Submission ID: S00F77DB6

As an interested party I sent this written statement to the planning inspectorate hearing on 30th Sept 2026 as I was unable to attend in person due to my work. I delegated for it to be read out by [redacted]. In the event he summarized my statement so I wish for it to be recorded here in full. Please see also attached maps and hydrology report showing how the contamination is highly likely to have reached the principal aquifer underneath the OXSRFI site.

Water Resource Associates
A network of consultants in hydrology, water resources and environmental issues

Please reply to:
[redacted]

[redacted]

Gallos Brook PFAS Contamination
Upper Heyford, Oxfordshire

[redacted]

July 2026
Technical Note for the Initial Assessment of Catchment Hydrology, Hydrogeology Biotoxicity and Potential Catchment Water Quality Modelling



Executive Summary

An initial assessment has been undertaken to examine PFAS contamination in the Gallos Brook and to identify more detailed studies to better understand the problem. This current assessment included background hydrology, details on hydrogeology and groundwater abstractions, testing the toxicity of river water at locations in the Gallos Brook and River Cherwell and information on how PFAS contamination could be modelled at the catchment scale. The key findings are as follows:

1. The Gallos Brook is a tributary of the River Ray and drains an area of 35 km^2 with its source in the area of the former Upper Heyford airbase. It includes the Leys Farm Ditch, within its upper reaches which flows along the eastern edge of Upper Heyford, while the start of the Gallos Brook is further west through Caulcott.
2. Fieldwork within the catchment in June 2026 found some channels were flowing, such as the Leys Farm Ditch and at Weston Fen, but other channels were dry at Caulcott, the A4095 bridge, at the Weston-on-the-Green Church and near the River Ray confluence.
3. A significant proportion of the catchment is underlain by permeable limestone bedrock under the general classification of Jurassic Limestone, which dips from north-west to south-east. This means that groundwater movement from the airbase would be expected to flow towards the SE from the groundwater divide, except groundwater draining into the Cherwell Valley and Padbury Brook.
4. The depth of groundwater is variable across the area with shallow groundwater in the Leys Farm Ditch, but deeper groundwater further west in the upper reaches of the Gallos Brook accounting for the flow observed in Leys Farm Ditch compared to the lack of flow in the Gallos Brook at Caulcott.
5. The groundwater flow exhibits a divide at the area of the airbase, with 65% flowing towards the River Cherwell to the west, 30% flowing to the Gallos Brook and Leys Farm Ditch to the south and 5% flowing to the Padbury Brook to the east.
6. Interbedding of impermeable mudstones results mainly in a 2-tier water table beneath the Upper Heyford disused airbase. This means that there is shallow perched groundwater at 2 to 3 m bgl and the main water table in the White Limestone at greater depths of the order 12 to 28 m bgl. Contaminants will migrate firstly to the shallow water-bearing strata, followed by vertical leakage to the deeper layers.
7. There are 78 groundwater abstractions in the area around the airbase. PFAS measurements should be taken for those closest to the firepit location (the source of historic PFAS) at Manor Farm and Park Farm. As there would appear to be a scarcity of PFAS data in groundwater, sampling and analysis should be carried out at boreholes closest to the firepit location (the source of historic PFAS) including Manor Farm and Park Farm and any boreholes wells or springs in the Cherwell Valley.

8. The existing PFAS measurements in groundwater were taken further from the site and the only available sample down gradient to the south-east of the airbase is Promise Land Farm which is 8.5km away with PFAS well below the DWI guidelines.
9. Water samples taken from the Gallos Brook and River Cherwell for biotoxicity testing showed highest acute toxicity in the Leys Farm Ditch and Weston-on-the-Green. The lowest toxicity was measured in the River Cherwell and the Gallos Brook downstream near Islip, but still showing effects of poor water quality in relation to a control sample.
10. The results do not measure PFAS but give a rapid assessment of overall toxicity and the higher measurements demonstrate the need for more detailed monitoring and testing.
11. Catchment scale water quality modelling could be undertaken to demonstrate the movement of potential PFAS contamination throughout the catchment.

Background

Water Resource Associates (WRA) was engaged by the Gallos Brook Conservation Group to assist in highlighting the issue of Per- and poly fluoroalkyl substances (PFAS) contamination in surface and groundwater within the Gallos Brook catchment and neighbouring area in Oxfordshire. This technical note includes a review of the hydrology and hydrogeology of Gallos Brook, an assessment of the potential impact of PFAS and an outline of how a detailed water quality modelling programme could be undertaken to gain a better understanding of PFAS contamination. Information was provided by the Gallos Brook Conservations Group from previous testing for PFAS undertaken by Subadra Consulting and application documents associated with the redevelopment of the Upper Heyford Airbase. The work of this current study included referring to these documents but did not represent a full document review. In addition, spot samples from water courses were analysed for biotoxicity.

PFAS are a group of synthetic chemicals often referred to as forever chemicals as they do not readily degrade in the environment. They have been used since the 1940's and one particular application was in foams used for firefighting. Such foams were commonly used in fire-fighting operations at the former Upper Heyford airbase, and testing from the Environment Agency (EA) in 2023-2025 and by Subadra Consulting in April 2026 has found elevated levels of PFAS in water courses draining the Upper Heyford site.

Study Area

The Upper Heyford Airbase covers an area of some 3.6 km^2 in north Oxfordshire, 7km north-west of the town of Bicester, as shown in Figure 1. The airbase was decommissioned in 1994 and has since been redeveloped including residential and commercial areas. The airbase site is in an upland area above 120m in altitude on the eastern dip slope of the Cotswold Hills. The Gallos Brook is one of a number of watercourses draining from the site to the south and joining the River Ray near Islip, 12km to the south. Upper Heyford Airbase is located on the watershed of three catchments, the River Cherwell draining to the west, the River Ray draining to the south and the Bedford Ouse draining to the north. The topography and the catchment boundaries are shown in Figure 2. More detail on the Gallos Brook is given in the Hydrology section below.

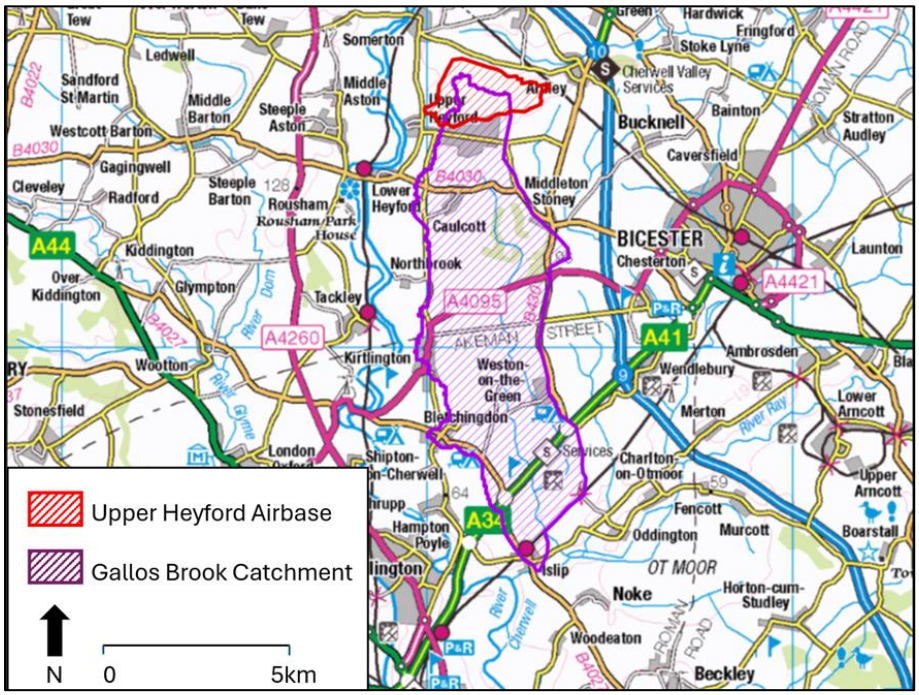


Figure 1. The study area showing the Upper Heyford Airbase extent outlined in red and the Gallos Brook catchment in green (background map OS Open Raster, scale 1:100,000).

