

## **REVIEW OF REMEDIATION WORKS AND PROPOSED METHOD STATEMENT / VERIFICATION PLAN FOR SITE REDEVELOPMENT**

### **FORMER BROADWAY PETROL FILLING STATION, CROWLAND**

#### **Summary of Historical Remediation Works:**

Originally, the site was operated as a petrol filling station with underground tanks remaining in-situ until 2003. EPS has been informed that historical remediation was carried out when the site was decommissioned but, until recently, there has been limited detail on the exact remediation activities performed. However, copies of two former reports for the site have now been found which show that several phases of investigation were carried out prior to tank removal and which provide details of the type of remediation carried out. The report titles and references are as follows:

- *Contamination Report for Former Broadway Garage, Crowland* – (JP Chick & Partners Ref.: NGEN8340/JS/tb – 30<sup>th</sup> June 2003)
- *Proposal for Remedial Measures at the Site* – (JP Chick & Partners Letter Report – Ref.: NG8340/JS/AC – 13<sup>th</sup> August 2008)
- *Site Investigation Report – Former Broadway PFS, Crowland, Lincolnshire, PE6 0BH* (Applied Geology, Ref.: AG1031-08 – November 2008)

The following provides a short summary of the content of these reports:

- 1) Three other previous reports were referred to by JP Chick which have not been made available. These include:
  - *Investigation 1* – P Robson – 18<sup>th</sup> December 2000
  - *Investigation 2* – Ground Engineering Ltd – 9<sup>th</sup> November 2001
  - *Investigation 3* – JP Chick & Partners – 20<sup>th</sup> September 2002
- 2) The above previous investigations identified localised hydrocarbon contamination in the subsurface around the underground tanks, which was thought to have arisen from a single unleaded petrol tank leak.
- 3) Contaminant transport in groundwater was modelled by JP Chick in their report of 20<sup>th</sup> September 2002 using the Con Sim modelling software, but this found 'little' risk to chosen receptors.
- 4) Proposals were put forward for removal of the tanks and associated contaminated soils in the September 2002 report, which were approved by the local Council at the time. Although specific details are not included in the report provided to EPS, the remediation strategy generally consisted of removing two large underground tanks as well as smaller tank, which was known to have leaked. A layer of soil immediately surrounding the smaller tank was also removed.
- 5) The 2003 report stated that a further four redundant underground storage tanks were also discovered beside the highway and removed during excavations intended for removal of fill materials found across the area.

- 6) Once these four tanks were removed an excavation measuring approximately 10m width by 18m length and 2.5m depth was left and a total of 360m<sup>3</sup> waste soils had been removed from site.
- 7) Various samples of groundwater collected from trial pits made after the tank removal work had been completed showed only very low dissolved concentrations of hydrocarbon were identified.
- 8) The council issued a Certificate of Decontamination and Reclamation for the site in 2004.
- 9) The JP Chick report prepared in August 2008 was subsequently commissioned to address further contamination found in advance of some proposed redevelopment works.
- 10) The 2008 report states that further hydrocarbon contamination was found between the original building and the areas of former tank excavation, which appeared to remain free of impact.
- 11) The 2008 report also presents the details of further modelling work which concludes that due to variable groundwater conditions below the site, it is not possible to accurately predict the risks to the neighbouring receptors however it does recommend remediation is carried out to reduce risks as far as possible.
- 12) The remediation work proposed included excavating a sump at the centre of the site so that groundwater could be pumped through the site interceptor before being discharged back to ground. In addition, soils heavily contaminated by hydrocarbons were to be excavated and placed into skips for testing and subsequent treatment by turning to reduce concentrations to less than 1000mg/kg before subsequent disposal.
- 13) The use of absorbent mats on groundwater exposed by excavations was also suggested as an alternative for reducing hydrocarbon contamination in groundwater.
- 14) The Applied Geology Report of 2008 passed to EPS for review consists of a number of site plans with various notes appended to each to summarise various findings. Very little detail is included, however it appears Applied Geology attended the site in March 2008 to excavate several trial pits across the site and to install six on-site groundwater monitoring wells (BHA-F). In May 2008, one additional deeper ground monitoring well was installed (BH1A) and JP Chick & Partners Ltd subsequently undertook some groundwater testing of the seven on-site monitoring wells in June 2008. The results of the groundwater sampling identified elevated concentrations of hydrocarbons in several monitoring wells across the site, in particular BH1A situated in the central area of the site where up to 2mm of liquid hydrocarbon was found.
- 15) The monitoring wells were subsequently tested again in November 2008 by Applied Geology which indicated that the elevated concentrations of hydrocarbons were still present in the groundwater underlying the site, with the concentration of Total Petroleum Hydrocarbons detected in monitoring well BHA at a concentration of 72mg/l.
- 16) A very brief summary of some remediation activities, proposed by Celtic Technologies Ltd, was also included in the report, which involved excavation of up to 3250m<sup>3</sup> (6688 tonnes) of contaminated soil from the majority of the northern half of the property for subsequent off-site disposal. It is not clear if this work was ever completed.

