

**Site Details:**

Marylands, Hemel Hempstead

**Client Ref:** GIS\_2024\_0303  
**Report Ref:** GSIP-2024-14652-17633\_SS\_2\_3  
**Grid Ref:** 510683, 210822

**Map Name:** National Grid

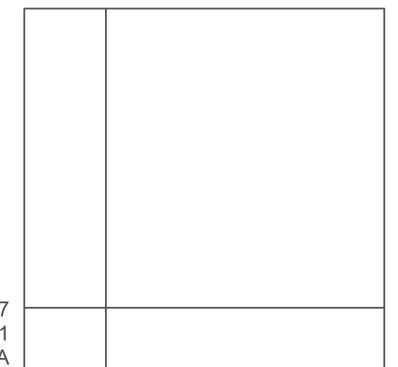
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 Edition N/A  
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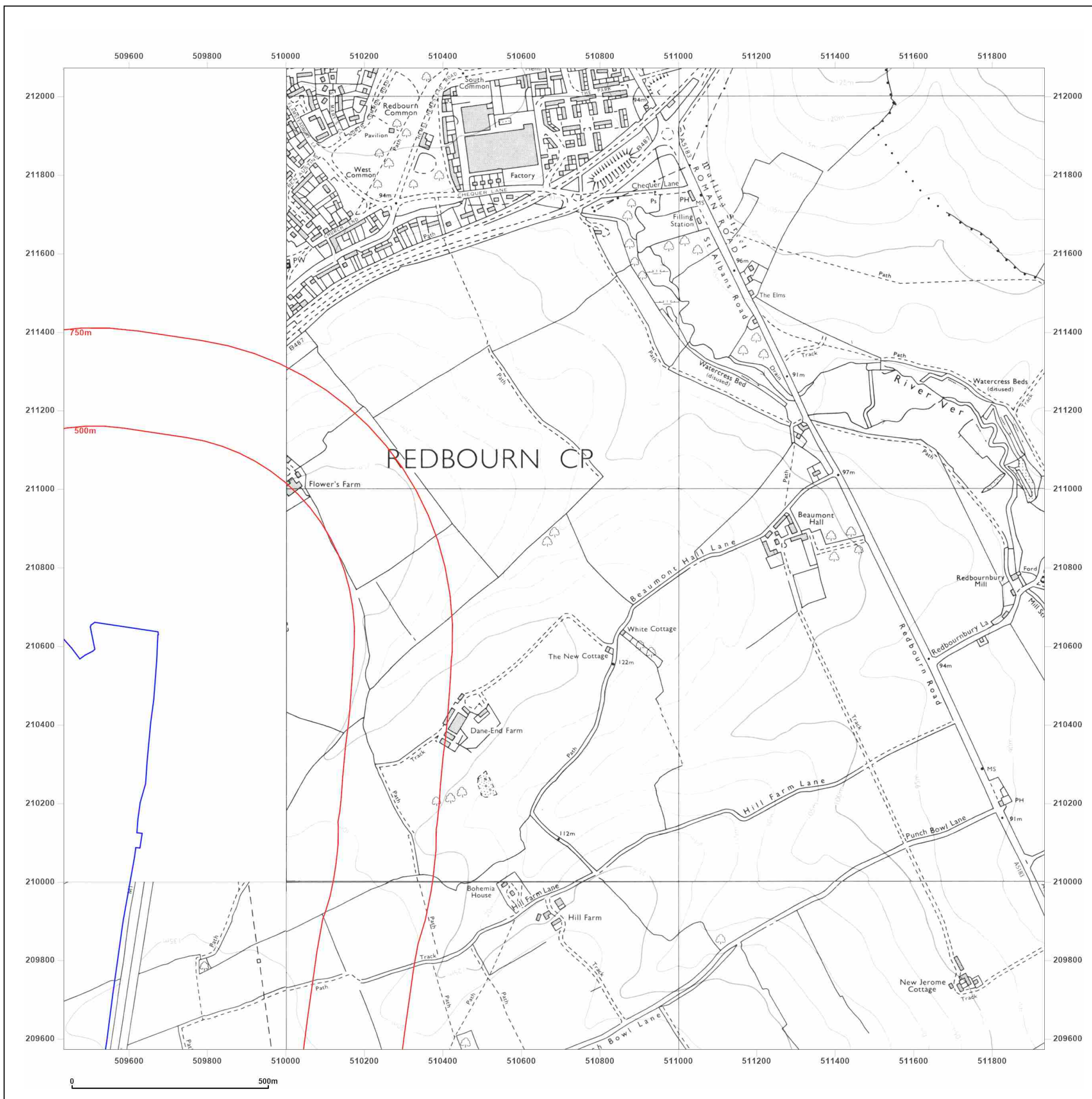


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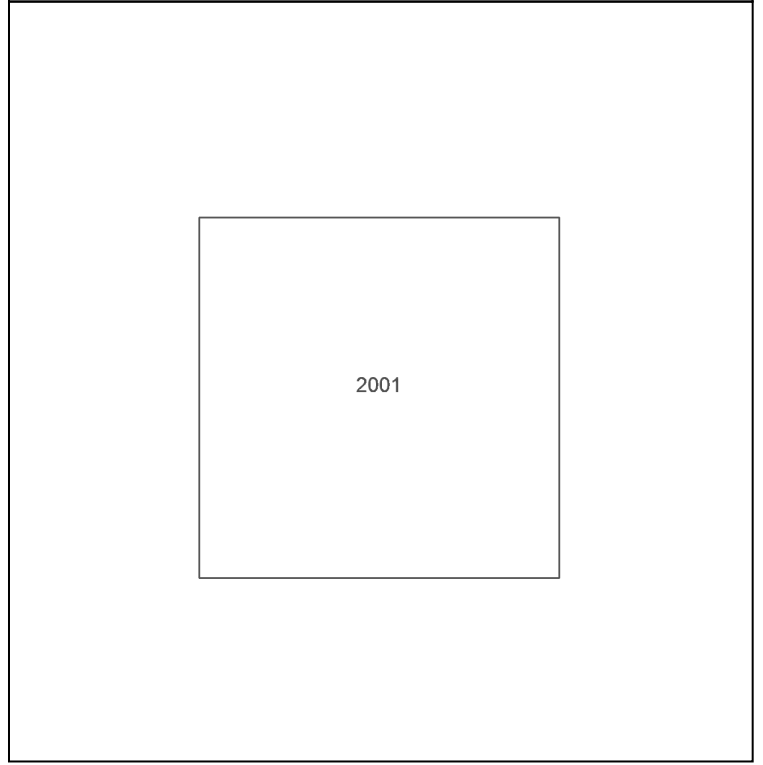
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**Grid Ref:** 510683, 210822

