Conceptual Model of Flooding in Colnbrook

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Conceptual Model of Flooding in Colnbrook

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1. Introduction

To provide context for the groundwater monitoring, modelling/mapping and early warning workstreams within the Colnbrook community area, a conceptual model of flooding mechanisms has been produced This conceptualisation addresses all relevant forms of flooding, including fluvial (river) flooding. It also provides an overview of flood receptors and known impacts.

Colnbrook is one of three focus communities within Project Groundwater where Permeable Superficial Deposit (PSD) groundwater flooding is known to occur. The town sits on the superficial deposits of the Shepperton Gravel Member and alluvium which make up part of the River Colne Floodplain and includes the floodplains of the Horton Brook and Colne Brook (BGS, 2025a).

The town has an area of approximately 5.6km^2 and the population at the time of the 2021 Census was approximately 6,420 people (between Colnbrook and Poyle), with approximately 1,900 of this in Colnbrook (City Population, 2025).

Colnbrook is located southeast of Slough between Horton Brook and Colne Brook and within the Coln Operational Catchment, see Figure 1-1 (Environment Agency, 2025a). These brooks flow roughly north to south and are tributaries to the River Thames, and discharge into the River Thames around 5km downstream of Colnbrook. The channels have historically undergone flood alleviation works which has included construction of a series of flood relief channels, increasing bank heights, channel clearance and the widening of channels all effective to varying degrees.

The flood conceptualisation is based on data and local experiences of flooding in the Colnbrook area. Use is also made of river level data within and upstream of the area for the period 1986 to 2025 and limited groundwater level data within the wider area from 2004 to 2025 taken from the Environment Agency's hydrology data explorer (Environment Agency, 2025b). Hydrological and hydrogeological data has been compared to understand and identify to what degree are they linked, as river levels influence and respond to groundwater levels through baseflow contributions and hydraulic connectivity.

This document provides an overview of the data sources used in developing the conceptual model, and then contextual information on the area, primarily the hydrogeology and hydrology, followed by the conceptualisation of flooding, and lastly an assessment of the knowledge gaps.

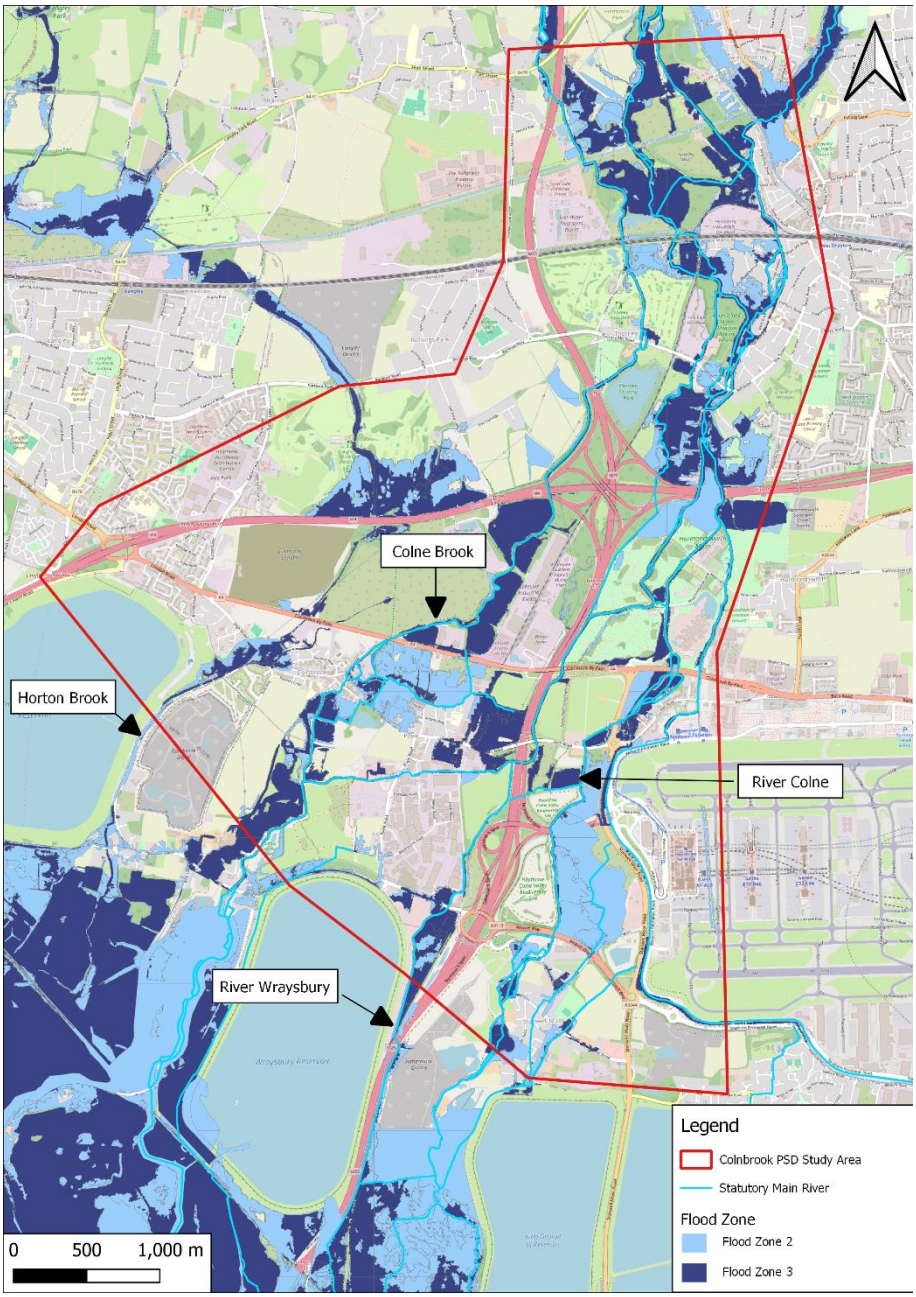


Figure 1-1. Colnbrook PSD Study Area

2. Information and data sources

2.1 National Hydrometeorological Monitoring Network and spatial mapping

Data from the Environment Agency (EA) hydrometeorological monitoring network contributed to the development of the conceptual flood model for Colnbrook (Environment Agency, 2025b). These include:

- Groundwater level data (with a combination of both continuous data and manual dips).
- River water level data.
- Rainfall data.

Monitoring stations are both local to Colnbrook and in the catchment upstream (see Figure 2-1) with six stations located just outside of the Colne Operational catchment but considered relevant for the purpose of this study (Environment Agency, 2025b). The monitoring locations located outside the catchment are relevant as the geological setting and conditions are similar, it also allows river conditions at the discharge points on the River Thames to be assessed. The data was used to understand the response of river levels and groundwater levels (in the superficial deposits) in the Colnbrook area to rainfall events in the catchments of the various watercourses that flow north to south through the Colnbrook area.

The monitoring stations used and presented in Figure 2-1 are listed in Table 2-1.

Table 2-1. Environment Agency Monitoring Stations Used in Colnbrook PSD Study Area

Monitoring Station	Station Type	Station ID	Location	Start of Record
Radlett	Rainfall	277407TP	Within catchment	1998
Chenies	Rainfall	278744TP		1998
Heathrow Airport	Rainfall	247540TP	Outside catchment to the east	2003
Pinner Cemetery	Rainfall	247281TP	Outside catchment to the east	1991
Ham Island	Rainfall	417417TP	Outside catchment to the southwest	2004
Penton Hook	River Level	2901TH	Outside catchment to the south	1986
Poyle Trading Estate	River Level	2892TH	Within catchment	1988
Uxbridge	River Level	2889TH	Within catchment	1984
Clisbys Bridge	River Level	2882TH	Within catchment	1996
Farlows Bridge	River Level	2883TH	Within catchment	2018
Yiewsly^	River Level	2891TH	Within catchment	1996
West Drayton	River Level	2885TH	Within catchment	1996
Stanwell Mill	River Level	2893TH	Within catchment	1988
Horton Mill	River Level	2897BTH	Within catchment	2023
Bell Weir	River Level	2702TH	Outside catchment to the south	1986

Monitoring Station	Station Type	Station ID	Location	Start of Record
Albany Park	Groundwater (Dipped)	TQ07_179	Within catchment	2004
Windsor Road	Groundwater (Dipped)	TQ07_184	Outside catchment to the southwest	2004

^Station offline since 1998

In addition to hydrometeorological data, spatial mapping from the Environment Agency (2025c) was also used within the conceptual modelling to identify areas where topography may play a part in where various types of flooding occur. Geological bedrock and superficial deposits maps of the area are available at 1:50,000 scale from the British Geological Survey (BGS).

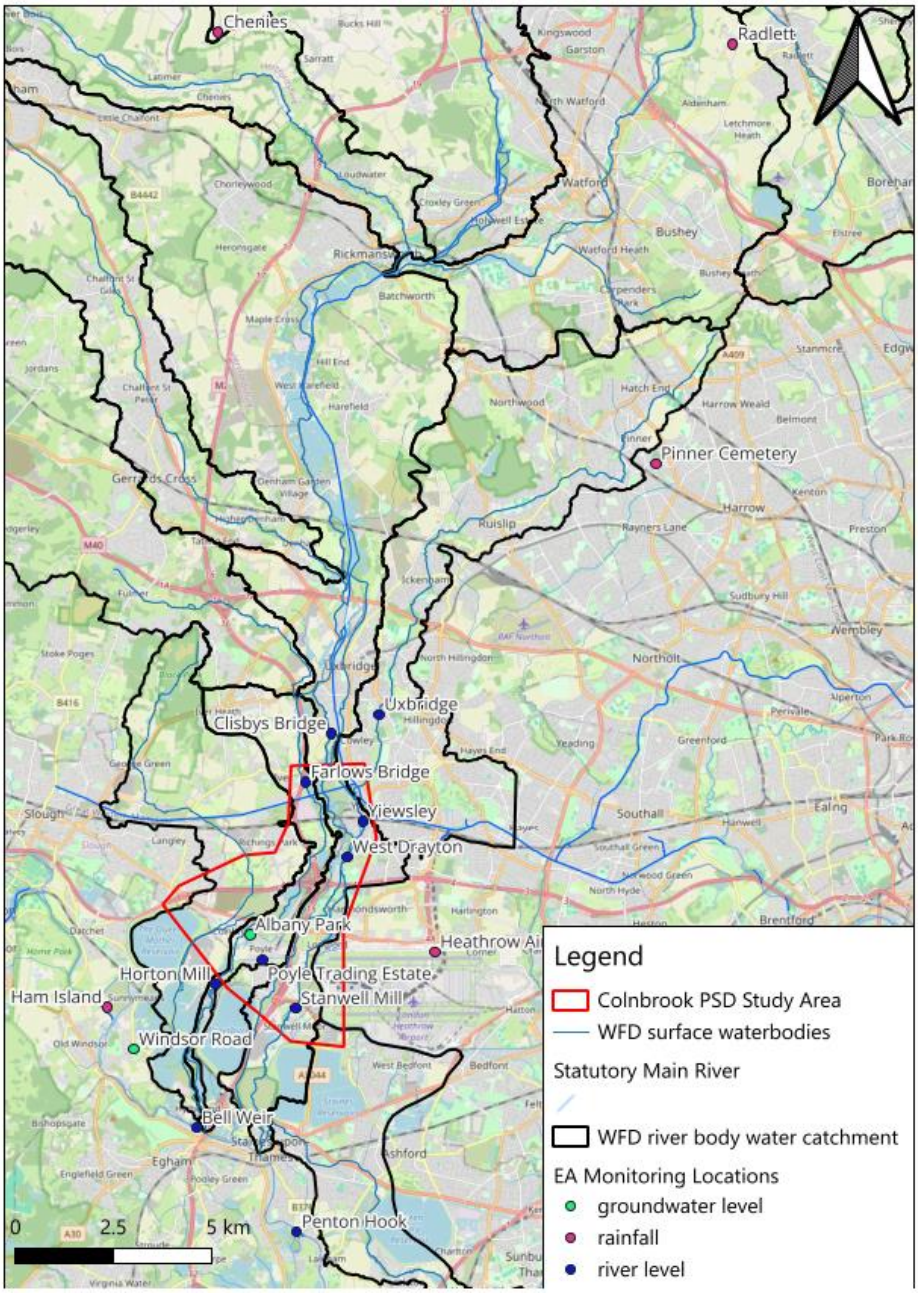


Figure 2-1. Environment Agency Monitoring Locations

2.2 Local Flood-Related Studies

Limited work has been undertaken to address flooding in the Colnbrook area, both for fluvial (river) and groundwater flooding. The majority of the work focuses on the ditch network around the neighbourhoods of Poyle and Colnbrook where flooding is recorded to be an issue.

