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Preliminary Site Assessment

Site 1 Camden Row - Newmarket 38 kV - May 2019

Electricity Supply Board

Project number: PR-427640_ACM_RP_ENV_002_8E

10 January 2020

Quality Information

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The site reconnaissance consisted of a general external inspection of the site aimed at identifying potential sources of ground contamination affecting the site. An environmental compliance audit and/or detailed structural inspection of existing buildings were outside the project brief. Similarly, the site visit excluded detailed consideration of the ecological or archaeological aspects of the site, and if such are believed to be of potential significance then it is recommended that specialist advice is sought.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

It should be noted that the effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance values are potentially subject to change. The conclusions presented

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The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information and an initial site reconnaissance by an AECOM employee. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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ABBREVIATIONS

AECOM	AECOM Ireland Limited
APEC	Area of Potential Environmental Concern
bgl	Below Ground Level
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CSM	Conceptual Site Model
ESB	Electricity Supply Board
EPA	Environmental Protection Agency
GSI	Geological Survey Ireland
IEL	Industrial Emissions Licence
IPC	Integrated Pollution Control
ITM	Irish Transverse Mercator
km	Kilometre
kV	Kilovolt
LAB	Linear Alkyl Benzene
m OD	Metres above Ordnance Datum
NHA	Natural Heritage Areas
NAPL	Non-Aqueous Phase Liquid
NPWS	National Park and Wildlife Service
NWCPO	National Waste Collection Permit Office
OECD	Organisation for Economic Co-operation and Development
OPW	Office of Public Works
OSI	Ordnance Survey Ireland
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCOC	Potential Constituents of Concern
pNHA	Proposed Natural Heritage Area
PSA	Preliminary Site Assessment
RFP	Request for Proposal
SAC	Special Area of Conservation
SDS	Safety Data Sheet
SIDS	Screening Information Datasets
SPA	Special Protection Area
TPH	Total Petroleum Hydrocarbons
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive

EXECUTIVE SUMMARY

Introduction

AECOM Ireland Limited (AECOM) completed a Preliminary Site Assessment (PSA) of a cable fluid leak location on Camden Row, Dublin 2 (the site).

ESB Networks operates and maintains a network of High Voltage (HV) underground cables of over 1,600 kilometres (km) across Ireland, of which approximately 175 km are insulated by a cable fluid. The majority of the fluid filled cables are located in urban settings across Dublin City and Cork City. The remainder are located outside these areas with limited numbers of fluid filled cables in other counties.

The length of each cable route varies and cable routes frequently extend across county boundaries. The cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be run more efficiently. Fluid filled cables are largely located in urban/suburban areas and so are particularly vulnerable to third party interference or damage. Over time cables can develop leaks due to corrosion / fracture/ defects in the cable sheath and in joints and terminations. When such leaks occur, there is potential for pollution to occur to surface water, groundwater, soils and ecology.

An above ground leak was repaired by Electricity Supply Board (ESB) at this site in May 2019. AECOM understand that the fluid type lost from the cable was a mixture of linear alkyl benzene (LAB) and mineral oil based products.

Objective

The assessment reported herein comprises the first step of Stage 1: Site Characterisation & Assessment – Preliminary Site Assessment (PSA) and was carried out in accordance with *EPA Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (July 2013),* and specifically the Guideline Template for Preliminary Site Assessment Report. This guidance draws on the *EPA Code of Practice (CoP), Code of Reference for Unregulated Waste Disposal Sites (2007*) and *UK Environment Agency, Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11 (September 2004).*

In terms of the data requirement for PSA reports, both the EPA CoP and CLR 11 outline that the findings of this initial risk assessment stage are largely based on desk-study information and a site walkover to identify potential pollutant linkages, which are then evaluated using appropriate criteria.

As such, the objective of the PSA reported herein is to:

- Identify potential contamination sources (i.e. the cable fluid), pathways (i.e. breathing in vapours, movement through made ground / soil) and receptors (i.e. who/what will be affected) and the likely interactions between each element;
- Assess the potential severity of the hazard and the sensitivity of the receptor (ranging from minor to severe);
- Assess the likelihood that a risk will occur (ranging from unlikely to high likelihood); and
- Develop a preliminary conceptual site model (CSM) based on an overall assessment of each of these elements above.

The preliminary CSM will then be used to identify potential risks to human health (site users and/or nearby residents) and controlled waters (i.e. groundwater and surface water) which may be associated with a fluid leak from the identified location. It should be noted that this stage of the risk assessment process is based mostly on qualitative information sources and identification of a potential risk at this stage does not necessarily indicate the presence of a risk, but rather the need for further assessment.

A table cross referencing the template headings from the EPA Guidance Template and where the corresponding information is reported herein is presented in Appendix B.

Assessment Findings

Based on the findings of the desktop study, the overall environmental sensitivity of the site is considered to be moderate. Identified sensitive receptors within 1 km of the site include:

- River Poddle located 0.5 km west of the site, which discharges to the River Liffey, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site;
- The Grand Canal located 0.7 km south of the site, although this may be protected by low permeability clay (natural and/or engineered when the canal was constructed); and
- The groundwater aquifer beneath the site, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site.

It is estimated that 244 litres of cable fluid was released over a nine year period between May 2010 and May 2019. It is assumed, based on information provided to AECOM by ESB, that the fluid lost was a mixture of LAB and mineral oil based products. Due to its high biodegradability, lower volatility and low solubility, it is considered that LABs are of less concern for adverse environmental impact than mineral oil based products. Given that there is potential for a mixture of both types of cable fluids to have been used at this site, potential contaminants of concern have been identified.

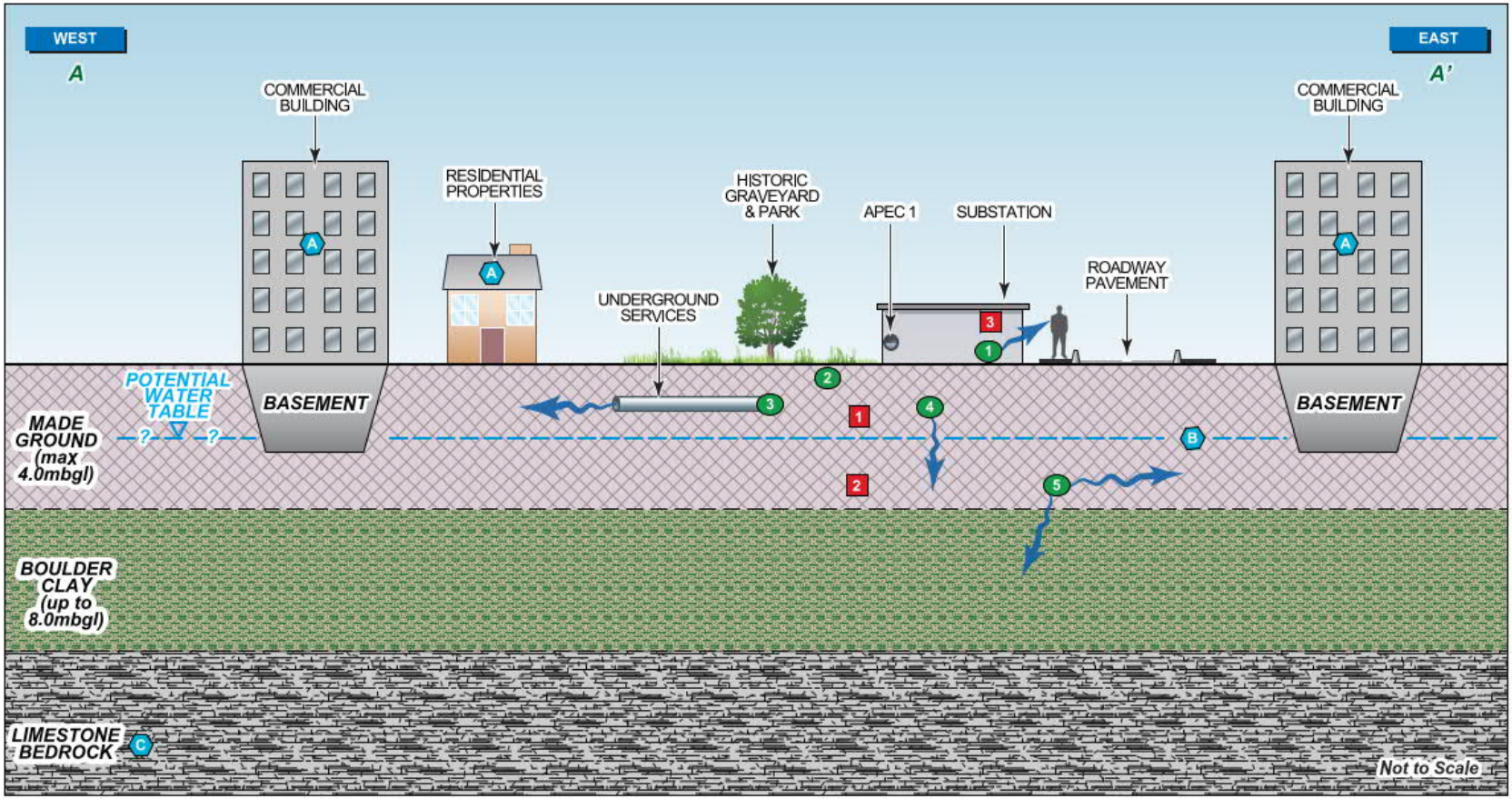
A summary of the source audit findings is as follows:

Area of Potential Environmental Concern

Number	APEC	Potential Contaminants of Concern	Potential Media Impacted
1	Leak at (1) Camden Row – Ringsend 38 kV (May 2010 – May 2019)	LABs TPH BTEX VOCs SVOCs PCBs	Soil Groundwater Soil Vapour Ground Gas

The preliminary CSM developed for the site looked at potential SPR linkages identified during the assessment works and found that potential risks were considered to be low. Based on these findings, further assessment is not considered to be required as no viable SPR linkages have been identified.