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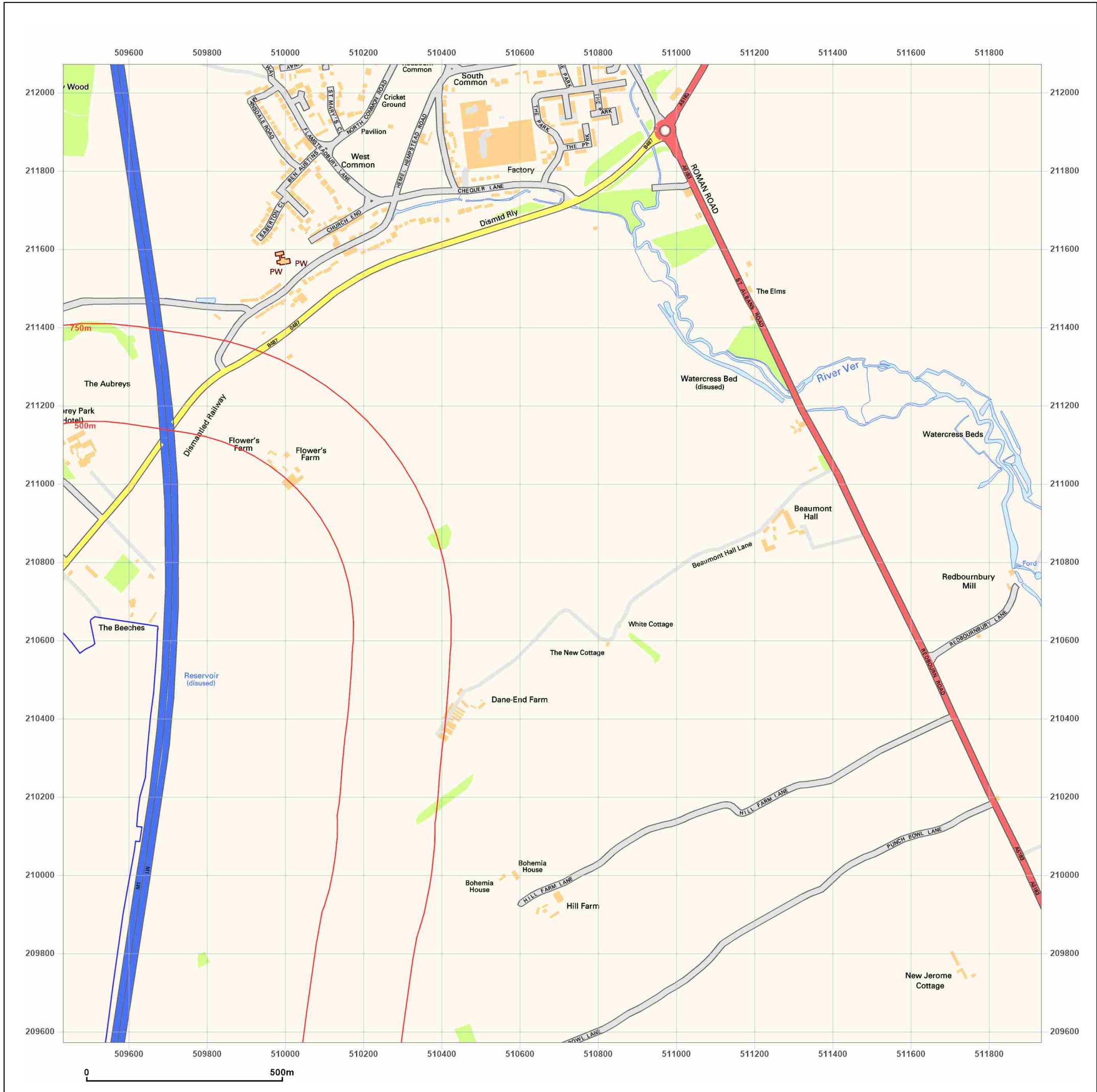


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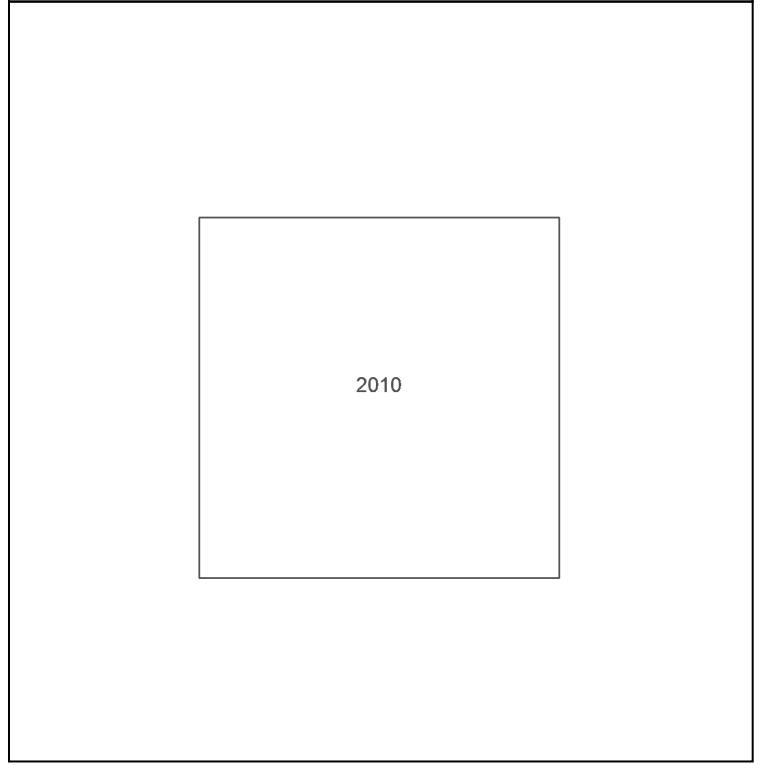
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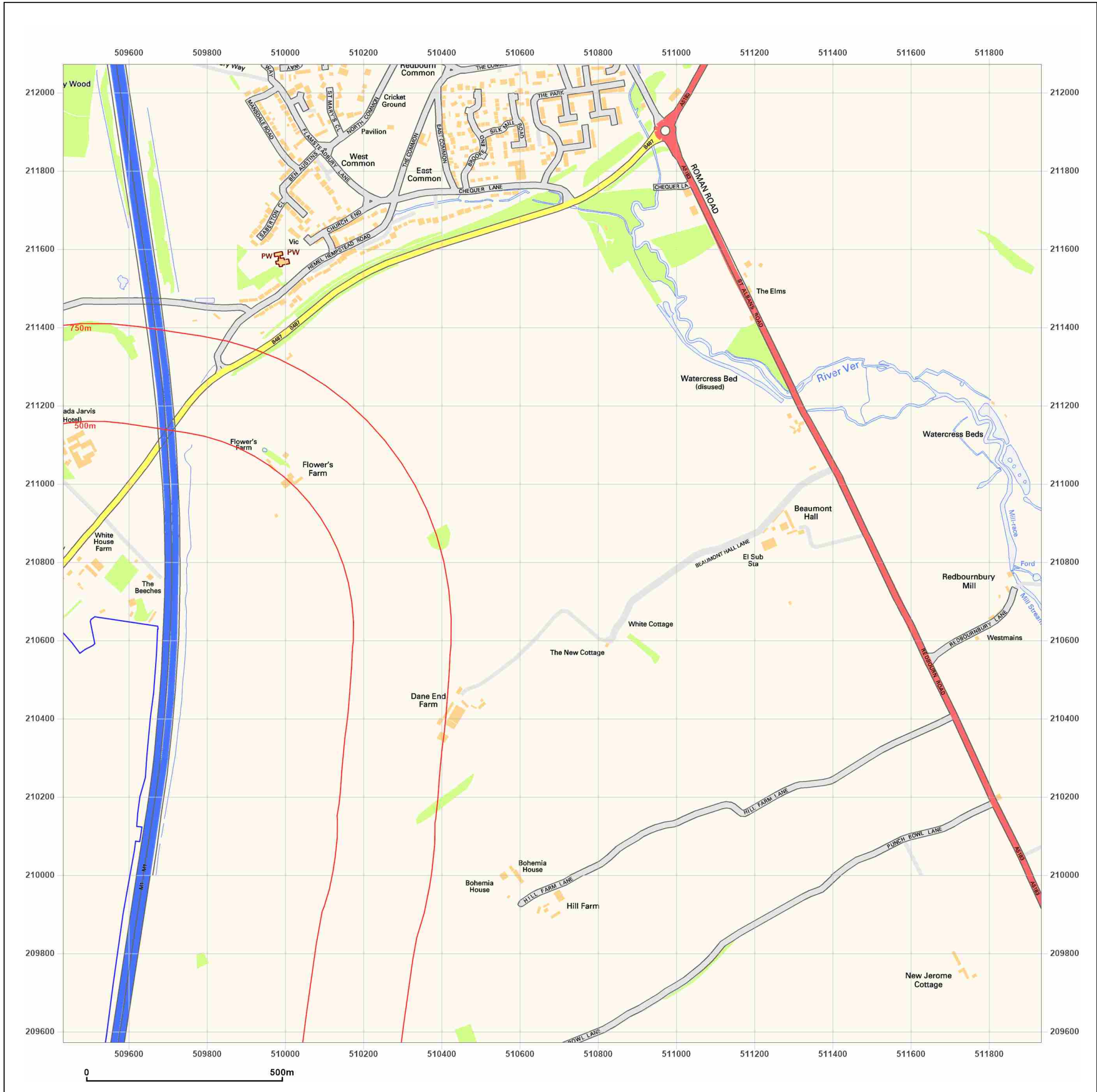


