Contaminated Land
Air Quality
Environmental Audit

SMITH GRANT Environmental Consultancy LLP

Partnership No: OC 300776

New Settlement Area, Heyford Park
Oxfordshire

Dorchester Phase 1b: Area 2
Remediation Earthworks
Completion Report

For: Urban Regen Ltd.

February 2016

Report Ref: R1742-R10-v2

Smith Grant LLP, Station House, Station Road, Ruabon, Wrexham, LL14 6DL
tel: 01978 822367 fax: 01978 824718 e-mail: consult@smithgrant.co.uk web: www.smithgrant.co.uk
Members: A F Smith (Chairman), K E Hawkins, B J Thomas

DOCUMENT CONTROL SHEET

Report Title: New Settlement Area, Heyford Park: Dorchester Phase 1b: Area 2 Remediation Earthworks Completion Report

Client: Urban Regen Ltd

Report Reference Number: R1742-R10

Report Status: Final

Version: v2

Report Date: 18th February 2016

Signed For Smith Grant LLP:

	Name	Position	Signature	Date
Author	**D Wayland BSc MSc MCIWEM**	**Consultant**		**18.02.16**
Reviewer	**A F Smith BSc PhD MCIWM SiLC**	**Partner**		**18.02.16**

Document Revision Record:

Version	Report Status	Date	Details of Revision
v1	Draft	22/12/15	Draft issued to client for comment
v2	Final	18/02/16	Inclusion of topsoil test results, final report issued to all parties

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1. Introduction

1.1. Planning permission for the redevelopment of the former RAF/USAF Upper Heyford airbase was granted by Cherwell District Council (CDC) on the 2nd November 2012, reference 10/01642/OUT. The site, converted to commercial and residential uses is known as Heyford Park, and is divided between the Flying Field Area (FFA) and New Settlement Area (NSA). Urban Regen Ltd. (URL) was instructed by the consortium of Dorchester Heyford Park Group Ltd and Bovis Homes to carry out demolition, remediation and preparatory earthworks across the NSA to prepare various zones for residential development. Dorchester Group and Bovis have divided the site into a number of development phases, and the URL works are referenced to these various phases.

1.2. The above planning consent contains the following conditions relating to contamination remediation:

24	*No operational development approved by this planning permission shall take place (or such other date or stage in development as may be agreed in writing with the Local Planning Authority), until the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved, in writing, by the local planning authority:*
a.	*A preliminary risk assessment which has identified:*
(i)	*- all previous uses.*
(ii)	*- potential contaminants associated with those uses.*
b.	*A conceptual model of the site indicating sources, pathways and receptors.*
c.	*Potentially unacceptable risks arising from contamination at the site.*
d.	*A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.*
e.	*The site investigation results and the detailed risk assessment (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.*
f.	*A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.* *Any changes to these components require the express consent of the local planning authority. The scheme shall be implemented as approved.*
25	*Prior to occupation of any new build dwellings, a verification report demonstrating completion of the works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to and approved, in writing, by the local planning authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met. It shall also include any plan (a "long-term monitoring and maintenance plan") for longer-term monitoring of pollutant linkages,*

	maintenance and arrangements for contingency action, as identified in the verification plan, and for the reporting of this to the local planning authority.
26	*If during development contamination not previously identified is found to be present at the site then no further development within 20m of the contamination shall be carried out until the developer has submitted to and obtained written approval from the local planning authority for an addendum to the method statement. This addendum to the method statement shall detail how this unsuspected contamination will be remediated (if necessary) and thereafter this will be carried out as approved before any development within 20m recommences. Following completion of any such additional remediation, a verification report shall be submitted within 3 months of the completion of the works for the approval of the Local Planning Authority in writing.*

1.3. A Remediation Strategy (ref: EED10658-109_S_12.2.3_FA, September 2012) prepared by Waterman Energy, Environment and Design Ltd. (Waterman) on behalf of Dorchester Group, together with a Demolition and Remediation Method Statement produced by Vertase F.L.I Ltd. were submitted to the Local Planning Authority (Cherwell District Council). The Council subsequently approved the discharge of Condition 24 on 2/11/12. Whilst the role of Waterman has changed within the remediation scheme, and Vertase FLI is no longer involved in the site, the principles of the remediation strategy remain the same, and have been adopted by URL in their role as Principal Contractor to Dorchester Group and Bovis.

1.4. For clarity, SGP re-submitted an updated Remediation Strategy (R1742-R01-v3) in April 2014 that reflects the changed contractual circumstances with respect to contamination remediation. Approval of the revised Strategy was received from the EHO in October 2014; however the completed works as detailed within this report were completed in accordance with that of the Waterman Strategy.

1.5. Smith Grant LLP (SGP) has been instructed by URL to advise upon the implementation of the remediation works and to carry out all necessary inspections and monitoring of the works and to prepare all necessary verification reports as the preparatory earthworks in each phase are completed by URL. This verification reporting is intended to assist in the discharge of Condition 25 (although some aspects can only be completed by the developers). SGP also assesses whether the requirements of Condition 26 relating to previously unidentified contamination need to be invoked.

1.6. This report deals with the completion of remediation by URL for Dorchester Group (the Developer) across Dorchester Phase D1b: Area 2. The site location is shown below and the site boundary that makes up the wider Dorchester Phase 1b area (D1B) and the sub-phase area (referred to by the Developer as Phase 3) is marked on Drawing D02. A separate Completion Report (R1742-R07-v2) was submitted for the sub-phase handover area of Dorchester Phase D1b: Area 1 in November 2014.

1.7. A development layout plan has not been provided however it is anticipated that the development will consist of a variety of detached, semi-detached and terraced housing with private gardens and associated infrastructure.

Figure 1.1 Approximate boundary of Phase D1B: Area 2

1.8. SGP has regularly inspected the URL preparatory earthworks carried out to date, and has collected samples of the stripped or replaced soil surfaces and aggregate for determination of compliance with the agreed quality standards. This report describes the works carried out, drawing conclusions and making recommendations concerning the further works required by Dorchester in order to fully discharge Planning Conditions 25 and 26.

2. Remediation Strategy

2.1. Expected Contamination

2.1.1. The wider development comprises an area of the former Upper Heyford Airbase, latterly developed and used by the United States Airforce, which has been decommissioned and is used in part for civilian purposes, including commercial and residential uses as part of Heyford Park. Identified known or potential contamination sources determined from the historical uses of the site and site investigations were generally found to be minor, consisting of low-level but pervasive contamination by metals / metalloids and PAHs, with localised hydrocarbons associated with bulk fuel storage tanks and the potential for asbestos in pipe laggings and gaskets, insulation board and cement-bound products, or as dispersed fibre in

made ground. The key identified contamination hot-spots in the wider site were associated with bulk underground fuel storage tanks (USTs).

2.1.2. Natural background contamination may be present in the bedrock and soils. The site lies within or adjacent to the "ironstone domain" as described in DEFRA Technical Guidance Sheet TGS01 "Arsenic", July 2012; the site lies within 1km of mapped outcrops of ironstones within the Jurassic sedimentary rocks. Within the ironstone domain, the normal background concentration (NBC) of arsenic is reported to be 220 mg/kg; the NBC is defined as the upper 95% confidence limit of the 95th percentile of topsoil concentrations. The normal background concentration of vanadium within the ironstone domain is reported by BGS to be >128 mg/kg. Both values substantially exceed the Remediation Strategy Table B1 criteria for cover soils.

2.2. Remediation Objectives and Approach

2.2.1. The key contamination remediation objectives are to:

- create a significant betterment of the groundwater environment thereby protecting groundwater quality at and beyond the site boundary;
- remove/remediate significant pollution sources such as hydrocarbon hot-spots, if present, that pose a risk to man and the environment, to the extent feasible;
- break significant or potentially significant future pollutant linkages resulting from the change of landuse, in particular related to shallow garden soils and human exposure;
- carry out further soil investigations/inspections to complete gaps in the existing investigation coverage;
- respond appropriately to contingencies in particular the discovery of previously undisclosed contamination;
- remove development constraints and prepare the site physically to enable residential development;
- manage all emissions to air and water to protect surface waters and groundwater and the atmosphere during the remediation works;
- provide appropriate additional protection measures where necessary, to be implemented during construction, including building gas barriers, water mains protection, and garden / open space soil quality and thickness.

2.2.2. The general requirements for garden and landscaped soils taken from the approved Remediation Strategy are as follows:

- provision of 600mm of clean soil cover over made ground materials within garden and landscaped areas;
- materials to be used as the garden/landscape soils must be suitable for use and validated, to comply with contamination targets set out in the Remediation Strategy at a rate of 1 sample per 500m^3;

- imported soils used for cover purposes to comply with contamination targets set out in the approved Remediation Strategy at a rate of 1 sample per 250m^3 with a minimum of 3 samples per source;
- in areas where natural uncontaminated soils are present following the site re-grade, clean topsoil may be required as a growing medium but there will be no requirement for a full 600mm of placed soil cover;

2.2.3. It is confirmed that the Dorchester D1B phase may be generally classed as "Green" under the NHBC classification scheme with no special measures required to address risks posed by ground gas. A localised area of residual heavy fuel oil within bedrock was present in the area of former borehole BH-NSA-06 following remediation of the source area (underground storage tanks UG-NSA1 – 3); in the absence of post-remediation ground gas monitoring, precautionary building gas protection measures are recommended in this area.

2.3. Site Characterisation

2.3.1. Area 2 of the wider Dorchester Phase 1b area extends to about 7.4 ha and was previously occupied by 31 buildings, roads and grassed areas. Buildings formerly located within the D1B-Area2 are detailed in the table below:

Table 2.1 Buildings formerly located within the D1B-Area2

Building Number	Building Use	Date of Construction
441, 467	Boiler House	1970
445, 446	Barrack Blocks	1970/72
449, 484	Disused	1940/77
459	Single Sergeants Quarters	1925
461	Cabin/Sheds	1939
465	Bunker/Command Centre	1935
466, 471, 483	Barracks; Block Type C	1925
467	Boiler House	1925
468	Office/Store	1940
470	Unknown	1940/77
481	Thrift Shop	1973
487	Electric Substation	1940
493	Petrol Station	1985
498, 500, 594	Barracks; Block Type H	1926
502	Offices	1939
529	Leisure Unit	1935
593, 596, 598	Barrack Block	1970-72
472A	Mess Complex	1939

472B	Recreation Centre	1939
UH11	Portacabin	-
UH9	Generator	Unknown

2.3.2. Two buildings (488 and 465) currently remain in the centre of D1B: Area 2. SGP understand that it is proposed that these buildings will remain as part of the re-development works.

2.3.3. Three clusters of tanks were present within the Phase D1B: Area 2 with the adjacent ground investigated by Jomas in 2011. SGP attended site on 20th November, 2013 to inspect the tanks and their contents.

2.3.4. The first set of tanks (UG-NSA 1- UG-NSA-3) was present in the north-west of the site and was associated with building 467, a former boiler house. Ground conditions observed during the initial intrusive investigation reported some hydrocarbon staining within the fissures of the limestone and sandstone bedrock at depths of between 2.5 - 4.8m bgl. Screening with a PID reported a maximum reading of 50.7 ppm at 2.7m bgl. The tanks were of steel construction of which two (UG-NSA-1 and UG-NSA-2) contained a slight sheen whilst UG-NSA-3 was found to contain ~54,000 litres (~14,000 US gallons) of heating oil based on the tank dimensions recorded. PID screening of the headspace recorded a maximum reading of 15.5 ppm in UG-NSA-1.

2.3.5. A monitoring well located approximately 11m to the south of the UG-NSA-1-3 tanks, BH-NSA-06, had previously recorded variable thicknesses of floating hydrocarbon product on the water table, although contamination had not been found to extend as far as a second line of wells subsequently installed down-gradient to the south (BH-NSA-42 – 44), about 40m from UG-NSA-1-3. Hydrocarbons that had historically leaked into bedrock were found to pose a low environmental risk and their remediation was considered not cost-effective and was therefore not required under the approved Remediation Strategy.