In the 1990's, a weir-controlled channel was constructed to the east of river/ditch Colne Brook to facilitate flow from the County Ditch into the Coln Brook. This was constructed as part of an Environment Agency flood alleviation scheme to reduce flood risk in the residential areas there. However, this did not adequately deal with the volume of water; the channel conveyance did not stop the County Ditch from backing up and flooding. After flood events in 2000 and 2003 (the Strategic Flood Risk Assessment was not able to specify when in 2000 and 2003 the fluvial flooding occurred) further work included the creation of a new overflow channel to connect to Cottesbrooke Ditch through Albany Park (Figure 2-2)(Slough Borough Council, 2021).

Cottesbrooke Ditch carries water south through Albany Park and discharges water back into Colne Brook south of Cottesbrooke Close. Other measures as part of this flood alleviation scheme involved raising the banks of the Colnbrook West Lake, clearance along Colne Brook and the widening and introductions of controls on the County Ditch (Slough Borough Council, 2012a).

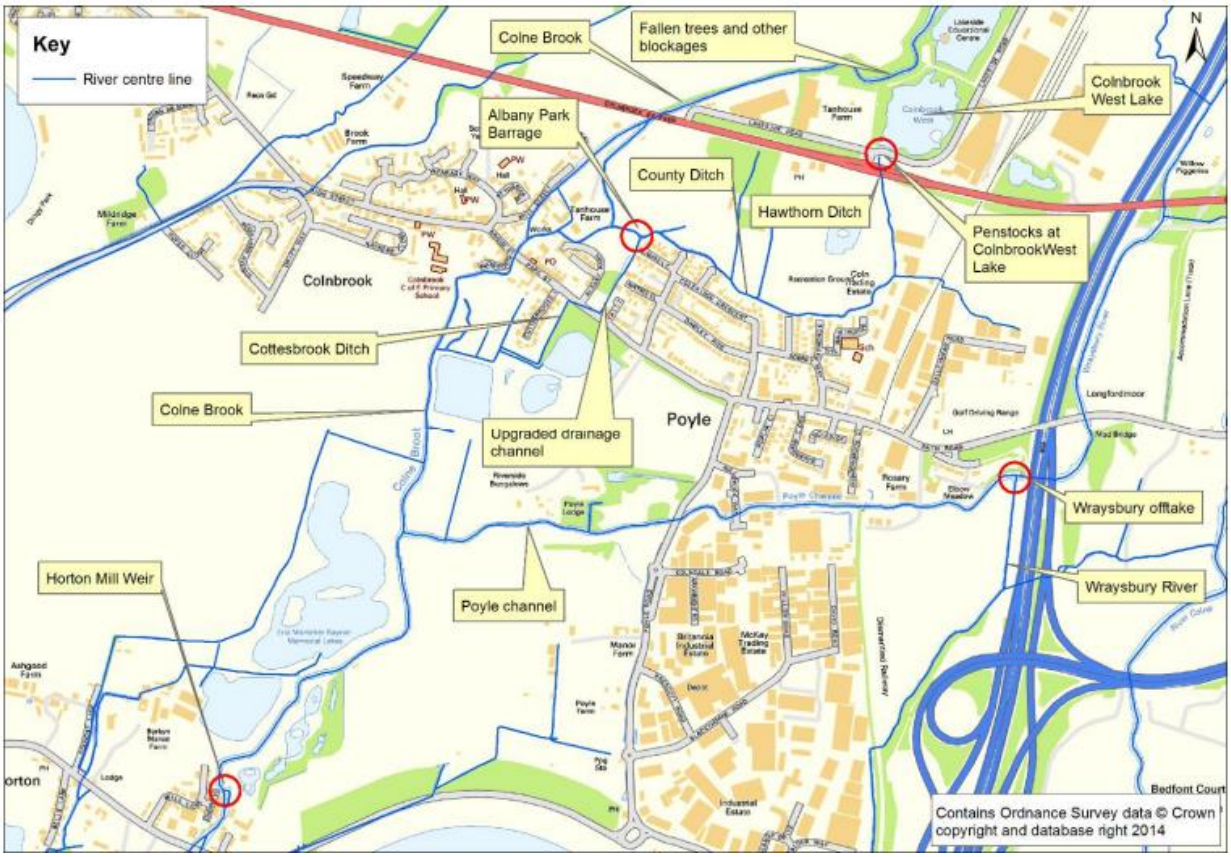


Figure 2-2. Surface Water and Ditch Network in Colnbrook (Slough Borough Council, 2015)

To the north of Colnbrook, just north of the Great Western Main railway line, a bentonite wall was constructed around the Thame's Water Iver South Sludge Treatment Works as a flood defence against both fluvial and groundwater flooding. The bentonite wall was able to alter shallow groundwater levels and flows around it (Slough Borough Council, 2012a).

2.3 Local Flood Impact Data

2.3.1 Section 19 Flood Investigation Report

A Section 19 Flood Investigation Report for Colnbrook was produced in 2015 (Slough Borough Council, 2015). This flood investigation report relates to flooding in January and February 2014 (precises dates are not recorded, though the flood event itself was initial reported to the council on 31 January 2014). During this flood event, fluvial flooding in the catchment was experienced in areas around Northern Poyle/east Colnbrook including the following key areas; Fawsley Close and Albany Park, Cottesbrook Close and Mill Street.

Reportedly, the flood event occurred due to prolonged heavy rainfall throughout December 2013 to February 2014, where the south of England received 250% of the long-term average rainfall (Slough Borough Council, 2015). This led to rising water levels in both watercourses (Horton Brook and Colne Brook), underlying superficial aquifers, and overland storage (West Lakes reached maximum capacity). Fluvial flooding occurred in the Albany Park Area as a result of high levels in Cottesbrook Ditch (fed by County Ditch). Fluvial flooding (from Colne Brook) was reported along Mill Street, with one incident of groundwater flooding recorded here.

During the event, as well as prolonged rainfall raising water levels in the ditch, water in Colnbrook West Lakes (natural lakes formed as a result of gravel extraction which act as flood storage) overtopped, bypassing the penstocks and flowed into Colnbrook village. The penstocks on the overland storage at Colnbrook West Lakes remained open which allowed a constant flow of water into Colnbrook via Hawthorn Ditch and County Ditch. The open pen stocks further exacerbated the flood event by elevating local groundwater levels, which resulted in internal flooding in properties at Coleridge Cresent and other nearby closes and Cottesbrook Close.

2.3.2 Surface Water Management Plan

The Surface Water Management Plan from Slough Council (2012b) indicates that there are records of surcharged sewers during historical flood events in Colnbrook and Poyle; no further details on this are available, however.

2.3.3 Strategic Flood Risk Assessment

A strategic flood risk assessment (SFRA) was developed in 2012 for the Slough area and acknowledges that the entire area is prone to groundwater flooding (Slough Borough Council, 2012a). The SFRA was updated to draft form in 2021 (Slough Borough Council, 2021).

The 2021 SFRA provides an itemisation of historic flood incidences in the Slough Borough. Those specific to Colnbrook are reiterated in Table 2-2. Note, flooding events were recorded in 2009 and 2016 due to poor drainage managed during construction/modification and/or lake of maintenance of roads.

Table 2-2. Historic Flood Events in Study Area (SFRA, 2021)

Year	Month	Flood Type	Catchment	Area	Description of flood event taken from council records
2000,2001,2003	-	Fluvial	River Colne	Colnbrook and Poyle	Fluvial flooding in Colnbrook and Poyle
2014	February	Fluvial	River Colne Horton Brook	Colnbrook	Heavy rainfall in Colnbrook flooded residential areas including Colebridge Crescent, Albany Park, Mill Street, Rudsworth Close, Cottesbrooke Close, Colnbrook High Street and the A4

The 2012 SRFA notes that parts of the Colnbrook PSD Study Area in west Colnbrook are within the functional floodplain of Horton Brook including parts of Crown Meadow, Popes Close, Willow Close, Hunstanton Close and the western parts of Moreland Avenue, High Street and Vicarage Way. Other areas in the functional floodplain are in western Poyle/east of Colnbrook at Cottesbrooke Close, Poyle New Cottages, along the Poyle Channel and the confluence of the Colne Brook and Country Ditch.

Within this report it is noted that the area between the Colnbrook Bypass and the County Ditch is outside the functional floodplain, though is located in an area of known flooding. Other areas of known flooding in Colnbrook include Hellmann's site which is north of the Colnbrook Bypass and north of the flood alleviation works undertaken in the 1990's and after the 2000 and 2003 flood events (Slough Borough Council, 2012a).

The SFRA notes periods of fluvial flooding in Colnbrook and Poyle in 2000, 2001 and 2003, although the months in which these occurred and the sources of the flooding are not provided. It is also noted that the Council is aware of groundwater flooding around Popes Close and Galleymead Road in Colnbrook (Slough Borough Council, 2012a).

3. Contextual Information

3.1 Physical Features, Including Surface Water Network

Colnbrook and Poyle lies to the west of Heathrow Airport, west of the M25. The Colnbrook PSD Study Area (referred to as Study Area for remainder of report) is mainly urban and lies north of the River Thames, with tributaries to the Thames flowing through the area from north to south. Within the Study Area to the south of Colnbrook there are two large reservoirs; The Queen Mother Reservoir and Wraysbury Reservoir which are Water Framework Directive (WFD) Lake Water Bodies within the Colne Operational Catchment (Environment Agency, 2025a).

There is also a dense network of smaller lakes/ponds (some man-made) which are the result of old gravel workings which over time have been allowed to fill with water (likely to be both surface water and groundwater) (National Library of Scotland, 2025). Aerial mapping shows large areas of open land which are mainly historic landfills in old gravel workings.

3.1.1 Topography

Figure 3-1 illustrates the ground elevation of the Colnbrook PSD Study Area. The area is shown on topographical maps to be located within the Lower Colne Valley which feeds into the River Thames to the south. Within the Study Area elevations range from approximately 36 metres above ordnance datum (mAOD) in the northwest to 18mAOD in the southwest, sloping very gently to the south towards the River Thames.

The towns of Colnbrook and Poyle are situated in a low-lying area where elevations range from approximately 18mAOD to 21mAOD, in the Lower Colne Valley. To the east and west of the towns the land rises very slightly to mark out the wider hydrological catchment for the Colne Operational Catchment (i.e. Lower Colne Valley), which contains the catchments for the Colne Brook, Horton Brook, River Colne and Wraysbury River. As seen in Figure 3-1 the individual catchments for each watercourse are relatively narrow around Colnbrook and Poyle.

Within the Study Area there are multiple active/ inactive quarries for gravel workings which create anomalies in the topographical data and show very slight topographical lows. Where old gravel pits use to be these have now mainly been filled with landfill, with some landfills in the area still active.