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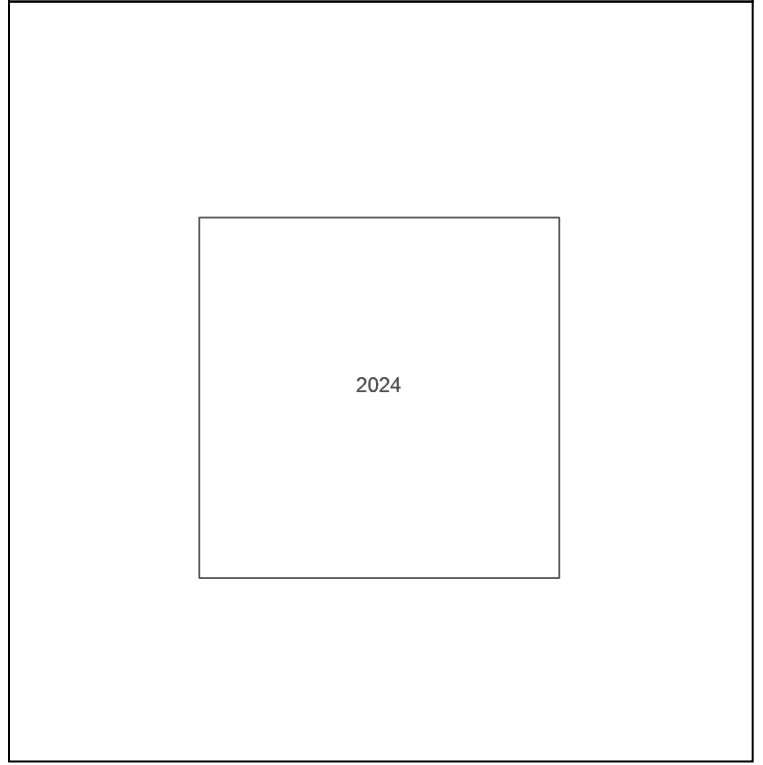
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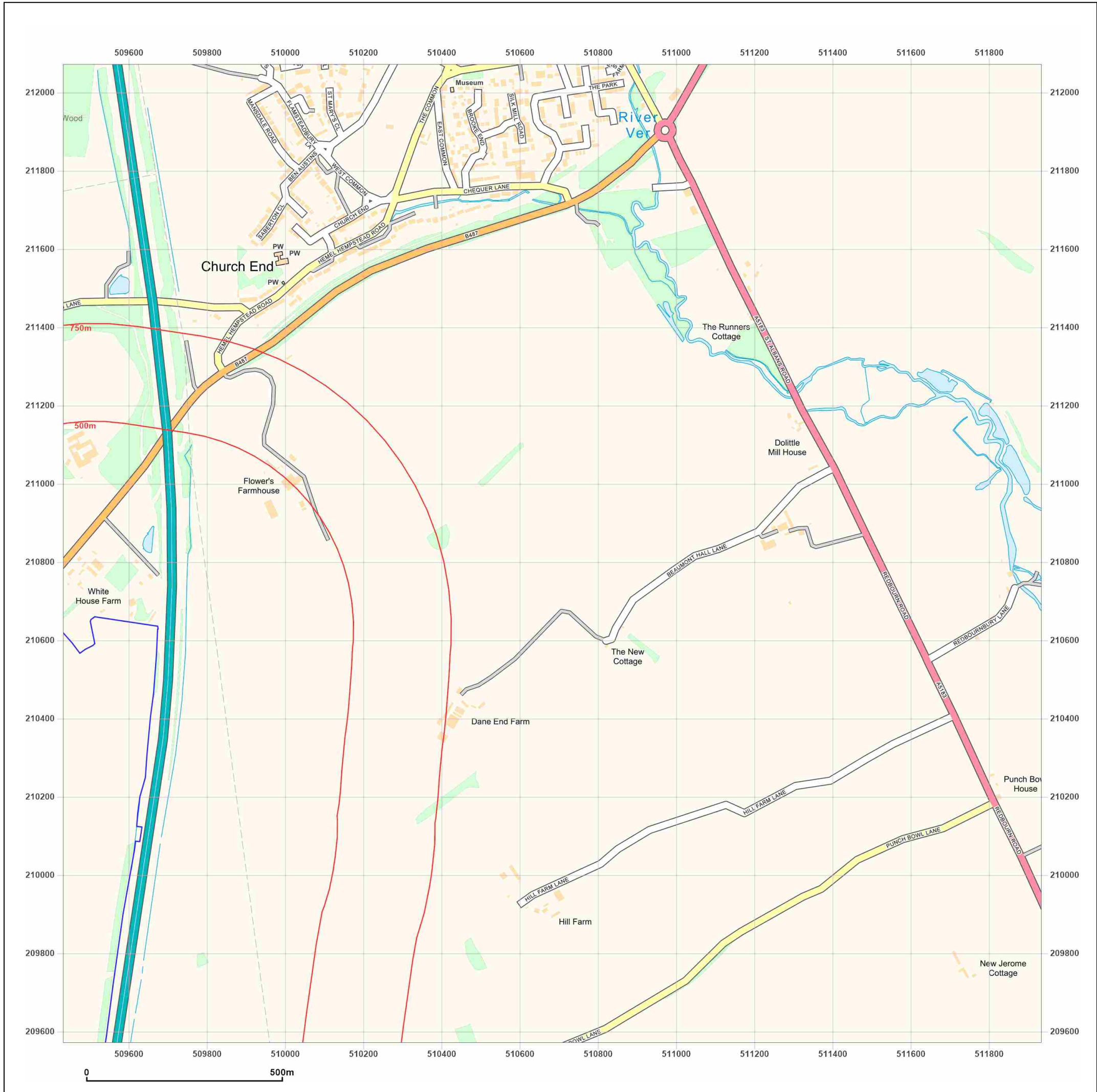



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## Appendix B: EA Correspondence

Mr Chris Smith  
Associate Director  
Wardell Armstrong Ltd  
Sir Henry Doulton House  
Forge Lane  
Stoke-on-Trent  
Staffordshire  
ST1 5BD

**Our ref:** NE/2014/121110/01-L01

**Date:** 10 September 2014

Dear Chris

**Preliminary Opinion: residential, commercial and industrial development east of Hemel Hempstead**

Thank you for coming to us for pre-application advice. We appreciate the opportunity to work with developers at this early stage to make the most of the environmental opportunities on site.