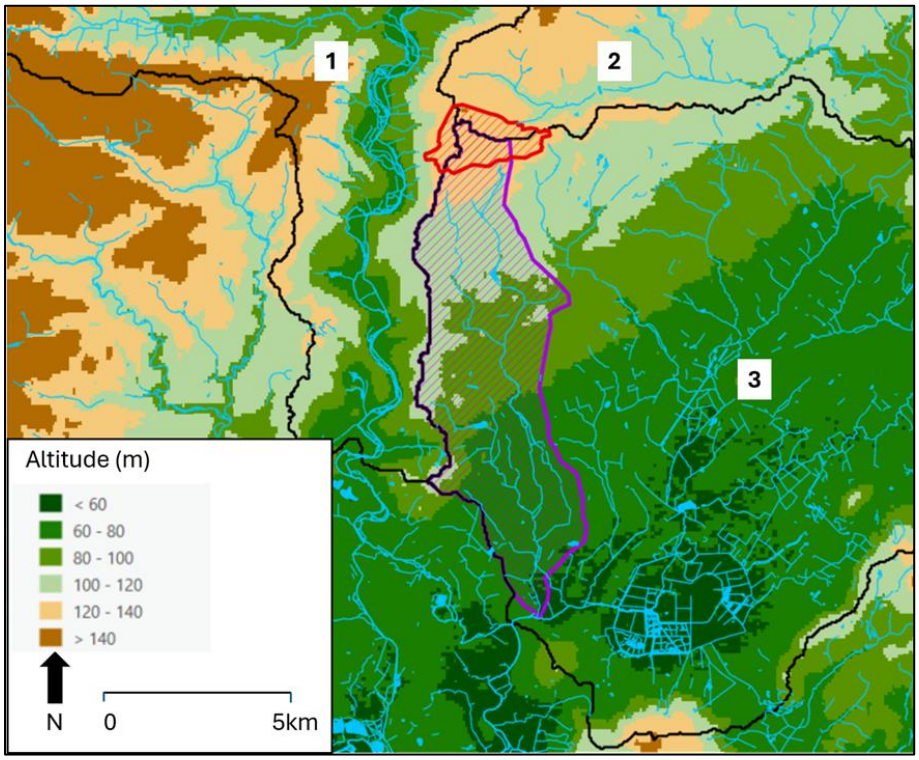


Figure 2. Topography of the study area with catchment boundaries for the Cherwell (1), Bedford Ouse (2) and Ray (3) shown in black.

Hydrology

As mentioned, the Gallos Brook is a tributary of the River Ray and drains an area of 35 km^2 in the western side of the Ray catchment. The Gallos Brook does not have any permanent flow monitoring, the closest gauging station is on the River Ray at Islip. The Standard annual average rainfall for the Ray catchment (incorporating the Gallos Brook) is given as 669mm (CEH, 2026) for the period 1991-2020, this is a 6% increase on the previous period (1961-1990) showing the impact of climate change. The Gallos brook is a largely rural catchment, a significant proportion underlain by the highly permeable Jurassic limestone bedrock. The lower reaches are underlain by impermeable clay. More detail on the underlying geology and its impact on groundwater is given in the hydrogeology section of this report.

The Gallos Brook drains from the southern side of the airbase site and includes a few channels and tributaries along its course to the River Cherwell. Fieldwork undertaken in the catchment in June 2026 inspected most of these channels as shown on the mapping in Figure 3 and the following photographs. The fieldwork was undertaken in the summer during a period of dry conditions which would have contributed to the low flows or lack of flow observed in some places.

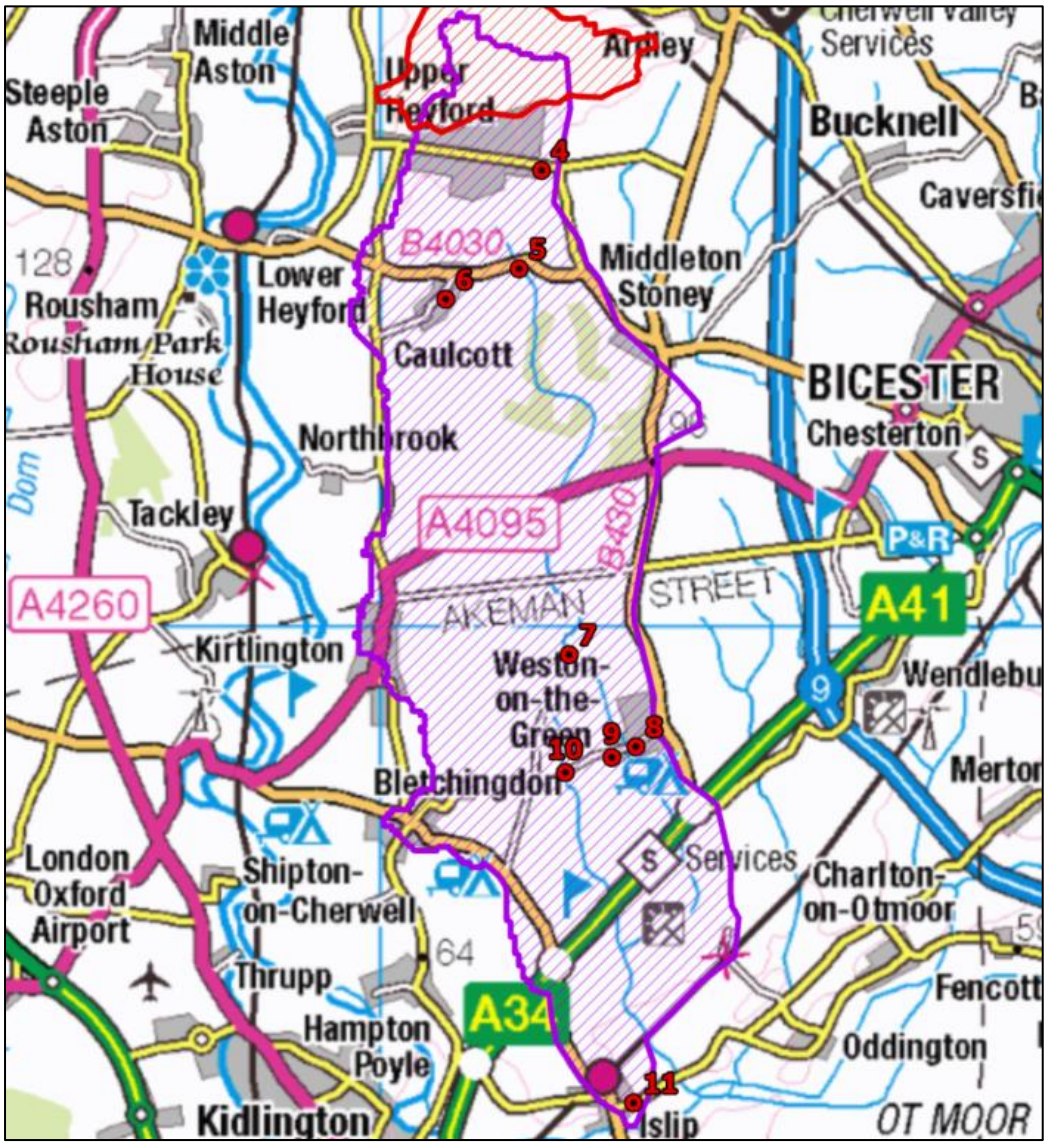


Figure 3. Locations of photos shown in Figures 4-11.

Two small streams form the headwaters, the Leys Farm Ditch to the east (Figure 4 and 5) and Gallos Brook to the west (Figure 6) through the village of Caulcott. During fieldwork the Leys Farm Ditch had a reasonable flow but the Gallos Brook at Caulcott was dry, with local residents suggesting water had been extracted as part of the constructions works at Upper Heyford. These converge 4.5km to the south just south of the A4095 road, although the channel from the Leys Farm Ditch just upstream of the confluence was also dry. The possible explanation of this was water being held up in within the grounds of Middleton Park. Downstream of the confluence, flow was restored as the Gallos Brook passed south through the Weston Fen SSSI (Figure 7), so water must have been present in the western Gallos Brook channel downstream of Caulcott. The Brook is split into two channels in the village of Weston-on-the-Green (Figure 8 and 9) and once again one of these, the eastern most channel was dry. Local residents had observed this for a few years and thought this was the result of some quarrying operations near Weston-on-the-Green.