2.3.6. A second boiler house (building 441) with associated fuel tanks (UG-NSA-5 - UG-NSA-7) was also present in the south-west corner of the site. Contamination indicators were observed within borehole entry (BH-NSA-10) where a faint hydrocarbon odour (2.3 ppm) was observed within a horizon of silty clayey sand between 2.7-3.1m bgl. SGP observed an oily film/sheen within the water in the tanks which were of steel construction and were an estimated volume of ~ 55,000 litres (~14,500 US gallons). Screening of the headspace with a PID reported a maximum concentration of 3.4 ppm in UG-NSA-7.

2.3.7. The final set of tanks within the D1B: Area 2 was located in the north-east of the site associated with the former filling station (building 493). Ground adjacent to the tanks was previously investigated by borehole (BH-NSA-3) which reported a moderate hydrocarbon

odour with some staining within fissures in the limestone bedrock between 3.2 and 4.2 m bgl. Screening of arisings with a PID reported a reading of 7.8 ppm at 3.5m bgl and 14.2 ppm at 4.0m bgl. Inspection of the tanks prior to remediation identified that they were of steel construction with an estimated volume of ~23,000 litres (~6,000 US gallons) based on the dimensions recorded. Residual product (petrol) was present within base of the tanks and screening of the headspace reported a maximum reading 870 ppm in UG-NSA-20

2.3.8. Elsewhere, and outside services trenches, the site was found to generally have a thin veneer of made ground or tarmac to around 0.3m depth over sandy clayey gravel derived from the weathered limestone at around 1m depth. The former filling station was located on the site of an old stone quarry, however inspection of the fill surrounding the storage tanks (UG-NSA-16-20) only revealed clayey gravel and cobbles fill similar to the natural made ground elsewhere within the site, and contained within limestone bedrock surrounds.

2.4. Phase-specific Strategy

2.4.1. It was concluded that the Dorchester Phase 1B-Area 2 posed a localised risk of contamination associated with the former underground fuel tanks (UG-NSA-1-3, 5-7 and 16-20) and former buildings.

2.4.2. The site-wide strategy of ensuring clean cover soils to 600mm depth is considered to be appropriate approach. No requirement for hydrocarbon remediation of soils or groundwater was identified pending additional inspection / investigation of the former UST locations after emptying and removal of the tanks. The verification measures specific to dealing with USTs as set down in the approved Remediation Strategy were to be invoked with regard to the UG-NSA-1-3, UG-NSA-5-7 and US-NSA 16-20 locations.

3. Description of Works

3.1. General Approach

3.1.1. Preparatory works within Phase 1B: Area 2 included:

- soft strip and vegetation clearance;
- asbestos survey and strip in accessible buildings and structures;
- segregation of waste materials including wood, metal and plastic for recovery / disposal;
- demolition of all above ground structures.

3.1.2. Remediation earthworks within Phase 1b: Area 2 included:

- grubbing out of relict ground floor slabs, foundations, roadways and services down to natural strata;

- removal / treatment of underground storage tanks in accordance with the Remediation Strategy
- trim site surfaces to approximately -250mm below pre-existing ground levels
- crushing on-site of suitable hard materials (masonry, concrete and brick) to recover aggregate for reuse.

3.1.3. The works within the Phase D1b: Area 2, including site preparatory works, were carried out over the period from March 2014 and were completed by November 2014 with the exception of finalising development levels which SGP understands is to be completed by the developer.

3.1.4. The existing buildings were demolished following an asbestos survey carried out by a specialist sub-contractor. Removal of any asbestos containing material (ACM) from the buildings was carried out prior to demolition; copies of the asbestos survey reports and removal of ACM certificates are retained by URL and are available on request.

3.1.5. Shallow natural deposits of weathered limestone were present at surface levels following breaking out and removal of hard-standing. Bedrock of limestone underlies the weathered natural deposits and was encountered at a minimum depth of approximately 0.5m bgl.

3.1.6. Oversized materials (classed as those which may present an obstacle to sub-surface infrastructure and foundation construction), voids and relict structures such as foundations, drains and redundant infrastructure were removed. Recoverable materials such as concrete, brick and masonry were segregated before crushing to produce aggregate to be used by the developer as bulk fill or construction platform/sub-base under building footprints, roads and private gardens. Waste timbers were removed to a processing area in the north of the remaining Phase 1b area to undergo chipping prior to off-site removal. Scrap metal was sent for recycling.

3.1.7. An estimated 22,000m^3 of site-generated aggregate has been placed within 5 temporary stockpiles (referred to as Agg-D1B-SE, Agg-D1B-W, Agg-D1B-NW, Agg-D1B-SW and Agg-D1B-Centre) which are intended to be handed over to the developer for use within the Ph1b: Area 2.

3.2 Contamination Hot-Spots

3.2.1 Three areas within the Phase D1b: Area 2 were determined as potential contamination hotspots due to the presence of underground fuel tanks (UG-NSA-1-3, UG-NSA-5-7 and UG-NSA-16-20), the locations of which are indicated on Drawing D01. Previous intrusive investigations around the USTs identified that residual contamination existed although this was generally limited to fissures within the shallow bedrock, however there was considered to be potential for significant hydrocarbon contamination.

3.2.2 Tanks were subject to emptying, purging and removal, followed by validation testing as described in Section 4 and 5. Contamination indicators encountered were considered indicative of a small quantity of potentially unacceptable contamination consisting of black hydrocarbon impacted gravel. Contaminated arisings were removed and placed on an impermeable membrane in a temporary quarantine area within Phase D1b: Area 2 with along with arisings generated from other UST remediation within the wider site.

3.2.3 Validation testing on the base and sidewalls of the excavation following tank and contaminated arisings removal was carried out by SGP in accordance with the Remediation Strategy.

3.2.4 Following removal of the UG-NSA-1-3 tanks and their bedding surrounds, it was noted that residual hydrocarbon was present in the south and southeast faces of the excavation at below around 2.4m depth, down to the water table at around 3.0m depth. The hydrocarbon was a viscous black liquid that was present in some joints and bedding planes within the weathered rock. This material was excavated back to solid bedrock during the remediation works and prior to validation testing.

3.2.5 Groundwater monitoring in BH-NSA-06 by SGP at the same time as the UG-NSA-1-3 remediation recorded an approximate 20mm thick layer of LNAPL (light non-aqueous phase liquid) at around 3.17m depth below ground level. PID monitoring of the borehole headspace recorded a VOC concentration of 7ppm. A sample of the LNAPL was found to comprise a weathered heavy fuel oil with the characteristics of low mobility, low solubility and low volatility, and appeared to be the same substance as observed in the bedrock on the southern wall of the UG-NSA-1-3 excavation. Further remediation of this material was not required, however precautionary recommendations are made with respect to building gas protection and water mains protection in the potentially affected area, as shown on drawing D11

3.2.6 Following a period of turnover by URL, SGP sampled the quarantined soil stockpile on 24.09.14 to identify whether hydrocarbon contamination had reduced to concentrations acceptable for retention on the site. Three samples 'HC Spile 1A – 1C' were collected and submitted for TPHCWG analysis (lab ref: 14-11667). Concentrations were below the remediation target criteria and the stockpile material was placed into the excavation void of UST 22-23.

3.3 Validation of Formation Level Strata

3.3.1 It is a requirement under the Remediation Strategy that a 600mm cover of clean soils over made ground is placed in garden areas, however due to the requirement to trim development areas by -200mm below existing ground levels, made ground was largely absent due to the

shallowness of natural strata. This meant that a 400mm depth of natural soil/ weathered rock will be left which could form part of the full 600mm of garden soil cover after placement of garden topsoil.

3.3.2 In-situ sampling of the formation level strata was carried out by sampling of the upper 400mm at a test frequency of 1 sample per 500m^3, the residual depth 400mm depth equating to 1 sample per 1250m^2 plan area of development. Sixty one in-situ samples were collected from the exposed formation level with depth validation photos showing the 0-400mm soil profile. Samples were analysed for a suite of contaminants as specified within the Remediation Strategy.

3.3.3 Multiple or significantly elevated concentration exceedances within the in-situ sampling resulted in the collection of further validation samples to delineate areas around the exceedance and to provide further assessment.

3.4 Site Waste Management

3.4.1 As described, waste materials removed from the Phase D1b: Area 2 included timber, scrap metal, ACM and hydrocarbon impacted soils. Recovered wastes of metal and wood were temporarily stockpiled in the north of Phase D1B: Area 2 before off-site removal of further treatment and assessment.

3.4.2 Timber associated with beams, flooring and roof-trusses was recovered following demolition and were temporarily stockpiled in the north of Phase D1B: Area 2 along with recovered timber waste from the wider phase area. A specialist sub-contractor chipped the timber which has been subsequently removed from the site.

3.4.3 ACM removed prior to demolition works was disposed off-site by a specialist sub-contractor.

3.4.4 Hydrocarbon impacted arisings generated from the removal of contaminated strata from UG-NSA 1-3, 4, 5-7, 24-25 and 34-35 were temporarily stored on an area of hard-standing before placement on an impermeable membrane within the D1B:Area 2. The stockpile was frequently turned and mixed by a mechanical excavator to allow aeration of the soils before further sampling and assessment was carried out. The results of the further assessment are detailed within section 3.2.6 above, and in the SGP UST Remediation Verification Report (R1742-R06).

3.5 Constraints and Limitations

3.5.1 Remediation earthworks within the Phase 1B: Area 2 were constrained due to a number of live services which cross the site. An electricity cable crosses the southern half of the site in a westerly direction, whilst a water and sewer line run across the southern boundary. A

stand-off corridor was adopted in the location of the services during the remediation earthworks; SGP understand that the services are to be diverted at a later date. A number of structures are also to be retained within the site which has not undergone remediation; these are two buildings in the centre/south of the site (building 488 and 465) and a roadway in the north-west corner. The locations of these constraints to the remediation earthworks are reproduced in Drawings D02 and D03.

3.6 Unforeseen Contamination

3.6.1 No unforeseen contamination was identified or encountered during the remediation earthworks.

4. Inspections and Testing

4.1. SGP attended the site on nineteen occasions during and following the remediation earthworks. The dates and activities carried out in the Phase D1B: Area 2 during SGP attendance, cross referenced to the site inspection photographic record (Appendix A), formation level validation photo record (Appendix B) and Analysis Results (Appendix C) are summarised in the table below.