There is an aesthetic impact due to the staining of the pumping station walls and grave headstones. A suitable contractor should be appointed to clean these surfaces where possible.



SOURCES

1. NON-VOLATILE CONTAMINANTS IN SOIL
2. CONTAMINANTS IN GROUNDWATER
3. VOLATILE CONTAMINANTS FROM CONCRETE WITHIN BUILDING

PATHWAYS

1. VAPOUR INHALATION
2. DERMAL CONTACT / DUST INGESTION
3. PERMEATION OF AND MIGRATION ALONG EXISTING UNDERGROUND SERVICES
4. LEACHING FROM SOIL TO GROUNDWATER
5. VERTICAL & HORIZONTAL MIGRATION OF CONTAMINATED GROUNDWATER

RECEPTORS

- A RESIDENTIAL / COMMERCIAL SITE USERS
- B SHALLOW GROUNDWATER
- C BEDROCK GROUNDWATER
- D SURFACE WATER

NOTES:

FOR INFORMATION

ELECTRICITY SUPPLY BOARD

Camden Row
Newmarket 38 kV

FIGURE 3
CONCEPTUAL SITE MODEL

AECOM

Design: EGD Drawn: RDH
Check: DM Appr: DM
Date: JULY 2019 Scale: As Shown

Project No.	Dwg No.	Size	Rev
60610407	3	.	0

EPA Contaminated Land and Groundwater Risk Assessment Methodology

Table 1. EPA Methodology

Stage	Methodology	Report Reference	Report Date	Status
Stage 1: Site Characterisation and Assessment				
1.1	Preliminary Site Assessment	PR-427640_ACM_RP_ENV_002	10 January 2020	Final
1.2	Detailed Site Assessment			
1.3	Quantitative Risk Assessment			
Stage 2: Corrective Action and Feasibility Design				
2.1	Outline Corrective Action Strategy			
2.2	Feasibility Study and Outline Design			
2.3	Detailed Design			
2.4	Final Strategy and Implementation Plan			
Stage 3: Corrective Action Implementation and Aftercare				
3.1	Enabling Works			
3.2	Corrective Action Implementation and Verification			
3.3	Aftercare			

Source: EPA Guidance on the Management of Contaminated Land at EPA Sites

1. Introduction

AECOM Ireland Limited (AECOM) is pleased to present this preliminary site assessment (PSA) completed on behalf of Electricity Supply Board (ESB) for a site on Camden Row, Dublin 2, Ireland (the site).

This report was commissioned by ESB under a request for proposal (RFP) issued on 26 June 2019 (Ref. Qd-354120-01R460_002-001-001) and carried out in accordance with AECOM proposal reference PR-427640_ACM_PL_ENV_001_3, dated 03 July 2019. AECOM understand that ESB has undertaken these works on behalf of ESB Networks.

1.1 Project Background

ESB Networks operates and maintains a network of High Voltage (HV) underground cables of over 1,600 kilometres (km) across Ireland, of which approximately 175 km are insulated by a cable fluid. The majority of the fluid filled cables are located in urban settings across Dublin City and Cork City. The remainder are located outside these areas with limited numbers of fluid filled cables in other counties.

The length of each cable route varies and cable routes frequently extend across county boundaries. The cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be run more efficiently. Fluid filled cables are largely located in urban/suburban areas and so are particularly vulnerable to third party interference or damage.

An above ground leak at this location was identified in May 2010 and repaired in May 2019, which comprises a pumping station to maintain fluid pressure within the 38 kV cable running from the site (Camden Row) to Newmarket. Over time, pipework associated with such pumping equipment can develop leaks due to corrosion / fracture / defects in pipes, joints and terminations. When such leaks occur, there is potential for pollution to occur to surface water, groundwater, soils and ecology.

An above ground leak was repaired by Electricity Supply Board (ESB) at this site in May 2019. AECOM understand that the fluid type lost from the cable was a mixture of linear alkyl benzene (LAB) and mineral oil based products. The site location is presented in Figure 1 and the site layout showing the site is presented in Figure 2.

1.2 Project Objective

The assessment reported herein comprises the first step of Stage 1: Site Characterisation & Assessment – Preliminary Site Assessment (PSA) and was carried out in accordance with *EPA Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (July 2013),* and specifically the Guideline Template for Preliminary Site Assessment Report. This guidance draws on the *EPA Code of Practice (CoP), Code of Reference for Unregulated Waste Disposal Sites (2007*) and *UK Environment Agency, Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11 (September 2004).*

In terms of the data requirement for PSA reports, both the EPA CoP and CLR 11 outline that the findings of this initial risk assessment stage are largely based on desk-study information and a site walkover to identify potential pollutant linkages, which are then evaluated using appropriate criteria.

As such, the objective of the PSA reported herein is to:

- Identify potential contamination sources (i.e. the cable fluid), pathways (i.e. breathing in vapours, movement through made ground / soil) and receptors (i.e. who/what will be affected) and the likely interactions between each element;
- Assess the potential severity of the hazard and the sensitivity of the receptor (ranging from minor to severe);
- Assess the likelihood that a risk will occur (ranging from unlikely to high likelihood); and
- Develop a preliminary conceptual site model (CSM) based on an overall assessment of each of these elements above.

The preliminary CSM will then be used to identify potential risks to human health (site users and/or nearby residents) and controlled waters (i.e. groundwater and surface water) which may be associated with a fluid leak from the identified location. It should be noted that this stage of the risk assessment

process is based mostly on qualitative information sources and identification of a potential risk at this stage does not necessarily indicate the presence of a risk, but rather the need for further assessment.

A table cross referencing the template headings from the EPA Guidance Template and where the corresponding information is reported herein is presented in Appendix B.

2. Scope of Work

To achieve the above objective, the following scope of work was undertaken:

- A site walkover by AECOM staff (completed on 08 July 2019);
- A desktop review of site history to identify areas of potential environmental concern (APEC);
- A desktop review of publicly available information regarding the site's environmental setting and sensitivity, including:
  - Geological Survey of Ireland (GSI) Groundwater Public Viewer Maps (www.gsi.ie/Mapping), accessed 08 July 2019.
  - EPA Geoportal Site (https://gis.epa.ie/EPAMaps/), accessed 08 July 2019.
  - EPA Incidents Database (https://www.epa.ie/newsandevents/incidents/recent/), accessed 08 July 2019.
  - Ordnance Survey of Ireland (OSI) (http://geohive.ie), accessed 08 July 2019.
  - Glucksman Map Library, Trinity College, Dublin, accessed 10 July 2019;
  - Office of Public Works (OPW) Flood Maps (http://www.floodinfo.ie), accessed 05 July 2019.
  - National Parks and Wildlife Service (NPWS) (http://webgis.npws.ie/npwsviewer/), accessed 08 July 2019.
  - National Waste Collection Permit Office (NWCPO) website (http://www.nwcpo.ie/).
- A review of information provided by ESB in the RFP; and
- Data assessment and reporting.

3. Environmental Setting

3.1 Topography

The site is located on Camden Row, Dublin 8 (ITM 715433, 733206) at an elevation of approximately 18 m above ordnance datum (m OD). The surrounding topography is relatively flat, with a relatively gentle gradient towards the River Liffey north of the site.

3.2 Geology

The Teagasc Soils Map indicates that the site is underlain by made ground.

The GSI website indicates that the Quaternary geology of the site locality is urban to the north of Camden Row (the site location) and till derived from limestones to the south of Camden Row.

The GSI Bedrock Geology Map (scale 1:100,000) indicates the site is underlain by marine basinal facies, a dark fine-grained limestone and shale of the Lucan formation. No geological features are noted within the surrounding area.

A number of geotechnical records are available on the GSI website for site investigations located in the vicinity of the site.

- GSI report 329, four boreholes located between 60 m and 150 m to the west and north-west of the site, all were terminated between 2.5 m and 8.0 m below ground level (bgl) without encountering bedrock;
- GSI report 616, four boreholes located between 150 m and 200 m east of the site, all were terminated at 5.2 m bgl without encountering bedrock; and

- GSI report 841, six boreholes located between 70 m and 175 m west and north-west of the site, five of the boreholes were completed between 4.7 m and 8.0 m bgl without encountering bedrock while the sixth was completed at 9.5 m and encountered bedrock at 7.0 m bgl.

The stratigraphic sequence above bedrock immediately west of the site (60 m) is recorded as being fill / made ground to a maximum depth of 4.0 m bgl, overlying boulder clay. At three locations gravel was encountered below 5.0 m bgl.

To the east of the site, the sequence encountered consisted of fill / made ground to a maximum depth of 1.8 m bgl with brown boulder clay beneath to the completion depth.

