A is a nearby location that was terminated. Passive vapour tubes in VP105 became saturated by perched water and so were not analysed. The presence of water at this depth indicates that any unsaturated zone is limited in thickness and that there are not laterally migrating vapours since vapour cannot migrate through water. Furthermore the presence of water indicates that neighbouring basements are watertight and so vapours are unlikely to migrate into them.

No visual or olfactory signs of COPC were reported in VP105 (terminated at 3m bgl) or in VP105A (terminated at 0.6m bgl due to refusal on large slab of concrete). Soil samples collected from VP105/0.4mbgl and VP105/2.7m bgl reported all analytes below detection limit with the exception of ethanol (0.107 mg/kg) and EC21-EC35 Aromatics (0.34mg/kg) atVP105/0.4m bgl, which were below GAC.

Findings from MW102 and VP101, Close to Footprint of Extension

Active vapour samples were collected from shallow wells MW102 and VP101 in proximity of the proposed shop extension. A vacuum could not be maintained in the leak check before sampling, indicating potential leakage of the sample train when under high vacuum. The maximum vapour concentration in either well was a factor of at least 600 below the GAC, indicating that even if 600 times as much ambient air was sampled as air from the well then there would not be a GAC exceedance.

Conclusions for Proposed Development based on Previous Site Investigation

- An unacceptable risk to on-site workers and site visitors or off-site residents from ground within the development area has not been identified.
- An unacceptable risk to on-site workers and site visitors from ground within the PFS but outside the development area has not been identified.

3. PROPOSED ENVIRONMENTAL STRATEGY

3.1 Introduction

The findings of the site investigation and risk assessment indicate that COPC beneath the site are unlikely to present an unacceptable risk to the identified receptors.

It is noted that the two locations within the Development Area did not report evidence of significant COPC impact, with the majority of COPC below detection limits. Therefore based on current knowledge there is unlikely to be a requirement for remediation. However, it is acknowledged that ground conditions can change or previously unidentified impacts could be present and that a strategy is required address these situations.

The following strategy is proposed in order to control the potential risks to site workers during the redevelopment phase; and to protect future occupiers from COPC impacts. The strategy is based on the assumption that the site will be used for Continued Petroleum Use (CPU), with extension of the site shop.

The strategy comprises the following elements:

- Task 1: Watching brief to be maintained throughout the works by the groundworks contractor for evidence of COPC impact or ground conditions different to those expected;
- Task 2: Decommission vapour well VP105 by pouring in bentonite cement slurry and removing the pipe and headworks
- Potential Task 3: If required, delineation of impacted soils deemed likely to fail risk assessment, and classification of waste materials;
- Potential Task 4: If required, excavation of significantly impacted soils failing risk assessment (if encountered) to the extent practicable;
- Potential Task 5: If required, remedial excavation soil validation sampling;
- Potential Task 6: If required, backfilling of remedial excavations;
- Task 7: Within the Development Area, collect five (5) shallow samples and analyse to validate shallow soil quality and confirm the waste classification of the material
- Task 8: Verification report detailing the verification works that were undertaken at the site.

3.2 Watching Brief for Contractor

The contractor will be requested to keep watch during groundworks for signs of COPC impacts, particularly separate phase hydrocarbons, hydrocarbon odours or staining. If these are encountered then the contractor will request attendance and advice on next steps from Shell's environmental consultant.

3.3 Vapour Well Decommissioning

No potentially unacceptable risks to controlled waters and human health receptors were identified at the site during the site investigations/ monitoring between 2016 and 2017.

Monitoring well VP105 located within the planned extent of the development will be decommissioned. Other non-affected monitoring wells outside the development area are proposed to be kept on the site for the purpose of future vapour monitoring.

The well will be decommissioned by removing the headworks and surrounding concrete, manually removing the well pipe, and backfilling the borehole with a bentonite/cement grout to ground level. If the well pipe cannot be removed, the pipe will be backfilled with a bentonite/cement grout in situ.