Table 4.1 SGP Inspection Summary

Date	SGP Activities	Record
05.12.13	Collection of in-situ validation samples (PLOT 459-SS1 – SS3) following demolition of building 459	Appendix A – Photo 1 Appendix B – Photo 1-3 Appendix C - Lab Ref: 13/11463
30.04.14	Site inspection prior to demolition works	Appendix A - Photos: 2-7
02.06.14	Site inspection; supervision of underground storage tanks UG-NSA 5-7 removal	A detailed photographic record; validation samples and laboratory certificates are provided within R1742-R06-UST Remediation Verification Report
03.06.14	Site inspection; supervision of underground storage tanks UG-NSA 5-7 and UG-NSA 1-3 removal	See R1742-R06- UST Remediation Verification Report
04.06.14	Site inspection; supervision of underground storage tanks UG-NSA 5-7 and UG-NSA 1-3 removal	See R1742-R06- UST Remediation Verification Report
05.06.14	Site inspection; supervision of underground storage tanks UG-NSA 5-7 and UG-NSA 1-3 removal; collection of validation samples	See R1742-R06- UST Remediation Verification Report
09.06.14	Site inspection; supervision of underground storage tanks UG-NSA 1-3 removal	See R1742-R06- UST Remediation Verification Report
09.07.14	Site inspection; supervision of underground storage tanks UG-NSA 1-3 removal; collection of validation samples	See R1742-R06- UST Remediation Verification Report
04.08.14	Site inspection; supervision of underground storage tanks UG-NSA 16-20 removal	See R1742-R06- UST Remediation Verification Report
07.08.14	Site inspection; supervision of underground storage tanks UG-NSA 16-20 removal; collection of validation samples	See R1742-R06- UST Remediation Verification Report

Date	SGP Activities	Record
18.08.14	Site inspection; in-situ formation level sampling (SS1, 5, 7, 9, 13-35)	Appendix B – Photos: 4-31 Appendix C- Lab Ref: 14-08441 & 14-9392
19.08.14	Site inspection; sample aggregate stockpile Agg-SE (1-3)	Appendix A – Photos: 8-14 Appendix C – Lab Ref: 14-08439 & 14-9392
26.08.14	Site inspection; sample aggregate stockpiles Agg-W (1-6), Agg-NW (1-3) & UST16-20 (A1-A2 & B1-B2)	Appendix A – Photos: 15-19 Appendix C – Lab Ref: 14-08801 & 14-9695
10.09.14	Site inspection; sample aggregate stockpile Agg-SW (1-8)	Appendix A – Photos: 20-25 Appendix C – Lab Ref: 14-09783 & 14-10359
24.09.14	Site inspection; in-situ formation level sampling (SS37-43, 46-48, 50-54 & 57); sample hydrocarbon arisings from UST remediation	Appendix A – Photos: 26-31 Appendix B – Photos 32-47 Appendix C – Lab Ref: 14-11667 & 14-10872
07.10.14-08.10.14	Site inspection; sample aggregate stockpiles Agg-SE (4-10) & Agg-SW (9-14), sample site won subsoil (Sub 1-3); in-situ formation level sampling (SS45, 49, 55-56, 58, 66, 69)	Appendix A – Photos: 32-36 Appendix B – Photos 48-54 Appendix C – Lab Ref: 14-11756 & 14-12168
22.10.14	Site inspection; sample aggregate stockpile Agg-Centre (1-2); sample site won subsoil (4-9); in-situ formation level sampling (SS59-60, 63-64, 67-68, 70-71); in-situ re-tests following exceedance SS38 (A-D), SS41 (A-D), SS42 (A-D)	Appendix A – Photos: 37-40 Appendix B – Photos 55-74 Appendix C – Lab Ref: 14-12802 & 14-12853
12.01.15	Completion visit; sample aggregate stockpile Agg-SW (15-18 & Agg-W (7-11) following finalised volumes	Appendix A – 41–48 Appendix C – Lab Ref: 15-00973 & 15-2346
20.01.16	Collection of 4 samples of site won subsoil stockpile following removal of asbestos impacted portion of stockpile	Appendix C – Lab Ref: 16/00802
04.02.16	Sampling of site won topsoil stockpile and vegetation stockpile prior to screening of organic matter	Appendix C – Lab Ref: 16/02787 & 16-4531

4.2. Validation of USTs (UG-NSA-1-3, 5-7 & 16-20) Removal

4.2.1. SGP attended site during the removal of UG-NSA-1-3 (03.06.14 – 09.07.14), UG-NSA-5-7 (02.06.14 – 05.06.14) and UG-NSA-16-20 (04.08.14 – 07.08.14) to carry out the required inspection and validation procedure as outlined within the Remediation Strategy. Information detailing the screening of excavated arisings, the collection of validation samples, removal of contaminated strata and the interpretation of the chemical results are discussed in detail within the SGP UST Verification Report (R1742-R06). Validation works within the report are supplemented with a detailed photographic record.

4.2.2. Minor volumes of contaminated soils were identified and removed during the removal of UG-NSA-1-3 and UG-NSA-5-7; no residual contamination was identified within the excavation of UG-NSA-16-20. Following the removal of tanks and concrete surrounds, and chasing out and removal of any contaminated soils, validation samples were collected from the sidewalls of the excavations. Concentrations of hydrocarbons within the validation samples were below the assessment criteria in all instances.

4.3. Validation of Formation Level Soils

4.3.1. Sampling and analysis was carried out to determine the suitability of formation level soils to form part of the 600mm soil cover system. Development levels for the site are yet to be confirmed by the developer; however in-situ sampling of the formation level will determine whether a reduced 200mm topsoil cover can be placed within garden areas providing the 400mm of natural strata is chemically suitable for retention.

4.3.2. A total of 62 samples (excluding re-samples) were taken from the stripped or replaced soil surfaces within the Phase D1B: Area 2 and within sampling cells which straddle both areas of the site. On the worst case assumption of the soils forming the lower 400mm of the garden / landscaping cover layer and a total site area of ~73,700m^2, the volume of validated soil is effectively 29,500m^3 and the test rate is equivalent to 1 sample per 475m^3, achieving the specified rate of 1 sample per 500m^3.

4.3.3. All samples were collected by SGP geo-environmental consultants and were placed in appropriate laboratory-provided containers and stored in cooled boxes. Samples submitted for chemical analysis were delivered to Jones Environmental Ltd (JEL) within 24 hours of collection and samples for asbestos screen were sent to Chemtest within 48 hours of collection. SGP retains chain of custody documentation.

4.3.4. Chemical laboratory certificates (13-11463, 14-9392, 14-11667, 14-12802, 14-12168, and 14-12802) and asbestos laboratory certificates (14-08441, 14-10872, 14-11756 and 14-12853) are included within Appendix C. Results are summarised in the table below and are compared to assessment criteria for garden cover soils.

Table 4.2 Analysis Summary for 0-400mm Formation Level Soils

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
SOM	62	0.2-22.8	-	None
pH	62	8-11.03	WRAS <5>8	**All**
asbestos fibre*	62	NFD (<0.001%)	<0.001%	None
antimony	59	<1-7	550	None
arsenic	66	7.8-40.70	32	**(1) SS38**
barium	62	14-500	1300	None
beryllium	62	<0.5-1.9	51	None
cadmium	62	<0.1-1.1	10	None
chromium	62	6.8-56.5	3000	None
chromium IV	62	<0.3	4.3	None
cobalt	62	2.8-16.8	240	None
copper	62	<1-42	300	None
lead	66	<5-613	450	**(1) SS42**

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
mercury	62	<0.1-0.4	1	None
molybdenum	62	0.5-5.2	670	None
nickel	62	7-33.8	130	None
selenium	62	<1	350	None
vanadium	62	20-124	75	**(9) SS7 SS21, SS33, SS38, SS42, SS58, SS64, Plot 459-SS2 & Plot 459-SS3**
water soluble boron	62	<0.1-2.9	291	None
zinc	62	14-621	300	**(1) SS68**
naphthalene	70	<0.04-0.8	1.5	None
acenaphthylene	70	<0.03-1.21	210	None
acenaphthene	70	<0.05-7.31	170	None
fluorene	70	<0.04-5.2	160	None
phenanthrene	70	<0.03-42.64	92	None
anthracene	70	<0.04-14.49	2300	None
fluoranthene	70	<0.03-77.02	260	None
pyrene	70	<0.03-59.42	560	None
benzo(a)anthracene	70	<0.06-29.44	3.1	**(1) SS37**
chrysene	70	<0.02-25.32	6	**(1) SS37**
benzo(bk)fluoranthene	70	<0.07-38.79	-	**-**
benzo(a)pyrene	70	<0.04-25.98	0.83	**(11) SS9, SS16, SS27, SS37, SS38, SS41, SS62, SS64, SS66, SS68, SS69**
indeno(123cd)pyrene	70	<0.04-14.04	3.2	**(1) SS37**
dibenzo(ah)anthracene	70	<0.04-1.91	0.76	**(1) SS37**
benzo(ghi)perylene	70	<0.04-12.68	44	None
aliphatic C5-C6	62	<0.1	30	None
aliphatic C6-C8	62	<0.1	73	None
aliphatic C8-C10	62	<0.1	19	None
aliphatic C10-C12	62	<0.2-33.3	93	None
aliphatic C12-C16	62	<4-71	740	None
aliphatic C16-C21	62	<7-8	1000	None
aliphatic C21-C35	62	<7-157	1000	None
aromatic C6-C7	62	<0.1	30	None
aromatic C7-C8	62	<0.1	120	None
aromatic C8-C10	62	<0.1	27	None
aromatic C10-C12	62	<0.2-2	69	None
aromatic C12-C16	62	<4-22	140	None
aromatic C16-C21	62	<7-218	250	None
aromatic C21-C35	62	<7-418	890	None
benzene	62	<0.005	0.08	None
toluene	62	<0.005	120	None
ethylbenzene	62	<0.005	65	None
o-xylene	62	<0.005	45	None
m-xylene	62	<0.005	44	None

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
p-xylene	62	<0.005	42	None
methyl tert butyl ether	62	<0.005	49	None

* not included in approved Waterman's Remedial Strategy but proposed in SGP revised Strategy, R1742-R01 Table 6.2

4.4. Validation of Formation Level Soils – Arsenic Exceedance

4.4.1. A single sample of the natural soil of weathered bedrock in D1B-SS38 was found to marginally exceed the 32 mg/kg screening criteria for arsenic, at 40.7 mg/kg. Following the exceedance a further four samples (SS38A-SS38D) were collected within the D1B-SS38 sampling location to assess whether the elevated arsenic was representative of the soils within that area. Re-test results were below the respective assessment criteria with a concentration range of 13.9-21.9 mg/kg. In the absence of any identified anthropogenic material, it was determined that a statistical estimate should be carried out of the sample mean within the Phase 1B: Area 2 as a single averaging area. The location of the arsenic exceedance is reproduced in Drawing D03 with results of the statistical analysis tabulated in the table below:

Table 4.3 Statistical Analysis of Arsenic Concentrations

statistic	arsenic (mg/kg)
criterion	32.0
no. of samples	66
Grubbs outlier test for highest value (P0.05)	D1B-SS38 (max value 40.7 mg/kg) is an outlier
arithmetic mean, including outlier	18.5
upper confidence limit (UCL 0.95) including outlier	19.37 (pass)
arithmetic mean, excluding D1B-SS12 outlier	17.80 (pass)
upper confidence limit (UCL 0.95) excluding outlier	18.89 (pass)

4.4.2. The statistical analysis shows that the single arsenic exceedance is a statistical outlier with a UCL (0.95) of 19.37 mg/kg when the outlier of D1B-SS38 is included in the dataset. Arithmetic mean of arsenic concentrations within the D1B: Area 2 including the outlier is below the assessment criteria (32 mg/kg) with a concentration of 18.5 mg/kg.

4.4.3. Soil sampled was of natural appearance from an area of the site remote from identified historical contaminative activities, identical in appearance to other soils around the phase, and mineralisation is therefore likely to be of natural origin. Typically the bio-accessibility of naturally occurring arsenic associated with ironstones (normally present in the form of arsenopyrite) will be low, and the risk to future residential use is therefore considered also likely to be low. Updated generic soil quality criteria were published by LQM/CIEH in 2015,

following DEFRA and EA guidance, referred to as "Safe for Use" levels or S4ULs, indicating minimal risk of harm to human health[2]. The S4UL for arsenic in residential garden soil where plants may be grown for consumption is 37 mg/kg. The maximum soil concentration recorded was only slightly above this value.

4.5. Validation of Formation Level Soils – Vanadium Exceedances

4.5.1. Exceedances of vanadium were recorded in 9 samples (D1B: SS7, SS21, SS33, SS38, SS42, SS58, SS64, Plot 459-SS2 and Plot 459-SS3), exceeding the 75 mg/kg screening criterion with a maximum concentration of 124 mg/kg.

4.5.2. Statistical analysis on the dataset including the exceedances are summarised in the table below with vanadium locations reproduced on Drawing D06.