3.3 Hydrology

3.3.1 Surface Water Features

The site lies within the lower catchment of the River Liffey and Dublin Bay, which covers an area of 1,624 km^2. The closest surface water body to the site is the River Poddle (0.5 km west of the site). The River Poddle flows approximately 9 km north-east from its source near the Institute of Technology Tallaght to the outfall to the River Liffey at Wellington Quay (1 km north of the site). The Poddle traverses heavily urbanised areas of Templeogue, Kimmage, Harold's Cross, Crumlin and Temple Bar, and is culverted for several sections of its course.

The River Liffey flows easterly into South Dublin Bay. This comprises the following protected sites:

- South Dublin Bay Special Area of Conservation (SAC) (Site Code 000210);
- South Dublin Bay and River Tolka Special Protection Area (SPA) (Site Code 004024); and
- South Dublin Bay proposed Natural Heritage Area (pNHA) (Site Code 000210).

The Grand Canal (a pNHA, Site Code 002104) is located 0.7 km south of the site. The canal flows from west to east and discharges to the River Liffey Estuary approximately 1.85 km north-east of the site. The Grand Canal is an engineered watercourse whose construction began in the mid-1700s. As impervious materials are generally used to line canals during construction, it is not considered likely that the Grand Canal is in hydraulic continuity with groundwater in the area.

Given its proximity to the site, the River Poddle is considered to be the most sensitive surface water receptor.

3.3.2 Surface Water Quality

The Water Framework Directive (WFD) status of the Poddle River is characterised as 'at risk' of not meeting its WFD objectives. The most recent reported EPA water quality status of the Poddle River (monitoring station 'The Priory' Kimmage Road) is a Q Value of 3 and a rating 'Poor'.

The Grand Canal is referred to as an Artificial Water Body (AWB). Waterways Ireland assess the biological quality of the Grand Canal, which along the section adjacent to the site during the period 2015 – 2017 was classified as 'good' quality[1].

The WFD status of both the upper and lower sections of the Liffey Estuary (classified as a Transitional Water Body) is 'Moderate' and 'at risk' of not meeting WFD objectives. The most recent reported EPA water quality status of the River Liffey (monitoring station 'Island bridge UCD boat club) is a Q Value of 3 and a rating 'Poor'.

3.3.3 Flooding

According to OPW flood maps, the immediate area surrounding the site does not lie within the low, medium or high probability modelled extent of land that might be flooded by rivers in a very extreme event. However, on the boundary of the 1 km radius to the north, the River Liffey has been modelled to indicate a high probability flood status. Therefore, there is an annual exceedance probability of 10% of a flood event occurring or being exceeded in any given year. As well as having a *River – High Probability* status, the River Liffey also has a *Coastal – High Probability* status.

[1] EPA, *Water Quality in 2017, An Indicators Report*, 2018

Approximately 0.5 km west of the site, the area surrounding the River Poddle has been modelled as *River – Medium Probability*, indicating a 1% chance of a flood event occurring or being exceeded in any given year.

Further, a number of flooding events have occurred within a 1 km radius of the site namely;

- Wexford Street, Dublin 2, 26 July 2013, 0.1 km east of the site;
- Grafton Street, June 1963, 0.7 km north-east of the site; and
- Clanbrassil Street, June 1963, 0.5 km south-west of the site.

3.4 Hydrogeology

3.4.1 Aquifer Classification

According to the GSI, the bedrock beneath the site is classified as a Locally Important Aquifer that is moderately productive in local zones. The bedrock underlying the site is moderately productive in local zones. The soil permeability in the surrounding area is low; consequently the groundwater recharge in this aquifer is approximately 60 millimetres/year (mm/yr).

Regional groundwater flow direction is likely to be to the north and northeast towards the River Liffey and South Dublin Bay. A more detailed site assessment would be required to assess the local groundwater flow regime.

The closest groundwater wells and springs are located over 1 km north and east of the site.

The site is not mapped as being located within a Source Protection Area for either a public water supply or a group water supply scheme.

3.4.2 Groundwater Vulnerability

The GSI National Groundwater Vulnerability Mapping identified some spatial variation in groundwater vulnerability within a 1 km radius of the site, ranging from low (to the north-west) to extreme in localised areas to the north-east and south-east of the site. However, the site itself and the surrounding area within a 0.5 km radius is classified as having moderate vulnerability.

3.4.3 Groundwater Quality

Groundwater beneath the site is part of the Dublin Groundwater Body (IE_EA_G_008) which, according to the WFD Ireland website (2010 – 2015), is characterised as having 'Good' status and is not at risk.

3.5 Natural Habitats and Protected Species

The Grand Canal, which lies 0.7 km south of the site, is a pNHA throughout its course.

The River Liffey is located approximately 1 km north of the site. The River Liffey flows easterly into South Dublin Bay (an SAC, SPA and pNHA). Site Codes for each of these protected areas are provided in Section 3.3.1.

There are no other protected areas within 1 km of the site.

3.6 Regulatory Database Search

3.6.1 National Waste Collection Permit Office

The National Waste Collection Permit Office (NWCPO) website was reviewed to identify authorised waste facilities within the jurisdiction of Dublin City County Council near the site. The NWCPO website indicated that there are two waste facilities within 1 km of the site as summarised in Table 2 below.

Table 2. Dublin City County Council Waste Facilities within 1 km of the Site

Authorisation Number	Facility Name	Location	Waste Activity
WFP-DC-11-0022-02	Mullen Scrap	31 & 32 Upper Clanbrassil Street Dublin 8	Scrap metal recycling
WFP-DC-11-0028-02	Mitchell Taylor Exports Limited	Newmarket Dublin 8	Edible oil and fat

3.6.2 Storm Water Discharges

Three Irish Water storm water overflow discharge locations have been identified within 1 km of the site, as summarised in Table 3 below.

Table 3. Storm Water Discharges

Emission ID	Name	Register No.
TPEFF0700D0034SW227	Ringsend	D0034-01
TPEFF0700D0034SW051	Ringsend	D0034-01
TPEFF0700D0034SW052	Ringsend	D0034-01

3.6.3 EPA Waste Licensing

The EPA database of Waste licences was consulted and no active licensed waste facilities were identified within 1 km of the site.

3.6.4 EPA IE and IPC licensing

The EPA database of Industrial Emissions (IE) and Integrated Pollution Control (IPC) licences was consulted which identified one licence within 1 km of the site of the site. The table below provides further details.

Table 4. EPA IE and IPC facilities within 1 km of the site

IE Register Number	Facility Name	Location	Distance to Site	Activity
P0301-04, IE Licensed	Diageo Ireland (St. James Gate)	St. James's Gate, Dublin 8, Dublin	0.96 km north west	Brewing and combustion of fuel

According to the EPA website there have been no reported incidents within Dublin 2 from at least 2010.

3.7 Environmental Sensitivity

The overall environmental sensitivity of the site is considered to be moderate. Identified sensitive receptors within 1 km of the site include:

- River Poddle located 0.5 km west of the site, which discharges to the River Liffey, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site;
- The Grand Canal located 0.7 km south of the site, although this may be protected by low permeability clay (natural and/or engineered when the canal was constructed); and
- The groundwater aquifer beneath the site, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site.

4. Source Audit Findings

4.1 Site Description

The site is a substation which is accessed from the western side through an alleyway, leading northwards from Camden Row. The substation building is not manned, with workers only present on an occasional basis.

The substation building contains three small tanks sitting on a concrete plinth that contain cable fluid. The tanks range in capacity from 135 litres to 180 litres. The tanks are connected to two pressure gauges, personnel on site indicated that the gauges should read close to 20 psi. One gauge triggers a low-level alarm when the pressure falls below 11 psi while the second triggers an alarm when the pressure falls below 4.8 psi. The floor of the building comprises a sealed surface consisting of either concrete slab or concrete tiles.

Staining was apparent on the tiled floor and as well as the concrete plinth. The inside walls of the substation were painted but staining was visible through the paint, reaching approximately 75% of the way from floor to ceiling. A slight hydrocarbon odour was noted within the substation building during the site walkover. Staining was also apparent on the western and northern walls of the substation building, leading onto the adjacent historic graveyard / park (St. Kevin's Park), with some of the grave headstones in contact with the substation building wall also stained. No evidence of impact from the cable fluid release was noted on the grassed surface of the park during the site walkover, with vegetation growth not visibly impacted.

It was reported that repairs to valves on lines from the tanks had been conducted in May 2019.

4.2 Surrounding Land Use

Land use in the immediate vicinity of the site is predominantly commercial with some residential, as summarised in Table 5 below.

Table 5. Adjacent Land Use

Site Boundary	Land Use
North	Immediately north of the site is a historic graveyard / park, St. Kevin's Park. This graveyard is old and no longer used for burials but is publicly accessible and used as a park. Graves are present along the northern and western substation walls. Beyond this is a mix of residential, commercial and buildings associated with Dublin Institute of Technology (DIT), Kevin Street.
East	A number of small-scale commercial properties, including public houses, night clubs and cafes are located to the east of the site.
South	South of the site is Camden Row with commercial development on the opposite side of the road.
West	The graveyard / park extends around the west of the site from the north. Further west is a mix of residential properties and buildings associated with DIT Kevin Street.