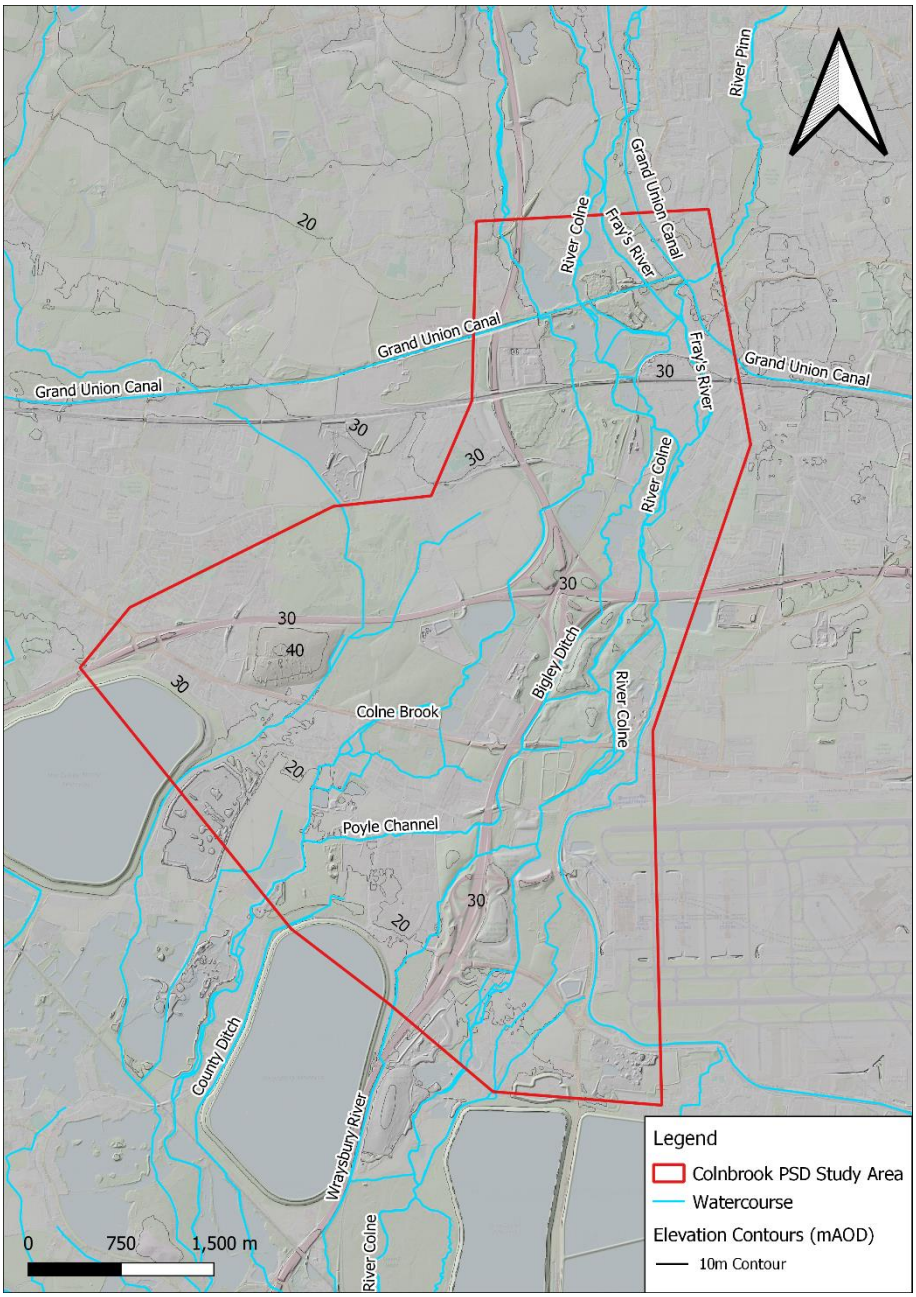


Figure 3-1. Topography of Study Area

3.1.2 Surface Water Features

The complex hydrological setting of Colnbrook is displayed in Figure 3-2 and Figure 3-3. The watercourses in the Colne operational catchment cover a large area and originate in the chalk of the Chiltern Hills as far north as Luton, flowing south and discharge into the River Thames at Staines-upon-Thames. The Study Area is within the lower section of the Colne Operational Catchment with all individual watercourse catchments converging and bottlenecking around Colnbrook and Poyle.

In the town of Colnbrook, watercourses flow south on either side of the town, with Horton Brook to the west of the town and Colne Brook to the east. Both flow south joining the River Thames at Hythe End. Within the wider area, to the east of Poyle and the M25, the Wraysbury River and River Colne flow north to south, discharging to the River Thames at Staines-upon-Thames. Also within the Study Area are multiple smaller

Ordinary watercourses include Poyle Channel which, flows from east to west to connect the Wraysbury River to the Colne Brook south of Poyle. The County Ditch likewise flows east to west transporting water from Colnbrook West Lake to the Colne Brook.

Between Colnbrook and Poyle is the Cottesbrook Ditch which is fed from the County Ditch and flows southwest through Albany Park between Colnbrook and Poyle towards the Colne Brook downstream of the settlements. This ditch is mainly open with one culverted section under Bath Road in the west of Poyle at Albany Park.

To the north of Colnbrook and Poyle and west of Colne Brook is a series of lakes formed by gravel extraction referred to as the West Lakes. This group of lakes are close to Junction 48 of the M25 and comprise Colnbrook West Lake, Orlitts Lake and Old Slade Lake (UKCEH, 2026a).

On the north side of Junction 47, slightly north in the Study Area, there are additional lakes adjacent to Colne Brook, also formed by gravel extraction. These include Thorney Country Park, Mayfield Lakes, Farlows Lake, Little Britain Lake, Cowley Lake and other unnamed lakes. To the south of Colnbrook and outside the study area there are a series of smaller lakes and ponds along the floodplain of the Colne Brook.

The UK Centre for Ecology and Hydrology maintains a database for lakes in the UK; The lakes identified in the study area are generally small to very small, very shallow, with moderate to high alkalinity (UKCEH, 2026a). The elevation at the lakes is between 23 and 28mAOD with mean depth of 1m.

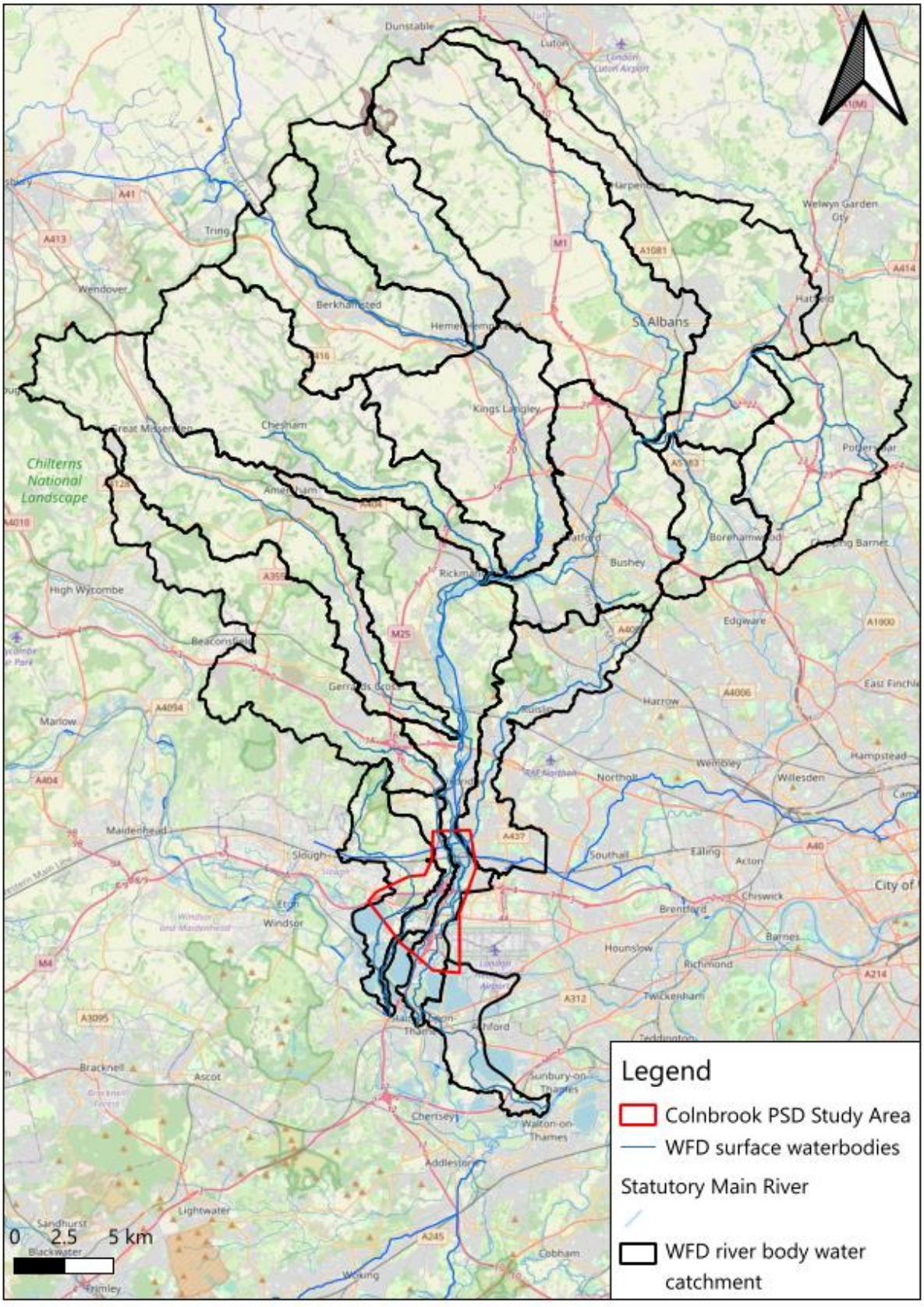


Figure 3-2. WFD Surface Water Body Catchments Within the Colne Operational Catchment