3.4 Delineation of impacts and Soil Removal (if required)

If requested by the contractor following the discovery of unexpected COPC impacts, an AECOM site engineer will attend site to observe the excavations undertaken during engineering works to construct the foundations. Soils encountered within the planned excavations that show visible and/or olfactory signs of significant hydrocarbons, assessed to fail risk assessment, will be delineated and/or removed from the site and disposed of at an appropriately licensed authorised landfill or soil processing facility. A PID will be used to identify the presence of VOCs and to assist in locating areas of potentially significant hydrocarbon-impact. Significantly hydrocarbon-impacted material, failing risk assessment, will be excavated as far as is practical and safe to do so as part of the proposed engineering scope of works.

Based on current soil and groundwater data it is not envisaged that any remediation will be required however localised excavation and removal of impacted soil and perched water could potentially be

needed if encountered during excavation works. Should significant concentrations and amounts of impacted material be encountered, including free product, that has not previously been identified and cannot be readily managed by off-site disposal, then a brief remedial options appraisal will be undertaken and the Local Authority informed.

In some circumstances where significant concentration and amounts of soil fail risk assessment and cannot be practically excavated during the site works, then an assessment will be made of the extent and potential risks associated with the retained materials and, if necessary, revisions made to this strategy.

Prior to removal of potentially impacted material from the site, Waste Acceptance Criteria (WAC) testing will be undertaken when appropriate, managed by the Shell Engineering Construction PMC. These data will allow a decision to be taken as to which landfill can accept the waste.

3.5 Validation

It is envisaged that within the Development Area, five (5) soil shallow samples will be analysed to validate shallow soil quality and confirm the waste classification of the material following the removal of hardstanding and any unexpected below ground structures.

Samples representative of in-situ soils will be sent to a UKAS accredited laboratory, with chemical analysis of the following suite:

- Speciated TPH (Total Petroleum Hydrocarbons);
- BTEX (Benzene, Toulene, ethylbenzene, xylene);
- Total organic carbon (TOC);
- MTBE (methyl tert-butyl ether), ETBE (ethyl tert-butyl ether), DIPE (di-isopropyl ether), TAME (tertiary amyl methyl ether), TBA (tertiary butyl alcohol) and ethanol;
- Speciated PAH;
- Heavy metals; and
- Asbestos screen.

Representative samples selected for waste classification will also be analysed for 'WAC-E' analysis (Leaching Procedure for CEN Two Stage Batch Test 2:1/8:1 Cumulative).

If the removal of any impacted soils failing risk assessment is required (to the extent practical and safe) , the sides and bases of each excavation will be visually inspected for hydrocarbon impact and soil samples will be taken. The frequency of soil sampling is to be based on field observations made during the site works, although it is envisaged that sampling will be conducted in accordance with the AECOM 'FP21 Verification Sampling of PFS Excavations Method Statement, November 2015', presented in **Appendix B**.

3.6 Backfill of Remedial Excavations (if required)

Backfilling is to be undertaken in accordance with Shell specifications. Where possible and acceptable from both chemical standpoint (to be decided by AECOM Engineer) and geotechnical standpoint (to be decided by contractors) the use of Inert or Non-Hazardous site-won materials should be considered for backfilling excavations.

Excavated material will be visually assessed and chemically screened for its suitability to be re-used on the site. If there is obvious evidence of significant hydrocarbon impact, the material will be removed from site and disposed of at a suitably licensed landfill.

Samples of the backfill material derived from site won materials will be collected at an approximate sampling frequency of 1 per 50 cubic metres (m^3). The samples will be sent to a laboratory for chemical analysis. The results will be compared to screening criteria suitable for the protection of human health based on continued petroleum use (and protective of off-site residents). If the backfill material fails the assessment and is deemed unsuitable for use on the site it will be removed and disposed of to landfill.

All imported backfill material brought on site for the backfill of excavations will be clean, inert material; the appropriate validation documentation, including details of the source of the material) will be supplied to AECOM prior to bringing the materials to site.

The earthworks contractor will keep a record of waste material transfer movements in accordance with their Duty of Care obligation.

3.7 Perched Water in Excavations

If required, perched water will be removed to facilitate excavation of shallow foundations, although this is unlikely. It will either be removed directly from site; or first treated on site prior to removal; or disposed

via the site interceptor system. Free phase hydrocarbon product, if encountered within open excavations, will be removed and disposed of off-site.