### **Recent Investigations:**

In 2014, EPS was instructed to attend the site and carry out investigations by Mr Ian Ladds to assess the condition of the site and to determine if there is any residual source of hydrocarbon contamination and what risks this poses to identified receptors, to ensure safe development as part of a future residential scheme. This work is document in the following previous reports:

- *Supplementary Sampling Report – Former Broadway PFS, Crowland, Lincolnshire, PE6 OBH* (EPS Ltd, Ref.: UK14.1470 – 14<sup>th</sup> January 2014)
- *Quantitative Risk Assessment – Former Broadway PFS, Crowland, Lincolnshire, PE6 OBH* (EPS Ltd, Ref: UK14.1470 – 23<sup>rd</sup> October 2014).
- *Phase I and II Geo-Environmental Assessment - Former Broadway PFS, Crowland, Lincolnshire, PE6 OBH* (EPS Ltd, Ref: UK14.1470 – 12<sup>th</sup> June 2015).
- *Groundwater Monitoring Report - Former Broadway PFS, Crowland, Lincolnshire, PE6 OBH* (Letter Report sent 14<sup>th</sup> April 2016)

EPS' first report was commissioned to investigate potential residual sources of contamination beneath the site after concerns were raised by South Holland District Council. This work consisted of excavating a number of trial pits to search for any residual tanks or other historical features / fuel infrastructure was still present beneath the site in the area of known contamination, which could serve as a residual source for hydrocarbon contamination; no evidence was found.

EPS then carried out drilling and sampling investigations which confirmed hydrocarbon contamination in soil and groundwater beneath the site and this had not significantly reduced in concentration or extent since the previous reports were carried out in 2008, suggesting that the remediation proposed by Celtic and/or JP Chick had not been carried out.

EPS then collected groundwater samples from off-site boreholes and carried out a detailed quantitative groundwater risk assessment, which found that hydrocarbon contamination did not appear to extend off-site, nor did it appear to pose risks to neighbouring property over time. A subsequent groundwater sampling event conducted in May 2015 did find very minor hydrocarbon contaminants dissolved in samples from the off-site boreholes but this was thought to have been the result of some recent excavation works carried out on site shortly before the samples were taken. It was concluded that the disturbance in the ground on site could have caused fluctuation in steady state contaminant plume conditions so repeat samples were collected in February and March 2016. These found no evidence of impact.

After discussions with Jeanette Reith (Contaminated Land Officer for South Holland District Council) it was agreed that samples of potable water supplies would be collected from each of the neighbouring properties. Whilst known impacts to the quality of soil (and groundwater) on site lie at or close to the depth of groundwater (around 2m below ground level) and potable water supply pipes would be expected to lie within the top 1m of soil, it was considered prudent to collect samples to verify that impacts were not present. The samples were collected during the visit in February and found no evidence of impact by hydrocarbon contaminants.



**Proposed Remediation and Remaining Uncertainty:**

In order to protect future site residents from known hydrocarbon contamination, EPS has made several recommendations in its previous reports for a number of remedial actions and control measures. These have been detailed and presented in the Remedial Method Statement attached to this document which also constitutes the Verification Plan.