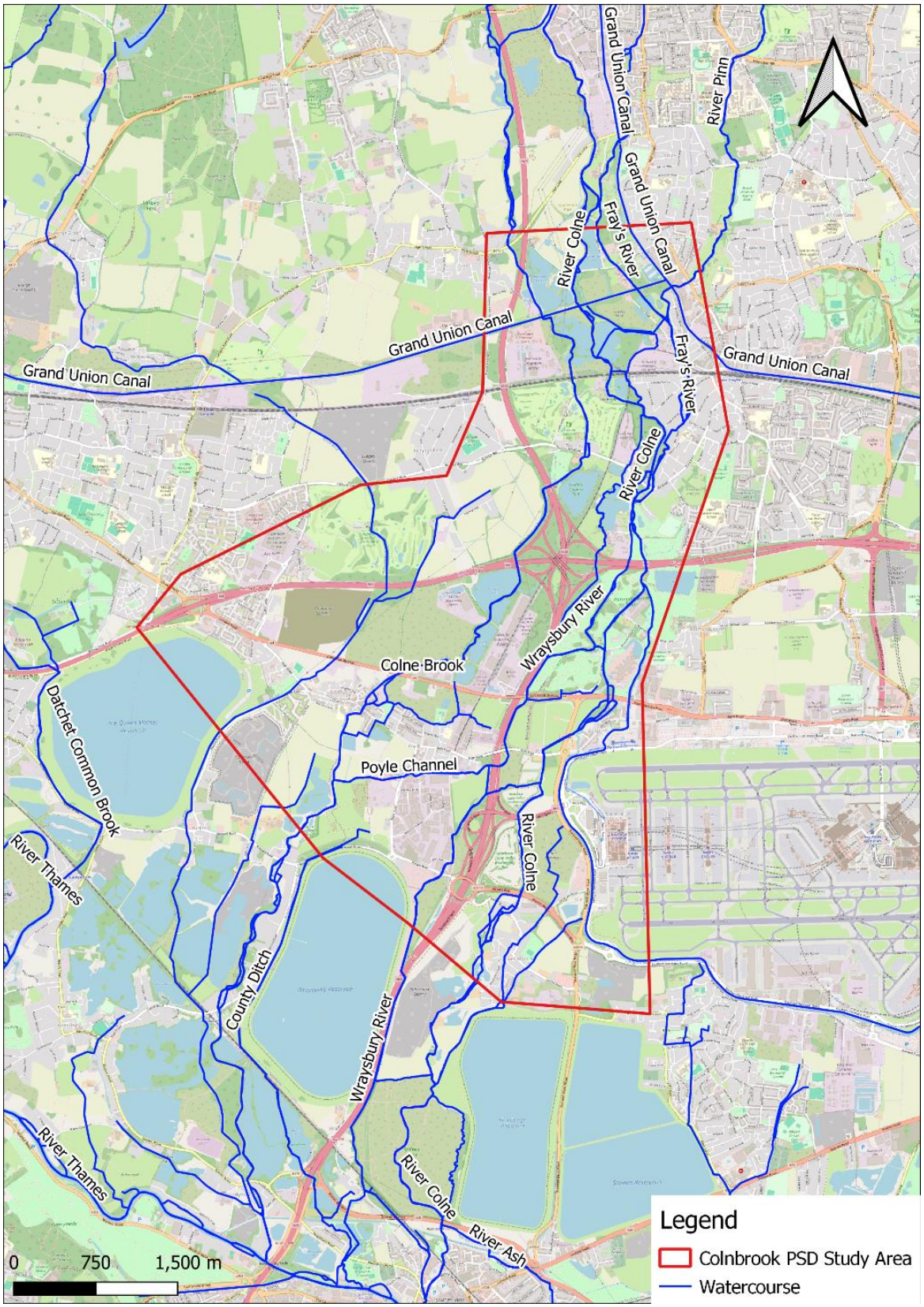


Figure 3-3. Hydrology Network Within and Around Colnbrook

3.1.3 Surface Water Controls

Within the Study Area there are multiple control structures on various watercourses which control the flows and levels (Slough Borough Council, 2015). These include:

- Penstocks at southern end of Colnbrook West Lake which control the volume going into Hawthorn Ditch leading to County Ditch.
- A tilting gate on the River Wraysbury which controls flow going into the Poyle Channel.
- Horton Mill Weir which controls levels on the Horton Brook downstream of the Study Area.

3.1.4 Statutory Designated Sites

There are two Sites of Special Scientific Interest (SSSI) in close proximity to Colnbrook which lie south of the town. These are Staines Moor SSSI and Wraysbury Reservoir SSSI (DEFRA, 2025).

The River Coln flows through the Staines Moor SSSI and a small unit of the SSSI (Poyle Meadow) is situated to the east of the Wraysbury River located on the west side of the M25. The SSSI is in the flood plain for both rivers. It is noted to contain 'wet communities' such as alluvial meadows supported by a high-water table, suggesting that this designated site is a groundwater dependent terrestrial habitat (GWDTE) (Natural England, 2026a). Staines Moore SSSI contains the Staines Reservoirs (2 lake water bodies) and the King George VI Reservoir (1 lake body) which are considered shallow, high alkalinity lake water bodies.

The Staines Reservoirs are (1) reservoir ID 42525 with mean depth of 7.5m and sits at 23m AOD and (2) Reservoir ID 42490 has mean depth 9.3m and sits at 26m AOD (UKCEH, 2026b) (UKCEH, 2026c).

King George VI reservoir is ID 42488 at elevation 29m AOD and with mean depth of 13.2m (UKCEH, 2026d).

Wraysbury Reservoir SSSI is located on the west side of the M25 and contains the Wraysbury reservoir. This reservoir is at elevation 31m AOD and has a reported maximum depth of 21.6m and a mean depth of 16.8m (UKCEH, 2026e). It is considered an artificial water body which supports wintering birds (Natural England, 2026b).

3.2 Geology and Hydrogeology

Both the superficial geology and bedrock geology of the Study Area and the surrounding catchment have been interpreted using 1:50,000 scale BGS mapping data (BGS, 2025a).

In the absence of any site-specific ground investigation (GI) data a selection of BGS boreholes have been selected from the area to give a representative summary of the geology and depths of various lithologies (BGS, 2025a).

Borehole records used for the conceptualisation of the study area are presented in Table 3-1.

Table 3-1. BGS Borehole Records Selected in the Study Area

BGS Borehole Reference	Depth (m)	Eastings	Northings	Borehole Log
TQ07NW102	45.75	502080	176690	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/573160

BGS Borehole Reference	Depth (m)	Eastings	Northings	Borehole Log
TQ07NW749	2.44	503250	177170	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/573807
TQ07NW232	4.50	504210	177315	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/573290

3.2.1 Superficial Geology

Superficial deposits overlying the bedrock consist of alluvium, and sand and gravels of the Shepperton Gravel Member (refer to Figure 3-4) (BGS, 2025a). Deposits of the Taplow Gravel Member are present to the west and east where elevations are slightly higher. These are all associated with the floodplain of the Colne and Horton Brooks and Wraysbury River and River Colne which are tributaries to the River Thames

From literature the Shepperton Gravel Member which underlies the floodplain are typically around 0 to 8m thick but locally can be up to 14m thick (BGS, 2025b). The Taplow Gravel Member which underlies the Shepperton Member is on average 5m thick but can be 9m locally (BGS, 2025c).

In the Study Area 'gravels' are identified to a depth of 14.3 metres below ground level (m bgl). However, the majority of locations have gravel to depths of between 4 to 7m bgl.

Within the Study Area there are areas where superficial deposit has been disturbed by sand and gravel workings with the alluvium having been removed to expose the gravels of the Shepperton Gravel Member at the surface for extraction. These have then been turned into landfills and backfilled or left open to form lakes.

Using the BGS Urban Interactive model for London and Thames Valley, synthetic cross sections from north to south and east to west across the Study Area were created (see Figure 3-5 and Figure 3-6). From these, the superficial geology is quite thin (approximately 1-5m) and is underlain by the London Clay Formation which has a greater thickness of >10m.

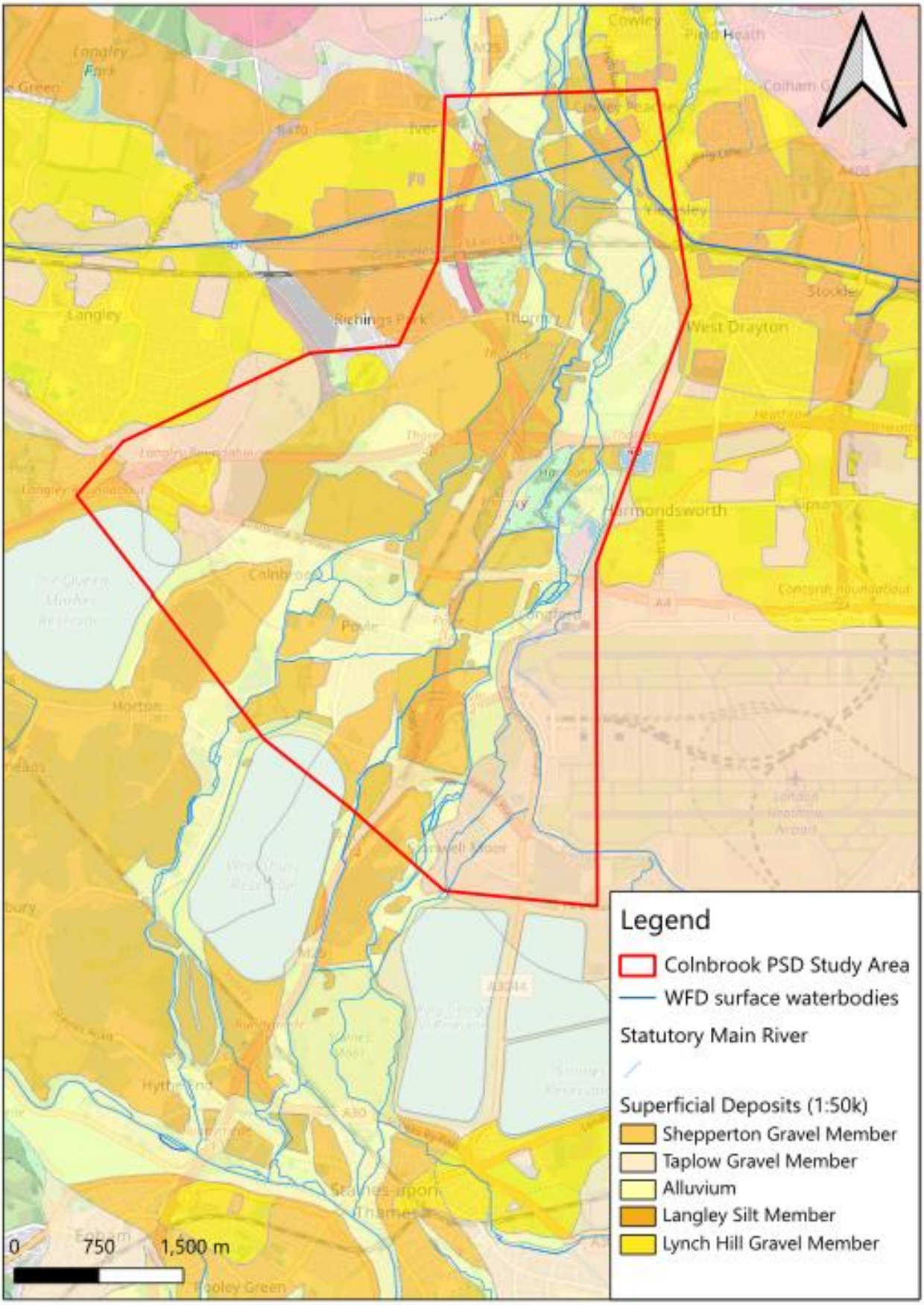


Figure 3-4. Superficial Deposits (1:50k)