4.3 Historic Site Review

4.3.1 Historic Maps and Aerial Photograph Review

A review of historical maps and aerial photographs available from Ordnance Survey Ireland (OSI) and Google Earth for the years 1837 to 1842, 1888 to 1913, 1995, 2000, 2005 and 2012 was carried out. A summary of the findings is presented in Table 6.

Table 6. Historic Map and Aerial Photograph Review

Year	Description
1837 to 1842 (OSI)	The area around the site appears to have been well developed by this stage. St. Kevin's Church and grave yard are present to the immediate north and west of the site, it does not appear that the graveyard extended into the current site location. A school is present at the western end of Camden Row with the Meath St hospital on the opposite corner with Bride St.

Year	Description
	A factory is noted to the north of the site along Kevin St Lower. Commercial and residential buildings line Camden St and Wexford St to the east. To the south of the site there appears to have been little development at this stage
1888 to 1913 (OSI)	St Kevin's church and graveyard are present and the corner occupied by the site remains undeveloped. The density of development in the surrounding area has increased. To the west of the church and graveyard is a saw mill. The factory no longer appears to be present to the north, having been replace by a technical school and public library. To the south of the site are houses and commercial buildings including a mineral water works.
1847 (Five feet to Statute Mile) Trinity Maps	The site is developed with St. Kevin's Church and adjoining graveyard located immediately west of the site. Wexford Street is located to the east and runs north to south, Camden Row in immediately south and runs east to west. The land surrounding the area is developed with what appears to be mostly residential buildings. There is a brewery located to the north of the site. Water pipes run north to south down Wexford site east of the site.
1864 (Five feet to Statute Mile) Trinity Maps	There have been no major changes from the previous historical map. Heytesbury Street Asylum is located to the southwest at the junction of Heytesbury street and Camden Row.
1890 (Five feet to Statute Mile) Trinity Maps	Liberty Lane is located immediately east of the site. There is a steam saw mill located approximately 50m northwest of the site, there is also a Mineral Water Works also located close by to the northwest of the site. There is a parochial school located to the west on the corner of Camden Row. Meath Hospital and Co. Dublin infirmary is located to the west across Heytesbury Street.
1908 (Five feet to Statute Mile) Trinity Maps	There is a tramway that runs along Wexford street, there are also two banks now located to the south of the site. Dublin Technical School is located to the northwest of the site along with a library. There are no other significant changes compared to the previous historical map.
1935 (1:1,000) Trinity Maps	St Kevin's Church is now labelled as "in ruins", Lucania Cycle and Engineering works is located to the south opposite St. Kevin's Church. There is also Camden Hall, De Luxe Cinema to the south also.
1969 (1:1,000) Trinity Maps	College of Technology has now extended and occupies where the saw mill was previously, there is a factory located where the parochial school was. To the south they are three factories, two schools and ballroom previously Camden Hall. There are no other significant changes compared to the previous map.
1991 (1:1,000) Trinity Maps	The land surrounding the site has become more residential. Apart from this there are no major changes to the historical map compared to the previous one.
1994 (1:1,000) Trinity Maps	There are no major changes in this historical map.
1995 (OSI)	Little detail can be discerned from this black and white aerial photograph. The substation building is visible in the south-eastern corner of the graveyard. The surrounding area is heavily developed.
2000 (OSI)	No major changes are apparent in this colour aerial photograph.
2005 (OSI)	No major changes are apparent in this colour aerial photograph
2012 (Google Earth)	No changes appear to have occurred since 2005.

4.4 Potential Sources

4.4.1 Cable Fluid Source

Information on the potential fluids released was provided in the ESB RFP document.

It was estimated that 244 litres of cable fluid was released between May 2010 and May 2019, equating to an average loss of 2.3 litres of fluid per month. The affected circuit runs from the substation westwards along Camden Row.

The loss is reported to have occurred from a wall mounted tank in the substation. Observations of staining on the substation walls and floor during the site walkover indicate that this is likely.

It is assumed, based on records and Safety Data Sheets (SDS) provided to AECOM by ESB, that the fluid lost was a mixture of the following cable fluid products:

- 'T 3788' manufactured by H&R ESP Ltd of Milton Keynes in the UK;
- 'Masse 106' produced by Felten & Guilleaume Energietechnik AG in Germany; and
- Shell Diala Cable Oil.

T 3788 is a low viscosity blend of linear alkyl benzenes (LABs) (CAS # 67774-74-7). Shell Diala Cable Oil has the same CAS # as T 3788, so is essentially the same product but made by a different manufacturer. The SDS for Masse 106 does not give its CAS # or details of its composition but states that it is a blend of highly refined mineral oils and additives.

4.4.1.1 Linear Alkyl Benzenes (LABs)

Physical and Chemical Properties

LABs have side alkyl chains of 10-13 carbon atoms in length attached to a benzene ring. The alkyl chain may be attached to the benzene ring at any position except the terminal (end) position. As LABs are a mixture, their precise physico-chemical properties are dependent upon the components of the mixture, but they are generally colourless, oily liquids, less dense than water, with very low aqueous solubility and low volatility. Their potential spreading in the ground will therefore be similar to other light non-aqueous phase liquids (LNAPL) but with very little mass loss due to volatilisation or dissolution.

Information relating to the nature and toxicity of linear alkyl benzenes has been primarily sourced from the following documents:

- Safety Data Sheet (SDS) for T 3788;
- European Union Risk Assessment Report, Benzene, C10-13 alkyl derivatives, 20 June 1997; and
- Organisation for Economic Co-operation and Development (OECD) Screening Information Datasets (SIDS) Initial Assessment Reports for High Production Volume Chemicals, United Nations Environment Programme, Chemicals Branch, May 2002.

Table 7 summarises the basic physical and chemical properties of LABs.

Table 7 Linear Alkyl Benzene Physical and Chemical Properties

Property	Description
Molecular Weight	239-243 g/mol
Melting Point	<-70^{o}C
Boiling Point	251-320^{o}C @ 1 atm (OECD)
Vapour Pressure @ 25^{o}C	6.5 x 10^{-5} kPa (OECD)
Aqueous Solubility	0.041 mg/L (OECD)
Henry's Law Constant	9.34 x 10^{-4} atm-m^3/mol (OECD)
Density	0.86 @ 20^{o}C
Flash Point	140^{o}C
Explosive Properties	None

LAB (C12) has a calculated octanol-water partition coefficient (Koc) of 2.2x10^4 and is classified by the EU risk assessment as a high adsorptive substance.

Degradation

The OECD SIDS (2002) review concluded that LABs undergo "rapid primary biodegradation in natural waters and complete mineralisation by micro-organisms under aerobic conditions". A measured half-life in water of four to nine days was reported. Microorganisms in sewage sludge and soil were reported to rapidly and completely biodegrade LABs. Anaerobic biodegradation was inferred to occur, but at a slow rate.

Degradation in soil is expected to occur but to be slower than in surface water due to the much slower mixing and the limited availability of oxygen. Where oxygen is available, aerobic degradation would occur at the fringes of a body of LNAPL in the soil/groundwater, producing elevated carbon dioxide levels in the soil and potentially elevated alkalinity in the groundwater.

In the absence of oxygen, anaerobic degradation may occur by methanogenesis or by reduction of sulphate, nitrate, ferric iron (Fe^{3+}) and manganese (Mn^{3+}). These processes could lead to reducing conditions in the groundwater, with depleted concentrations of sulphate (SO_4^-) and nitrate (NO_3^-) and increased concentrations of dissolved methane (CH_4), ferrous iron (Fe^{2+}) and dissolved manganese (Mn^{2+}). Such conditions would be expected to occur close to the LNAPL body and locally downgradient. With increased distance from the LNAPL, mixing with the surrounding groundwater and aeration from seasonal fluctuations and groundwater recharge would gradually allow ambient (most likely oxidised) conditions to be re-established.

Toxicity

According to the OECD review, LABs were assessed to be not acutely toxic to human health. Data from repeat exposure, reproductive and genotoxicity studies also indicated a low potential for toxic effects. The OECD concluded that "Linear alkyl benzenes do not present any significant acute or sub-chronic health effects by various exposure routes. LAB is not teratogenic (i.e. causing birth defects) and does not produce selective reproductive toxicity."

Laboratory studies have shown that repeated exposure to LABs may be irritating to the skin, and the SDS recommends the use of gloves when handling LABs. The low vapour pressure of LABs limits the potential for exposure via inhalation, and this is not expected to be a significant exposure route at normal temperatures.

Eco-toxicity studies reviewed by the OECD found no acute toxic effects on aquatic species tested at concentrations up to and exceeding solubility limits. The only exception to this was for the water flea Daphnia magna. No data was available regarding terrestrial eco-toxicity studies.

Due to its high biodegradability and rapid metabolism, the OECD concluded that LABs were of little concern for adverse environmental impact. The OECD and EU review of LABs both concluded that LABs were a low priority for further investigation.

4.4.1.2 Masse 106 Mineral Oil

Information on Masse 106 has been obtained from a Safety Data Sheet (SDS) dated 1995 provided by ESB.

Physical and Chemical Properties

Masse 106 is understood to be a blend of highly refined mineral oils and additives. The SDS does not provide information on the identity of the mineral oils or additives, or on their proportions within the oil.