Figure 4. Leys Farm Ditch at Upper Heyford.



Figure 5. Leys Farm Ditch at the B4030.



Figure 6. Gallos Brook at Caulcott.



Figure 7. Gallos Brook at Weston Fen SSSI.

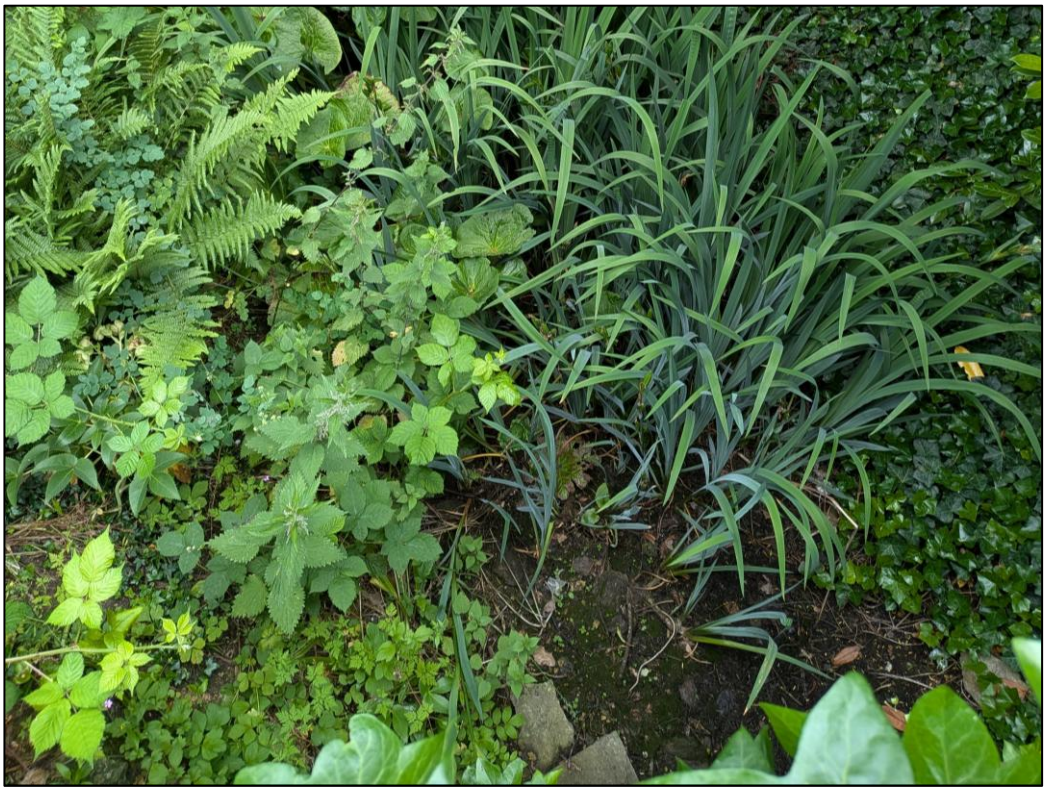


Figure 8. Dry side channel of Gallos Brook at Weston-on-the-Green



Figure 9. Gallos Brook main channel at Weston-on-the-Green.



Figure 10. Tributary channel west of Weston-on-the-Green.



Figure 11. The Gallos Brook near Islip.

A further tributary stream originating from Kirtlington on the western boundary of the catchment (Figure 10) joins the main channel just downstream of the A34. Near the catchment outlet the channel has been diverted by the railway line running through the southern portion of the catchment so that the main channel of the stream passes along the eastern side of Islip (Figure 11). The original stream channel as shown on the OS maps was dry, so it is assumed this only receives drainage from south of the railway line.

Hydrogeology

An assessment of geological conditions underlying Upper Heyford airbase and the surrounding area has been made using BGS generalised digital geological map data and the depth-to-groundwater dataset. Solid geology is based on both the New Series 1:50 000 and Old Series 1:63 360 scale mapping, using updated formation nomenclature: the distribution of local rock types and faultlines is shown in Figure 12 and stratigraphy is summarised in Figure 13. A geological cross-section has been drawn in Figure 14 along the Cotswold dip slope to demonstrate the regional dip of the rocks towards the south-east.

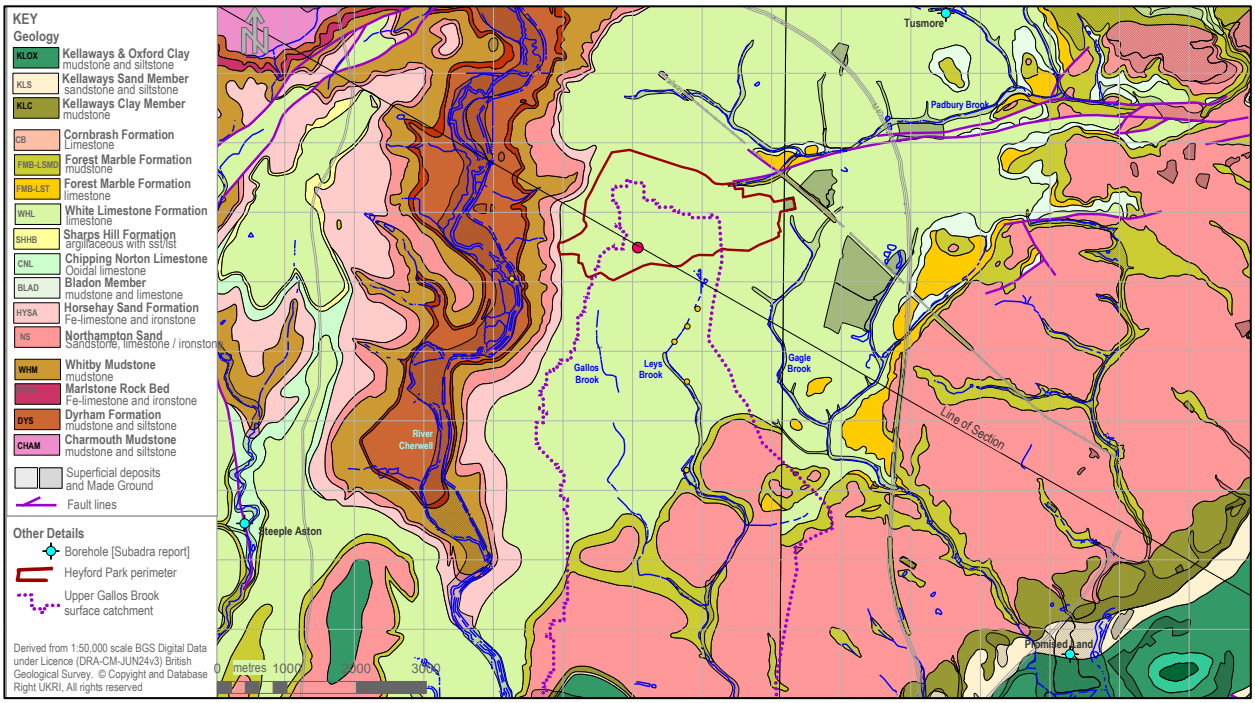


Figure 12. Geological map for the area around Upper Heyford.