Table 4.4 Statistical Analysis of Vanadium Concentrations

statistic	vanadium (mg/kg)
criterion	75
no. of samples	62
Grubbs outlier test for highest value (P0.05)	No Outliers
arithmetic mean, including outlier	59.56
upper confidence limit (UCL 0.95)	64.59 (pass)
arithmetic mean, excluding outlier	As above (no outlier) - Pass
upper confidence limit (UCL 0.95) excluding outlier	As above (no outlier) - Pass

4.5.3. Elevated vanadium concentrations were not determined as statistical outliers with concentrations recorded within the natural background concentrations of the ironstone domain. Statistical analysis of the dataset produced an arithmetic mean of 59.56 mg/kg and an Upper Confidence Limit of 64.59 mg/kg below the assessment criteria of 75 mg/kg.

4.5.4. Vanadium forms very insoluble compounds with iron as demonstrated by analysis of naturally elevated concentrations in soils formed on Jurassic ironstone rocks in the elsewhere in the UK[1]. The GAC screening criterion is published by LQM/CIEH based on a tolerable daily intake (oral) of 3 µg per kg bodyweight per day of vanadium in the form of sodium metavanadate, a highly soluble compound (water solubility 211 g/l. The GAC is therefore highly conservative and is unrealistic for exposure to naturally occurring vanadium in soil.

4.5.5. An updated GAC has been published by LQM/CIEH since the date of the Remediation Strategy in the S4ULs for Human Health Risk Assessment[2] document. The report provides

[1] N Breward, BGS "Arsenic and presumed resistate trace element geochemistry of the Lincolnshire (UK) sedimentary ironstones, as revealed by a regional geochemical survey using soil, water and stream sediment sampling". Applied Geochemistry 22 (2007) 1970-1993

[2] Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3102. All rights reserved

an updated assessment utilising revised toxicological data. In the case of vanadium, the tolerable daily intake (oral) has increased to 10 µg per kg bodyweight per day of vanadium. A revised vanadium GAC value of 410 mg/kg for residential soil with plant uptake is reported, this would result in all vanadium concentrations within the D1B: Area 2 falling below the GAC.

4.5.6. It is concluded that vanadium within the site and within future garden soils poses no significant risk to human health.

4.6. Validation of Formation Level Soils – Lead and Zinc Exceedance

4.6.1. Single exceedances of the metals lead (613 mg/kg) and zinc (621 mg/kg) were reported in sample D1B-SS42 (lab ref: 14-11667) and sample D1B-SS68 respectively. Following the reported exceedance of lead which was though likely to be due to lead based paint used on the site, SGP attended site to collect a further 4 samples (denoted SS42 A-D) to confirm whether the exceedance was representative of the soil within the area. Re-test concentrations were significantly reduced and below the assessment criteria with a lead concentration range of 7-16 mg/kg. The exceedance location of lead and in-situ retest locations are reproduced in Drawing D07 and D08.

4.6.2. Statistical analysis has been completed on the dataset to confirm that the single exceedances of lead and zinc are outliers. Results of the analysis are summarised in the table below:

Table 4.5 Statistical Analysis of Lead and Zinc Concentrations

statistic	lead (mg/kg)	Zinc (mg/kg)
criterion	200	300
no. of samples	66	62
Grubbs outlier test for highest value (P0.05)	D1B-SS42 (max value 613 mg/kg) is an outlier	D1B-SS68 (max value 621 mg/kg) is an outlier
arithmetic mean, including outlier	28.01	66.50
upper confidence limit (UCL 0.95)	43.32 (pass)	83.66 (pass)
arithmetic mean, excluding outlier	19.01 (pass)	57.41 (pass)
upper confidence limit (UCL 0.95) excluding outlier	21.99 (pass)	65.55 (pass)

4.6.3. It is concluded that the both the elevated lead (D1B-SS42) and zinc (D1B-SS68) samples are statistical outliers and even when included within the dataset the upper confidence limit and arithmetic mean are below the respective assessment criteria.

4.6.4. The assessment criterion for zinc is based on the DEFRA sensitive plant species threshold value of 300 mg/kg, a concentration at which phytotoxic effects may be observed within metal-sensitive plants. The recently published LQM/CIEH S4ULs for Human Health Risk

Assessment adopt a concentration of 3,700 mg/kg of zinc for residential soils with plant uptake calculated with updated toxicological data within CLEA v1.06. For the purpose of human health risk assessment the zinc concentrations have been compared to the S4UL value of 3,700 mg/kg which is specific for the intended end-use of the site; this would result in the initial exceedance falling below the criterion.

4.7. Validation of Formation Level Soils – PAH Exceedances

4.7.1. Eleven sampling locations (D1B-SS9, SS16, SS27, SS37, SS38, SS41, SS62, SS64, SS66, SS68 and SS69) recorded elevated concentrations of PAHs, these were generally limited to the PAH benzo(a)pyrene (BaP), however sample D1B-SS37 contained widespread PAH exceedances of benzo(a)anthracene, chrysene, benzo(a)pyrene, ideno(a)pyrene, dibenzo(ah)anthracene, benzo(b)fluoranthene and benzo(k)fluoranthene. Exceedances of BaP ranged between 0.85 mg/kg in D1B-SS9 (a marginal exceedance of 0.02 mg/kg) to a maximum concentration of 25.98 mg/kg in D1B-SS37. The exceedance locations of PAH are reproduced in Drawing D09.

4.7.2. Widespread B(a)P exceedances of the assessment criteria (0.83 mg/kg) excluding the D1B-SS7 location ranged from 0.85 mg/kg to 3.12 mg/kg, a similar concentration range to those recorded in the D1B: Area 1.

4.7.3. PAH ratio analysis to confirm the source of the PAHs on the 11 samples where exceedances in retained soils remained was carried out in order to determine the likely source. Source identification suggests a coal (pyrolitic) source; a copy of the plot is included within Appendix D. It is likely as per previous PAH exceedances across the re-development area that inclusions of relatively small proportions of coal/clinker/tarmac may be mixed up within the formation level soils following removal of hard-standing and the -200mm trim. Source identification confirms a probable low bio-availability due to the sequestration of PAHs within a carbon or vitrified matrix with BaP concentrations (with the exception of sample D1B-SS7) significantly below the DEFRA C4SL criteria of 5 mg/kg for garden soils, and BaP is therefore unlikely to represent an unacceptable risk to human health.

4.7.4. Multiple PAH exceedances reported within validation sample D1B-SS37 are located within an area of proposed landscaping associated with the cricket pitch, therefore there is only a requirement for a reduced (300mm) cover system. The risk associated to residual PAHs beneath the reduced cover system in landscaped/open space areas is considered low in comparison to soils within private garden areas.

4.8. Validation of Formation Level Soils – pH Exceedances

4.8.1. Soil pH values ranged from 8 within D1B-SS28 to alkaline at 11.03 within D1B-SS52 with all samples (62) exceeding the former WRAS trigger pH value of >8. Elevated concentrations of

pH are likely to be attributed to the ubiquitous presence of carbonate limestone identified across the NSA, although the highest pH values are probably also indicative of concrete fragments; the hydroxides in freshly exposed concrete will undergo carbonation over a period of days, with an accompanying reduction in pH.

4.9. Validation of Site Generated Crushed Aggregate

4.9.1. Sampling and analysis was carried out to determine the suitability of crushed recovered aggregate for potential reuse during the development phase. A total of five stockpiles of processed aggregate remain on the D1B: Area 2, the locations of which are reproduced on Drawing D10. It is proposed that the stockpiles will be handed over to the developer for use during construction. Stockpiles have been denoted as "Centre, SE, SW, W and NW" depending on their location within the phase, their approximate volumes and sampling frequencies completed are summarised in the table below:

Table 4.6 Site Generated Aggregate Stockpile Sampling Information

Stockpile Ref	Approximate Volume (m^3)	No. Chemical Tests	Sampling Frequency	No. Asbestos Tests	Sampling Frequency
D1B-Centre	1,000	1	1 per 1000m^3	2	1 per 500m^3
D1B-SE	5,000	5	1 per 1000m^3	10	1 per 500m^3
D1B-SW	9,000	9	1 per 1000m^3	18	1 per 500m^3
D1B-W	5,500	6	1 per 917m^3	11	1 per 500m^3
D1B-NW	1,500	2	1 per 750m^3	3	1 per 500m^3
Total	**22,000**	**23**	**1 per 956m^3**	**44**	**1 per 500m^3**

4.9.2. Results of the chemical testing (lab ref: 14-9392, 14-12168, 14-9695, 14-10359, 14-12802 and 15-2346) and asbestos screen (lab ref: 14-08439, 14-11756, 14-08801, 14-09783, 14-12853 and 15-00973) are provided in Appendix C and are summarised in the table below:

Table 4.7 Screening Summary for Aggregate Stockpiles within D1B: Area 2

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Screening criteria* (mg/kg unless stated)	Albion Water Pipeline Screening Criteria (mg/kg unless stated)	Exceedances
SOM	23	0.2-23	-	-	-
pH	23	8.49-11.95	WRAS <5>8	-	**All**
asbestos fibre*	47	NFD (<0.001%)	<0.001%	-	None
antimony	23	<1-4	550	-	None
arsenic	23	9.10-45	**32**	-	**(2) W-Agg7, SW-Agg-2**
barium	23	34-211	1300	-	None
beryllium	23	<0.5-1.10	51	-	None
cadmium	23	<0.1-0.9	10	-	None
chromium	23	14.3-51.2	3000	-	None

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Screening criteria* (mg/kg unless stated)	Albion Water Pipeline Screening Criteria (mg/kg unless stated)	Exceedances
chromium IV	23	<0.3-0.6	4.3	-	None
cobalt	23	3.4-7.8	240	-	None
copper	23	<1-18	300	-	None
lead	23	8-150	450	-	None
mercury	23	<0.1-0.2	1	-	None
molybdenum	23	0.8-3.5	670	-	None
nickel	23	8.4-24.3	130	-	None
selenium	23	<1	350	-	None
vanadium	23	24-56	75	-	None
water soluble boron	23	0.9-4.6	291	-	None
zinc	23	32-230	300	-	None
naphthalene	23	<0.04-1.21	1.5	-	None
acenaphthylene	23	<0.03-0.6	210	-	None
acenaphthene	23	<0.05-1.83	170	-	None
fluorene	23	<0.04-1.23	160	-	None
phenanthrene	23	<0.05-13.35	92	-	None
anthracene	23	<0.04-4.40	2300	-	None
fluoranthene	23	<0.06-18.92	260	-	None
pyrene	23	<0.06-15.28	560	-	None
benzo(a)anthracene	23	<0.06-7.62	**3.1**	-	**(7) SE-S4, SE-S5, W-Agg8, SW-Agg1, SW-Agg3, SW-S12, SW-S13**
chrysene	23	<0.04-7.16	**6**	-	**(1) SW-S13**
benzo(bk)fluoranthene	23	<0.07-11.85	-	-	**-**
benzo(a)pyrene	23	<0.04-8.27	**0.83**	-	**(12) SE-Agg1, SE-S4, SE-S5, SE-S6, W-Agg7, W-Agg8, SW-Agg1, SW-Agg2, SW-Agg3, SW-S12, SW-S13, Centre-1**
indeno(123cd)pyrene	23	<0.04-5.36	**3.2**	-	**(2) SE-S5, SW-12**
dibenzo(ah)anthracene	23	<0.04-0.8	**0.76**	-	**(2) SE-S5, SW-12**
benzo(ghi)perylene	23	<0.04-4.57	44	-	None
aliphatic C5-C6	23	<0.1	30	10	None
aliphatic C6-C8	23	<0.1	73	10	None
aliphatic C8-C10	23	<0.1	19	10	None
aliphatic C10-C12	23	<0.2-<0.8	93	10	None
aliphatic C12-C16	23	<4-<16	740	**10**	**(3) W-Agg7, W-Agg9, SW-Agg16**
aliphatic C16-C21	23	<7-28	1000	**10**	**(3) W-Agg7, W-Agg9, SW-Agg16**
aliphatic C21-C35	23	<7-153	1000	500	None
aromatic C6-C7	23	<0.1	30	10	None