The SDS states that containers of Masse 106 should be kept tightly closed and in a well-ventilated space and that it should be used only in well-ventilated areas. This suggests that Masse 106 may contain volatile components.

The table below summarises information from the SDS for Masse 106.

Table 8 Masse 106 Physical and Chemical Properties

Property	Description
Vapour Pressure @ 20°C	<0.01 hPa
Aqueous Solubility	negligible
Density	888 kg/m^3
Flash Point	145°C
Flammability range	0.6% volume to 6.5% volume

Property	Description
Kinematic viscosity@ 40°C	8.5 mm^2/s

Based on these properties, Masse 106 would behave as a relatively viscous LNAPL in the ground. The SDS states that if the product enters soil it will be adsorbed to soil particles and not be mobile.

Degradation

The SDS for Masse 106 indicates that it is not readily biodegradable. Nevertheless, as it is expected to be comprised mainly of petroleum hydrocarbon compounds, gradual degradation is expected to occur, especially in water. The rate of biodegradation is likely to depend on the availability of oxygen and of favourable geochemical conditions. As with LABs and with other petroleum hydrocarbons, where oxygen is available, aerobic degradation would be expected to occur at the fringes of a body of LNAPL in the soil/groundwater, producing elevated carbon dioxide levels in the soil and potentially elevated alkalinity in the groundwater. In the absence of oxygen, anaerobic degradation may occur by methanogenesis or by reduction of sulphate, nitrate, ferric iron (Fe^{3+}) and manganese (Mn^{3+}). These processes could lead to reducing conditions in the groundwater, with depleted concentrations of sulphate (SO_4^-) and nitrate (NO_3^-) and increased concentrations of dissolved methane (CH_4), ferrous iron (Fe^{2+}) and dissolved manganese (Mn^{2+}). Such conditions would be expected to occur close to the LNAPL body and locally downgradient. With increased distance from the LNAPL, mixing with the surrounding groundwater and aeration from seasonal fluctuations and groundwater recharge would gradually allow ambient (most likely oxidised) conditions to be re-established.

Toxicity

The 1995 SDS for Masse 106 states that the components of the preparation are not expected to impart hazardous properties to the product. Whilst this suggests the product is not hazardous, it is noted that standards for hazard assessment and SDS production have evolved since 1995 and therefore the information cannot be relied upon with full confidence in relation to current standards for hazard assessment.

The SDS indicates that Masse 106 is expected to be practically non-toxic to aquatic organisms.

In relation to human toxicity, the SDS gives the following information:

- It is expected to be slightly irritant, so all forms of skin contact should be minimised. It is not expected to be a skin sensitiser.
- Respiratory protection is not normally required but it should be used only in well-ventilated spaces. It is based on mineral oils and other components not known to be carcinogenic.

4.4.1.3 Conclusion

Based on the above, leakage of LABs from above ground within a concrete structure is not likely to lead to significant issues from dissolved hydrocarbons or vapours. Although the components of Masse 106 are not known and its aqueous solubility is stated on the SDS as “negligible”, it is unclear what this means in the context of dissolution of components from a NAPL. Based on the requirement for it to be used only in well-ventilated spaces, it appears that Masse 106 contains some relatively volatile components.

The main concern from LABs and a concern also for mineral oils such as Masse 106 is the potential for them to migrate and spread as a LNAPL, downwards through unsaturated soil that is present and then laterally in the vicinity of the groundwater table. The extent of LNAPL migration will depend on the properties of the surrounding soil and on the saturation and pressure distribution within the LNAPL. These in turn would depend on the quantity of cable fluid lost and the timescale over which the leakage occurred.

Vapour impacts are considered to be unlikely from LABs but could be of concern for Masse 106.

Degradation of the cable fluid may lead to the generation of ground gas (including carbon dioxide and methane) and affect groundwater chemistry in the vicinity and locally downgradient of the LNAPL.

Given that a mixture of LABs and a mineral oil based cable fluid have been used in the past, potential contaminants of concern associated with mineral oil based fluids would include the following:

- Total Petroleum Hydrocarbons (TPH);
- Benzene, toluene, ethylbenzene and xylene (BTEX) compounds;
- Volatile organic compounds (VOCs);
- Semi volatile organic compounds (SVOCs); and
- Polychlorinated biphenyls (PCBs).

4.4.2 Potential Off-site Sources of Contamination

Given the long history of development in the area, which included a factory and saw mills in the vicinity of the site, and that some of the neighbouring properties are likely to have heating oil tanks or generators, it is possible that off-site sources of contamination may be present. In addition, available geological records indicate that fill materials may be present to depths of 4.0 m bgl at some locations in the area.

The historic graveyard adjacent to the site could be a source of potential contaminants or lead to changes in groundwater chemistry. The cemetery appears to have been present since at least 1833 and is no longer actively used for burials.

4.5 Source Audit Summary

Based on the assessment works completed, the primary APEC for this site comprises the leak location identified by ESB. This is presented in Figure 2 and a description is provided in Table 9 below.

Table 9 Area of Potential Environmental Concern

Number	APEC	Potential Contaminants of Concern	Potential Media Impacted
1	Leak at (1) Camden Row – Ringsend 38 kV (May 2010 – May 2019)	LABs TPH BTEX VOCs SVOCs PCBs	Soil Groundwater Soil Vapour Ground Gas

The potential for off-site sources of contamination to also be present is a possibility. However, no information is available for neighbouring properties, therefore the only APEC assessed herein is the leak site at Camden Row substation.

5. Conceptual Site Model

A preliminary Conceptual Site Model (CSM) has been developed identifying potential contaminant sources, contaminant migration pathways and potential receptors.

In the context of land contamination, there are three essential elements to any risk:

- A **source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters;
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body; and
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway.

This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage. The preliminary CSM was developed to describe viable source-pathway-receptor (SPR) linkages for the site, which are presented in Table 14 below.

By considering potential SPR linkages, an assessment of the human health and environmental risks is made with reference to the significance and degree of the risk. The risk assessment has been undertaken with reference to BS10175-2011 + A2 2017 and CIRIA Document C552: 'Contaminated Land Risk assessment - A Guide to Good Practice' (2001).

The preliminary risk assessment completed for this site is based on consideration of whether a potential source of contamination can reach a receptor, and hence whether it is of major or minor significance. Considering that assessment works are still at preliminary stage and no intrusive investigation work has been completed, development of the preliminary CSM and assessment of potential risk is based on information provided by ESB on the nature of the leak, and on the AECOM site reconnaissance and desk based study. As such, only a qualitative assessment can be made around potential risks to receptors. This means that identification of potential risk does not necessarily indicate a risk to a receptor, rather that further assessment may be required to investigate assumptions made in the CSM and quantify whether a potential risk actually exists.

5.1 Qualitative Risk Assessment Methodology

A qualitative risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential severity of the hazard and the sensitivity of the target, based on the categories given in Table 10 below.

Table 10 Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters.
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species.

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given in Table 11 below.

Table 11 Probability of Risk Definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard as shown in the table below.

Table 12 Level of Risk for Potential Hazard Definition

Probability of Risk	Potential Severity			
	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

A description of the levels of risk outlined in Table 12 is provided in the following table:

Table 13 Description of the Classified Risks and Likely Action Required

Level of Risk	Description
Very High Risk	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. This risk, if realised, is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild, if realised.
Low Risk	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.
Very Low Risk	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.

5.2 Preliminary CSM Assumptions

Based on the findings of the desktop study and information provide in the RFP by ESB, the following assumptions made in development of the preliminary CSM:

- The fluid assumed (based on records provided) to have leaked from the cable is a mixture of LAB and a mineral oil based cable fluid;
- The location of the leak is assumed to be from an above ground tank within the pumping station. It is assumed that no cable fluid was released below ground;
- The geology beneath the site is assumed to comprise approximately 4 m of made ground underlain by clay up to a depth of 8 m bgl. Limestone bedrock is assumed to be present at a depth of approximately 8 m bgl;
- Groundwater is assumed to be present at relatively shallow depths within the made ground;

- It is assumed that the is no direct connection between the site and surface water bodies; and
- Other below ground utilities including mains water are assumed to be present in the vicinity of the site.

The preliminary CSM is presented graphically in Figure 3.