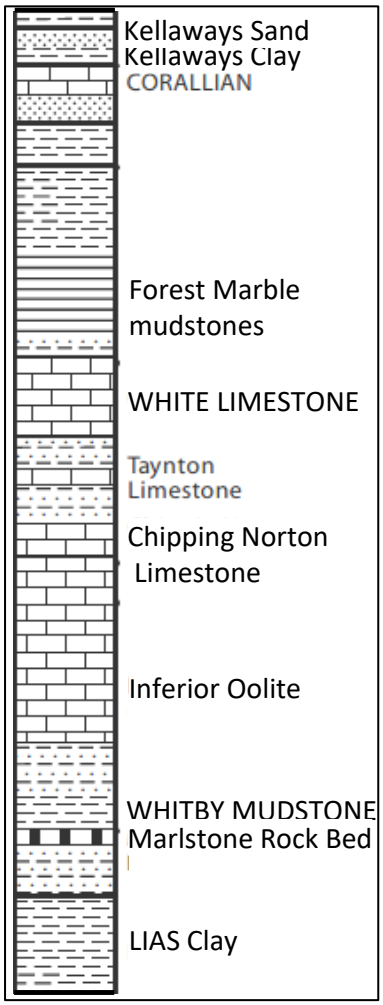


Figure 13. Detail of the strata around the Upper Heyford area.

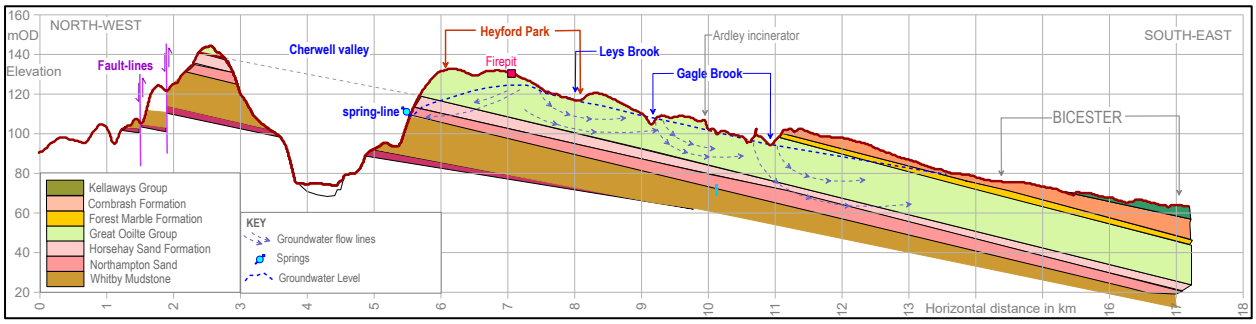


Figure 14. A cross section of the geology as shown by the line in Figure 12 from north-west to south-east.

The White Limestone and Chipping Norton Limestone are important water-bearing strata of the Cotswold Hill geology and present a thick permeable formation which is used for public water supply and irrigation agriculture. The Upper Heyford airbase is underlain by this rock sequence,

which is characterised by high transmissivity and storativity typical of fractured limestone. The complete sequence of permeable strata between the White Limestone and Whitby Mudstone are considered by the Environment Agency to be a single hydraulic unit and water resource licensing is accordingly based on output from this group as a whole. It would be expected that rain falling on the area would infiltrate and provide recharge of groundwater in this group. This would include rain on both the natural and artificial surfaces such as road, roofs and paved areas. Detention basins to attenuate surface runoff from impermeable surfaces were observed (such as Figure 15), and it is known that swales have been escavated as part of the new development which allow excess water to naturally infiltrate into the soil and underlying rock.



Figure 15. A detention basin to collect surface water runoff from impermeable surfaces of the new development at Upper Heyford.

However, with respect to contaminants, the sequence is characterised by frequent intercalation of mudstone beds with the limestone, which will impede and deflect downward and lateral movement of groundwater, with leakage through to greater depth. The Sharps Hill and Bladon strata are dominated by such mudstone intercalation, and there are thinner mudstone bands in the two principal limestone formations. This means that there is shallow perched groundwater at 2 to 3 m bgl and the main water table in the White Limestone at greater depths of the order 12 to 28 m bgl. Contaminants will migrate firstly to the shallow water-bearing strata, followed by vertical leakage to the deeper layers.

Information on soils for the area was obtained from the Soilscapes dataset from Cranfield University (2026). This shows that the White Limestone outcrop is characterised by free-draining lime-rich loamy soils, generally used for arable farming with grassland at higher elevation. Natural habitats include herb-rich chalk and limestone pastures and lime-rich deciduous woodlands. This suggests that rainfall would be expected to recharge limestone groundwater by direct infiltration.

BGS borehole archive data have been reviewed across the White Limestone outcrop to obtain an appreciation of the depth of groundwater in m bgl (below ground level) and characteristics of the ground surface. This information shows two important facts:

- Shallow geology consists of a fairly clayey and impermeable layer of made ground, silty sand-clay with some limestone rubble over soft to firm clay formed from limestone weathering to depths of 1 to 2 m bgl.
- Groundwater occurs in two distinct levels, a shallow water table at 2 to 3 m bgl and the main water table in the White Limestone at greater depths in the range 12 to 28 m bgl.

BGS Depth-to-Groundwater [DTGW] data have been used to generate the isolines in Figure 16. This shows that groundwater is at greatest depth on the NW side of Upper Heyford, while groundwater is close to the surface in the headwaters of Leys Farm Ditch and Gagle Brook. Similar interaction between groundwater and runoff in Gallos Brook only occurs downstream of Caulcott and Aves Ditch, which would also explain the observation of Gallos Brook being dry at Caulcott.

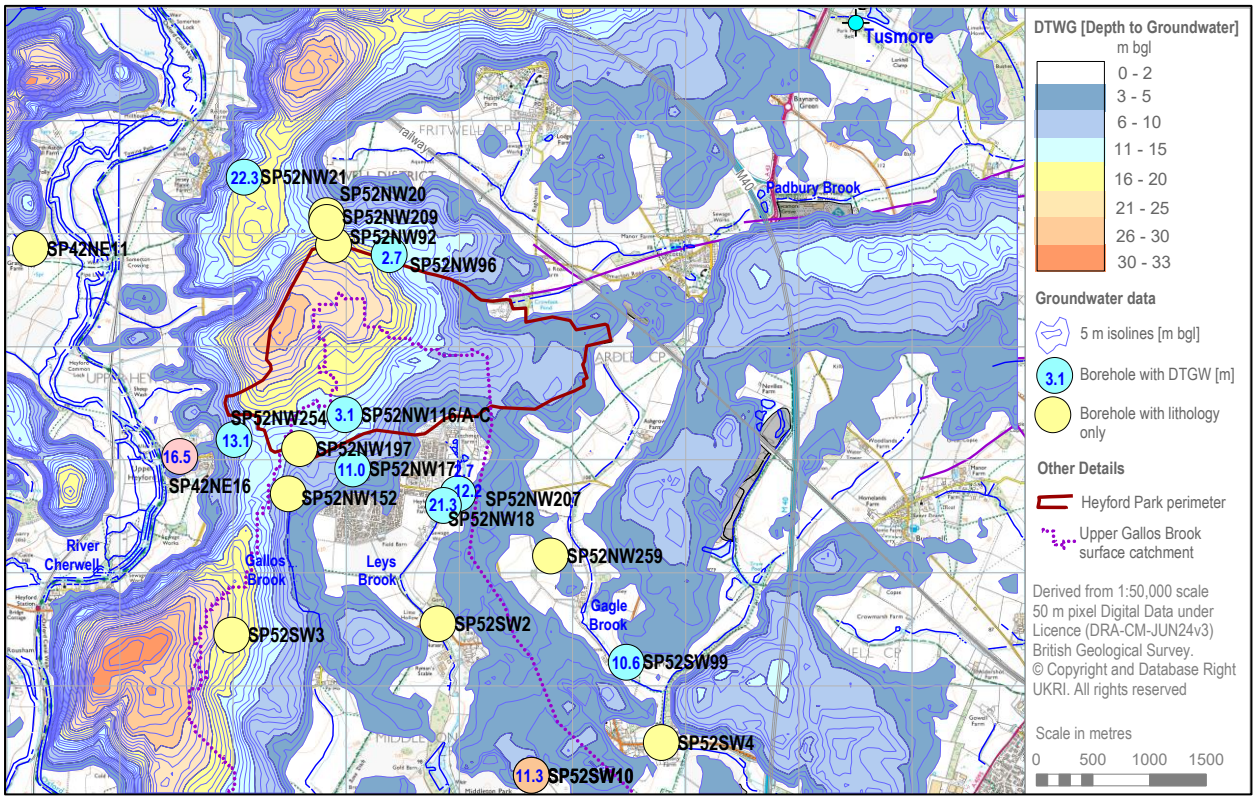


Figure 16. Depth to groundwater

Padbury Brook is an important feature which has developed along East-West faultlines in the White Limestone and Cornbrash. Hard-rock fracturing will be well-developed in association with these faults and will provide enhanced groundwater circulation. Impermeable material can also infill fault fractures through brecciation, and these can act to deflect groundwater movement. It is noteworthy that one of the fracture lines extends to the perimeter fence of the former airbase boundary, so this will likely intercept infiltration on the north-east corner of Upper Heyford. Higher transmissivities can be expected along the fault zone. On the Cotswold escarpment, these fracture systems are large enough to form small caves which can be penetrated for 100m or so, although they lack the stability of caves in Carboniferous limestone. Finally, it should be noted that the DTGW data are average values, and seasonal variation should be expected with higher levels in winter and lower in summer.