This development proposal does raise some environmental concerns, mainly due to its location adjacent to the [Buncefield oil depot](#). There was an explosion at the depot in December 2005 which has resulted in contamination of the surrounding area. You may need to undertake further work to show how these concerns can be satisfactorily addressed to ensure no adverse environmental impacts from this development.

**Ground Conditions**

The development site lies above the Mid-Chilterns Chalk groundwater body. It is a Drinking Water Protected Area and in a Source Protection Zone 3, which means that the groundwater is used for potable water supplies. The groundwater is currently classified as being of 'poor' chemical status under the [Water Framework Directive](#).

The resultant fire from the oil depot explosion lasted for five days. Fuel, water and fire-fighting foam spilled into the surrounding areas. The pollutants in this run-off consisted of PFOS (perfluorooctane sulphonate) from the foam, and hydrocarbons such as benzene and xylene. These pollutants have entered the chalk aquifer beneath the site.

Any development should avoid interfering with the groundwater flow. Any borehole soakaways through the superficial clays or groundwater abstractions from the chalk are highly unlikely to be acceptable because they could move the plume of PFOS and hydrocarbon pollution into areas of the chalk aquifer that are currently unaffected.



The site is predominantly agricultural land and is bounded by the M1 to the east. There is potential for agricultural products (fertilisers, pesticides etc) and run-off from the motorway to also have contaminated the site.

[National Planning Policy Framework](#) (NPPF) paragraph 109 states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of water pollution. Paragraph 121 also states that planning policies and decisions should ensure that adequate site investigation information, prepared by a competent person, is presented.

A Preliminary Risk Assessment (PRA) will therefore be required with any planning application. This must identify all sources and receptors for contaminants, and address potential pathways for contamination that would be introduced by the development. Impacts to the water environment as well as to human health should be considered. Our [GPLC3 Reporting Checklists](#) provide information as to what should be included in a PRA on page three.

Groundwater quality monitoring is still ongoing in the area following the Buncefield oil depot explosion. Site investigation and monitoring reports can be obtained from both Dacorum and St Albans Councils which will help inform your PRA. If there are any active boreholes on your site, you will need to check any access requirements with the owners. If there are any inactive boreholes on site, you will need to ensure they have been properly decommissioned so that pollution pathways are not created.

### **Flood Risk**

There are no main rivers or associated flood zones on site, however as the development area is over one hectare in size, a flood risk assessment (FRA) will need to be submitted with any planning application. This FRA must demonstrate that the proposed development will not create an increased risk of flooding from surface water. It should be carried out in accordance with the [NPPF](#) and the [Practice Guide](#), giving preference to infiltration over discharge to a watercourse, which in turn is preferable to discharge to surface water sewer. I have attached a guidance note to help prepare your FRA.

[Sustainable Drainage Systems](#) (SuDS) such as green roofs, ponds and swales should be used to manage surface water on site. SuDS seek to mimic natural drainage systems and retain water on or near the site, as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SuDS offer significant advantages over conventional tanked or piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge and biodiversity benefits, as well as improving water quality and amenity value.

A site of this size will have plenty of opportunities for open water storage solutions which should be incorporated into the Masterplan designs from the outset. Commercial / industrial buildings lend themselves well to green and brown roofs due to their size, and would help mitigate for the loss of habitat that will come about from this development.

Please be aware that infiltration techniques are unlikely to be feasible owing to contamination on site which must not be allowed to enter the groundwater. Your ground investigations should provide more clarity on this. Please refer to our document [Groundwater Protection: Principles and Practice](#) for more information.

Hertfordshire County Council is soon expected to become a SuDS Approving Body (SAB) in line with the requirements of [Schedule 3](#) of the Flood and Water Management Act (2010). The SAB's role will be to approve SuDS proposals for new developments, and to adopt and maintain SuDS for certain schemes. We recommend that you review their [Interim SuDS Policy Statement](#), and consult them at an early stage.

This advice is in line with St Albans District Council's local plan policy 84 which states that development must include appropriate surface water run-off control measures.

### **Water Efficiency**

The development is located within an area of serious water stress due to limited water resources in the local area and high and growing demand for water. Water efficiency measures should be implemented in all developments, with the aim to achieve 105 litres/head/day (l/h/d), equivalent to level 3/4 for water within the [Code for Sustainable Homes](#).

Achieving this standard of water efficiency within new homes can be accomplished at very little extra cost, and typically only involves low/dual flush toilets, low flow/aerated taps and showerheads and efficient appliances (dishwasher and washing machines). The Government's '[Water Calculator](#)' provides information on how to achieve and assess water efficiency within new homes.

### **Local Wildlife Sites**

The development area includes two Local Wildlife Sites (LWS): Nicky Way Dismantled Railway to the north; and Westwick Row Wood to the south. LWSs are areas of local importance for nature conservation that often support both locally and nationally threatened wildlife. You should contact Herts and Middlesex Wildlife Trust and St Albans District Council to discuss any potential impacts to these sites as a result of the development.

### **Further technical advice**

This is our free preliminary opinion. If you would like more detailed technical advice prior to any formal submission, this can be provided through our charged advice service. This allows us to recover our costs for providing planning advice. Our staff time is charged at £84 an hour. Do let me know if you would like to set up a charging agreement.

**Pre-application advice**

Please note that the views expressed in this letter by the Environment Agency are a response to a pre-application enquiry only and do not represent our final view in relation to any future planning application made in relation to this site. We reserve the right to change our position in relation to any such application and you should seek your own expert advice in relation to technical matters relevant to any planning application before submission.

Yours sincerely

**Caroline Sabberton**  
**Sustainable Places Specialist (Major Projects)**

Tel: 01707 632390

Email: [sphatfield@environment-agency.gov.uk](mailto:sphatfield@environment-agency.gov.uk)

# Sites over 1 hectare factsheet

## North East Thames area

Produced October 2013 v.1

**This factsheet provides information on the requirements for Flood Risk Assessments (FRA) on sites over 1 hectare within North East Thames area, to assist you with producing a satisfactory FRA for your development. It should be read alongside the Environment Agency's general FRA advice (FRA Guidance note 1).**

It covers matters relating to flood risk assessments only, and does not outline other considerations we may take into account, (e.g. proximity to a watercourse, contaminated land, biodiversity requirements).

The Environment Agency will assess Flood Risk Assessments for all planning applications over a hectare in size. A local exception to this is when the actual development footprint is 250 square metres or less, when we will pass the assessment over to the Local Planning Authority (LPA).

A surface water strategy should be carried out to demonstrate that the proposed development will not create an increased risk of flooding from surface water. It should be carried out in accordance with the National Planning Policy Framework and the Practice Guide, giving preference to infiltration over discharge to a watercourse, which in turn is preferable to discharge to surface water sewer. Guidance on the preparation of surface water strategies can be found in the Defra/Environment Agency R&D Technical Report W5-074/A/TR/1 Revision E "Preliminary rainfall runoff management for developments".