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Screening criteria* (mg/kg unless stated)	Albion Water Pipeline Screening Criteria (mg/kg unless stated)	Exceedances
aromatic C7-C8	23	<0.1	12	10	None
aromatic C8-C10	23	<0.1	27	10	None
aromatic C10-C12	23	<0.2-1.4	69	10	None
aromatic C12-C16	23	<4-18	140	**10**	**(1) SE-S6**
aromatic C16-C21	23	<7-118	250	**10**	**(13) SE-Agg1, SE-S4, SE-S5, SE-S6, W-Agg3, SW-Agg1, SW-Agg2, SW-Agg3, SW-Agg4, SW-S12, SW-S13, SW-S14, Agg-Centre1**
aromatic C21-C35	23	<7-416	890	500	None
benzene	23	<0.005	0.08	0.1	None
toluene	23	<0.005	120	0.1	None
ethylbenzene	23	<0.005	65	0.1	None
o-xylene	23	<0.005	45	0.1	None
m-xylene	23	<0.005	44	0.1	None
p-xylene	23	<0.005	42	0.1	None
methyl tert butyl ether	23	<0.005	49	0.1	None

* not included in approved Remedial Strategy but proposed in SGP revised Strategy, R1742-R01 Table 6.2

4.2.1 All samples collected from the D1B: Area 2 stockpiles were reported as containing 'no asbestos fibres present'. Chemical exceedances above the assessment criteria for material within the capping / garden cover system were reported within the following stockpiles:

Table 4.8 Exceedance of capping / garden cover system criteria for Aggregate Stockpiles within D1B: Area 2

Stockpile	Exceedance of capping / garden cover system criteria
D1b-Centre	benzo(a)pyrene
D1b-SE	benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123cd)pyrene and dibenzo(ah)anthracene
D1b-SW	arsenic, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123cd)pyrene;
D1b-W	arsenic, benzo(a)anthracene, benzo(a)pyrene;
D1b-NW	none

4.2.2 Aliphatic (C12-C16 and C16-C21) and aromatic (C12-C16 and C16-C21) hydrocarbons exceeded the Albion Water Pipeline Screening criteria (10 mg/kg) in at least one instance within all stockpiles with the exception of AGG-NW where there were no exceedances. A maximum concentration of 118 mg/kg for the aromatic (C16-C21) range was reported in stockpile Agg-SE (S6).

4.2.3 It is anticipated that the PAH and aromatic hydrocarbon exceedances are attributed to the minor presence of "tarmac" fragments which have been processed with the concrete hard-standing during crushing.

4.2.4 The stockpiles (SE, SW and W) have been sampled for grading analysis with a total of 5 samples collected for analysis by Murray Rix. The laboratory certificate of analysis is provided in Appendix C; all samples met the grading requirement for class 6F2 material.

4.3 D1B Phase Won Subsoil

4.3.1 During the preparatory earthworks within the larger D1B area, approximately 400m^3 of subsoil was recovered from landscaped areas and verges. The subsoil was temporarily stockpiled in the south of the D1B: Area 2 pending testing to determine the suitability for re-use within the development.

4.3.2 SGP collected 4 samples (lab ref: 14-11756 and 14-12168) achieving a sampling frequency of 1 sample per 100m^3 of soil and submitted them for analysis in accordance with chemical criteria outlined in the Strategy for material in the capping layer. Results are summarised in the table below:

Table 4.9 Analysis summary for D1B won subsoil

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
SOM	4	1.4-1.8	-	None
pH	4	8.07-8.53	WRAS <5>8	None
asbestos fibre*	4	Fibres Detected	<0.001%	**1: Sub-1 (Possible exceedance, asbestos not quantified)**
antimony	4	1-2	550	None
arsenic	4	18.7-25.6	32	None
barium	4	96-108	1300	None
beryllium	4	1.1-1.6	51	None
cadmium	4	<0.1-0.2	10	None
chromium	4	34.6-71.3	3000	None
chromium IV	4	<0.3	4.3	None
cobalt	4	8-13.5	240	None
copper	4	4-14	300	None
lead	4	24-27	450	None
mercury	4	<0.1	1	None
molybdenum	4	1.9-3.3	670	None
nickel	4	18.5-34.1	130	None
selenium	4	<1	350	None
vanadium	4	56-103	75	**2: Sub-2, Sub-3**
water soluble boron	4	1.3-2.2	291	None
zinc	4	69-88	300	None

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
naphthalene	4	<0.04-<0.8	1.5	None
acenaphthylene	4	<0.03-<0.6	210	None
acenaphthene	4	<0.05-<1	170	None
fluorene	4	<0.04-<0.8	160	None
phenanthrene	4	0.27-0.99	92	None
anthracene	4	0.06-<0.8	2300	None
fluoranthene	4	0.47-1.7	260	None
pyrene	4	0.41-1.48	560	None
benzo(a)anthracene	4	0.25-<1.2	3.1	None
chrysene	4	0.26-0.95	6	None
benzo(bk)fluoranthene	4	0.35-1.79	-	None
benzo(a)pyrene	4	0.18-1.2	0.83	**1: Sub-4**
indeno(123cd)pyrene	4	0.16-0.73	3.2	None
dibenzo(ah)anthracene	4	<0.04-<0.8#	0.76	None
benzo(ghi)perylene	4	0.13-<0.8	44	None
aliphatic C5-C6	4	<0.1	30	None
aliphatic C6-C8	4	<0.1	73	None
aliphatic C8-C10	4	<0.1	19	None
aliphatic C10-C12	4	<0.2	93	None
aliphatic C12-C16	4	<4	740	None
aliphatic C16-C21	4	<7	1000	None
aliphatic C21-C35	4	<7	1000	None
aromatic C6-C7	4	<0.1	30	None
aromatic C7-C8	4	<0.1	120	None
aromatic C8-C10	4	<0.1	27	None
aromatic C10-C12	4	<0.2	69	None
aromatic C12-C16	4	<4	140	None
aromatic C16-C21	4	<7-22	250	None
aromatic C21-C35	4	<7-145	890	None
benzene	4	<0.005	0.08	None
toluene	4	<0.005	120	None
ethylbenzene	4	<0.005	65	None
o-xylene	4	<0.005	45	None
m-xylene	4	<0.005	44	None
p-xylene	4	<0.005	42	None
methyl tert butyl ether	4	<0.005	49	None

* not included in approved Waterman's Remedial Strategy but proposed in SGP revised Strategy, R1742-R01 Table 6.2

Concentration exceeds screening criteria following x20 dilution

4.3.3 Three potential exceedances were reported above the assessment criteria with the identification of chrysotile fibres in cement form within sample Sub-1 (not quantified), two exceedances for vanadium (Sub-2 and Sub-3) and a single exceedance for the PAH benzo(a)pyrene (Sub-4).

4.3.4 Following identification of asbestos fibres within sample Sub-1, SGP collected a further 5 samples (lab ref: 14-12853) from the stockpile to delineate the volume impacted by asbestos fibres. The further screening indicated that no additional fibres were detected and consequently only the northern portion of the stockpile (location of Sub-1) was determined not suitable for use within the capping layer or placement at shallow depth where future disturbance is likely.

4.3.5 The Remediation Strategy notes in Section 4.6.5 that if asbestos fibre is detected in quantifiable amounts (over 0.001%) in fills, then this material will be excluded from use in soil cover and will be placed at depths over 1m below ground level within excavations (primarily within tank backfills) subject to geotechnical suitability.

4.3.6 URL subsequently segregated the impacted subsoil and placed it as backfill within the remediated tank void of UG-NSA-22-23. SGP collected a further 4 samples of the subsoil (lab ref: 16/00802) following removal of the impacted portion to confirm adequate removal; no further asbestos incidences were reported.

4.3.7 Minor vanadium exceedances of 93 mg/kg (Sub-2) and 108 mg/kg (Sub-3) were reported however these concentrations are lower than those reported within the in-situ formation soils which have undergone further assessment (see section 4.5) and are deemed to pose no significant risk to human health. The values are substantially below the 2015 S4UL generic assessment criterion for garden soil of 410 mg/kg referred to above.

4.3.8 A minor exceedance of the assessment criteria for benzo(a)pyrene (1.2 mg/kg) was reported in sample Sub-4 which following a PAH source identifications confirms a coal signature with a probably low bio-availability due to the sequestration of PAHs within a carbon of vitrified matrix with BaP concentrations significantly below the DEFRA C4SL criteria of 5 mg/kg and the LQM/CIEH S4UL of 2.2 mg/kg for garden soils. Minor exceedances were reported within the formation level soils at concentrations similar to that within the subsoil stockpile, further assessment has been provided (section 4.7) and confirmed that the reported BaP concentrations are unlikely to represent an unacceptable risk to human health.

4.3.9 It is concluded that following the removal of the fibre impacted section (northern 100m^3) of subsoil then the remaining 300m^3 is suitable for use within the capping layer.

4.4 D1B Phase Won Topsoil

4.4.1 During the preparatory earthworks within the larger D1B area, approximately 300m^3 of topsoil (TS1) and 600m^3 of vegetation strip including topsoil (TS2) was recovered and temporarily stockpiled in the south of the D1B: Area 2, adjacent to the site won subsoil, pending testing to determine the suitability for re-use within the development.

4.4.2 SGP collected 3 samples (lab refs: 16-4531 & 16-02787) of the topsoil stockpile on 04/02/2016 achieving a sampling frequency of 1 sample per 100m^3 and 2 samples of the vegetation stockpile prior to organic matter removal at a screening frequency of 1 sample per 300m^3 to determine the potential for re-use. Results are summarised in the table below:

Table 4.10 Analysis summary for D1B won topsoil

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
SOM	5	3-5.1	-	None
pH	5	7.86-8.25	WRAS <5>8	**(3) D1B-TS1-A, D1B-TS1-C, D1B-TS2-A, D1B-TS2-B**
asbestos fibre*	5	NAD	<0.001%	None
antimony	5	-	550	None
arsenic	5	27-47.6	32	**(3) D1B-TS1-C, D1B-TS2-A, D1B-TS2-B**
barium	5	68-159	1300	None
beryllium	5	1.1-2.7	51	None
cadmium	5	<0.1	10	None
chromium	5	42.6-98.8	3000	None
chromium IV	5	<0.3	4.3	None
cobalt	5	8.4-14.8	240	None
copper	5	13-19	300	None
lead	5	44-77	450	None
mercury	5	<0.1-0.1	1	None
molybdenum	5	1.5-2.2	670	None
nickel	5	19.4-45.1	130	None
selenium	5	1-2	350	None
vanadium	5	70-172	75	**(4) D1B-TS1-A, D1B-TS1-B, D1B-TS1-C, D1B-TS2-B**
water soluble boron	5	1.9-4.6	291	None
zinc	5	81-165	300	None
naphthalene	5	<0.04	1.5	None
acenaphthylene	5	<0.03-0.09	210	None
acenaphthene	5	<0.05	170	None
fluorene	5	<0.04	160	None
phenanthrene	5	0.14-0.42	92	None
anthracene	5	<0.04-0.18	2300	None
fluoranthene	5	0.38-1.56	260	None
pyrene	5	0.31-1.43	560	None
benzo(a)anthracene	5	0.19-0.85	3.1	None
chrysene	5	0.19-0.88	6	None
benzo(bk)fluoranthene	5	0.33-1.69	-	None
benzo(a)pyrene	5	0.19-0.96	0.83	**(1) D1B-TS2-B**
indeno(123cd)pyrene	5	0.14-0.7	3.2	None
dibenzo(ah)anthracene	5	0.06-0.12	0.76	None
benzo(ghi)perylene	5	0.13-0.65	44	None
aliphatic C5-C6	5	<0.1	30	None
aliphatic C6-C8	5	<0.1	73	None

Contaminant	Samples	Range of Concentrations (mg/kg unless stated)	Residential Use	
			Screening criteria* (mg/kg unless stated)	Exceedances
aliphatic C8-C10	5	<0.1	19	None
aliphatic C10-C12	5	<0.2	93	None
aliphatic C12-C16	5	<4	740	None
aliphatic C16-C21	5	<7	1000	None
aliphatic C21-C35	5	<7-35	1000	None
aromatic C6-C7	5	<0.1	30	None
aromatic C7-C8	5	<0.1	120	None
aromatic C8-C10	5	<0.1	27	None
aromatic C10-C12	5	<0.2	69	None
aromatic C12-C16	5	<4	140	None
aromatic C16-C21	5	<7-31	250	None
aromatic C21-C35	5	<7-504	890	None
benzene	5	<0.005	0.08	None
toluene	5	<0.005	120	None
ethylbenzene	5	<0.005	65	None
o-xylene	5	<0.005	45	None
m-xylene	5	<0.005	44	None
p-xylene	5	<0.005	42	None
methyl tert butyl ether	5	<0.005	49	None

* not included in approved Waterman's Remedial Strategy but proposed in SGP revised Strategy, R1742-R01 Table 6.2

4.4.3 A single minor arsenic exceedance of 38.6 mg/kg was reported in the topsoil stockpile (D1B-TS1-C) and two exceedances of 32.9 mg/kg and 47.6 mg/kg within the two samples from vegetation stockpile D1B-TS2. When concentrations are compared to the LQM/CIEH Suitable For Use Levels (S4UL) for a residential scenario at 37 mg/kg only two exceedances occur, one within each stockpile remain, and one of these was marginal. The average of all 5 tests is 35.2 mg/kg, with the results being normally distributed and the maximum value is not a statistical outlier.