Groundwater Movement and Contamination

The DTWG data has been further used to obtain an estimate of groundwater movement by subtracting the DTGW 50 m pixel values from the LiDAR 1 m DTM, with resulting map shown in Figure 17. It can be seen that the groundwater divide between Cherwell valley drainage and dip-slope drainage lies close to the eastern and south-east perimeter of Heyford Airbase, which implies that contaminants entering groundwater on the western 65% of the site will move towards springs on the Cherwell valley-side. On the eastern part of the site, 30% would move into the Leys Farm Ditch and Gagle Brook area and 5% into the Padbury fault zone.

The National Abstraction Licensing Database [NALD] shows that there are 78 licensed groundwater sources in the area of the 1:50,000 geological map used for this review, of which 16 are used for private water supply. The others are used primarily for irrigation agriculture or general farming and domestic supply. Location of these boreholes is shown in Figure 18. The closest are located 2.0 and 2.3 km SE of the firepit, at Manor Farm on the Gagle Brook and Park Farm on the Leys Farm Ditch near Middleton Stoney and are used for general farming and domestic purposes. It would be logical to investigate water quality in these two boreholes. The other close borehole is most likely in the Northampton Sand on the Cherwell valley side, 1.9 km to the south-west. The next group of four boreholes is located 5 km away from the firepit, to the south and east. It is unlikely that the routine testing sent to the local health authority would analyse for PFAS.

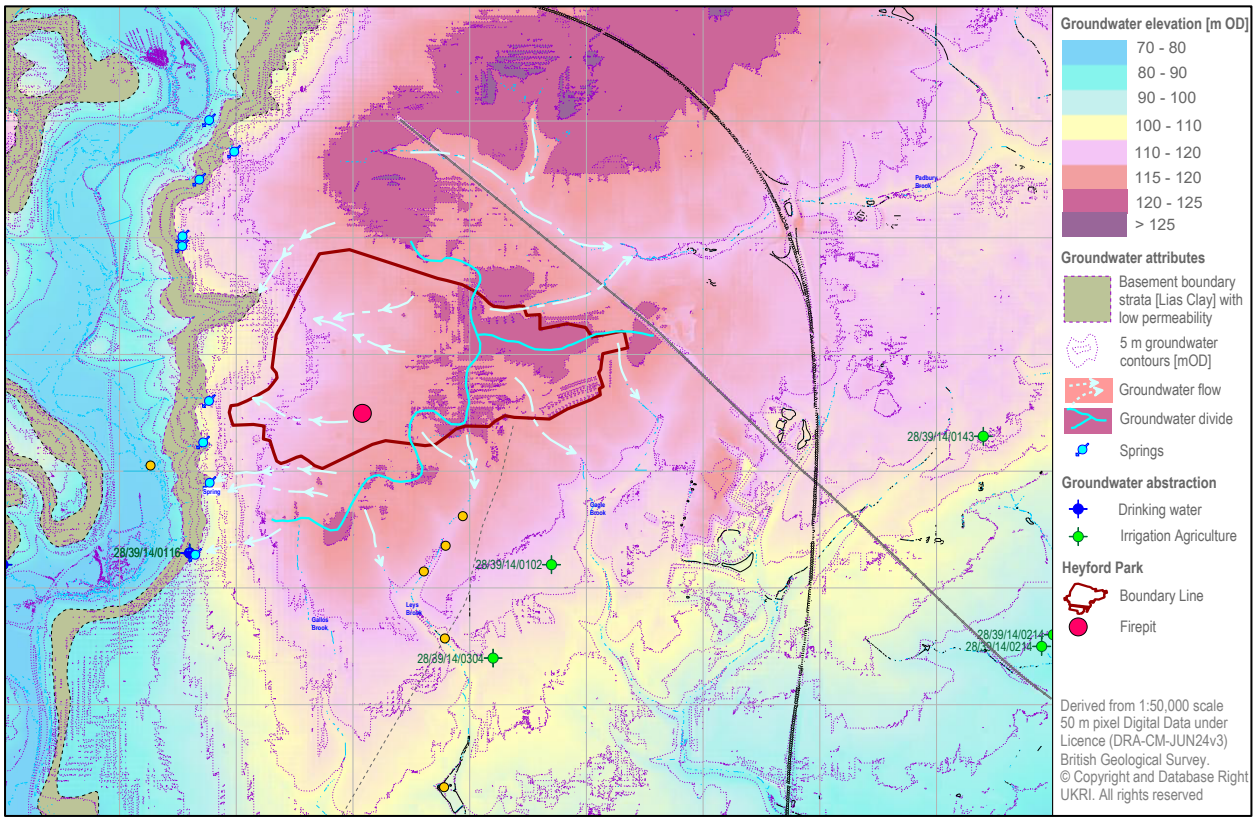


Figure 17. Groundwater divide and flow in the vicinity of the Heyford Airbase.

As there would appear to be a scarcity of PFAS data in groundwater, measurements sampling and analysis should be taken carried out those at boreholes closest to the firepit location (the source of historic PFAS) including at Manor Farm and Park Farm, and any boreholes, wells or springs in the Cherwell Valley.

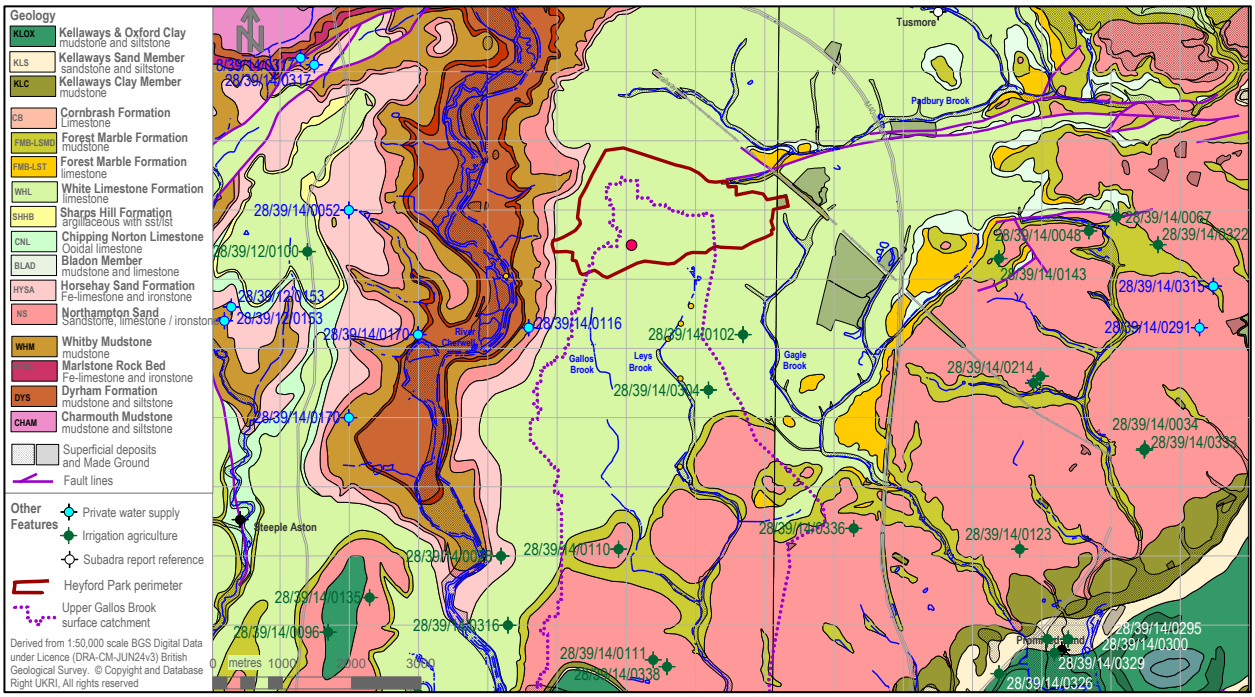


Figure 17. Licensed boreholes used for irrigation and private water supply.