Table 14 Conceptual Site Model

Source	Pathway	Receptor	Severity	Likelihood	Potential Risk	Discussion
LAB / Volatile TPH and VOC concentrations in soils	Inhalation of vapours from cable fluid lost within the substation building and emanating from the concrete walls and floor into atmosphere of the above ground substation	Site users in a commercial scenario	Mild	Low Likelihood	Low	Based on records provided, a mixture of LAB and mineral oil is assumed to be the cable fluid used. The low vapour pressure of LABs limits the potential for exposure via inhalation, and this is not expected to be a significant exposure route at normal temperatures. However, given that the fluid lost is a mixture, there is a potential for vapours to be generated from the mineral oil fraction. Evidence of cable fluid loss within the substation building was observed both visually and in the form of a slight hydrocarbon odour noted during the site inspection. The substation building is not manned, with workers present only occasionally. No buildings adjoin the substation, the area to the north and west is open ground (a historic graveyard / park) while that to the south and east is paved roadway with commercial buildings beyond. Based on these factors, it is considered that there is a low risk from the inhalation of vapours within the substation building. Based on the volume of cable fluid released (244 litres), duration of time over which it was released (9 years) and distance to the nearest residential dwellings (80 m west), it is considered unlikely that a mineral based cable fluid may have migrated beneath low density residential houses with gardens (most sensitive receptor). It is considered that there is a low risk from the inhalation of vapours from potential mineral oil-based products present beneath the site in this scenario.
	Inhalation of vapours which have migrated from the ground to above ground buildings	Site users in a commercial / low to high density residential with plant uptake scenario	Medium	Unlikely	Low	

Source	Pathway	Receptor	Severity	Likelihood	Potential Risk	Discussion
NAPL and non-volatile TPH, VOC, SVOC and PCB concentrations in soils	Soil and dust ingestion from near surface soils Dermal contact with near surface soils Inhalation of fugitive dust from near surface soils Ingestion of soils via consumption of vegetables grown in near surface soils	Site users in a commercial / public open space with plant uptake scenario	Mild	Low Likelihood	Low	The leak occurred from above ground and there is evidence of concrete staining on the outside of the substation walls and grave headstones which adjoin the graveyard / park. No evidence of impact to vegetation in the graveyard / park was observed.
		Intrusive site workers	Minor	Likely	Low	Workers carrying out intrusive works adjacent to the site may come into contact with mineral oil based NAPL and impacted soil, meaning there will be a requirement to wear personal protective equipment to mitigate against potential impacts. Given the relatively low toxicity of LABs (assessed to be not acutely toxic), exposure to LABs is not considered to represent a significant risk.
NAPL and TPH, VOC, SVOC and PCB concentrations in soils	Migration of ground gas generated from the degradation of the cable fluid to above ground buildings.	Site users in an industrial / commercial / low to high density residential scenario.	Medium	Unlikely	Low	If a significant source of cable fluid NAPL is present on groundwater, there is potential for ground gas to be generated from degradation processes. However, given the timeframe over which the leak occurred (9 years) and the relatively small volume of fluid released at this location (244 litres), it is unlikely that ground gas is being generated in significant quantities and potential risk from this pathway is considered to be low.
NAPL and TPH, VOC, SVOC and PCB concentrations in	Permeation of LAB or mineral oil NAPL through plastic water supply pipes.	Site users in a commercial / low to high density residential with plant uptake scenario	Medium	Unlikely	Low	Public water mains likely to be present in the vicinity of the leak, servicing commercial and residential properties, however given the relatively low volume of cable fluid released (244 litres) over a 9-year period it is not considered

Source	Pathway	Receptor	Severity	Likelihood	Potential Risk	Discussion
soils						likely that a sufficient volume of NAPL could be present to impact water mains. ESB has consulted with Irish Water (statutory body responsible for water supply) regarding the potential risk for cable fluid present in the vicinity of water supply pipes. Following review of their records, AECOM understands that Irish Water do not have concerns regarding impact of water supplies from cable fluid leaks. It is therefore considered that the potential risk of a pollutant linkage being present is low.
NAPL and TPH, VOC, SVOC and PCB concentrations in soils	Migration of potential contaminants along preferential flow pathways, such as underground services and permeable backfill around the electricity cable.	Site users in a commercial / low to high density residential with plant uptake scenario and nearby surface water bodies	Medium	Unlikely	Low	Likely to be a high concentration of services present in the vicinity of the leak given the urban setting. Given that the leak occurred above ground and the relatively low volume leaked over a 9-year period it is considered unlikely that a significant pollutant linkage exists.
NAPL	Migration in saturated and unsaturated soil	Groundwater beneath the site	Medium	Unlikely	Low	Given that the leak occurred from above ground within the substation building, the presence of a concrete / tiled floor within the building, the volume of cable fluid released (244 litres) and duration over which it was released (9 years), the potential risk of NAPL being present is considered to be low. There is an aesthetic impact due to the staining on the pumping station walls and grave headstones.
Dissolved phase leaching from NAPL or from soils containing elevated concentrations of TPH, VOCs, SVOCs and PCBs	Leaching from concrete to soil Leaching from soil to groundwater Vertical and horizontal migration of contaminants through groundwater Horizontal migration of contaminants through groundwater to nearby surface water receptors	Groundwater in superficial deposits beneath the site	Medium	Unlikely	Low	Considering the leak occurred above ground and the relatively low volume of cable fluid released over the 9-year leak period, it is considered that the risk of shallow groundwater being significantly impacted is low.

Source	Pathway	Receptor	Severity	Likelihood	Potential Risk	Discussion
LAB, TPH, VOC, SVOC and PCB concentrations in groundwater		Groundwater in limestone bedrock aquifer beneath the site	Mild	Low Likelihood	Low	Information on the local geology indicates the presence of underlying boulder clay, which would reduce vertical migration of groundwater to the bedrock aquifer.
		Off-site surface water	Mild	Low Likelihood	Low	The potential risk to Rivers Poddle and Liffey, and the Grand Canal is considered low given the distance and potential for dilution.

6. Conclusions

AECOM completed a Preliminary Site Assessment of the site located on Camden Row, Dublin 2. The objective of the PSA was to identify potential human health and environmental risks that may be associated with a fluid leak from the identified location.

Based on the findings of the desktop study, the overall environmental sensitivity of the site is considered to be moderate. Identified sensitive receptors within 1 km of the site include:

- River Poddle located 0.5 km west of the site, which discharges to the River Liffey, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site;
- The Grand Canal located 0.7 km south of the site, although this may be protected by low permeability clay (natural and/or engineered when the canal was constructed); and
- The groundwater aquifer beneath the site, although this may also be protected by low permeability clay deposits which are likely to be encountered beneath the site.

It is estimated that 244 litres of cable fluid was released over a nine year period between May 2010 and May 2019. It is assumed, based on information provided to AECOM by ESB, that the fluid lost was a mixture of LAB and mineral oil based products. Due to its high biodegradability, lower volatility and low solubility, it is considered that LABs are of less concern for adverse environmental impact than mineral oil based products. Given that there is potential for a mixture of both types of cable fluids to have been used at this site, potential contaminants of concern have been identified. A summary of the source audit findings is as follows:

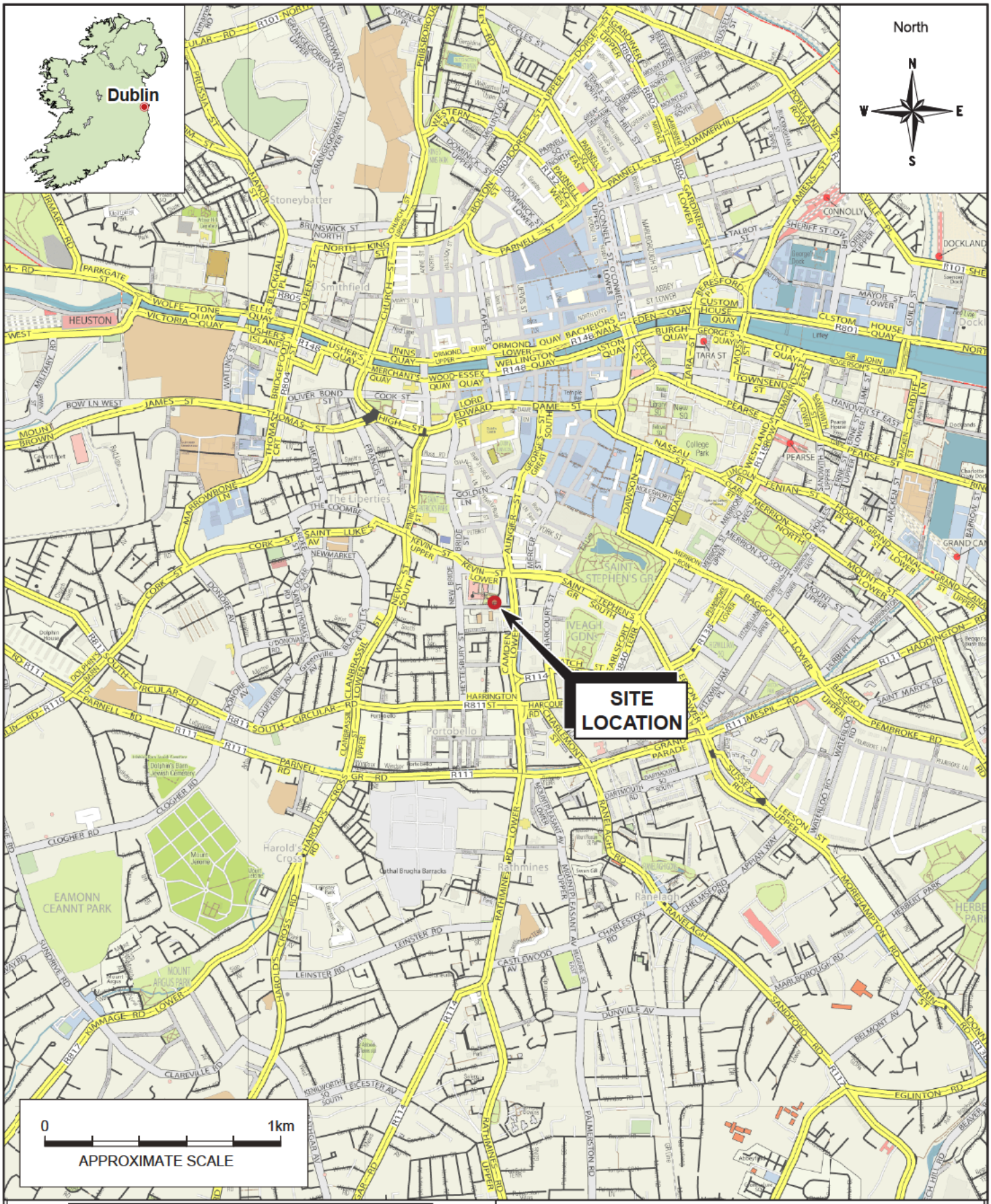
Table 15 Area of Potential Environmental Concern

Number	APEC	Potential Contaminants of Concern	Potential Media Impacted
1	Leak at (1) Camden Row – Ringsend 38 kV (May 2010 – May 2019)	LABs TPH BTEX VOCs SVOCs PCBs	Soil Groundwater Soil Vapour Ground Gas

The preliminary CSM developed for the site looked at potential SPR linkages identified during the assessment works and found that potential risks were considered to be low. Based on these findings, further assessment is not considered to be required as no viable SPR linkages have been identified.