The treatment and disposal of groundwater will be the responsibility of the earthworks subcontractor under contract to the Shell PMC (including all related licensing).

3.8 Reporting

On completion of the works, a validation report will be generated that will include details of sampling activities undertaken at the site, analytical results of soil samples and risk assessment on material left in situ, including a detailed quantitative risk assessment (DQRA), if necessary. The report will be used to provide assurance that the site is suitable for its continued use as a fuel service station as per Town Planning Condition 4b.

3.9 Sustainability

In designing the scope of works outlined above, AECOM made the following considerations of sustainability:

- Waste will be screened, analysed, and segregated on-site to reduce the requirement for off-site disposal and soil treatment.
- Sustainability is a key consideration when evaluating the available remedial options in accordance with the principles of the Sustainable Remediation Forum (SURF).
- Wherever possible, AECOM site engineers will be resourced from the local AECOM office to reduce travel impact.

4. METHOD STATEMENTS

All works will be undertaken in accordance with Shell's Health & Safety, Security and Environment (HSSE) Policy. This requires that the construction works adhere to the following:

- Safe working instructions (e.g. health and safety plans);
- Local permits, regulatory and other legal requirements;
- Written instructions or variations from Shell;
- The work scope and its related contract; and
- Consultant standard operating procedures (SOPs).

5. CONTACT INFORMATION

We trust that the information submitted to date along with this proposed environmental strategy is suitable to allow discharge of any Environmental Conditions to the planning application for the proposed engineering works.

However, if you require clarification or further information please do not hesitate to contact

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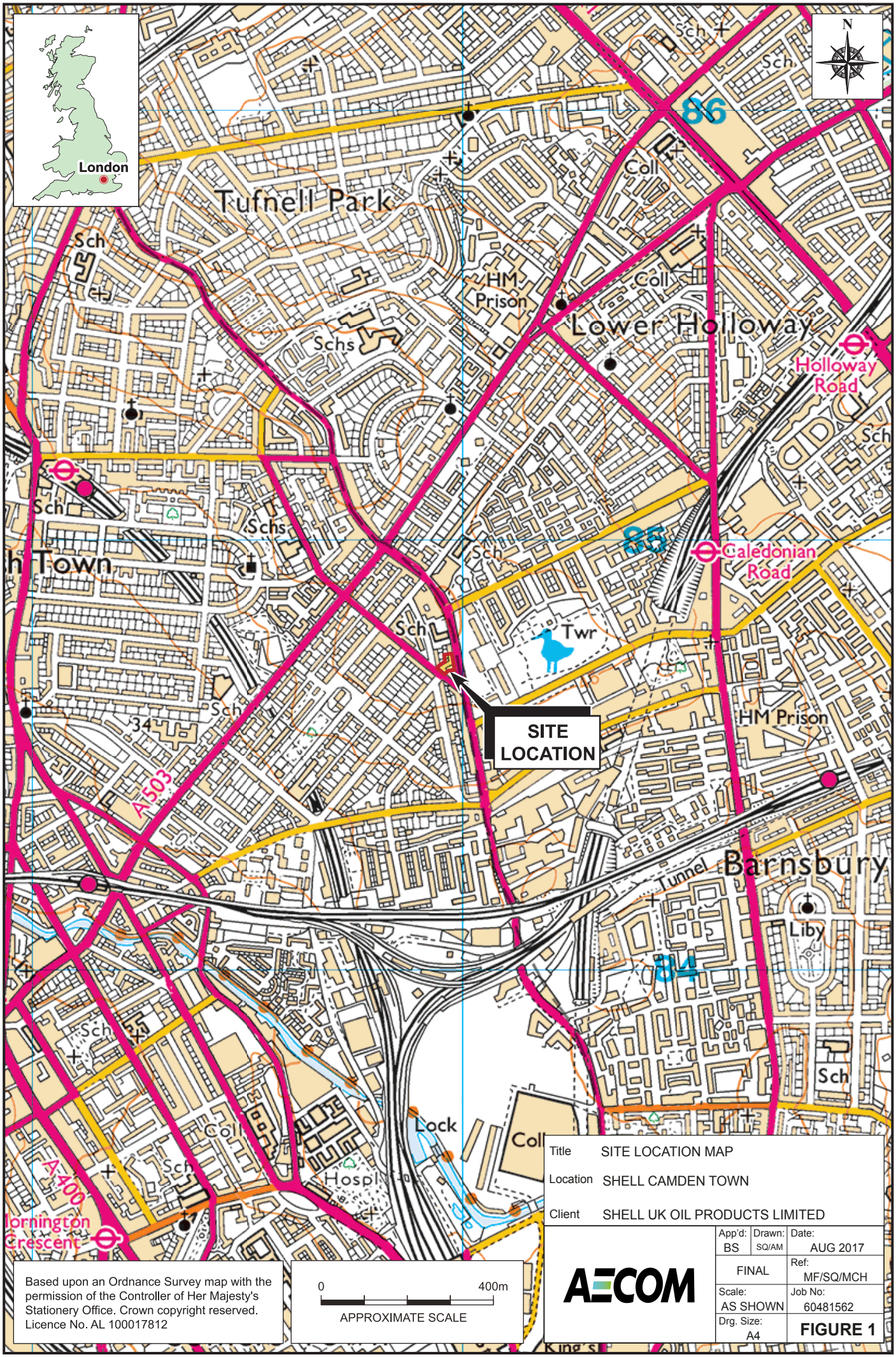
FIGURES