***We recommend that the FRA demonstrates the following (1-4) as a minimum:***

### **1. Runoff rates**

Peak discharge rates from site will not increase as a result of the proposed development, up to a 1 in 100 chance in any year including an allowance for climate change storm event. We expect all applicants to strive to achieve greenfield runoff rates to reduce the impact of the development on the surface water drainage infrastructure, unless it is demonstrated that this is not practicable

### **2. Storage volumes**

Storage volumes for all events up to a 1 in 100 chance in any year including an allowance for climate change storm event can be provided on site.

The site will not flood from surface water up to a 1 in 100 year chance in any year including an allowance for climate change event, OR surface water flooding will be safely contained on site up to this event, ensuring that surface water runoff will not increase flood risk to the development or third parties.


### **3. Sustainable drainage techniques**

Sustainable Drainage Systems (SuDS) such as green roofs, ponds, swales and permeable pavements will be used.

SuDS are an approach to managing surface water run-off which seeks to mimic natural drainage systems and retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SuDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge and biodiversity benefits, as well as improving water quality and amenity value.

The SuDS hierarchy should be followed as you design the site. The methods at the top of the hierarchy are preferred because they are beneficial in terms of sustainability and biodiversity. The hierarchy should be used in descending order, with any obstacles to the use of SuDS methods clearly justified.

## SuDS Hierarchy

	SuDS technique	Flood reduction	Pollution reduction	Landscape and wildlife benefit
<b>Most Sustainable</b>  <b>Least sustainable</b>	Living roofs and walls	✓	✓	✓
	Basins and ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices	✓	✓	✓
	Permeable surfaces and filter drains	✓	✓	
	Tanked and piped systems	✓		

A site's drainage design can be made up of a range of SUDS techniques. The variety of SuDS techniques available means that any development should be able to include a scheme based around these principles. These should be explored early on in the design of any development, to ensure they are an integral part of the site layout. Further information on SuDS can be found in:

- CIRIA C522 Sustainable Drainage Systems – design manual for England and Wales
- CIRIA C697 SuDS manual
- CIRIA C609 SuDS management train
- The Interim Code of Practice for Sustainable Drainage Systems.

#### 4. Residual Risk

The residual risk of flooding can be managed and contained safely on site should any drainage features fail (e.g. pumps or hydrobrakes) OR during an extreme storm event. The location and depth and flow routes of any overground flooding should be clearly shown on a plan.

#### 5. Climate change allowances

Guidance on climate change allowances can be found within the National Planning Policy Framework Technical Guidance.

#### 6. Infiltration rates

Infiltration rates should be worked out in accordance with BRE 365. If it is not feasible to access the site to carry out soakage tests before planning approval is granted, a desktop study could be undertaken looking at the underlying geology of the area and assuming a worst-case infiltration rate for that site.

#### *Local policies and recommendations*

You should, as part of the surface water strategy, demonstrate to the LPA that the requirements of any local surface water drainage planning policies have been met and the recommendations of the relevant Strategic Flood Risk Assessment and Surface Water Management Plan have been considered, including an assessment of the risk of flooding from other sources (e.g. groundwater).

#### *Further Information*

We cannot prepare or provide FRAs. Our Customers and Engagement Team can provide any relevant flooding information that we have available for you to use. There may be a charge for this information. Please email: [NETenquiries@environment-agency.gov.uk](mailto:NETenquiries@environment-agency.gov.uk), or telephone 03708 506 506 and ask for the North East Thames Customers and Engagement team. For further information on our flood map products please visit our website at: [www.environment-agency.gov.uk/research/planning/93498.aspx](http://www.environment-agency.gov.uk/research/planning/93498.aspx)

Alex Garman  
Expedition  
Temple Chambers 3-7 (Suite 41-44)  
Temple Avenue  
LONDON  
EC4Y 0HP

**Our ref:** NE/2024/137325/03 &  
ENVPAC1HNL00569

Dear Alex,

## **Masterplan for East Hemel, Immediate West of the M1 Motorway, HP2 4FL**

### **RE: Environment Agency Review of Groundwater Testing Specification**

Thank you for consulting us on the above Groundwater Testing Specification on 18 December 2024. We particularly welcome early engagement during the development process. As part of the consultation, we reviewed the Groundwater Testing Specification, for the East Hemel Masterplan ref. prepared by Expedition, EHUK-EXP-XXX-XXX-SW-C-00001, rev. P01, dated 18/12/2024.

### **Comments**

#### **Monitoring well network**

It appears that there are some areas (south and north-east) which are not covered by the current monitoring well network. Depending on the results of the proposed sampling event and proposed works, more monitoring wells may need to be installed to cover these areas.

#### **Groundwater flow direction**

It is not clearly mentioned in the report, but it would be useful to provide a groundwater flow direction map, based on the groundwater level readings collected during the field work. The depth of monitoring wells to be recorded as well. We would also suggest that the monitoring wells be properly purged and samples collected from the appropriate depth (i.e., middle of the screen) to be representative of the formation. The depth of collected samples to be provided along with the borehole logs of each monitoring well.

#### **Perfluoroalkyl and polyfluoroalkyl substances (PFAS)**

PFAS suite of analytes should be extended to include:

- The list of 48 PFAS recommended by the Drinking Water Inspectorate (DWI), as the site is located within source protection zones for drinking water supply. <https://dwi.gov.uk/pfas-and-forever-chemicals/>
- As well as PFAS known to be associated with firefighting foam usage, such as:
  - 6:2 fluorotelomer sulfonamide alkylbetaine (6:2 FTAB)

- Perfluoro-1-hexanesulfonic acid (PFHxS)
- Perfluoro-1-octanesulfonic acid (PFOS)
- 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)
- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)

Efforts should be made to identify all PFAS associated with the site, as the ones listed and recommended (i.e. DWI list) above might not be sufficient. For example: the agricultural land might have been spread with sewage sludge which is known to be PFAS contaminated.

The use of fertilizers, pesticides, insecticides, herbicides, etc on agricultural land should also be considered and relevant contaminants included in the suite of analytes.

### **Groundwater Monitoring**

Groundwater monitoring might be required prior, during and after ground works. Therefore, the monitoring wells should be properly maintained for future sampling events. Decommissioning should be done following the applicable guidance.

Should you have any queries regarding these comments, please contact me.

Yours sincerely,

**Lauren Clayton-Spencer**  
**Planning Advisor**

Email: [HNL.SustainablePlaces@environment-agency.gov.uk](mailto:HNL.SustainablePlaces@environment-agency.gov.uk)

Direct Dial: 020 3025 0962

## Finlay Campbell

---

**Subject:** FW: East Hemel : EA Ref : NE/2024/137325 & ENVPAC1HNL00569

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**From:** HNL Sustainable Places <[HNL Sustainable Places@environment-agency.gov.uk](mailto:HNL Sustainable Places@environment-agency.gov.uk)>

**Sent:** 04 April 2025 11:14

**To:** Adam Cadman <[adam.cadman@a2-studio.com](mailto:adam.cadman@a2-studio.com)>

**Subject:** RE: East Hemel : EA Ref : NE/2024/137325 & ENVPAC1HNL00569

Hi Adam,

Stefania has the following comments:

*“We do not have enough data related to the site to make informed and detailed comments. However, we consider that the proposed approach is acceptable.*

*We trust the applicant, as they know the site better. If any changes to the monitoring/ investigation plan would be necessary later in the process, we trust these would be brought to our attention.”*

Should you have any further questions, please let me know.