Contaminated soil on site will contribute to groundwater contamination by direct infiltration. There would appear to be little information available on PFAS in groundwater at Upper Heyford. The Subadra report (2026) mentions three boreholes which were sampled by the EA, but they are a significant distance away from the site: Tusmore Estate (5.7 km NE), Steeple Aston (6.8 km SW on the opposite side of the River Cherwell and past the Whitby Mudstone barrier), and Promised Land (8.5 km SE in Bicester). The only relevant site is the Promised Land farm borehole, which would be expected to lie in the path of regional groundwater movement in the Great Oolite Group. However, testing found only trace concentrations as follows:

- Tusmore Estate zero
- Steeple Aston 0.00081 µg/l
- Promised Land 0.00076 µg/l

These values are well below the Drinking Water Inspectorate guidelines of 0.1 µg/l, and monitoring would be required if they exceed 0.01 µg/l.

Biotoxicity Measurements in the Gallos Brook

As part of this current study samples were taken in the Gallos Brook and River Cherwell for a biotoxicity assessment. This is a rapid assessment to identify whether the water would be toxic to any plant or animal life based on the response of natural bacteria to water samples. The samples were taken at 7 locations on the Gallos Brook and one location on the River Cherwell. These are shown on the map in Figure 18. Sampling was undertaken at sites where flow was observed in the

channel, namely those in Figures 4,5,7,9,10 and 11. In addition a further sample was taken from the River Cherwell at Cuttle Mill as a comparison (Figure 19). Sample number 5 was not possible as the river here was dry.

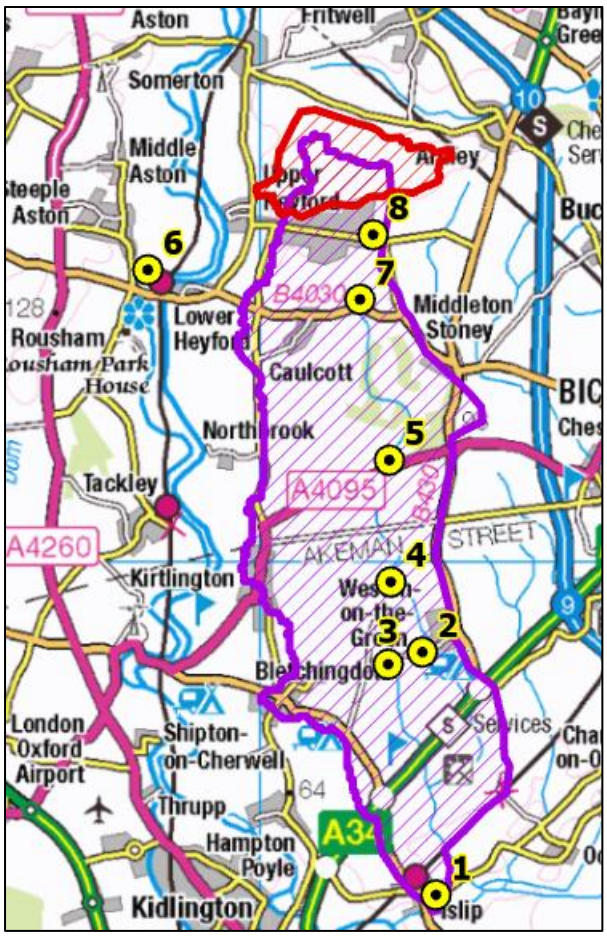


Figure 18. Sampling locations shown in yellow.



Figure 19. The River Cherwell at Cuttle Mill.

Oxford Molecular Biosensors Ltd, a spin-out company from the University of Oxford, has been developing whole-cell biosensors to assess toxicity of water pollution to living organisms. The technology has been engineered through targeted DNA editing of naturally occurring soil bacteria, so that changes in cellular responses triggered by changes in water quality (e.g. specific pollutants and nutrient changes) are relayed through the release of measurable light. This change in light over the 30-minute assay is measured to quantify acute toxicity from a biological organism perspective. This allows bioavailable toxicity to be measured directly, rather than inferred from chemical concentration alone. This way, the bio-impact of complex cocktails of chemicals can be rapidly assessed, which may impact biological life living in streams such a macroinvertebrates and fish. In summary, the biosensors are a new tool which can be deployed to monitor and manage environmental pollution.

The measured biosensor luminescence when in a water sample is compared with the luminescence with a set of positive and negative controls. Decreased light output infers acute toxicity. The design allows it to respond at very low concentrations of a toxic contaminant, with sensitivity over several orders of magnitude. The biosensors respond rapidly (<30 minutes) so can be used as an early warning of toxic pollution. The results of the testing are shown in Figure 20.

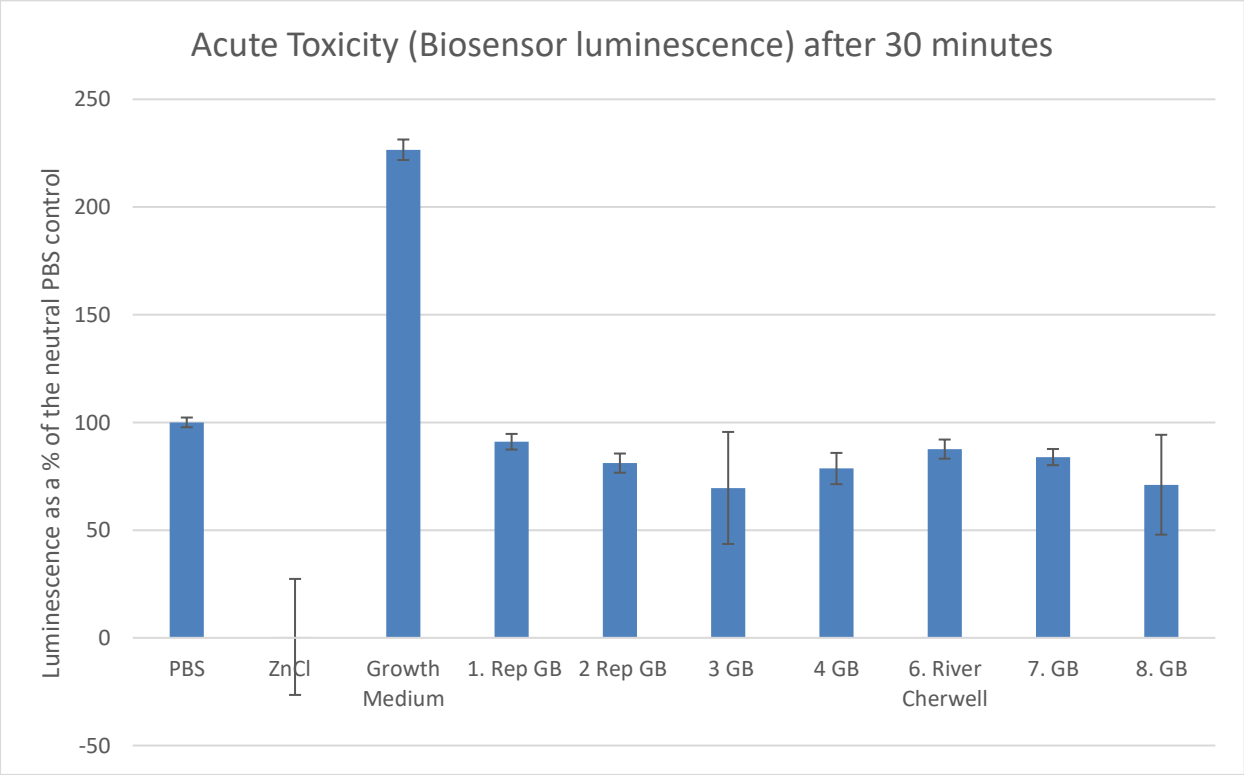


Figure 20. Results of the biotoxicity testing.