In addition, to address concerns raised by Jeanette Reith over possible residual source(s) of hydrocarbon contamination found by site investigations in 2008, a watching brief is also recommended alongside all excavation works to identify any plausible sources for hydrocarbon contamination which may not yet have been identified. Details of this brief have also been included in the Remedial Method Statement attached.

## REMEDIAL METHOD STATEMENT

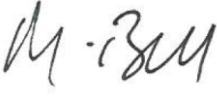
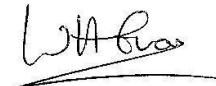
### **Identification & Control of Any Residual Risks**

- 1) All intrusive excavations that are proposed as part of the redevelopment work should be supervised to monitor for evidence of plausible hydrocarbon sources such as old underground storage tanks, fuel pipework, pits, interceptors and soakaway structures.
- 2) Should any unexpected contaminants or contaminant sources be identified, the site specific method statement included in Appendix A should be followed. Photographs should also be collected of open excavations made during the development.
- 3) In accordance with recommendations made in EPS' Phase I and II Geo-Environmental report, clean imported topsoil should be used in landscaped and garden areas (supported by appropriate chemical analysis), to ensure a suitable growing medium for any plants within plot 4 and provision of impermeable hardstanding such as asphalt or paving in Plots 1-3 as shown in Figure 1. No special provisions are made for gardens or landscaping in Plot 5.
- 4) Any new trees / deep-rooted shrubs planted in the northern half of the site should be cited in deep planters to protect against deeper phytotoxic contaminants.
- 5) To prevent any ingress of hydrocarbon vapours into the proposed residential buildings from groundwater, a proprietary gas and vapour resistant membrane will need to be installed into the ground floor footprint of Plots 1-4 in order to resist the passage of volatile vapours into the living space above. Photographic evidence and certification of the installations will also be required.
- 6) All construction workers operating at the site should be advised of the potential for contact with hydrocarbon products which could still be stored at the site and the potential for exposure to made ground in the subsurface at the site. Appropriate health and safety precautions should also be adopted during any excavation works to avoid exposure to soils. Reference should be made to the following CIRIA document, *R132 Guide to Safe Working on Contaminated Sites*.
- 7) In order to reduce potential risks from linkages associated with ingress of contaminants to underground water supply pipework, aluminium barrier pipework meeting Water Industry Standard 4-32-19 and associated fittings can be used subject to agreement with the local water company. If other pipework is preferable, more detailed testing may be required in accordance with UK Water Industry Research Report 10/WM/03/21 - "*Guidance For The Selection Of Water Supply Pipes To Be Used In Brownfield Sites*" (2010).