4.4.4 No made ground or ashy deposits were observed within the topsoil and it is anticipated that some vertical mixing of the underlying ironstone where naturally elevated arsenic and vanadium concentrations have been reported within similar concentration ranges has taken place. Typically the bio-accessibility of naturally occurring arsenic associated with ironstones (normally present in the form of arsenopyrite) will be low, and the risk to future residential use is therefore considered to be low.

4.4.5 Vanadium exceedances were reported within 5 out of the 6 samples collected with exceedance concentrations ranging from 76 mg/kg (D1B-TS1-B) to 172 mg/kg (D1B-TS1-B). Concentrations reported were similar to those reported within the in-situ formation soils which have undergone further assessment (see section 4.5) and are deemed to pose no significant risk to human health.

4.4.6 A minor exceedance of the assessment criteria for the PAH benzo(a)pyrene (0.96 mg/kg) was reported within sample D1B-TS2-A which exceeded the criteria of 0.94 mg/kg when the relevant SOM content of 2.5% is adopted. When the recently published S4UL for B(a)P is utilised for a residential scenario with an SOM content of 2.5% the assessment criteria is raised to 2.7 mg/kg resulting in no exceedances. It is therefore determined that the reported B(a)P concentrations are unlikely to represent an unacceptable risk to human health.

4.5 Unknown Contamination

4.5.1 No previously unknown contamination was encountered within the Dorchester Phase 1b: Area 2, with the exceptions of the locally elevated natural concentrations of arsenic and vanadium within the formation level strata. Exceedances of the PAHs, primarily benzo(a)pyrene, zinc, lead and arsenic have been identified and have undergone further assessment.

5. Conclusions and Recommendations

5.1. Verification of Remediation

5.1.1. The site formation level surfaces and generated aggregate materials have been inspected and sampled by SGP in accordance with the approved Remediation Strategy. The types of materials encountered during the additional assessment and remediation works carried out in Phase 1B: Area 2 area was consistent with those described in the site characterisation.

5.1.2. On the basis that URL has stripped the overall area to -200mm existing ground levels (development levels are yet to be confirmed), SGP has validated and sampled the formation level surfaces to an average depth of 400mm (see validation photos in Appendix B). A sampling frequency of 1 per 500m^3 of potential cover soil material has therefore been achieved.

5.1.3. One exceedance of the arsenic screening criterion and 9 of vanadium were identified with capping layer soils, however concentrations are considered to represent normal background concentrations in the area arising from the bedrock, and evidence is available to suggest their low bio-availability, and consequent minimal significance for human health.

5.1.4. Statistical analysis conducted on the sample of arsenic exceedance confirmed that sample D1B-SS38 (40.7 mg/kg) was a statistical outlier to the dataset and when the outlier was removed, the upper confidence limit (UCL 0.95) reduced to 18.89 mg/kg below the assessment criteria value of 32 mg/kg. Statistical analysis on vanadium exceedances confirmed that concentrations were not outliers and is typical of natural background concentrations, the UCL (0.95) of the D1B: Area 2 dataset for vanadium produced a

concentration of 64.59 mg/kg, below the assessment criteria of 70 mg/kg. SGP conclude that on the basis of statistical analysis and assessment on the solubility and availability to human uptake that there is a minimal risk to future site occupants on the basis of arsenic and vanadium concentrations present in the capping layer soils.

5.1.5. Development levels are not finalised, and whilst in-situ validation sampling has been carried out to confirm the suitability of a reduced cover system in garden areas (i.e. 200mm of topsoil placed on top of validated formation level strata) it is possible that the final levels will require more than 200mm additional topsoil cover. SGP considers that the occurrences of elevated arsenic and vanadium in some validation samples represent normal background concentrations and are very unlikely to pose a risk to human health for future site residents, due to low bioavailability of these elements. However the concentrations do exceed the approved Remedial Strategy criteria and therefore represent a departure from the Strategy which should be agreed with CDC.

5.1.6. Single minor exceedances were reported for lead (D1B-SS42) and zinc (D1B-SS68) within formation soils, however statistical analysis confirmed that both lead (613 mg/kg) and zinc (621 mg/kg) were statistical outliers. When the outliers were removed from the dataset the UCL (0.95) for lead reduced to 21.00 mg/kg and zinc reduced to 65.55 mg/kg, both below their respective assessment criteria of 200 mg/kg and 300 mg/kg.

5.1.7. Exceedance of the soil cover screening criterion for benzo(a)pyrene (BaP) was found in a total of 11 sampling locations. One sampling location (D1B-SS37) reported multiple PAH exceedances, however this was located within a proposed open space / landscaping area associated with the cricket pitch and a 300mm soil cover is required rather than a full 600mm as per private gardens.

5.1.8. Residual exceedances for BaP were significantly below the DEFRA C4SL for garden soils of 5 mg/kg (with the exception of D1B-SS37) and a source identification ratio plot confirms the likely source to be coal. The identified sources are likely to be of low significance in terms of solubility and bioavailability due to the sequestration within coal / coal ash or bitumen, and in light of concentrations below the C4SL value SGP considers that the risk associated to future site occupants to concentrations within the capping layer to be minimal. Both DCLG and NHBC have confirmed that they consider C4SLs as useful in assessing the suitability of soils for planned residential land uses. Again, the concentrations do exceed the approved Remedial Strategy criteria and therefore represent a departure from the Strategy which should be agreed with CDC.

5.1.9. Three clusters of underground fuel storage tanks were located within the site (UG-NSA1-3, 5-7 and 16-20) associated with two former boiler houses and a petrol filling station. The tank

contents were removed for specialist treatment and the tank and surrounds were removed in accordance with the Remediation Strategy requirements, together with a small volume of hydrocarbon impacted soil / gravel. The tank surrounds were validated in accordance with the Strategy, and no significant hydrocarbon contamination was found; accordingly, no further remediation was required. Weathered fuel oil is recorded within bedrock, floating on the water table, in ground to the immediate south and southeast of UG-NSA-1-3; there is no requirement under the Remediation Strategy for further works to remove this; the plume areas has been previously shown to be effectively immobile and will be subject to depletion by natural processes (microbial decomposition).

5.2. Recovered Materials

5.2.1. Approximately 22,000m^3 recovered aggregate was generated on site and is temporarily placed in 5 stockpiles. A total of 44 samples have been collected for asbestos screening achieving the 1 per 500m^3 frequency and 23 samples for chemical analysis. No asbestos fibres were detected within the samples; however single exceedances of arsenic and multiple exceedances of PAHs mean that recovered aggregate from stockpiles Agg-Centre, Agg-SE, Agg-SW and Agg-W cannot form part of the garden capping layer. No exceedances of the criteria were reported in Agg-NW suggesting it may be placed within the capping layer. Recovered aggregate should not be used for water main pipe bedding or trench backfill, but there are no other restrictions on its' reuse.

5.2.2. Approximately 400m^3 of subsoil was recovered from the D1B area and is temporarily stockpiled in the south of the D1B: Area 2. Four validation samples were collected and reported exceedances for vanadium and BaP, and the identification of asbestos cement in one sample. Further asbestos screening sampling was carried out to delineate the portion of fibre impacted stockpile, and did no reveal any further asbestos. URL has removed the northernmost 100m^3 of soil and placed the material as backfill within the remediation void following removal of UG-NSA-22-23. Four further samples were collected from the remaining subsoil stockpile for an asbestos screen to confirm the sufficient removal of impacted material, and no fibres were identified. The remaining 300m^3 of subsoil contained 2 vanadium and 1 BaP exceedances above the cover layer criteria; however these concentrations are below those reported within the retained formation level soils which have undergone further assessment. The concentrations do exceed the approved Remedial Strategy criteria and therefore represent a departure from the Strategy which should be agreed with CDC before use within the cover layer.

5.2.3. Two phase-won topsoil stockpiles exist in the south of D1B: Area 2 adjacent to the subsoil stockpile; stockpile D1B-TS1 consists of recovered topsoil (300m^3) and D1B-TS2 consists of a topsoil and turf/vegetation strip (600m^3) which is currently awaiting organic matter screening and removal. Exceedances of vanadium were reported in all 3 samples of D1B-TS1 and 2

within D1B-TS2 which also included a single exceedance of B(a)P. Exceedances of vanadium and B(a)P were below the respective LQM/CIEH S4UL criterion. Three arsenic exceedances were reported, two of which remained above the LQM/CIEH S4UL of 37 mg/kg, one within each stockpile. The average of the 5 samples is below the S4UL value. No made ground material was observed and the topsoil / vegetation was stripped from landscape and POS areas. It is anticipated that the concentration reflect vertical mixing to the underlying ironstone deposits where naturally elevated arsenic concentrations within similar ranges have been recorded. Further assessment has been provided, however the concentrations do exceed the approved Strategy criteria and require confirmation of suitability for reuse within the cover layer by CDC prior to placement. Further sampling is required within D1B-TS2 following screening of organic matter to achieve the required sampling frequency.

5.3. Ground Gas / Vapour Hazards

5.3.1. No significant sources of hydrocarbon vapours were identified on or adjacent to the general site during remediation works. The former underground storage tanks (UG-NSA-1-3, 5-7 and 16-20) locations were not significantly contaminated following remediation, however the southern and southeastern faces of the excavation to UG-NSA-1-3 exhibited traces of a heavy fuel oil within the intact limestone bedrock at approximately 2.4m below ground level, and the same zone of contamination was recorded in BH-NSA-06, 11m to the south, at 3.17m depth. Whilst the gas and vapour risks from this residual contamination are likely to be low, in the absence of post-remediation ground gas monitoring it is recommended that precautionary measures be taken for building protection in the potentially-effected zone; this is delineated on Drawing 11.

5.3.2. Building gas protection measures where plots overlay the zone indicated on Drawing 11 should comprise sub-floor ventilation and use of a metal foil type gas barrier membrane with sealed service entries. Design details should be forwarded to CDC for approval.

5.3.3. Significant amounts of degradable organic materials were not reported elsewhere during the site turnover and there is no evidence to revise the classification of the site in respect to risks to development from hazardous ground gas.

5.4. Water Main Risk Assessment

5.4.1. No significant risks have been identified with respect to the laying of water mains; however the requirements of the water services provider, including risk assessment, should be followed. In particular, although the depth to any residual fuel oil contamination in the zone indicated on Drawing 11 is likely to be at least 1.5m vertically below any water mains, the service provider may still require use of protected pipe material as a precaution.