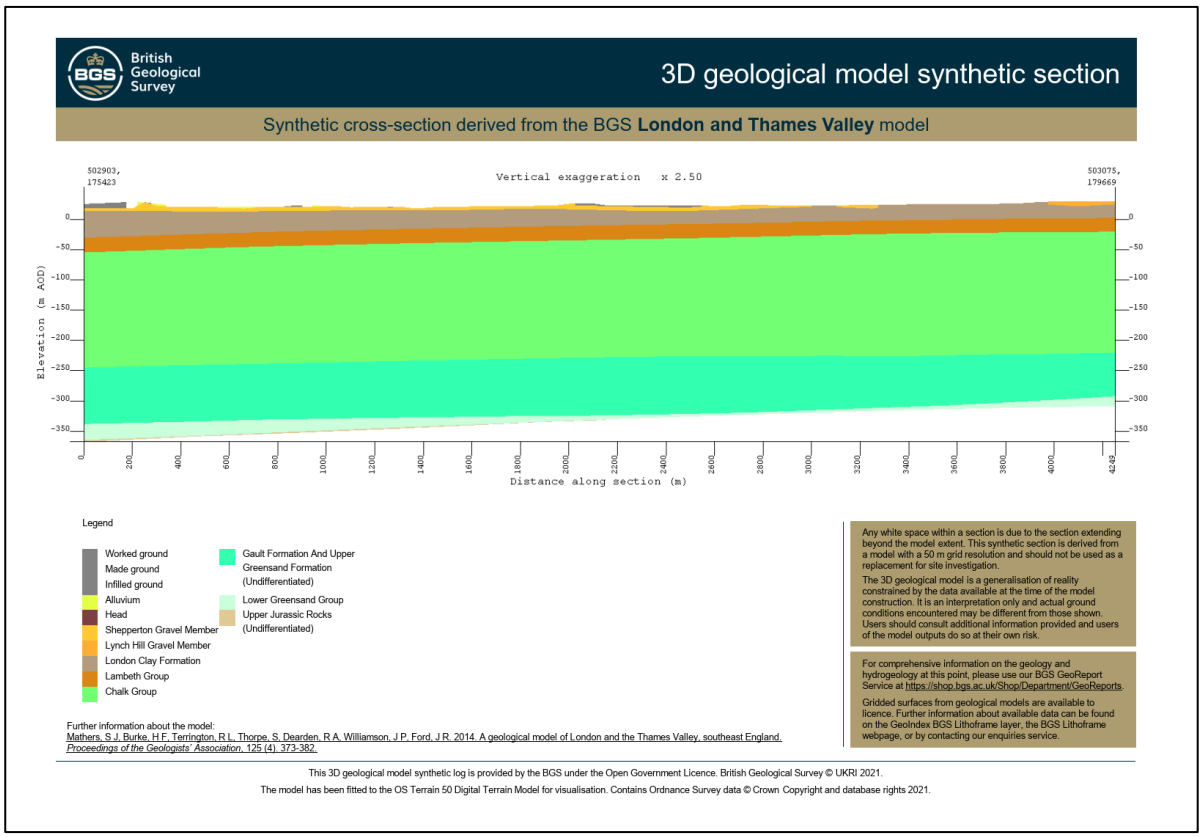


Figure 3-5. North to South Synthetic Cross Section

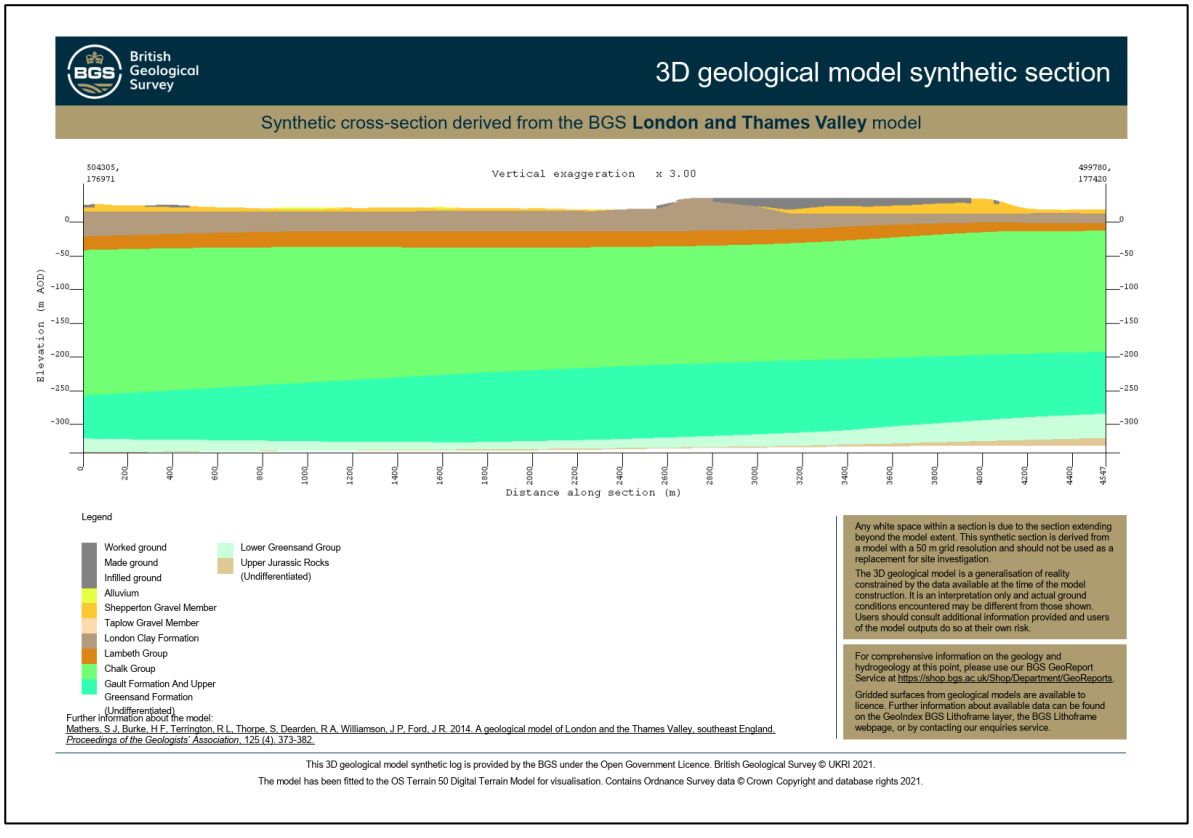


Figure 3-6. East to West Synthetic Cross Section

Table 3-2 below summaries the depth to bedrock of the boreholes used for the Study Area.

Table 3-2. Record of Superficial Deposits in Selected BGS Boreholes

BGS Borehole Record	Depth to Bedrock (m)	Superficial Deposit Description	Mapped Superficial Geology
TQ07NW102	4.36	0.00 – 0.90m Top soil 0.90 – 1.40m Soil and Gravel 1.40 – 2.10m Dirty Gravel 2.10 – 4.36m Brown Gravel	Shepperton Gravel Member – Sand and Gravel
TQ07NW749	-	-	Alluvium – Clay, silt, sand and gravel
TQ07NW232	-	0.00 – 3.90m Made Ground 3.90 – 4.30m Light brown silty fine Sand 4.30 – 4.50m Dark grey brown thinly interlaminated find Sand and silt and silty clay	Shepperton Gravel Member – Sand and Gravel

3.2.2 Bedrock Geology

The British Geological Survey (BGS) has mapped the bedrock geology underlying Colnbrook as the London Clay Formation (BGS, 2025a).

The aforementioned gravels are underlain by clay of the London Clay (Figure 3-8), and in some areas comprise of an upper boundary of sandy silty clays. In the boreholes selected the full depth of the London Clay was reached in two locations where the underlying Reading Beds (a formation of the Lambeth Group, predominantly clay or silty clay with sands) were recorded (at depths of 40m bgl and 57m bgl) (BGS, 2025a). Chalk was also encountered in these locations at depths of 50m bgl and 87m bgl, respectively.

Virtual borehole logs from each location have been generated using BGS Urban Interactive Model (London and Thames Valley) to illustrate the stratigraphy of the area (see Figure 3-7). These logs are in line with the borehole logs; depth to the London Clay is 5.5-10.4m and depth to the Lambeth Group is 39m to 43m. Chalk is encountered at approximately 60m depth.