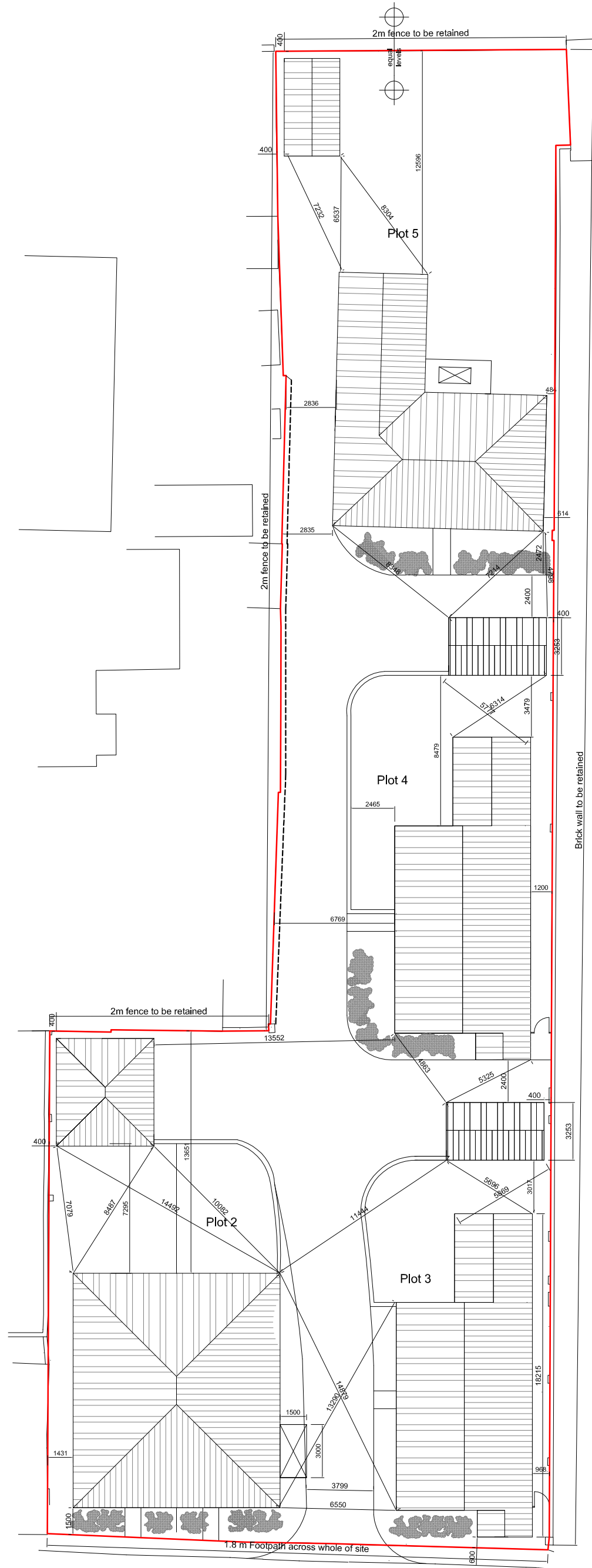
### Verification Requirements

1. Prepare a verification report which documents the following:
  - Results of groundwater and domestic water sampling
  - Photographic evidence and certification for the installation of vapour membranes within new houses
  - Certificates, delivery notes and photographic evidence for importation of any clean topsoil or construction of hardstanding across garden /landscaped/utility areas the new residential properties.
  - Certification, specifications and/or photographic evidence that suitable potable water pipe has been installed at the new development
  - If required, evidence to demonstrate that risks to domestic water supplies in neighbouring houses have been appropriately controlled.
  - If required, provision of all relevant sample data, photographs and a summary of works carried out in the event that unexpected or severe contamination is identified and remediated during excavations at the proposed development.

| Author:                                                                             | Reviewed:                                                                                          | Authorised:                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                 |                                                                                                   |
| Giles Lock                                                                          | Marcus Bell                                                                                        | Will Evans                                                                                                                                                                             |
| Consultant                                                                          | Principal Consultant                                                                               | Director                                                                                                                                                                               |
| <b>Document Ref:</b>                                                                | UK14.1470 – Remedial Method Statement & Verification Plan<br>Former Broadway PFS, Crowland - Final |                                                                                                                                                                                        |
| <b>Date:</b>                                                                        | 20 <sup>th</sup> April 2016                                                                        |                                                                                                                                                                                        |
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## **FIGURES**



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## **APPENDIX A**

### **Method Statement for Watching Brief and Dealing with Unexpected Contamination**



## **METHOD STATEMENT FOR FORMER BROADWAY PFS**

### **WATCHING BRIEF AND ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS**

A watching brief should be maintained throughout any excavation work. This should comprise supervision of all excavations by a nominated engineer who should look for the following:

- 1) Evidence of buried fuel infrastructure such as pipes and tanks.
- 2) Evidence of significant hydrocarbon contamination such as very odorous soil and/or groundwater.
- 3) Evidence of liquid hydrocarbons

If at any point during intrusive groundworks at a site, evidence of this nature or of a different / unforeseen source of contamination is encountered the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment.
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered.
- In cases where EPS consider the unforeseen contamination is potentially capable of posing an unacceptable risk to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken.
- Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and verification samples obtained and conclusions and recommendations for any further actions considered necessary.
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

#### **EPS Contact Details:**

|               |          |                    |
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