5.4.2. Further assessment should be carried out when the pipeline routes are confirmed, and following the completion of groundworks / prior to trench excavation.

5.5. Sulphates and Concrete

5.5.1. No specific testing has been undertaken for potentially aggressive conditions to concrete. Reference should be made to the preceding site investigation reports.

5.6. Further Requirements

5.6.1. In order to secure completion of remediation in Dorchester Phase D1B: Area 2 in accordance with the Remediation Strategy, the Developer is required to complete the agreed garden / landscaping cover system. This will entail a minimum further 200mm of clean, validated soils in all garden and landscaped areas and up to 600mm in gardens / 300mm in landscaping areas depending on development levels and acceptance by CDC of the risk assessments conclusions that the occasional residual minor exceedances of generic risk assessment criteria for arsenic, lead, zinc, vanadium and benzo(a)pyrene do not pose an unacceptable risk to human health.

5.6.2. Further sampling is required on the stockpile of phase won topsoil/vegetation (D1B-TS2) in order to satisfy the required sampling frequency. It is recommended that sampling is carried out once the screening of organic matter has taken in order to accurately determine the volume of topsoil present. It would be prudent to include bio-availability testing for arsenic if further exceedance of the target criteria are detected.

5.6.3. With the adoption of the above normal practices for Brownfield development, and on the information available to it, SGP concludes that the preparatory remedial works have been completed in accordance with the agreed strategy. In the event that any previously undisclosed contamination or suspect materials are identified then this should be assessed by an appropriately qualified and experienced person.

5.7. Long-term Management and Monitoring

5.7.1. No specific requirements for long-term monitoring or management have been identified within the site. Residual contamination has been found to be of low significance, low mobility and stable, and is unlikely to become a pollution source in the future.

5.8. Limitations

5.8.1. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

5.9. This report has been prepared by Smith Grant LLP, for the sole and exclusive use of Urban Regen Ltd. and Dorchester Group, and the benefit of this report may not be assigned to any third party without the prior agreement in writing of Smith Grant LLP.

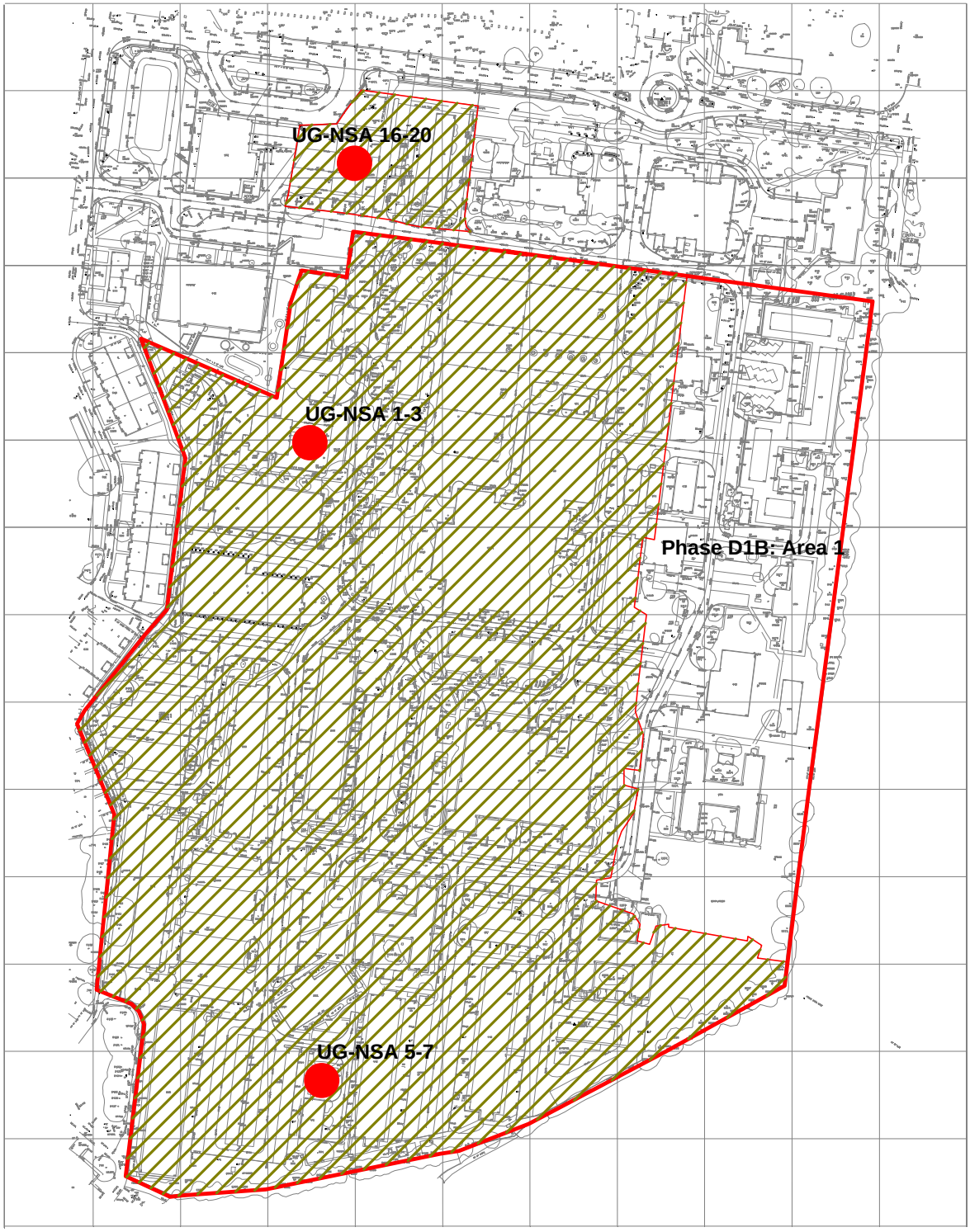
5.10. Reasonable skill, care and diligence have been exercised within the timescale and budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context. This report reviews and relies upon site investigations largely conducted by others. If errors or omissions in previous work have been noted then these have been duly noted, however SGP accepts no responsibility for advice given on the basis of incorrect factual information provided to it.

DRAWINGS

UST

Phase D1B: Area 2

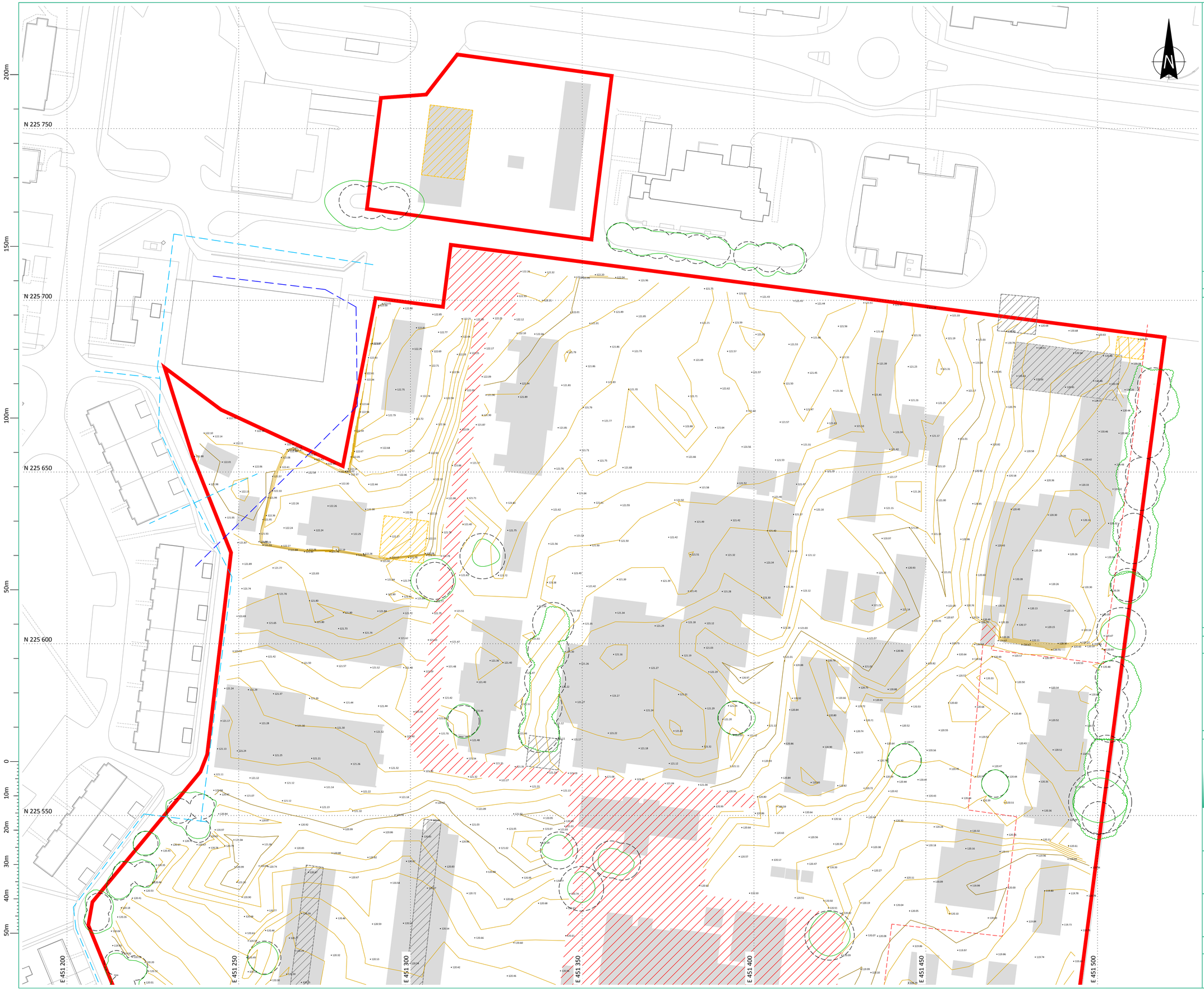
N

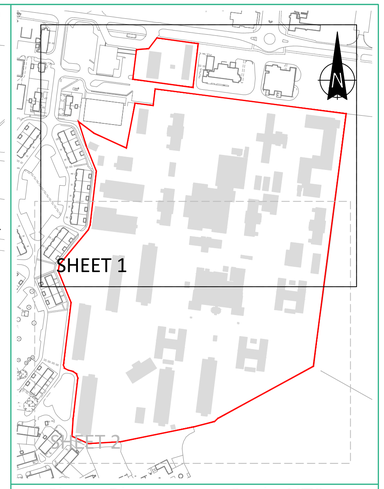


Smith Grant LLP
Station House
Station Road
Ruabon, LL14 6DL
Tel: 01978 822367
Fax: 01978 824718

www.smithgrant.co.uk
email: consult@smithgrant.co.uk

Project: Upper Heyford: Ph1b Dorchester		Drawn: DW	Checked: AFS
		Date: 28.01.15	Scale: 1:2,500
Drawing: Phase Boundary and UST Location Plan		Job No: R1742B	Drg No: D01





Sheet Plan Scale NTS

Legend

- Site boundary
- Major contour
- Minor contour
- Spot level ×120.12
- Bottom / top of bank
- Area unremediated due to structures being retained
- Building footprints (see note 2)
- In ground excavations (see note 3)
- Cellar excavations (see note 4)
- Tank excavations (see note 5)
- Trees and associated root zones (unremediated)
- Electricity cables (approximate position only - see note 7)
- Water (approximate position only)
- Sewer (approximate position only)

Notes

1. This plan is to be read in conjuction with SGP Reports R1742-R06-v1, R1742-R07-v2, R1742-R09-v1.
2. Made ground associated with the removal of the historic building foundations extends to approximately 0.5-1.5m below remediated ground levels.
3. Made ground associated with the removal of building service trenches, deep foundations and EWS's extends to approximately 1.5-2.5m below remediated ground levels.
4. Made ground associated with the removal of cellar structures extends to approximately 3-4m below remediated ground levels.
5. Made ground associated with the removal of in-ground tanks extends to approximately 4m below remediated ground levels.
6. Localised areas of made ground associated with the remediation works may be present on site but which are not detailed on this plan.
7. A 2m easement was established along the line of the live electricity cables. This easement may contain in-ground structures.