There is an aesthetic impact due to the staining of the pumping station walls and grave headstones. A suitable contractor should be appointed to clean these surfaces where possible.

Figures



Client

ELECTRICITY SUPPLY BOARD

Location

Camden Row – Newmarket 38 kV

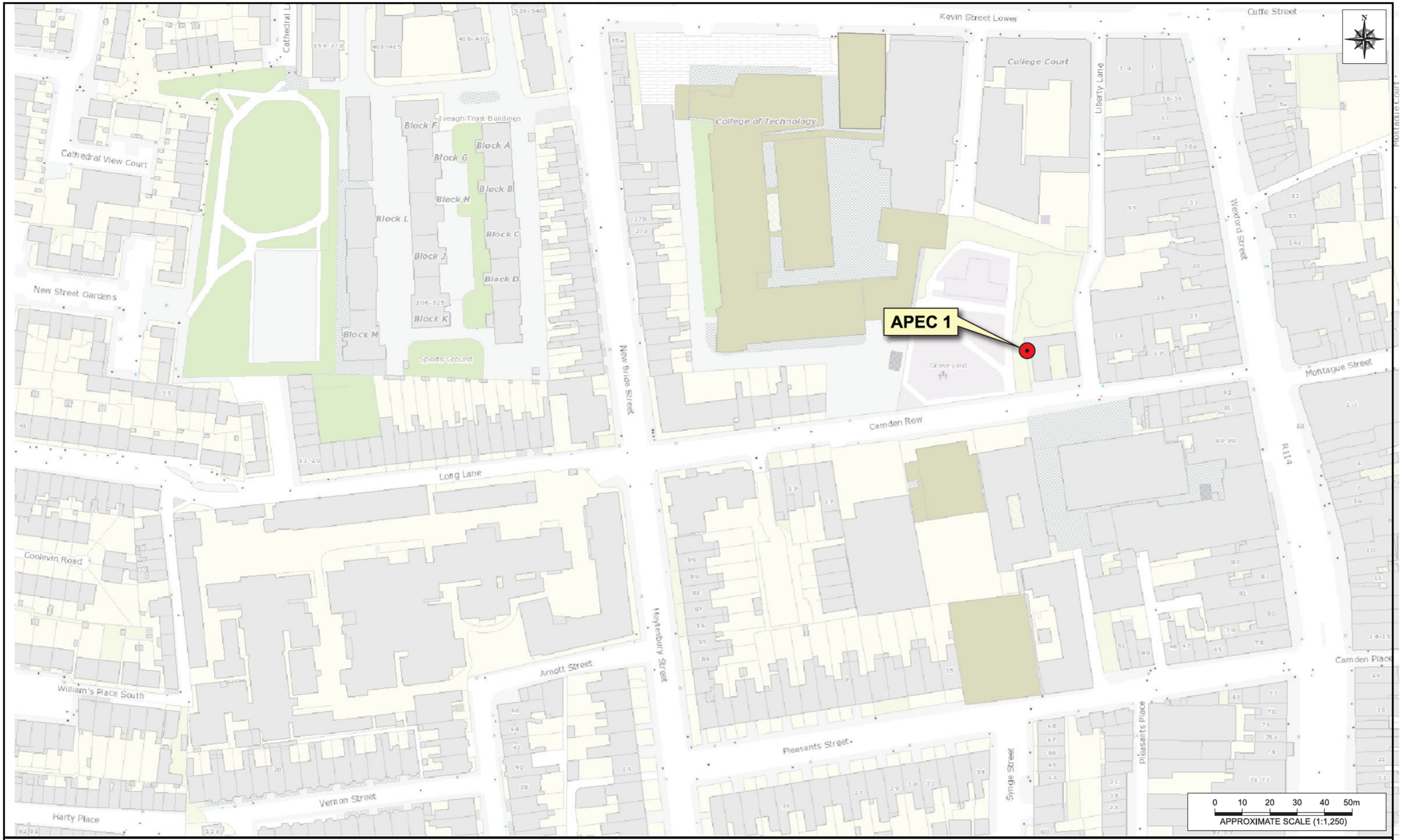
Drawing Title

FIGURE 1 - SITE LOCATION MAP

AECOM

4TH FLOOR, ADELPHI PLAZA, ADELPHI CENTRE, GEORGE'S STREET UPPER, DUN LAOGHAIRE, CO. DUBLIN, IRELAND. T+353 (0)1 238 3100, F +353 (0)1 238 3199

DRAWN	ILLUSTRATED	CHECKED	APPROVED	DATE
RH		CC	DM	JULY 19
SCALE	Job No.			REV.
N.T.S	PR-427640			



KEY:

Leak Location

Rev	Date	Detail	Made	Chk'd	App'd
Status: FOR INFORMATION					

NOTES:

Client: ELECTRICITY SUPPLY BOARD

Location: Camden Row Newmarket 38 kV

Title: FIGURE 2 SITE LAYOUT PLAN

AECOM
4th Floor, Adelphi Plaza, Adelphi Centre, George's Street Upper, Dun Laoghaire, Co. Dublin, Ireland.
Tel: +353 (0) 1 293 3200
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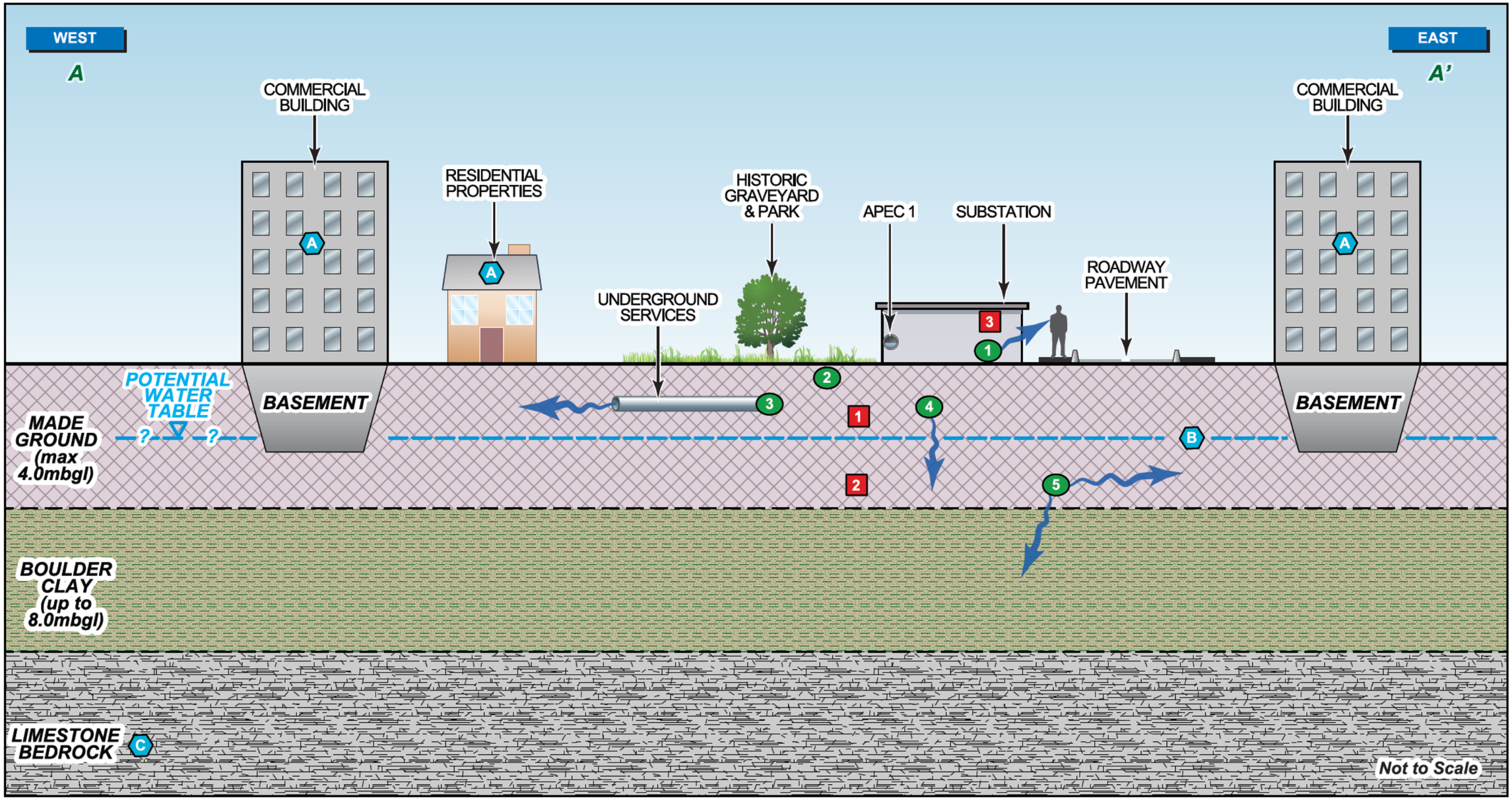
Design: ESB	Drawn: RDH		
Chk'd: CC	App'd: DM		
Date: JULY 2019	Scale: As Shown		
Project No. TBA	Drg No. 2	Stat. -	Rev: 0