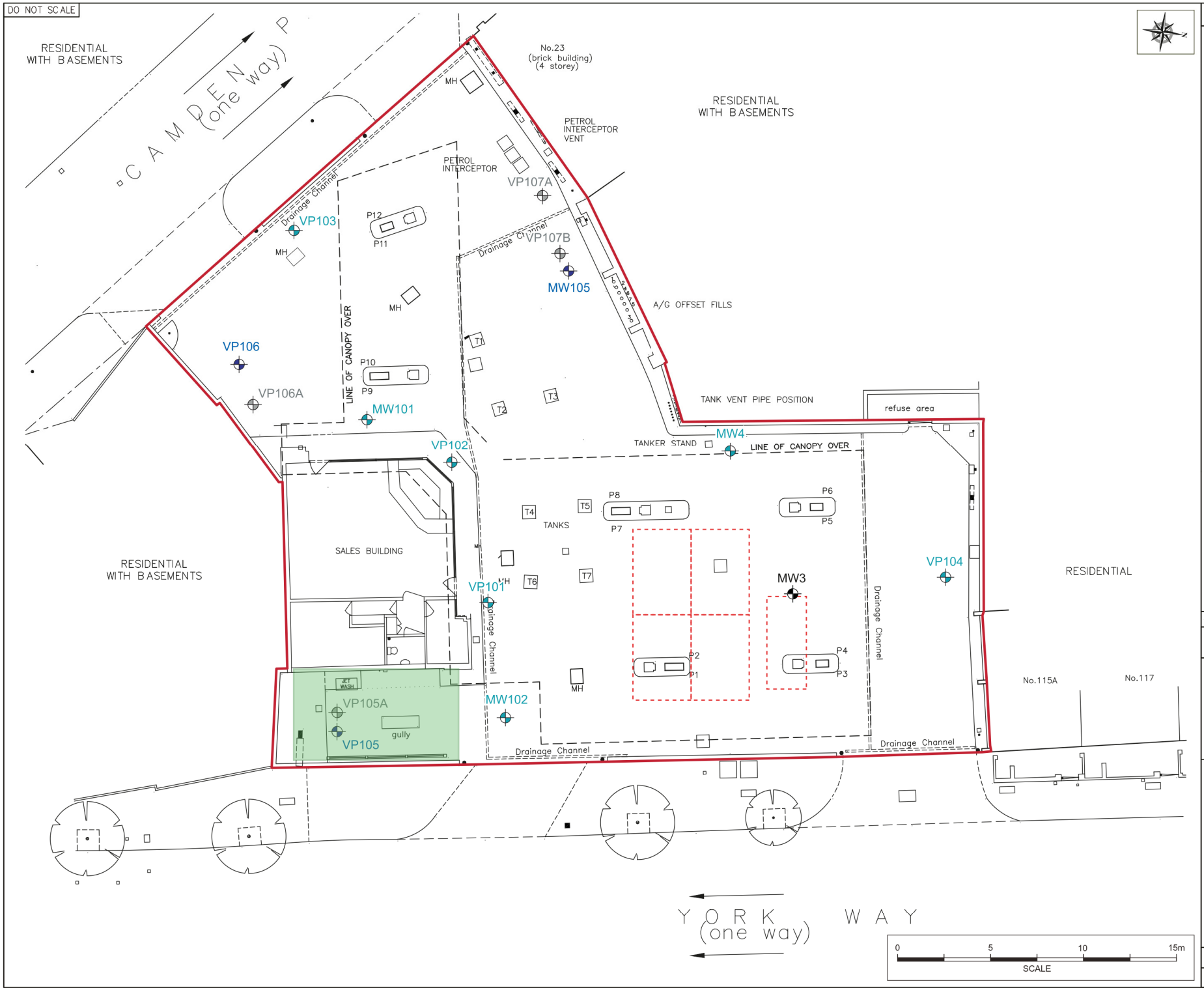


Based upon an Ordnance Survey map with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright reserved. Licence No. AL 100017812

Title	SITE LOCATION MAP
Location	SHELL CAMDEN TOWN
Client	SHELL UK OIL PRODUCTS LIMITED

AECOM

App'd:	Drawn:	Date:
BS	SQ/AM	AUG 2017
FINAL		Ref: MF/SQ/MCH
Scale: AS SHOWN		Job No: 60481562
Drg. Size: A4		**FIGURE 1**



NOTES

- Site Boundary
- Shallow Vapour Monitoring Well
- Deep Vapour Monitoring Well
- Refusal Location
- Historical Well - Failed Seal Test (Not Sampled)
- Historical Tank Location
- Proposed shop extension

NO	DESCRIPTION	DRAWN	APPROVED	DATE

STATUS
FOR INFORMATION

CONSULTING ENGINEERS
AECOM
BRIDGEWATER HOUSE, WHITWORTH STREET, MANCHESTER, M1 6LT
TEL 0161-907-3500 FAX 0161-907-3501

CLIENT
SHELL UK OIL PRODUCTS LTD

PROJECT
SHELL CAMDEN TOWN

DRAWING TITLE
Figure 2
Site Features Plan

DRAWN		CHECKED	APPROVED	DATE
SQ		BS	BS	MAR 2016

SCALE	DRG No.	REV.
As Shown	60481562	

APPENDIX A PLANNING CONDITIONS

Application ref: 2018/0561/P
Contact: David Peres Da Costa
Tel: 020 7974 5262
Date: 11 May 2018

Development Management
Regeneration and Planning
London Borough of Camden
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Judd Street
London
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RLDM Architects Ltd
1A Kingsway Place
Sans Walk
London EC1R 0LS

Dear Sir/Madam

DECISION

Town and Country Planning Act 1990 (as amended)

Full Planning Permission Granted

Address:
Shell petrol station
109 - 113 York Way
London N7 9QE

Proposal:
Erection of single storey side extension to existing petrol station shop.

Drawing Nos: Site location plan; 1481-01 ESP 2018; 1481-04 PSP 2018; 1481-03 EXT ELEVS 2018; 1481-02 PSP 2018 A.

The Council has considered your application and decided to grant permission subject to the following condition(s):

Condition(s) and Reason(s):

1 The development hereby permitted must be begun not later than the end of three years from the date of this permission.

Reason: In order to comply with the provisions of Section 91 of the Town and Country Planning Act 1990 (as amended).

2 All new external work shall be carried out in materials that resemble, as closely as possible, in colour and texture those of the existing building, unless otherwise specified in the approved application.

Reason: To safeguard the appearance of the premises and the character of the immediate area in accordance with the requirements of policy D1 of the London Borough of Camden Local Plan 2017.

3 The development hereby permitted shall be carried out in accordance with the following approved plans: Site location plan; 1481-01 ESP 2018; 1481-04 PSP 2018; 1481-03 EXT ELEVS 2018; 1481-02 PSP 2018 A.