Kind regards,

**Elizabeth Clements (MSc., BSc.)**

**Planning Specialist (Hertfordshire) | Sustainable Places** | Hertfordshire & North London  
**Environment Agency** | Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE

Pronouns: she/her ([why is this here?](#))

✉ [HNL Sustainable Places@environment-agency.gov.uk](mailto:HNL Sustainable Places@environment-agency.gov.uk)

☎ 02077644285



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**From:** Adam Cadman <[adam.cadman@a2-studio.com](mailto:adam.cadman@a2-studio.com)>

**Sent:** 27 March 2025 14:11

**To:** HNL Sustainable Places <[HNL Sustainable Places@environment-agency.gov.uk](mailto:HNL Sustainable Places@environment-agency.gov.uk)>; Clements, Elizabeth <[Elizabeth.Clements@environment-agency.gov.uk](mailto:Elizabeth.Clements@environment-agency.gov.uk)>

**Cc:** Alex Garman <[alex.g@expedition.uk.com](mailto:alex.g@expedition.uk.com)>; Lauren Lester <[lauren.l@expedition.uk.com](mailto:lauren.l@expedition.uk.com)>; Edward Wilson <[Edward.Wilson@turntown.co.uk](mailto:Edward.Wilson@turntown.co.uk)>; Finlay Campbell <[finlay.campbell@a2-studio.com](mailto:finlay.campbell@a2-studio.com)>

**Subject:** FW: East Hemel : EA Ref : NE/2024/137325 & ENVPAC1HNL00569

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Hi Lauren & Elizabeth,

Thank you again for your time on 7 March, it was very helpful to discuss the project and the approach going forward.

As discussed, it is intended to complete an initial round of groundwater sampling to assess changes to the plume(s) of contamination associated within the Buncefield Oil Storage Depot fire, as previously identified in investigations completed circa 2017. This will provide an updated 'baseline' to inform a land condition report that is being prepared to support the outline planning application. Additionally, initial soakaway testing will be completed in the areas of the proposed attenuation ponds to assess the ground conditions and permeability of the soils in these areas, in support of the proposed drainage strategy.

The land condition report will include a detailed data review of the existing site investigation reports, supplemented with the findings of the initial groundwater monitoring visit and soakaway testing, to derive a robust conceptual site model and complete a preliminary risk assessment with regards to contamination for the outline planning application. A geological hazard assessment would be completed to assess potential risks associated with natural and man-made cavities in the chalk, including digital imagery assessment supplemented with the findings of the existing ground investigations to derive a ground model. Data gaps would be identified and recommendations made for additional ground investigation and monitoring. Outline recommendations would be provided for remediation and geotechnical design.

We have reviewed the comments provided by the Environment Agency on the groundwater monitoring specification prepared by Expedition, and provide the following responses:

**1. Increase the monitoring well network to address current data gaps**

*Data gaps will be identified within the land condition report and will be addressed as part of additional site investigation to be completed post planning submission. At this stage, the initial monitoring visit will include sampling from the 27 monitoring installations previously installed and sampled as part of the site investigations completed circa 2017.*

**2. Establish the groundwater flow direction**

*Groundwater levels would be measured as part of the planned initial groundwater sampling visit. A-squared will use this data, together with the previous monitoring results, to assess the groundwater flow direction. These findings will be included within the land condition report.*

**3. Complete a broader suite of laboratory testing to include a wider range of PFAS than previously tested and for contaminants potentially arising from the current land use (fertilizers, pesticides, insecticides, herbicides).**

*A-squared agree that a broader suite of PFAS testing than previously completed would be helpful, along with contaminants associated with the current land use.*

*The following suite of testing will be completed for all 27 sample locations previously installed in circa 2017 (where serviceable) to mirror the testing previously completed in 2017, but with a broader PFAS suite and the addition of hardness and suspended solids, allowing direct comparison of changes to the plume(s) previously identified and additional assessment with regards to PFAS:*

- *BOD true total*
- *EPH CWG (Aliphatic)*
- *EPH CWG (Aromatic)*
- *GRO by GC-FID*
- *PFAS Broad Suite by LC-MS/MS*
- *pH value*
- *SVOC MS*
- *TPH CWG*
- *VOC MS*
- *Hardness - Total (as CaCO<sub>3</sub>)*
- *Suspended Solids*

*The following suite of testing will be completed for approximately half of the sample locations (14 in total) previously installed in circa 2017 (where serviceable) to provide broad coverage across the site to assess potential impacts arising from the current land uses; this quantum of testing will be sufficient to assess impacts associated with current land uses at pre-planning state, with additional testing, where required, completed in post-planning investigations:*

- *Organochlorine Pesticides*
- *Ammoniacal Nitrogen as N*
- *Chloride*
- *Nitrate (as N03)*
- *Nitrite (as N02)*
- *Nitrogen*
- *Orthophosphate (as P)*
- *Sulphate as SO4*

*The following suite of testing will be completed for approximately half of the sample locations (14 in total) previously installed in circa 2017 (where serviceable) to provide broad coverage across the site to assess common contaminants not previously analysed in the site investigations completed circa 2017, additional testing, where required, completed in post-planning investigations:*

- *PAH - Speciated (EPA 16) Inc Total*
- *Metals by ICPMS*
- *Boron (Dissolved)*
- *Chromium - Hexavalent*
- *Total Organic Carbon*
- *Dissolved Organic Carbon*

*Additionally, the following QA testing will be completed:*

- *Equipment decontamination water samples for PFAS Broad Suite – 4 samples*
- *Water Suite Total Trip Blanks for all contaminants listed above – 3 samples*
- *Water Suite Total Duplicate for all contaminants listed above – 3 samples*

We trust that this is acceptable, but please do not hesitate to contact me should you have any comments or queries.

We look forward to working with the Environment Agency going forward.

Kind regards,

**Adam Cadman**

BSc MSc FGS CGeol  
Geo-Environmental Discipline Director



**A-squared Studio**

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## Appendix C: 2025 A2SI Groundwater Factual Report



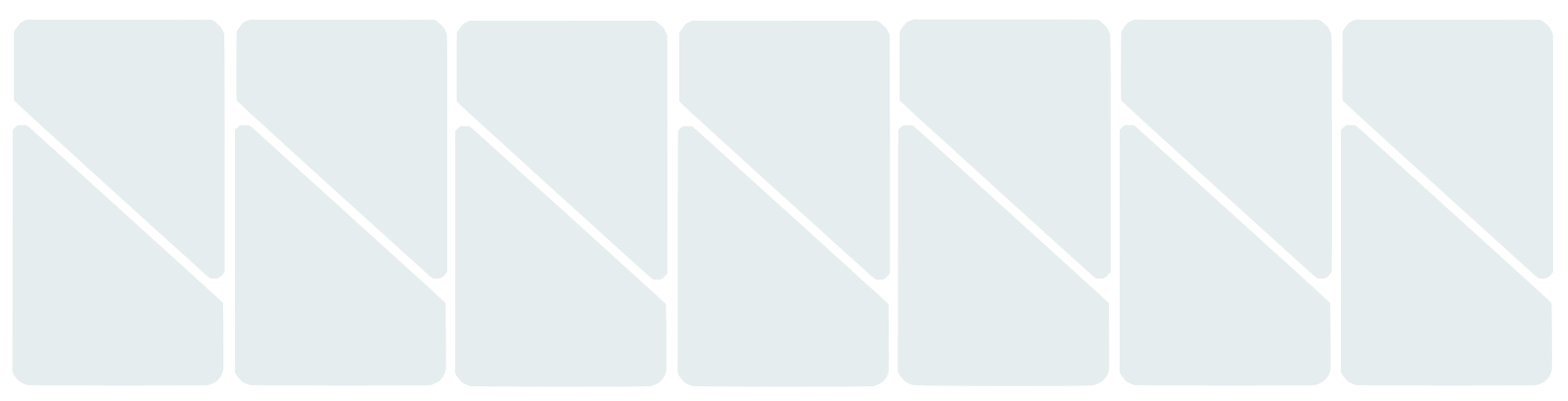
A2 Site Investigation

# East Hemel – Groundwater Sampling

Factual Report

A2SI-REP-001-03

August 2025  
64225-A2SI-XX-XX-RP-X-002-00





Project Name	East Hemel – Groundwater Sampling
Project Number	64225
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Document Name	Factual Report