SOURCES	PATHWAYS	RECEPTORS
1 NON-VOLATILE CONTAMINANTS IN SOIL	1 VAPOUR INHALATION	A RESIDENTIAL / COMMERCIAL SITE USERS
2 CONTAMINANTS IN GROUNDWATER	2 DERMAL CONTACT / DUST INGESTION	B SHALLOW GROUNDWATER
3 VOLATILE CONTAMINANTS FROM CONCRETE WITHIN BUILDING	3 PERMEATION OF AND MIGRATION ALONG EXISTING UNDERGROUND SERVICES	C BEDROCK GROUNDWATER
	4 LEACHING FROM SOIL TO GROUNDWATER	D SURFACE WATER
	5 VERTICAL & HORIZONTAL MIGRATION OF CONTAMINATED GROUNDWATER	

Rev	Date	Detail	Made	Chk'd	App'd

Status: FOR INFORMATION

NOTES:

Client: ELECTRICITY SUPPLY BOARD

Location: Camden Row Newmarket 38 kV

Title: FIGURE 3 CONCEPTUAL SITE MODEL

AECOM
4th Floor, Adelphi Plaza, Adelphi Centre, George's Street Upper, Dun Laoghaire, Co. Dublin, Ireland.
Tel: +353 (0) 1 293 3200
Fax: +353 (0) 1 293 3201
www.aecom.com

Design: ESB	Drawn: RDH		
Chk'd: DM	App'd: DM		
Date: JULY 2019	Scale: As Shown		
Project No. 60610407	Drg No. 3	Stat. -	Rev: 0

Appendix A Site Photographs

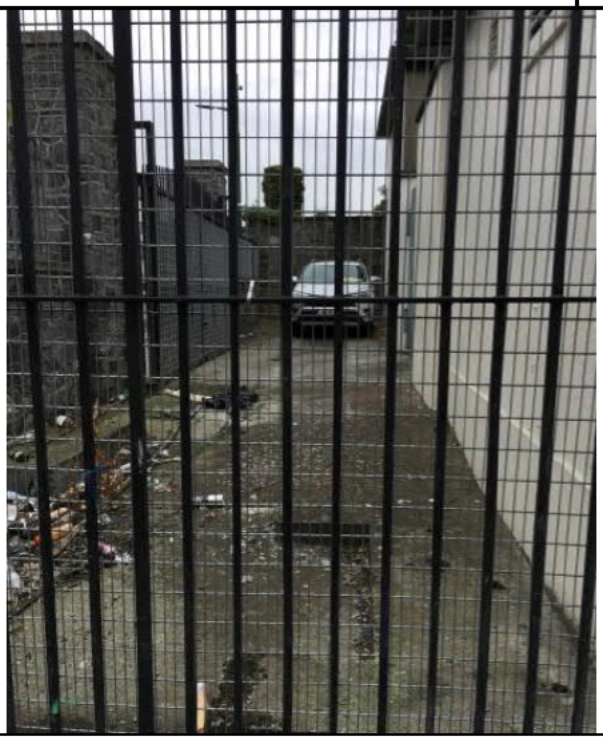
AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
ESB	Site 1: Camden Row – New Market	PR-427640

Date:
08 July 2019

Photo 1

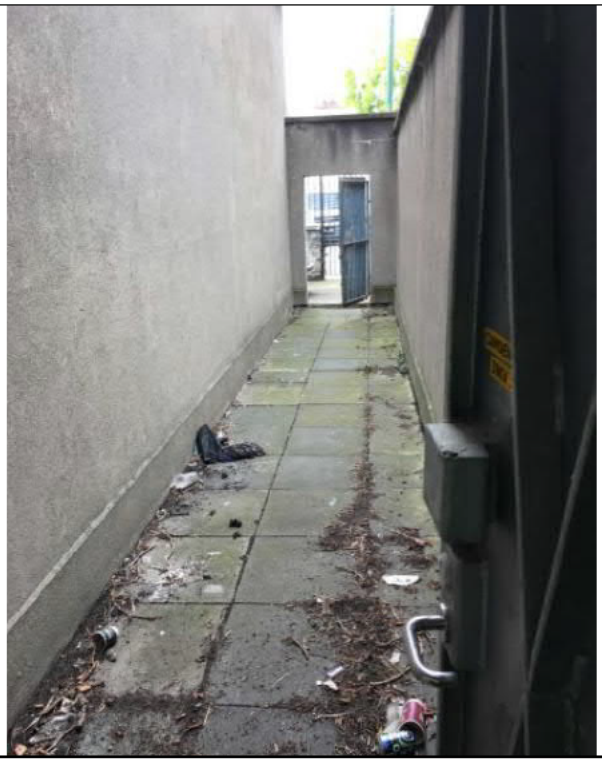


Description:

Front (south) of substation, Camden Row on left hand side (LHS).

Date:
08 July 2019

Photo 2



Description:

Access alleyway along side (west) of substation, historic graveyard / park on right hand side (RHS) of boundary wall.

AECOM

PHOTOGRAPHIC LOG

Client Name: ESB	**Site Location:** Site 1: Camden Row – New Market	**Project No.** PR-427640

Date: 08 July 2019

Photo 3

Description:

Access to substation from alleyway, historic graveyard / park on LHS of boundary wall.

Date: 08 July 2019

Photo 4

Description:

Storage tank for LAB cable fluid within substation, staining visible on tiled floor and at base of tank.

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
ESB	Site 1: Camden Row – New Market	PR-427640

Date:
08 July 2019

Photo 5

Description

Staining at base of tank, on tiled floor including the point where the cable enters the ground.

Date:
08 July 2019

Photo 6

Description:

Storage tanks within substation.

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
ESB	Site 1: Camden Row – New Market	PR-427640

Date:
08 July 2019

Photo 7

Description

Recent repairs to cable line.

Date:
08 July 2019

Photo 8

Description:

New wall mounted valves.

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
ESB	Site 1: Camden Row – New Market	PR-427640

Date:
08 July 2019

Photo 9

Description

Wall mounted pressure gauges.

Date:
08 July 2019

Photo 10

Description:

Staining visible through paint on wall behind pressure gauges.

AECOM

PHOTOGRAPHIC LOG

Client Name: ESB	**Site Location:** Site 1: Camden Row – New Market	**Project No.** PR-427640

Date:
08 July 2019

Photo 11

Description

Old valves which were removed in May 2019.

Date:
08 July 2019

Photo 12

Description:

Staining on outside of substation wall (north) within historic graveyard / park.

AECOM

PHOTOGRAPHIC LOG

Client Name: ESB	**Site Location:** Site 1: Camden Row – New Market	**Project No.** PR-427640

Date:
08 July 2019

Photo 13

Description

Staining on outside of substation wall (north-west corner) within historic graveyard / park.

Date:
08 July 2019

Photo 14

Description:

Staining on outside of substation wall (west) within historic graveyard / park.

AECOM

PHOTOGRAPHIC LOG

Client Name:	**Site Location:**	**Project No.**
ESB	Site 1: Camden Row – New Market	PR-427640

Date:
08 July 2019

Photo 15

Description

Liberty Lane, immediately east of substation.

Date:
08 July 2019

Photo 16

Description:

Commercial premises on southern side of Camden Row.

Appendix B PSA Template Report Table of Contents Cross Reference

EPA Template Table of Contents	Production Area Preliminary Site Assessment Report
Executive Summary	Executive Summary
1. Introduction	Section 1
1.1 Project Contractual Basis & Personnel Involved	Section 1
1.2 Background Information	Section 1.1
1.3 Project Objectives	Section 1.2
1.4 Scope of Works	Section 2
2. Source Audit Findings	Section 4
2.1 Current Site Operations	Section 4.1 to Section 4.2
2.2 Previous Site Operations	Section 4.3
2.3 Chemicals of Potential Concern	Section 4.4
3. Site Environmental Setting	Section 3
3.1 General Introduction	Section 3
3.2 Regional Geology and Hydrogeology	Section 3.2 and Section 3.4
3.3 Site Geology and Hydrogeology	Section 3.2 and Section 3.4
3.4 Summary of Previous Site Sampling and Monitoring Data	Not Applicable
4. Summary and Conclusions	Section 6
4.1 Summary and Conclusions	Section 6
4.2 Recommended Way Forward	Separate Cover Letter
5. References	Throughout Text