Reason: For the avoidance of doubt and in the interest of proper planning.

4 No development shall commence until:
(a) a written Preliminary Risk Assessment (PRA) and scheme of investigation has been submitted to and approved by the local planning authority in writing; the PRA must take account of the historical and environmental context of the site and can be based on a desk study or the Enhanced Environmental Information Review detailed below; and
(b) following the approval detailed in paragraph (a), a written scheme of remediation and mitigation during construction measures has been submitted to and approved by the local planning authority in writing.

The remediation measures shall be implemented strictly in accordance with the approved scheme and a written report detailing the remediation shall be submitted to and approved by the local planning authority in writing prior to occupation.

Reason: To protect future occupiers of the development from the possible presence of ground contamination arising in connection with the use of the site in accordance with policies G1, A1, and DM1 of the London Borough of Camden Local Plan 2017.

Informative(s):

1 Reason for granting permission:

The single storey side extension would be located in the same location as the existing jetwash which would be demolished. The height and width of the proposed extension would match the existing petrol station shop. The location, size and detailed design of the extension is considered acceptable and would be in-keeping with the existing building. Due to its location and size, there would be no impact on neighbouring amenity in terms of loss of daylight, sunlight or privacy. The Transport team has raised no objection to the scheme. The proposal was revised to include 2 cycle stands to provide space for 4 cycles adjacent to the existing shop unit. This provision would comply with the London Plan. The site is identified as having contaminated land potential and a condition requiring the submission of preliminary risk assessment is therefore required.

The planning and appeal history of the site has been taken into account when coming to this decision.

As such, the proposed development is in general accordance with policies TC1, TC3, D1, T1 and A1 of the Camden Local Plan 2017. The development also accords with the NPPF and the London Plan 2016.

2 Your proposals may be subject to control under the Building Regulations and/or the London Buildings Acts that cover aspects including fire and emergency escape, access and facilities for people with disabilities and sound insulation between dwellings. You are advised to consult the Council's Building Control Service, Camden Town Hall, Judd St, Kings Cross, London NW1 2QS (tel: 020-7974 6941).

3 Noise from demolition and construction works is subject to control under the Control of Pollution Act 1974. You must carry out any building works that can be heard at the boundary of the site only between 08.00 and 18.00 hours Monday to Friday and 08.00 to 13.00 on Saturday and not at all on Sundays and Public Holidays. You are advised to consult the Council's Noise and Licensing Enforcement Team, Camden Town Hall, Judd St, Kings Cross, London NW1 2QS (Tel. No. 020 7974 4444 or search for 'environmental health' on the Camden website or seek prior approval under Section 61 of the Act if you anticipate any difficulty in carrying out construction other than within the hours stated above.

4 With regard to condition 4 above the preliminary risk assessment is required in accordance with CLR11 model procedures for management of contaminated land and must include an appropriate scheme of investigation with a schedule of work detailing the proposed sampling and analysis strategy. You are advised that the London Borough of Camden offer an Enhanced Environmental Information Review available from the Contaminated Land Officer (who has access to the Council's historical land use data) on 020 7974 4444, or by email, http://www.camden.gov.uk/ccm/content/contacts/council-contacts/environment/contact-the-contaminated-land-officer.en, and that this information can form the basis of a preliminary risk assessment. Further information is also available on the Council's Contaminated Land web pages at http://www.camden.gov.uk/ccm/navigation/environment/pollution/contaminated-land/, or
from the Environment Agency at www.environment-agency.gov.uk.

5 This permission is granted without prejudice to the necessity of obtaining consent under the Town and Country Planning (Control of Advertisements) (England) Regulations 2007 for the proposed flag sign.

In dealing with the application, the Council has sought to work with the applicant in a positive and proactive way in accordance with paragraphs 186 and 187 of the National Planning Policy Framework.