The water samples showed statistically significant ($P<0.05$) acute toxicity relative to the phosphate buffered saline (PBS) control. Negative (toxic) control ZnCl was included, as well as growth medium (positive control) for reference. Samples 3 and 8, located at Weston on the Green and the Leys Ditch at Upper Heyford respectively, demonstrated the highest acute toxicity with a 38% and 36% reduction in luminescence respectively compared to the PBS control. The least toxic samples measured were sample 1 near Islip and sample 6 on the River Cherwell, however these still demonstrated around 20% reduction in light relative to the neutral PBS control, so an overall reduction in water quality.

This is a moderate but significant toxicity result which would require further work to evaluate the cause of toxicity. Potential causes of toxicity may include chemical pollutants such as metals, PFAS/PFOS or other sources e.g. effluent discharge (BOD or high Ammonia) from the base and housing developments at Upper Heyford. Note for the labels on the x-axis in Figure 20 the number given corresponds to the number on the map in Figure 18.

Catchment Scale Water Quality Modelling

One approach to understanding the movement and distribution of such chemicals is to make use of combined hydrological and chemical models. Such a model has been developed by Prof Paul Whitehead at WRA. The INCA (Integrated Catchment) suite of dynamic, processed based models cover a range of water quality constituents including nutrients (Nitrogen and Phosphorus), sediments, dissolved oxygen and biochemical oxygen demand and organic pollutants such as PCBs and POPs.

The INCA (Integrated Catchment) models are a family of complex, process based, dynamic flow and water quality models designed for water quality assessment (Whitehead et al., 1998a, 1998b). In summary, the discretization of catchment and river structure is provided by determining the order of streams, their length and width between reach points, and by compiling dimensions and characteristics of individual sub-catchments (including soil properties, chemical characteristics and land use information). INCA has been applied widely to 25 catchments across the UK and 70 globally. The models have been applied extensively to the River Thames catchments for all the water quality variables using a reach structure as shown in Figure 21. The INCA Organics version of the model incorporates the hydrological flows and the chemistry of PFAS to simulate the exchange between the water, the sediments in the streams and biology in the streams such as fish, as illustrated in Figure 22 for PCBs in the Thames.

It would be a worthwhile project to apply the INCA model to simulate PFAS in the Upper Heyford Streams. Once established this would give a clearer understanding of the contamination and the distribution of PFAS in the area.

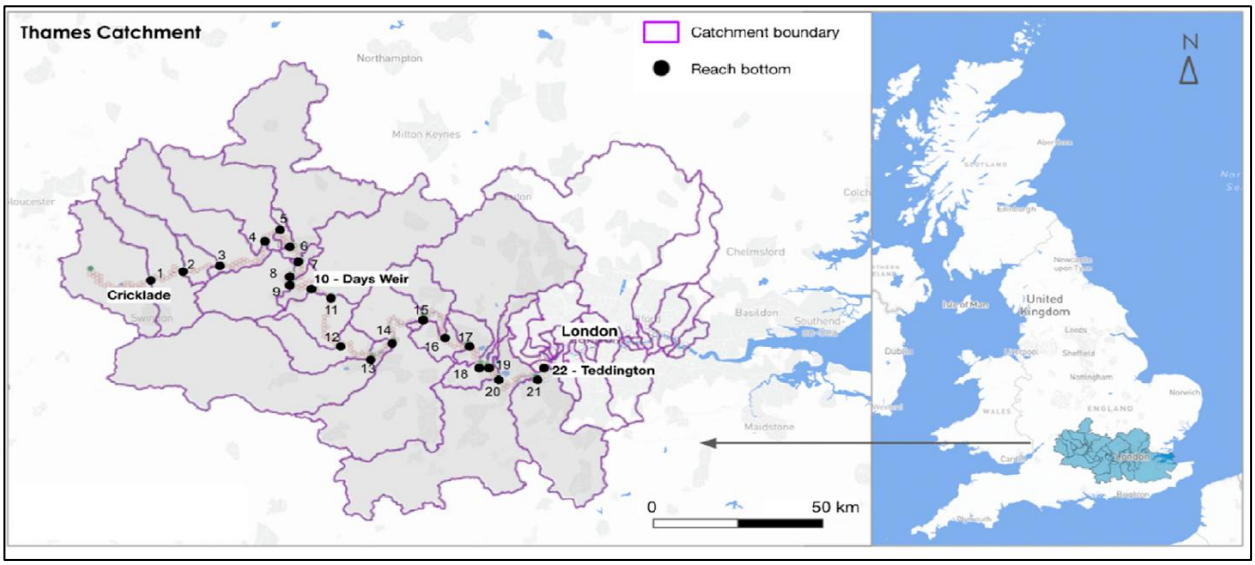


Figure 21. INCA application to the River Thames catchment.

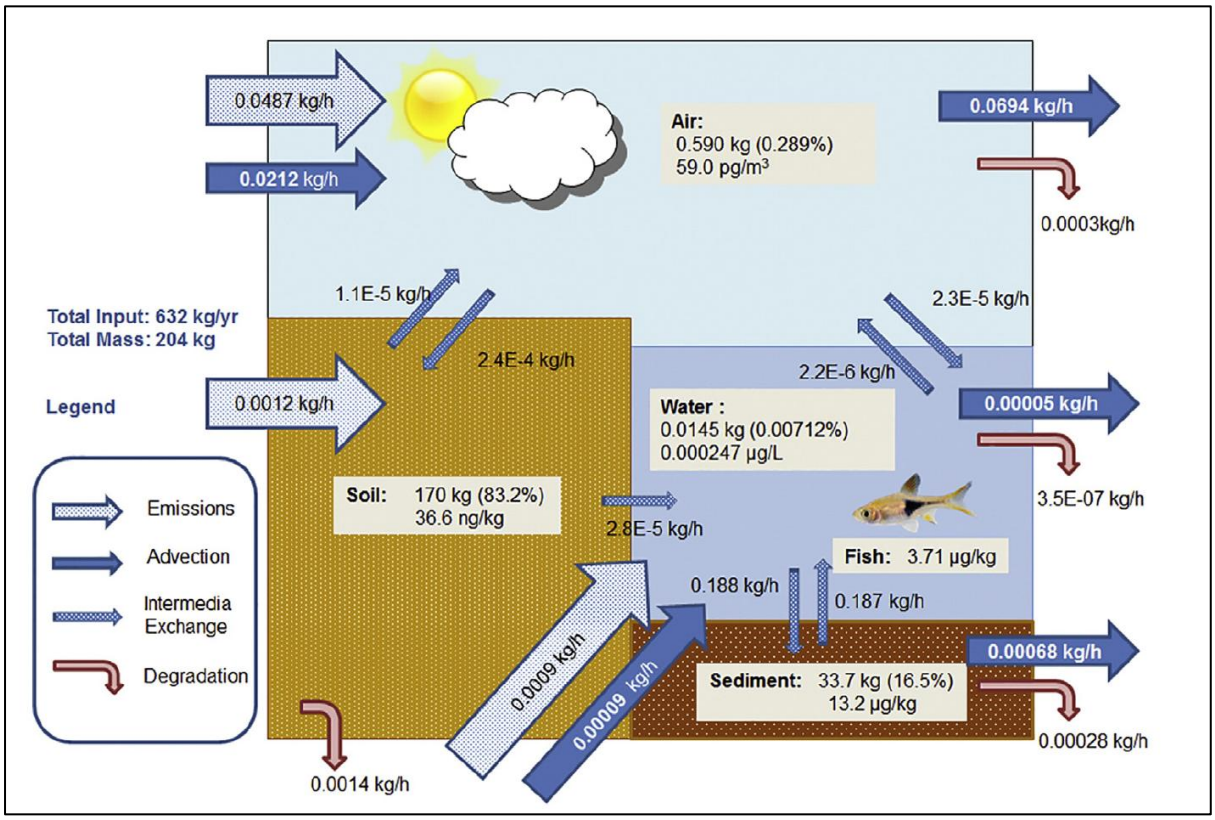


Figure 22. INCA modelled distribution of PCBs in the Thames.