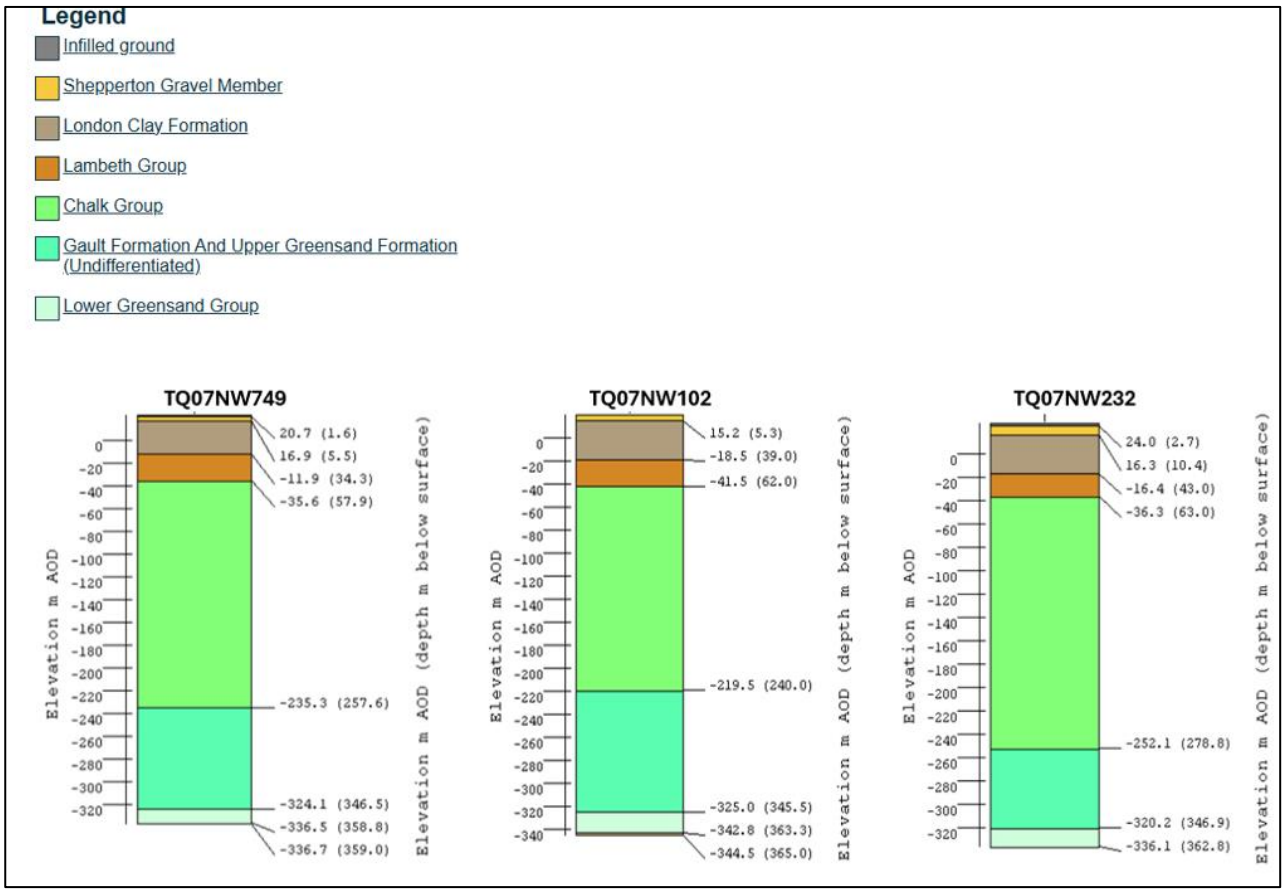


Figure 3-7. 3D Geological Synthetic Logs near Coln Brook

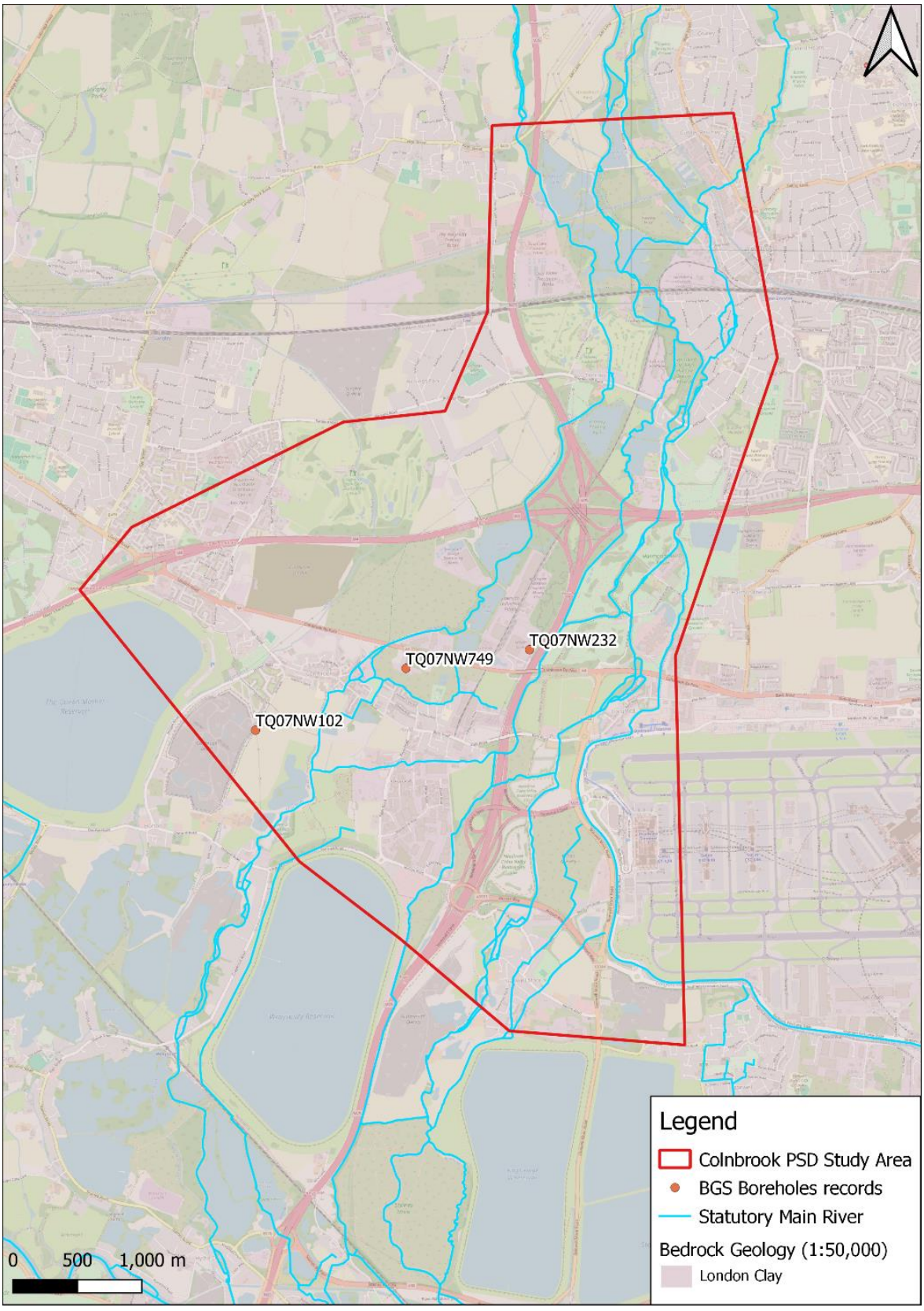


Figure 3-8. Bedrock Geology (1:50k)

3.2.3 Hydrogeology

The superficial deposits are classified as Secondary A aquifers, which comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers (DEFRA, 2025). The composition of the Shepperton Gravel Member (comprising sands and gravels) is highly permeable and likely allows rapid transport of water through the unsaturated zone to the water table.

The underlying London Clay Formation bedrock is classified as unproductive meaning it is largely unable to provide usable water supplies and is unlikely to have surface water and wetland ecosystems dependent on them (DERFA, 2025). Therefore, within the Study Area shallow groundwater is likely to be confined to the overlying superficial deposits as the London Clay will act as an aquitard and limit vertical movement of groundwater through the bedrock.

The London Clay is thought to be relatively thick in the Study Area, based on the two boreholes where its full thickness was recorded, and underlain by the Reading Beds (Lambeth Group) and Upper Chalk, both of which are productive aquifers. In deeper bedrock aquifers (i.e. the Reading Beds and Chalk) groundwater will be confined by the overlying London Clay with no connectivity between these more permeable units and superficial deposits expected in the Study Area.

3.3 Hydrological data

3.3.1 Groundwater Level Data

There is limited groundwater level data for the Study Area, with monitoring data for groundwater within the superficial deposits limited to one location within the Study Area and one location outside the Study Area. In additional groundwater level data that is available is manual recordings only, at monthly frequency. It is not possible to produce groundwater contour mapping for the Study Area and wider catchment due to the limited spatial and temporal data.

Table 3-3 summaries the Environment Agency groundwater monitoring boreholes utilised for this Study Area. Recordings from these boreholes are manual dips taken monthly and recording water levels in the Shepperton Gravel Member.

Table 3-3. Environment Agency Groundwater Monitoring Boreholes

Station Name	Area	Depth (m)	Datum (mAOD)	Maximum Groundwater Level (m bgl)	Minimum Groundwater Level (m bgl)	Lithology (m bgl)	Response Zone (m bgl)
Albany Park	Poyle	3.40	19.90	1.07	0.00	Soil 0-0.3 Clay w/flints 0.3-1.3 Gravel 1.3-2.8 Clay 2.8-3.4	1.5-3.4
Windsor Road	Wraysbury	8.00	16.69	2.95	0.47	Soil 0-0.8m Sand 0.8-1.5	1.5-8

Station Name	Area	Depth (m)	Datum (mAOD)	Maximum Groundwater Level (m bgl)	Minimum Groundwater Level (m bgl)	Lithology (m bgl)	Response Zone (m bgl)
						Gravel 1.5-7.5 Clay 7.6-8	

The SFRA notes that the entire area around Colnbrook at Poyle is prone to groundwater flooding suggesting shallow groundwater levels are present throughout the Study Area (Slough Borough Council, 2012a).

This is confirmed from groundwater levels at Poyle (Albany Park) which are less than 1m bgl, with an average level around 0.4m bgl (Environment Agency, 2025b).

From the Environment Agency groundwater monitoring data at Poyle (Albany Park) it is noted that from 2020, the frequency with which groundwater levels at (or near to) surface are recorded has increased. Since 2020, there have been four events when levels were recorded between 0m bgl and 0.1m bgl; Jan-March 2020, winter 2020 into 2021, winter 2022 into 2023, and winter 2024 into 2024.

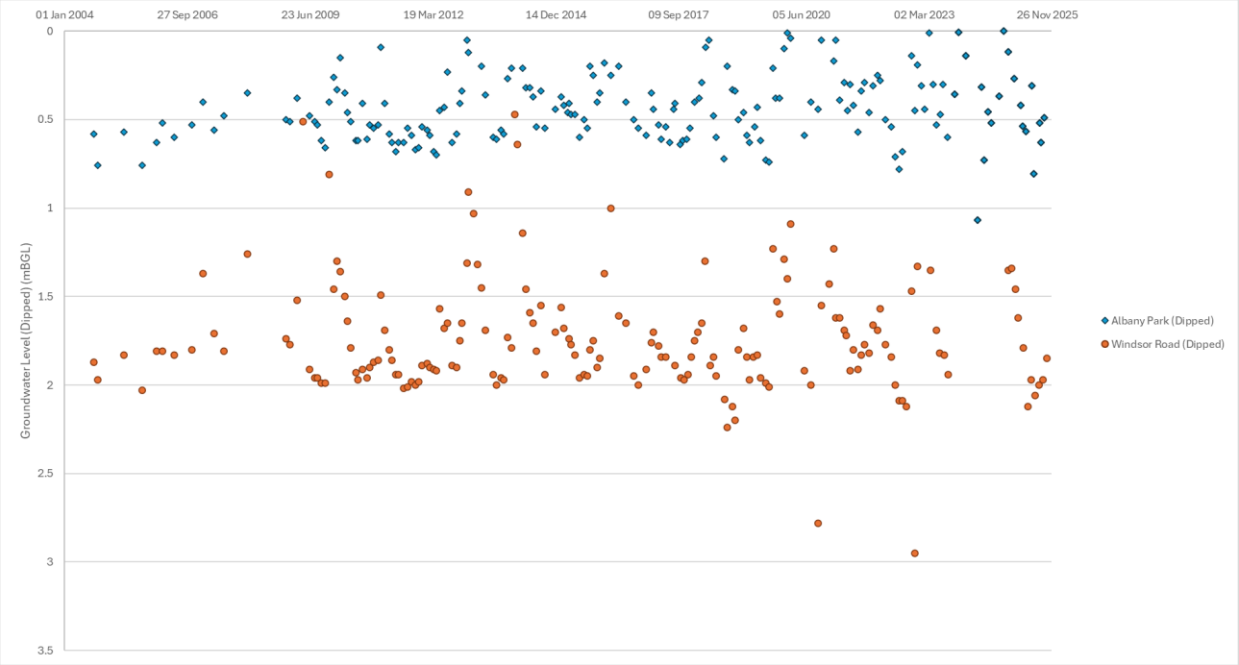


Figure 3-9. Manual Groundwater level Measurements (in mBGL)

Downstream, in Wraysbury (Windsor Road), groundwater levels in the gravels are deeper at approximately 1.5-2m bgl. In two events, 17/11/2020 and 05/01/2023, the groundwater level rose by over 1m.

From the groundwater level data in the gravels from Poyle and Wraysbury, it is observed that groundwater levels in both of the monitored locations follow the same trends, albeit with slightly different amplitudes of responses to rainfall, see Figure 3-10.

Groundwater levels in Poyle appear to show less of a response than levels at Wraysbury. However, this could be due to the monitoring point at Poyle being located closer to larger watercourses which may dampen the responses in groundwater as it discharges to the surface watercourses.

In terms of the relationship between groundwater and rainfall, trends are difficult to determine due to the infrequency of the groundwater level measurements (taken monthly on average, whereas rainfall is measured sub-daily) which means that the timing and responses to everyday rainfall are not obvious,

Figure 3-10 shows groundwater levels at Poyle (Albany Park) and Wraysbury (Windsor Road) against the 30-day preceding rainfall total recorded at Ham Island (closest rainfall station to these boreholes). It is clear that groundwater level spikes are preceded by particularly heavy rainfall events (approximately 100mm falling in the 30 days prior). The lag time is not known, but in-between the monthly dips, groundwater level rises is reflective of the rainfall events.

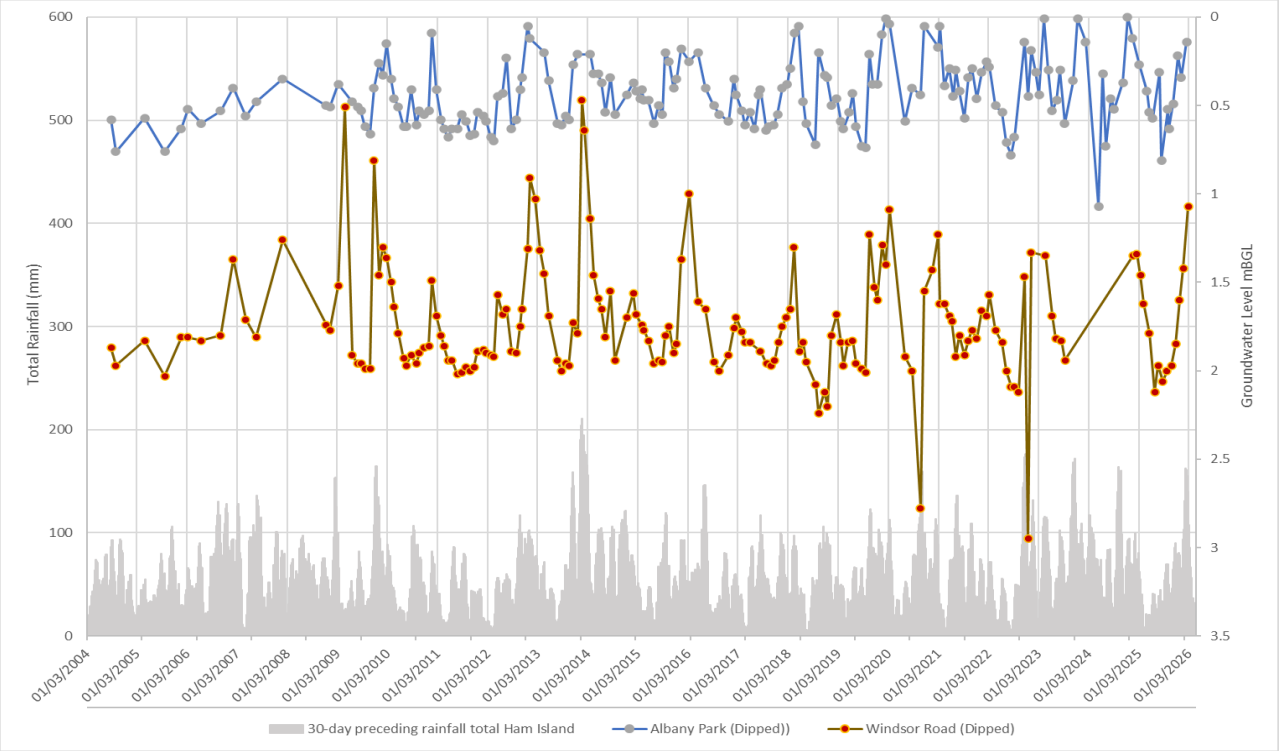


Figure 3-10. Groundwater Levels and Rolling 30-day Preceding Rainfall Total

Within the Study Area shallow groundwater flow in the superficial deposits are complex as they have been altered due to the backfilling of sand and gravel pits with waste, especially where these are sealed (land east of Sutton Lane). Additionally, reservoir construction in the south and the Thames Water Iver South Sludge Treatment Work in the centre will also have altered shallow groundwater flows. The treatment works have partially or totally blocked flow paths hence increasing flow in the aquifer surrounding the infrastructure and increasing levels locally.