You can find advice about your rights of appeal at:

http://www.planningportal.gov.uk/planning/appeals/guidance/guidancecontent

Yours faithfully

David T. Joyce

David Joyce
Director of Regeneration and Planning

APPENDIX B METHOD STATEMENT

This is not a health and safety risk assessment

1. APPLICABILITY

This method statement details the standard procedures used by AECOM during the excavation, sampling and backfilling of excavations on petrol filling station (PFS) sites. This standard method will be used for all such work carried out by AECOM in the UK and Ireland unless otherwise indicated.

2. SAFETY

Site redevelopment works in the UK are classified as "Construction Work" in the *Construction (Design and Management) Regulations*, 2015 (CDM 2015). The Principal Contractor, which may or may not be AECOM, will control the site.

All AECOM staff and subcontractors are required to follow all relevant AECOM and client-specific safety rules at all times while on site and to implement all applicable permit-to-work systems.

Safety requirements specific to excavation work are also detailed in the AECOM Safety Management Standard SMS13 Excavation Safety and will be followed unless specified otherwise in the project Health Safety & Environment Plan.

Great care should be taken during the excavation and inspection of made ground. In particular, the engineer should consider the potential for asbestos to be present in made ground materials, and wear the appropriate PPE if the presence of asbestos appears possible.

3. OBJECTIVES

The main objective of excavation sampling during site redevelopment is generally to collect samples of soil and to allow direct observation and detailed logging of ground conditions. The information recorded may be utilised in conceptual site model (CSM) development, preparation of risk assessments, site characterisation or assessment.

Excavations will generally be undertaken using a backhoe or other excavating machine operated by non-AECOM personnel, who may be under the direction of AECOM or of the Principal Contractor. The AECOM field engineer will discuss the objectives of the work, methods to be used and agree hand signals with the machine operator prior to commencing or may use a 2-way radio. The AECOM field engineer will observe the activity.

Soil samples are collected for subsequent laboratory analysis, on-site testing and/or logging of the subsurface conditions. For waste classification, the objective is to collect a sample that is representative of the subsurface conditions present including both the chemical composition and the geological consistency of the material; for site characterisation, samples representative of what appears to be the greatest degree of chemical impact (e.g. hydrocarbon staining, odorous material) should also be collected for analysis. Care needs to be taken not to introduce (or modify) chemical compounds to the sample or to destroy the geologic integrity of the materials.

4. METHOD

Preparation

Prior to excavation, make sure that the infrastructure to be removed has been agreed. Appropriate actions must be taken by whoever controls the site (AECOM or the Principal Contractor) to check for and avoid underground services.

The AECOM engineer should bring a photo-ionisation detector (PID) equipped with a 10.7 eV lamp to undertake breathing zone air monitoring in accordance with trigger levels as described in the AECOM Project Health and Safety Plan, and to record soil headspace readings during sample collection (see Field Procedure FP04 *Headspace Screening of Soil Samples*). Prior to first use each day and after

collection of heavily contaminated samples or suspected anomalous readings, the PID should be calibrated with isobutylene gas, and the results recorded in the AECOM field book.

At each location, consideration should be given to the wind direction, as excavations into dry soils can release substantial dust and excavations into highly contaminated soils can release vapours. The AECOM engineer should establish his/her work area up- or cross wind direction to avoid dust or vapours blowing into the work area. Ideally, this places the AECOM engineer at the other side of the long axis of the pit from the machine, in full view of the operator.

While the AECOM engineer will generally not be in control of the site, safety observations should always be communicated to the site foreman to ensure the safety of all contractors working around excavations.

Excavation

During excavation, the AECOM engineer shall generally stand at the narrow (short edge) end of the excavation opposite the machine and where possible also behind a fence, and communicate with the site foreman to direct where excavated material should be placed for logging or from which samples will be taken (generally on the upwind long side, well back from the edge of the excavation). The AECOM engineer will only move to take samples or examine arisings after signalling to the machine operator to cease excavation and after the machine bucket is at rest on the ground/spoil heap. Human entry into trial pits or excavations is not permitted under any circumstances.

Sampling and Logging

Geological logging of soil and groundwater conditions in each excavation (and geotechnical logging, where required) will be carried out in general accordance with BS 5930: 2015. Where the scope of work requires that samples be collected for field or laboratory testing, these will be collected using sampling equipment and containers appropriate to the planned testing.