Survey Information:

Co-ord System:	Co-ord Type:	Primary Survey Control:	Secondary Survey Control:
OSGB36(2)	Grid	Leica SmartNet	

Rev	Date	Amendment	Drawn	Checked

Woodrow Surveying and Management Services Ltd.
22 Manor Farm Close,
Carlton,
Nr. Goole,
East Yorkshire.
DN14 9QS

Tel: 01405 869217
Email: info@wsmsltd.com
Web: www.wsmsltd.com

WSMS
WOODROW SURVEYING AND MANAGEMENT SERVICES LTD

Client:

urban regen

Urban Regen Ltd.,
23 Springvale,
Edgworth,
Bolton.
BL7 0FS

Project:

Upper Heyford (Dorchester)

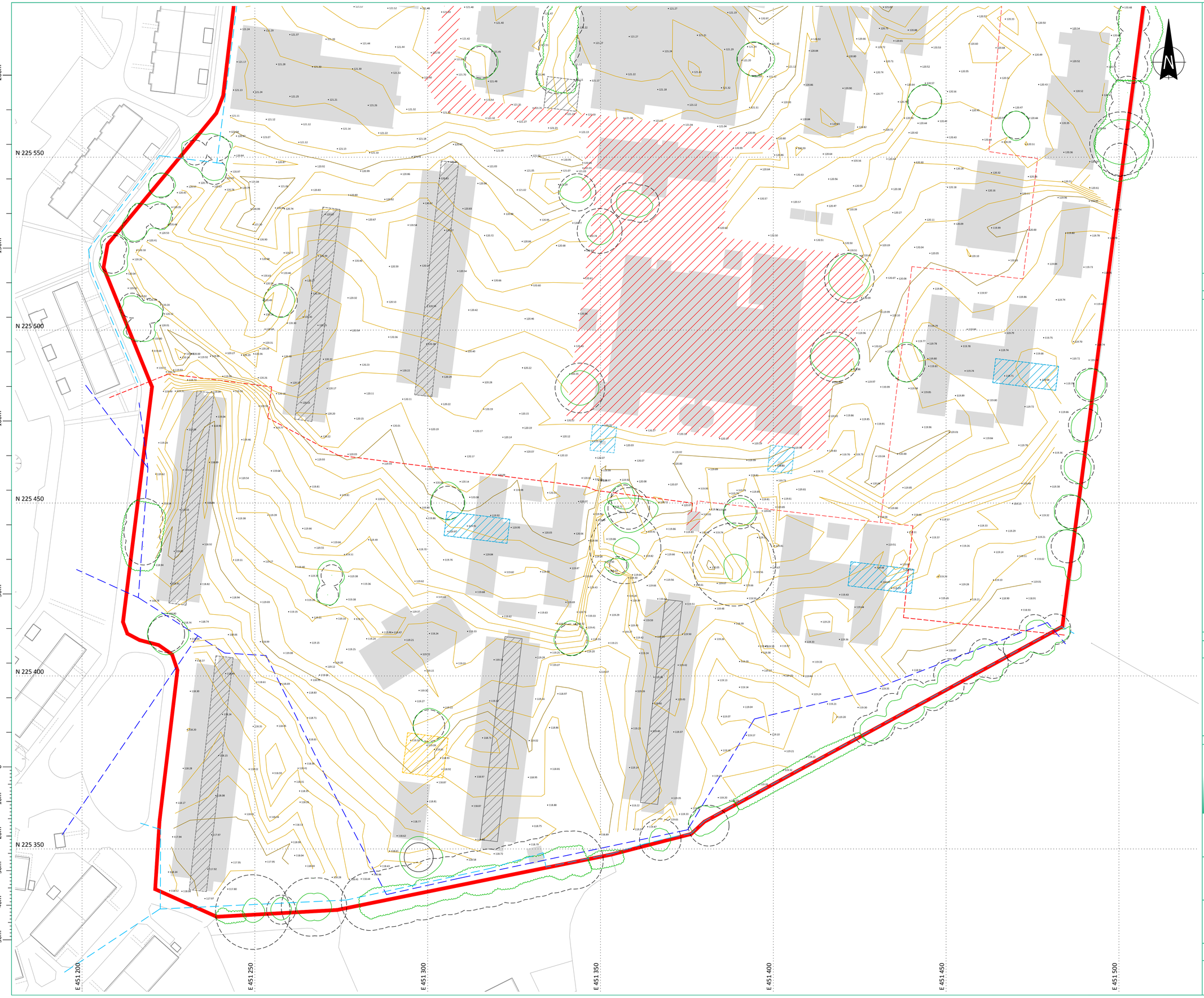
Title:

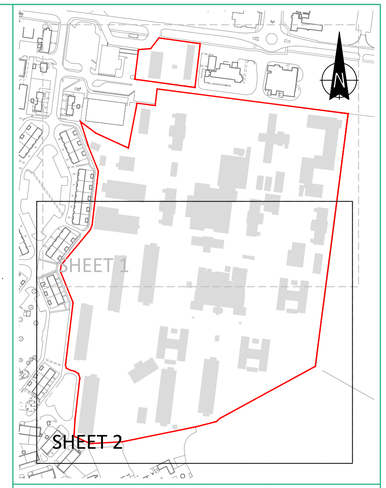
As built topographical survey and constraints plan - Phase D1B

Scale:	First Issue:	Drawn:	Checked:
1 : 500	16th Jan 2015	D.J.Woodrow	D.J.Woodrow

Drawing No: 0032-14-001-01

Revision:





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- Cellar excavations (see note 4)
- Tank excavations (see note 5)
- Trees and associated root zones (unremediated)
- Electricity cables (approximate position only - see note 7)
- Water (approximate position only)
- Sewer (approximate position only)

Notes

1. This plan is to be read in conjuction with SGP Reports R1742-R06-v1, R1742-R07-v2, R1742-R09-v1.
2. Made ground associated with the removal of the historic building foundations extends to approximately 0.5-1.5m below remediated ground levels.
3. Made ground associated with the removal of building service trenches, deep foundations and EWS's extends to approximately 1.5-2.5m below remediated ground levels.
4. Made ground associated with the removal of cellar structures extends to approximately 3-4m below remediated ground levels.
5. Made ground associated with the removal of in-ground tanks extends to approximately 4m below remediated ground levels.
6. Localised areas of made ground associated with the remediation works may be present on site but which are not detailed on this plan.
7. A 2m easement was established along the line of the live electricity cables. This easement may contain in-ground structures.

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OSGB36(2)	Grid	Leica SmartNet	

Rev	Date	Amendment	Drawn	Checked

Woodrow Surveying and Management Services Ltd.
22 Manor Farm Close,
Carlton,
Nr. Goole,
East Yorkshire.
DN14 9QS

Tel: 01405 869217
Email: info@wsmsltd.com
Web: www.wsmsltd.com

WSMS
WOODROW SURVEYING AND MANAGEMENT SERVICES LTD

Client:

urban regen

Urban Regen Ltd.,
23 Springvale,
Edgworth,
Bolton.
BL7 0FS

Project:

Upper Heyford (Dorchester)

Title:

As built topographical survey and constraints plan - Phase D1B

Scale:	First Issue:	Drawn:	Checked:
1 : 500	16th Jan 2015	D.J.Woodrow	D.J.Woodrow

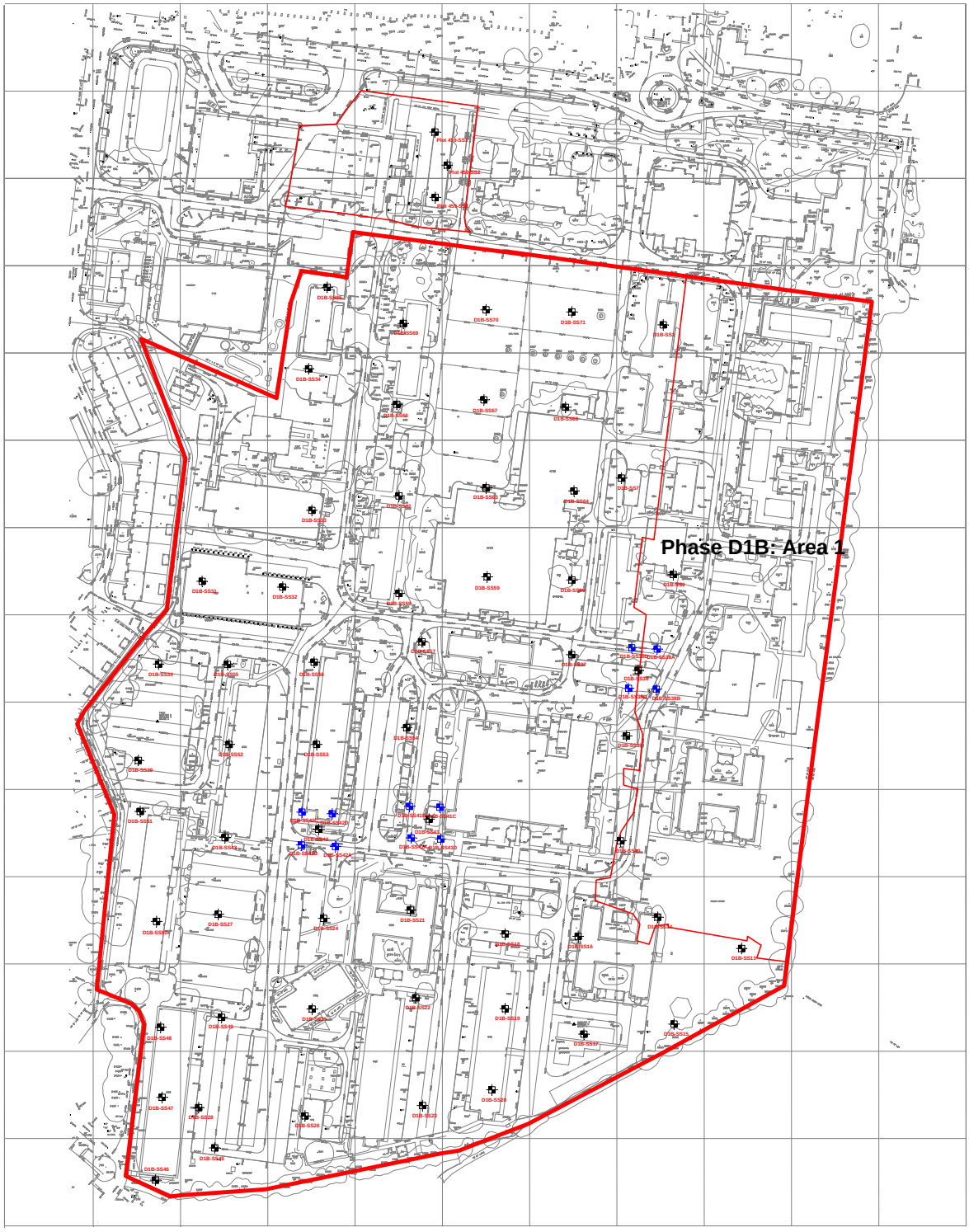
Drawing No: 0032-14-001-02

Revision:

In-situ test

In-situ re-test

N



SMITH GRANT Environmental Consultancy LLP

Smith Grant LLP
Station House
Station Road
Ruabon, LL14 6DL
Tel: 01978 822367
Fax: 01978 824718

www.smithgrant.co.uk
email: consult@smithgrant.co.uk

Project: Upper Heyford: Ph1b Dorchester		Drawn: DW	Checked: AFS
Drawing: In-Situ Soil Validation Location Plan		Date: 28.01.15	Scale: 1:2,500
		Job No: R1742B	Drg No: D04