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# Contents

1.	Introduction .....	1
2.	Site Location .....	1
3.	Scope and Purpose of the Investigation.....	2
4.	Limitations of Report .....	2
5.	Standards .....	2
6.	Investigation Summary .....	3
7.	Laboratory Testing .....	5

## Appendices

Appendix A: Summary of Exploratory Holes

Appendix B: Exploratory Hole Location Plan

Appendix C: Photographic Record

Appendix D: Geoenvironmental Laboratory Testing Results

Appendix E: Groundwater Sampling Record



## Abbreviations

Abbreviation	Full name	Abbreviation	Full name
ACM	Asbestos-containing Material	PL	Plastic Limit
BGS	British Geological Survey	PI	Plasticity Index
BH	Borehole	PSD	Particle Size Distribution
BRE	Building Research Establishment	SGV	Soil Guideline Value
BSI	British Standards Institution	SOM	Soil Organic Matter
BS	British Standard	SPT	Standard Penetration Test
CIRIA	Construction Industry Research and Information Association	SPZ	Source Protection Zone
GAC	Generic Assessment Criteria	SVOC	Semi-volatile Organic Compounds
LL	Liquid Limit	TPH	Total Petroleum Hydrocarbon
m bgl	Metres Below Ground Level	UST	Underground Storage Tank
m AOD	Metres Above Ordnance Datum	UXO	Unexploded Ordnance
PAH	Polycyclic Aromatic Hydrocarbons	VOC	Volatile Organic Compound
PCB	Polychlorinated Biphenyl	WAC	Waste Acceptance Criteria
PID	Photo Ionisation Detector	PFAS	Per-and Poly Fluoroalkyl Substances



# 1. Introduction

A2 Site Investigation (A2SI) were appointed by The Crown Estate to undertake a groundwater investigation at Hemel Hempstead, HP2 4UE. The groundwater testing was specified by Expedition, and A-Squared Studio acted as Investigation Supervisor.

## 2. Site Location

### 2.1. Development Location and Current Site Use

The site is situated in Hemel Hempstead, HP2 4UE, as presented in Figure 2.1. The site is located approximately at National Grid Reference 509187E, 207479N and falls within the administrative boundaries of the Dacorum Borough Council. The site is bounded by agricultural fields in the north and south, with the M1 and agricultural fields bounding the site to the east, Leverstock Green and Buncefield Oil Depot to the west. The site comprises of a greenfield with most of the land being used for agriculture.

The site is located near the Chilterns Area of Outstanding Natural Beauty (AONB) and within three Source Protection Zones (SPZs).



**Figure 2.1** Location of the proposed development (red line reflects the site boundary used for this assessment).

### 2.2. Site context and background

During the Buncefield Fire in 2005, the area surrounding the Buncefield Oil Depot was contaminated with PFOS associated with the use of firefighting foams and hydrocarbons and Bis (2 Ethylhexyl) Phthalate (DEPH, a result of burning plastics) compounds.

The site has previously been surveyed and investigated in 2017 by Wadell Armstrong and 2019 by (EHUK-WAA-1XX-XX-RP-E-09033).

The Preliminary Ground Conditions Assessment (Ref: EHUK-WAA-1XX-XX-RP-E-09022) and Preliminary Groundwater Assessment (Ref: EHUK-WAA-1XX-XX-RP-E-0923) carried out in 2017 comprised two phases of works, with the Phase 1 investigation occurring in 2014 and Phase 2 in 2017, with both phases carried out by Van Elle Ltd. The Phase 1 of works included a total of 7 No. boreholes,



drilled to a maximum depth of 20m bgl, whilst Phase 2 comprised of a total of 28 No. boreholes. A gas and groundwater monitoring standpipe was installed to the base of each borehole.

The site investigation from 2019 (Ref: EHUK-WAA-1XX-XX-RP-E-09033) was carried out by CC Ground Investigations Ltd, comprising an additional 38 No. rotary boreholes, 50 No. cable percussion boreholes and 109 No. dynamic sampling boreholes. A total of 19 No. gas and groundwater monitoring wells were installed in selected locations.

### 3. Scope and Purpose of the Investigation

A2SI have been commissioned to undertake a site investigation comprising:

- 1no. monitoring visit of groundwater levels and groundwater sampling
- Geoenvironmental laboratory testing of the groundwater samples.

#### 3.1. Investigation Strategy

Table 3.1 summarises the strategy for the investigation.

**Table 3.1 Summary of investigation strategy**

Location ID	Method	Purpose/Comments
A1 to A11 B1 to B3 C1 to C9 D1 to D4	Groundwater Sampling using low flow sampling methods.	Groundwater sampling to facilitate geoenvironmental risk assessment.

### 4. Limitations of Report

This report has been prepared in accordance with the specification provided by the client. The data reported relates to the specific locations where each exploratory hole was formed and may not represent the ground and groundwater conditions of the site as a whole. Furthermore, it should be considered that groundwater levels may vary throughout the year due to seasonal conditions and other influences such as flooding, leaking mains, storm drainage and foul water systems.

### 5. Standards

The site investigation, soil descriptions and laboratory testing were undertaken in accordance with the following standards:

- BGS Geology Viewer: 2022. <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>. British Geological Survey.
- BGS GeoIndex: 2022. <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>. British Geological Survey.
- British Standards Institution BS 10175:2011+A2:2017, Investigation of potentially contaminated sites – code of practice.
- British Standards Institution BS 5930:2015+A1:2020, Code of practice for site investigations.
- British Standards Institution BS 8576:2013 Guidance on investigations for ground gas - permanent gases and volatile organic compounds (VOCs).
- British Standards Institution BS EN ISO 5667-1:2023 Water quality. Sampling - Guidance on the design of sampling programmes and sampling techniques.
- UK Specification for Ground Investigation 3rd Edition, published by ICE Publishing (2022).



## 6. Investigation Summary

### 6.1. Fieldwork Overview

The fieldwork was carried out between 21<sup>st</sup> July 2025 and 24<sup>th</sup> July 2024. A site walkover was conducted during the first day of the investigation and confirmed the anticipated layout of the site.

The specific details of the investigation undertaken are discussed throughout Section 8 and comprised:

- 1no. monitoring visit of groundwater levels including groundwater sampling
- Geoenvironmental laboratory testing of groundwater samples.

All works were supervised by an experienced engineer.