Additionally, the removal of alluvium in some areas to expose gravels at the surface will have created windows of preferential pathways that will allow groundwater to more easily move towards the ground surface and downwards into the gravel aquifer, which underlies the alluvium, during high flow or flood periods.

3.3.2 Surface Water Level Data

Levels in the Colnbrook area are measured at multiple locations along the watercourses and those relevant to the study area are presented in Table 2-1 and Table 3-4.

Table 3-4. Environment Agency River Level Monitoring Stations

Station Name	Measurement	River	National grid Reference	Start of Recording	Maximum Level above Gauge Datum (m)	Minimum Level above Gauge Datum (m)
Penton Hook	River Level	River Thames	TQ04306950	1986	1.40	-2.18
Uxbridge	River Level	River Pinn	TQ0614082742	1984	1.89	0.004
Clisbys Bridge	River Level	River Colne	TQ0493082230	1996	1.40	0.00
Farlows Bridge	River Level	River Colne	TQ0430280977	2018	1.43	0.02
West Drayton	River Level	River Colne	TQ0541079090	1996	0.77	0.32
Poyle Trading Estate	River Level	Poyle Channel	TQ0329176417	1988	2.53	0.00
Stanwell Mill	River Level	River Colne	TQ0416975206	1988	1.59	-0.08
Bell Weir	River Level	River Thames	TQ01707210	1986	1.34	-0.21
Horton Mill	River Level	Colne Brook	TQ0211175776	2023	0.47	-0.18

The river level stations in the Coln show flashy responses around the time of the 2014 flood event, see **Figure 3-11**. Clisbys Bridge and Farlows Bridge stations, located higher up the catchment, in particular fluctuate greatly in comparison to West Drayton and Stanwill Mill, located in the lower catchment area. The river level stations along the Thames and its tributaries shows Uxbridge has a higher amplitude response – this is similarly higher up the catchment, see Figure 3-12.

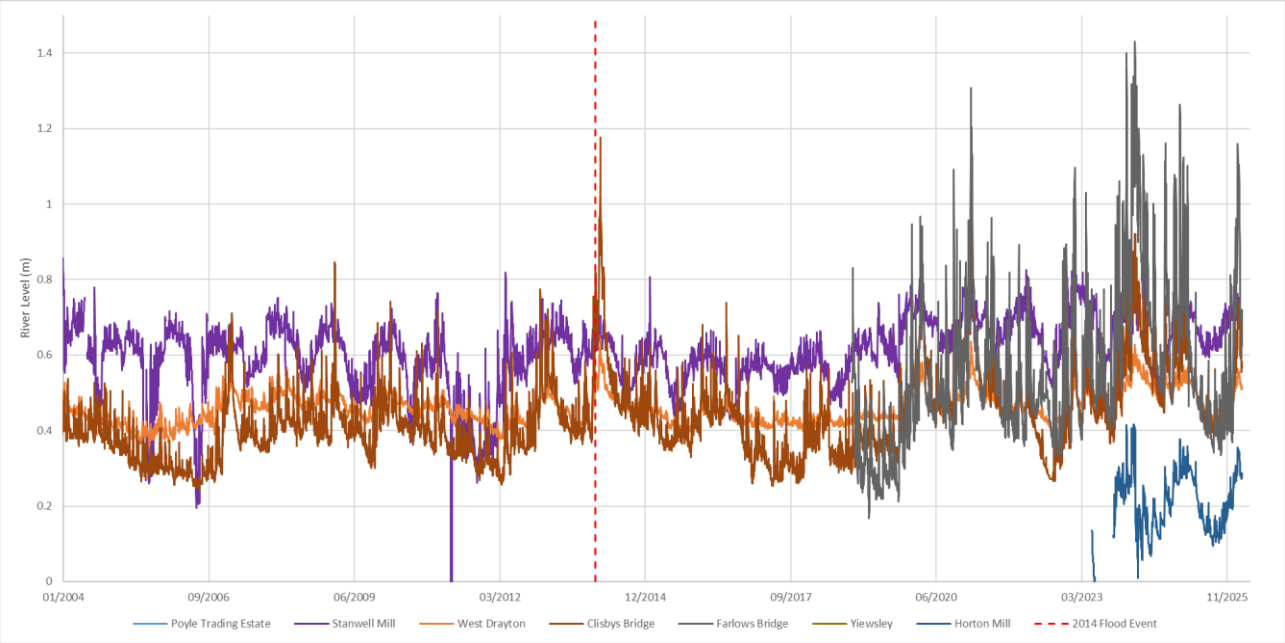


Figure 3-11. Surface Water Levels in the River Coln in Metres Above Gauge Datum

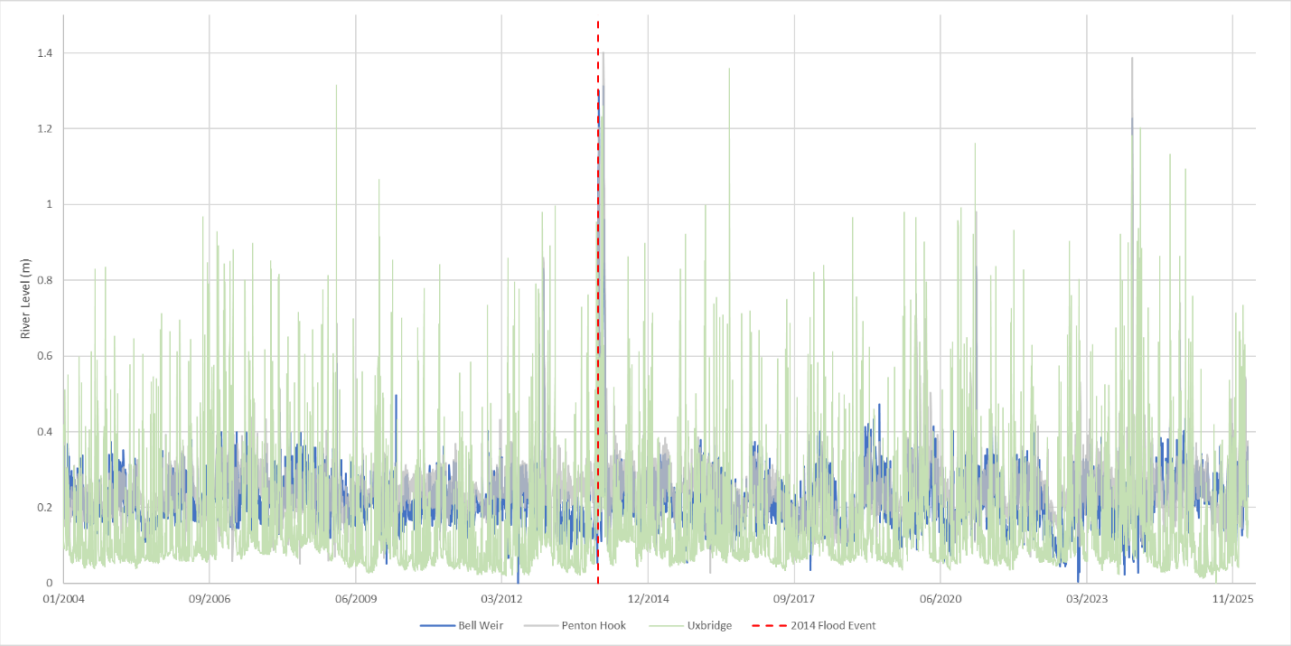


Figure 3-12. Surface Water Levels in River Thames in Metres Above Gauge Datum

3.3.3 Groundwater-Surface Water Interactions

There is a lack of continuous data from the superficial deposits within the Colnbrook area with only one Environment Agency monitoring borehole that records groundwater levels within the gravels, located in Poyle (Albany Park (station ID: TQ07_179)) (Environment Agency, 2025b). All other Environment Agency monitoring locations within the Colne Operational Catchment measure groundwater levels within the chalk which is a separate system to the groundwater than in the superficial deposits in the Colnbrook area,

therefore not relevant for this study. However, for the purpose of this study, another Environment Agency monitoring location within the sand and gravels at Wraysbury (Windsor Road (station ID: TQ07_184)) located downstream, has also been used (see figure 2-2 for location) (Environment Agency, 2025b).

Within the Study Area, river levels are available for the majority of the major watercourses including the River Colne, Colne Brook, River Pinn, River Thames, and Poyle Channel (Environment Agency, 2025b).

Along these watercourses, the base flow index (BFI) (a hydrological measure showing the proportion of a rivers total flow that comes from long-term groundwater storage) is reflective of substantial base flow contribution from Chalk.

In the upper catchment of the Coln (near Uxbridge), the National River Flow Archive (NFRA) reports a BFI at station 39010 of 0.87 – this is a river dominated by base flow from the Chalk (NRFA, 2026a). At the lower end of the Coln catchment, Station 39117 on the Coln Brook at Hythe End (prior to confluence with the Thames) has a BFI of 0.85 (NRFA, 2026b). Given the presence of London Clay in this area, it is likely the base flow is derived from the Shepperton Gravel Members (and other gravel members) as well as the Chalk in the upper catchment.

The NRFA reports the BFI on the River Thames (ID:390720) upstream of the confluence of the Coln with the Thames is 0.72 (NRFA, 2026c). Downstream of Colnbrook, on the Thames, the BFI is reported to be 0.67 at station 39111. The stations is downstream of a large abstraction (NFRA, 2026d). It is possible, therefore, that the Thames loses to groundwater as if progresses past the town of Colnbrook.

Figure 3-13 and Figure 3-14 illustrate the river levels in selected stations against the groundwater levels recorded at Albany Park and Windsor Road. Stanwell Mill in the lower catchment shows a more muted response than Farlow's Bridge higher up the catchment. It's possible that Farlows Bridge is responding directly to rainfall and possible release from storage of groundwater held in the chalk, whereas Stanwell Mill is broadly similar to the groundwater level recorded in the gravel members.