References

British Geological Survey (2026) https://geologyviewer.bgs.ac.uk/

Cranfield University (2026) http://www.landis.org.uk/soilscapes/

Centre for Ecology and Hydrology (2026) National River Flow Archive Gauging Station Search http://nrfa.ceh.ac.uk/data/search

Subadra (2026) PFAS Data Review for Former RAF Heyford and Surrounding Area Near Bicester.

Whitehead, P.G., Wilson, E.J. and Butterfield, D. (1998a) A semi-distributed Integrated Nitrogen Model for Multiple source assessment in Catchments (INCA): Part I - Model Structure and Process Equations, Science of the Total Environment, 210/211 pp. 547-558.

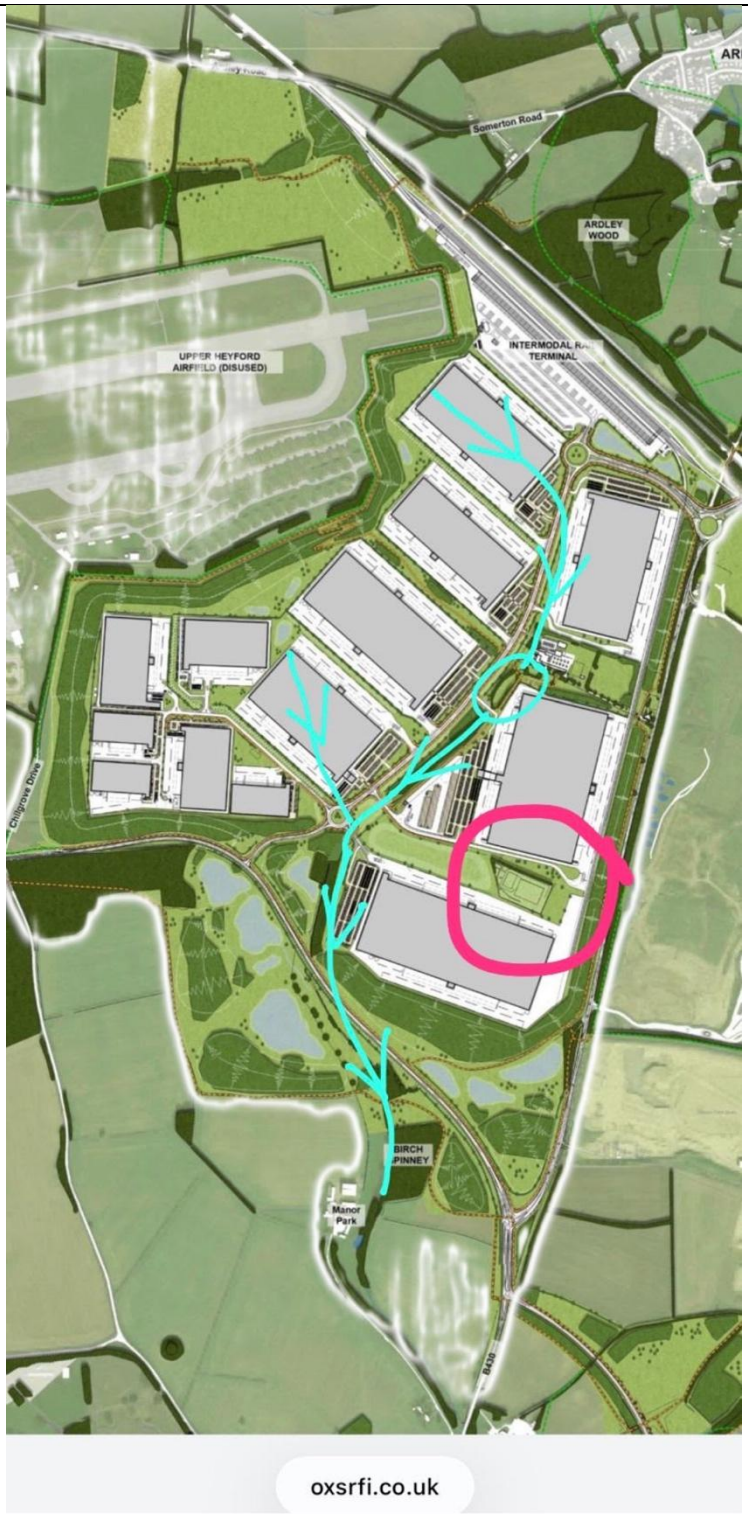
Whitehead, P.G., Wilson, E.J., Butterfield, D. and Seed K. (1998b) A Semi-distributed Integrated Nitrogen Model for Multiple source assessment in Catchments (INCA): Part II Application to large River Basins in South Wales and Eastern England, Science of the Total Environment 210/211 pp. 559-583

PFAS contamination affecting Oxfordshire Strategic Rail Freight interchange

- **PFAS is highly toxic and is linked to a range of serious health conditions** including cancer, immune suppression, liver and thyroid damage, high cholesterol and developmental issues in children.
- PFOS and PFOA are **banned worldwide and classed as carcinogenic.**
- People living near PFAS hotspots tend to have **elevated levels of PFAS in their blood** (recent examples are Bentham and Thornton-Cleveleys).
- PFAS is **highly mobile and spreads in a plume** of up to 10 km through air, soil, ground and surface water.
- **Extremely high levels of PFAS have been found in 9 streams** flowing from the former RAF Upper Heyford base (now Heyford Park) by the Environment Agency and environmental consultants BWB and Subadra. The highest was 42,174 nanograms per litre. This is thousands of times over the Environmental Quality Standard and significantly higher than other known PFAS hotspots such as RAF Fairford and the National Fire Service College.
- Groundworks for OXSFRI **risk disturbing PFAS contamination** and exposing the public and site workers.
- Two of the contaminated streams, tributaries of the Padbury and Gagle Brooks, **flow through the OXSFRI site.**
- Former airfields with fire training areas like RAF Upper Heyford are **well documented PFAS hotspots,** owing to large quantities of AFFF firefighting foams contaminating soil and waste-water runoff.
- Historic MOD documents obtained by Calum Miller MP recently confirmed that firefighting foam was '**washed down the drain'** at RAF Upper Heyford.
- Potential PFAS contamination in the area **has been acknowledged** by the 2021 Hydrock Ground Conditions report produced for OXSFRI and by Cherwell District Council in an email from Shawn Fleet.
- Risk assessments emphasise **protecting the Principal Aquifer** under the site, the Great Oolite Limestone Formation, which stretches for 200 miles across the south of England.
- However, **no testing for PFAS has ever been carried** out either at the OXSFRI site, or at Heyford Park.
- The **Fire Training Area has never been remediated**, despite this being recommended by the Planning Inspectorate in 2009, at the planning appeal for the initial redevelopment of the RAF Upper Heyford site.
- The National Planning Policy Framework **requires developers to show that the risks from contamination are not unacceptable** prior to permission being granted. In order to decide on the risks, extensive testing for PFAS including an intrusive ground investigation and controlled waters assessment, will be necessary.



Tributary of the Padbury Brook (part of the Bedford Ouse Catchment Area) flowing from the Northern Bomb Stores. This flows across the northern section of the OXSRFI going onto flood properties in the village of Fewcott before running along the southern edge of the Baynard's Green warehouse park and onto the village of Stoke Lyne.



East & West tributaries of the Gagle Brook which flow from interceptors on the base. OXSRFI will be constructed directly on top of these waterways. NB the eastern branch runs close to the Thames Water covered reservoir- circled in pink. The Gagle flows flows through the villages of Middleton Stoney, then Chesterton and ends up in the RSPB nature reserve on Otmoor.