Sampling Frequency

Samples should generally be recovered at regular depth intervals to determine the profile of the ground and at changes of strata. The frequency of sampling will largely depend upon the variability of the ground and the level of detail required from the investigation. Refer to Table A for a list of typical sample frequencies for given scenarios.

Table A: Validation Sampling Frequency on a Typical Petrol Filling Station Site*

Location	Sample Frequency
Excavation	minimum of one sample of every base and wall face per 25 m^2
Above ground storage tank bund area	Two per tank & two per bund, or one per 25 m^2, whichever is greater
Underground storage tank pit floor	Two per tank, or one per 25 m^2, whichever is greater
Underground storage tank pit walls	One per pit wall, or one per 25 m^2, whichever is greater
Dispenser/pump area	One per pump island for natural soil; Two per pump island where there is fill and natural soil
Underground fuel pipeline	One per 7 metres of pipeline
Above ground fuel pipeline	One per 15 metres of line
Waste oil underground storage tank	Minimum of two samples for each tank per 25 m^2
Used battery storage area	One per 25 m^2
Waste disposal area	One per 25 m^2
Interceptor and In-ground hoist pit	minimum of one sample of every base and wall face per 25 m^2
Excavated material for re-use on site	One per 50 m^3
Imported material for backfilling	One per 200 m^3 for quarried materials.

**Check with the PM if there are any client specific sampling frequencies*

For chemical analysis, site-specific consideration should be given to where contamination is most likely to be distributed, based upon the available information. Sampling of the top of silt/clay soils is often particularly important, especially if encountered immediately beneath more permeable horizons (sands or gravels). Sampling is also important at depths where the water table or smear zone is located, if this is encountered in the excavation.

Consideration should be given to the potential for cross-contamination or for inter-connection of different aquifer units if it becomes necessary to sample soil below the water table. Should water be observed to enter the excavation, it is recommended that a sample of the water be collected for analysis.

Samples for laboratory analysis will be selected on the basis of visual and olfactory observations made in the field, corroborated with the results of soil headspace screening on site (see FP04 *Headspace Screening of Soil Samples*).

Sample Size, and Filling and Storage of Sample Containers

Laboratories typically specify minimum requirements (volumes) for analytical methodologies, which should be checked prior to collection of samples. Although laboratories typically only use a fraction of the soil forwarded, it is important that the jars are filled as full as is reasonably possible. Soil samples are shipped unpreserved, and greater void space in the jar allows for increased volatilisation and/or degradation of the sample following its displacement from the subsurface.

Although jars need to be filled, this needs to be balanced against avoiding undue disturbance of the sample while it is removed from the sampler and transferred into the jar, particularly when the sample will be tested for volatile organic compounds.

Lids to sample jars must be tightened to minimise the potential loss of integrity of the sample during storage and transit. If necessary, the rim of the jar should be cleaned before applying the lid so the seal and rim form a seal when the lid is tightened.

Samples should be stored and transported appropriately to prevent alteration in composition. Generally this involves storing and transporting the samples at a stable temperature in the range 0-4 degrees Celsius (^{o}C) where practicable.

Equipment Decontamination

Prior to first use each day and after collection of each sample, all equipment that comes into contact with samples should be decontaminated (see FP07 *Decontamination of Equipment*).

Recording of Sampling Locations

Sampling locations should be recorded by surveying or by reference measurements from building corners, etc., placed on a detailed site plan and agreed with the Principal Contractor on site, so that the locations can be re-visited if necessary. If a GPS is used, its calibration must be checked by recording the coordinates of at least two known site features (such as corners of major buildings). A record of daily weather conditions should also be kept. The entering of open excavations is not permitted for AECOM staff.

5. ADDITIONAL INFORMATION

British Standards Institution BS5930:2015 Code of practice for ground investigations

British Standards Institution BS10175:2011 Investigation of Potentially Contaminated Sites - Code of Practice

BS EN 14688-1: 2002 Geotechnical Investigations and Testing: Identification and Classification of Soil: Identification and Description

BS EN 14688-2:2004 Geotechnical Investigations and Testing: Identification and Classification of Soil: Principles for Classification

URS Safety Management Standard SMS13 Excavation Safety