A summary of the exploratory holes and an exploratory hole location plan is presented in Appendices A and B. The coordinates and Ordnance Datum levels, which are presented on the exploratory logs, have been surveyed as part of the investigation.

### 6.2. Groundwater Monitoring Installations

A total of 26 No. groundwater monitoring pipes were located during the site visit (A1-A11, B1-B3, C1-C9, D1-D4). The monitoring installations comprised of 50mm internal diameter HDPE casing. Due to the duration since the wells were installed and likely farming activities, a number of the wells were damaged to the point they were not serviceable, additionally some wells appear to have been completely removed. Details are presented in Table 6.1. Photographic records of the condition of the identified installations is presented in Appendix C.

**Table 6.1 Conditions of the groundwater monitoring installations**

Location Ref	Base of Well (m bgl)	Water Level (m bgl)	Installation Diameter (mm)	Comments
A1	-	-	-	Damaged/Unable to measure
A2	-	-	-	Damaged/Unable to measure
A3	18.80	10.97	50	Sampled
A4	12.87	Dry	50	Insufficient water to sample
A5	19.17	19.08	50	Insufficient water to sample
A6	55.50	34.50	50	Sampled
A7	-	-	-	Damaged/Unable to measure
A8	46.20	39.50	50	Sampled
A9	0.54	Dry	50	Well obstructed with chalk
A10	-	-	-	Damaged/Unable to measure



Location Ref	Base of Well (m bgl)	Water Level (m bgl)	Installation Diameter (mm)	Comments
A11	28.58	Dry	50	Insufficient water to sample
B1	44.23	30.91	50	Sampled
B2	47.06	37.07	50	Sampled
B3	46.88	40.43	50	Sampled
C1	52.75	37.05	50	Sampled
C2	-	-	50	Blocked/Unable to measure
C3	48.61	32.79	50	Sampled Duplicate sample (Duplicate 2) taken
C4	53.65	26.91	50	Sampled Duplicate sample (Duplicate 1) taken
C5	46.68	46.08	50	Insufficient water to sample
C6	>60.0	52.98	50	Sampled
C7	-	-	-	Not Located
C8	48.05	30.53	50	Sampled
C9	42.17	Dry	50	Insufficient water to sample
D1	35.65	Dry	50	Insufficient water to sample
D2	52.03	45.32	50	Sampled Duplicate sample (Duplicate 3) taken
D3	47.60	43.73	50	Sampled
D4	43.70	41.83	50	Sampled



### 6.3. Groundwater Sampling

Water sampling was undertaken in accordance with the latest version of BS EN ISO 5667-1:2023. On each occasion groundwater was sampled using low-flow methods, to minimise disturbance of the aquifer and ensure representative uncontaminated samples. Any evidence / absence of potential contamination was recorded. New tubing was used for each monitoring well where water was present. Tubing was inserted into the middle of the screening zone before purging. The purged water was directed through a closed flow cell connected to a calibrated YSI multiparameter probe measuring pH, electrical conductivity (EC), temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP). Once the parameters were stable, samples were collected directly from the pump line, using clean containers appropriate for the analysis type (e.g. pre-preserved bottles for metals or VOCs), with minimal turbulence or headspace. The water purged from the well before sampling was stored in a container and disposed appropriately.

Quality control procedures were undertaken in the form of 3 No. trip blank samples, 3 No. equipment blank samples, and 3 No. duplicated samples.

During the site works, 13 No. out of the 27 No. designated locations could not be sampled due to insufficient water head, standpipe obstructions (damaged or blocked) or the wells could not be located. These limitations are detailed in the Table 6..

## 7. Laboratory Testing

### 7.1. Geoenvironmental Laboratory Testing

Groundwater samples were sent for geoenvironmental laboratory testing which was undertaken by ALS Laboratories (UK) Limited, a United Kingdom Accreditation Service (UKAS) accredited laboratory. The following type and number of tests scheduled is presented in Table 7.1 below and the results are presented in Appendix D.

**Table 7.1 Geoenvironmental testing - laboratory analysis - water**

Test description	Number of tests
Ammoniacal Nitrogen as N (W) by Spectrophotometric	21
Anions by Kone (w)	21
BOD True Total (W) by Meter	21
Chromium III - Calculation Only (W)	21
Dissolved Metals by ICP-MS	21
Dissolved Organic/Inorganic Carbon	21
EPH and CWG by FID	21
GRO by GC-FID (W)	21
Hexavalent Chromium (W) by Spectrophotometric	21
Hexavalent Chromium (W) by Spectrophotometric	21



Test description	Number of tests
Nitrite by Kone (w)	21
PAH Speciated 16 (W) by GC MS	21
Pesticides (Suite I) by GCMS (W)	21
PFAS Broad Suite by LC-MS/MS (W)	23
pH Value (W) by Meter	21
Phosphate (Orthophosphate as P) (W) by Spectrophotometric	21
Total Suspended Solids 105C (W) by Gravimetric	21
SVOC (W) by GC MS	21
Total Metals by ICP-MS	21
Total Nitrogen	21
Total Organic and Inorganic Carbon (W) by IR	21
TPH CWG (W) by GC FID/MS	21
VOC MS	21



## Appendix A: Summary of Exploratory Holes

Hole ID	Depth (m)	Location		
		Eastings (m)	Northing (m)	Level (m AOD)
A3	18.80	508717.6	210063.6	107.100
A6	55.50	508666.2	209608.4	130.080
A8	46.20	508665.2	209177.2	135.347
B1	44.23	509044.3	208556.1	126.369
B2	47.06	508970.7	208291.7	132.532
B3	46.88	509064	207931.4	135.977
C1	52.75	509077.6	207466.5	128.451
C3	48.25	508999.4	206992.5	124.721
C4	53.65	509228.8	207051.3	115.054
C6	60.00+	509164.7	206002.5	139.576
C8	48.05	509527.6	206906.4	116.117
D2	52.03	509737.2	207838.6	136.665
D3	47.60	509784.6	207600.1	133.839
D4	43.70	510063.4	207941.6	130.991



## Appendix B: Exploratory Hole Location Plan



Location	level	Easting	Northings
A1	111.06	508959.3	210140.2
A2	111.23	508897.7	210071.2
A3	107.09	508717.9	210063.6
A4	109.54	508652.3	210032.4
A5	115.5	508507.8	209893.1
A6	130.06	508666.1	209608.4
A7	133.54	508864.7	209487.2
A8	134.4	508665	209177.4
A9	134.55	508886	209144.4
A10	134.87	509102	209264.5
A11	124.28	509318.9	208612.3
B1	126.25	509044.5	208556
B2	133.09	508970.5	208291.6
B3	136.09	509064.2	207931.4
C1	128.55	509077.3	207466.4
C2	121.15	508840	207159.7
C3	124.8	508999.5	206992.3
C4	115.23	509228.7	207051.2
C5	132.81	509074.4	206349.7
C6	139.61	509164.9	206002.6
C7	119.83	509604.2	206858.3
C8	116.27	509527.5	206906.3
C9	130.17	509314.4	207304.6
D1	129.78	509547.7	208200.5
D2	136.78	509737.1	207838.6
D3	133.82	509784.8	207600.2
D4	131.09	510063.2	207941.9

0 500 1,000 m





## Appendix C: Photographic Record



Client	Project	Location	Created by	Approved by	Date
The Crown Estate	East Hemel – Ground Water Sampling	A1	MB	FA	30/07/2025