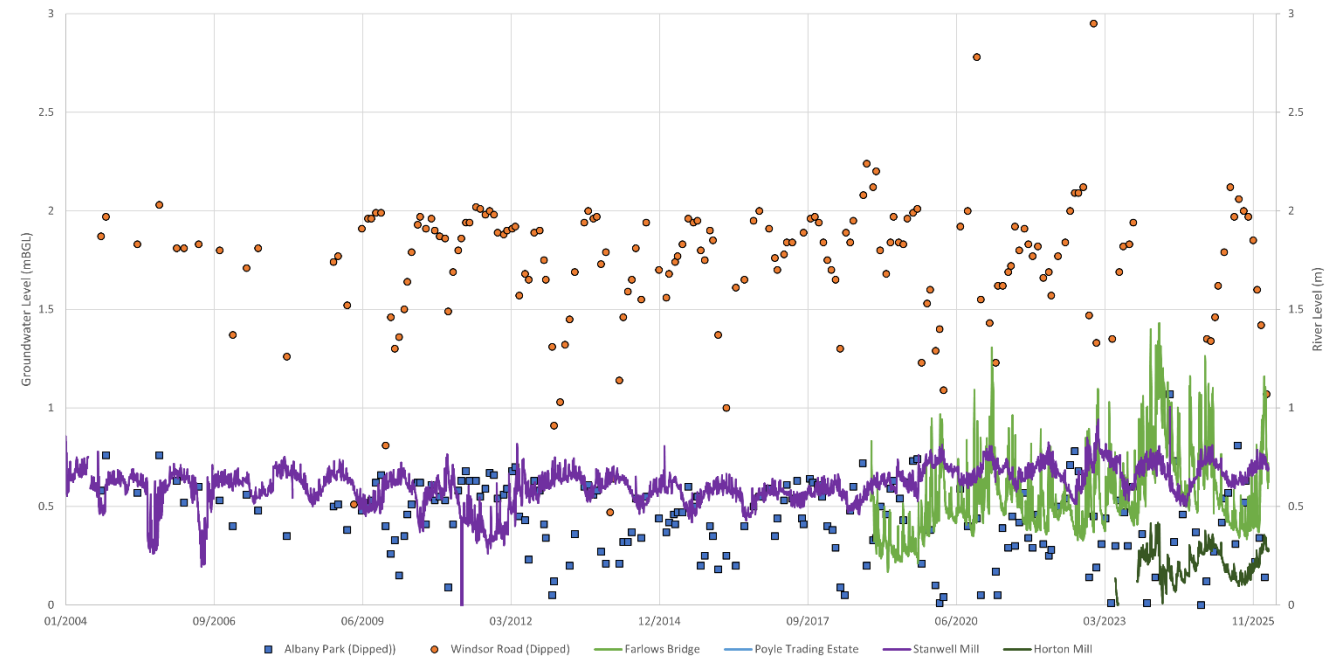


Figure 3-13. River Levels Against Groundwater Levels in the Gravels (in mBGL)

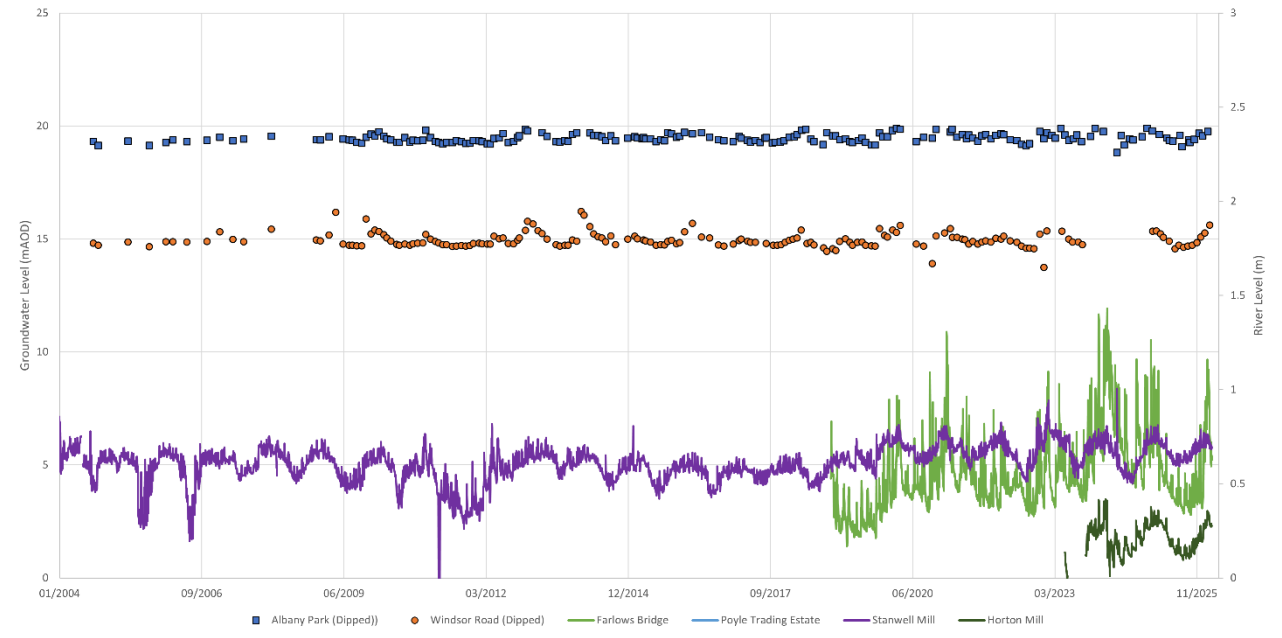


Figure 3-14. River Levels Against Groundwater Levels in the Gravels (in mAOD)

When compared to groundwater levels in the sands and gravels at Poyle, river levels in the area show similar trends to those in the groundwater. It should be noted that the groundwater data available is limited to manual periodic measurements and river level data is continuous 15min increments. However, the data suggests a strong hydraulic connection between groundwater levels in the superficial deposits and river levels in the lower catchment. Due to the nature of the groundwater data being manual dips, any lag times are harder to identify. However, from the limited data it appears that both levels in the river and groundwater rise at a similar time. The strong hydraulic connection between the rivers and the gravel aquifer mean that when river levels rise they likely have a relatively quick impact on groundwater levels. Indeed, from the BFI reduction in the Thames as it passes Colnbrook, this would suggest river levels can drive groundwater level rise in the gravel aquifer, though this would require further investigation to confirm.

Limited downwards movement of groundwater due to the presence of the London Clay underneath the superficial deposits means that pressure waves from river pulses during high flows events are likely to be quickly conveyed horizontally through the gravel aquifer due the high permeability of the deposits.

From the limited groundwater level and river level data in the Poyle area, groundwater levels (in mAOD) are shown to be approximately 1m lower than levels in the River Colne and Poyle Channel. However, there could be peaks in groundwater levels missing due to the nature of the data collection and at times groundwater levels could be closer to the surface. Additionally, recording of levels in both the groundwater and surface water post-dates major flood events in the early 2000s with records only starting in 2004.

3.3.4 Surface Water Levels and Groundwater Responses During Flood Period

There is limited information on flood events within the Colnbrook area. Anecdotal and council evidence suggests there were flood events in 2000, 2001 and 2003, along with the 2014 flooding. However, groundwater level data is only available from 2004 onwards, and data for the Colne Brook is only available from 2018.

Given the limitations with the data only the 2014 flood event can be analysed, with an analysis of the flood hydrographs from this event undertaken. The 2014 flood event has been marked on Figure 3-15 and Figure 3-16 and shows a steep rise in the Coln in January/February 2014 of up to 1m. This is also reflected in the Thames and its tributaries. Figure 3-17 illustrates groundwater level variation during the 2014 event.

Evidently the lack of high frequency recordings limits understanding of timing and amplitude of groundwater level changes immediately after and during the event.

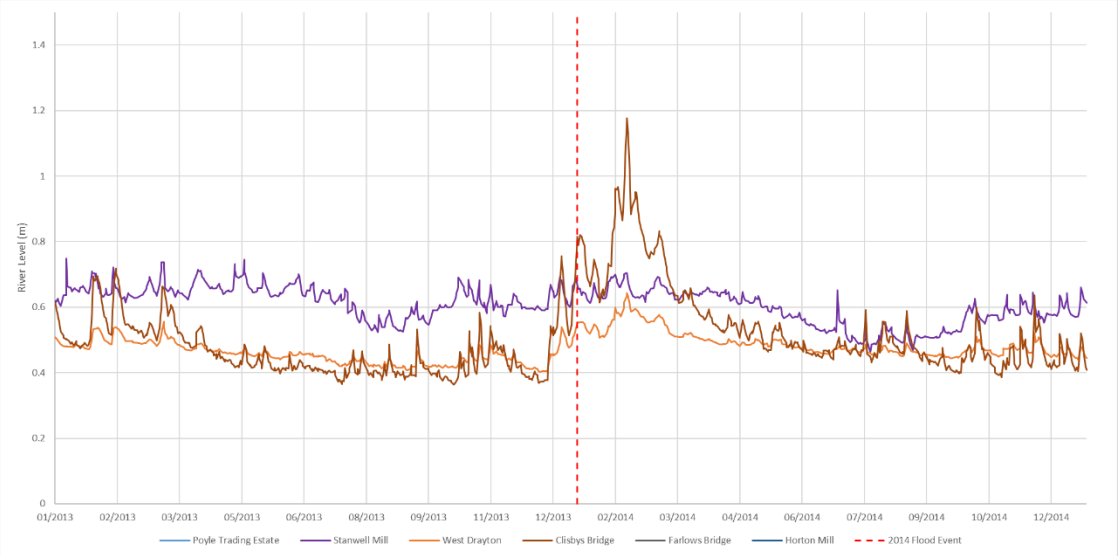


Figure 3-15. River Level in River Coln during 2014 Flood Event

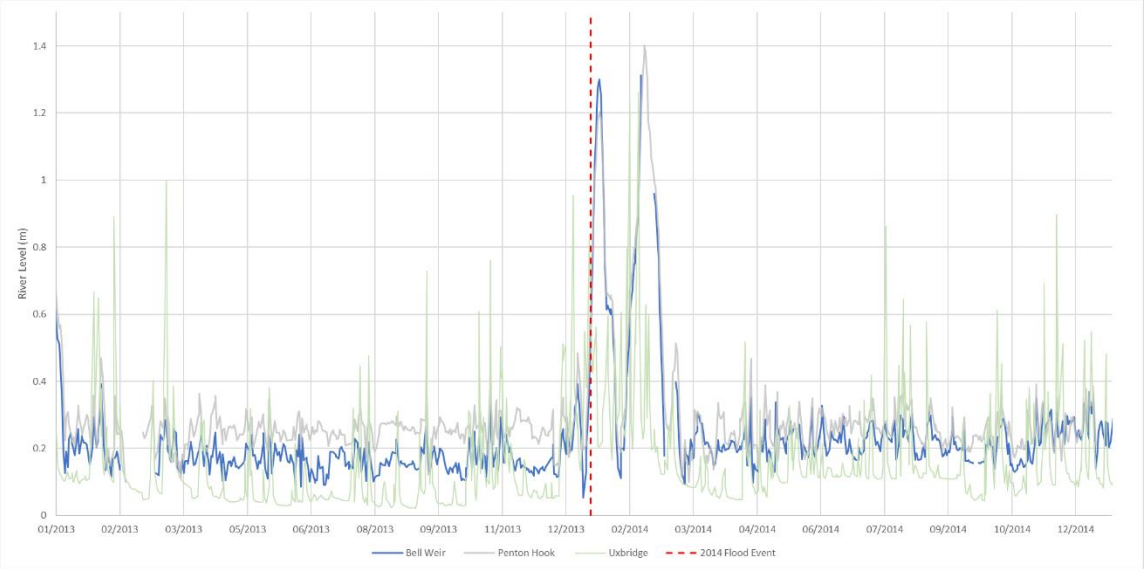


Figure 3-16. River Level in River Thames during the 2014 Flood Event

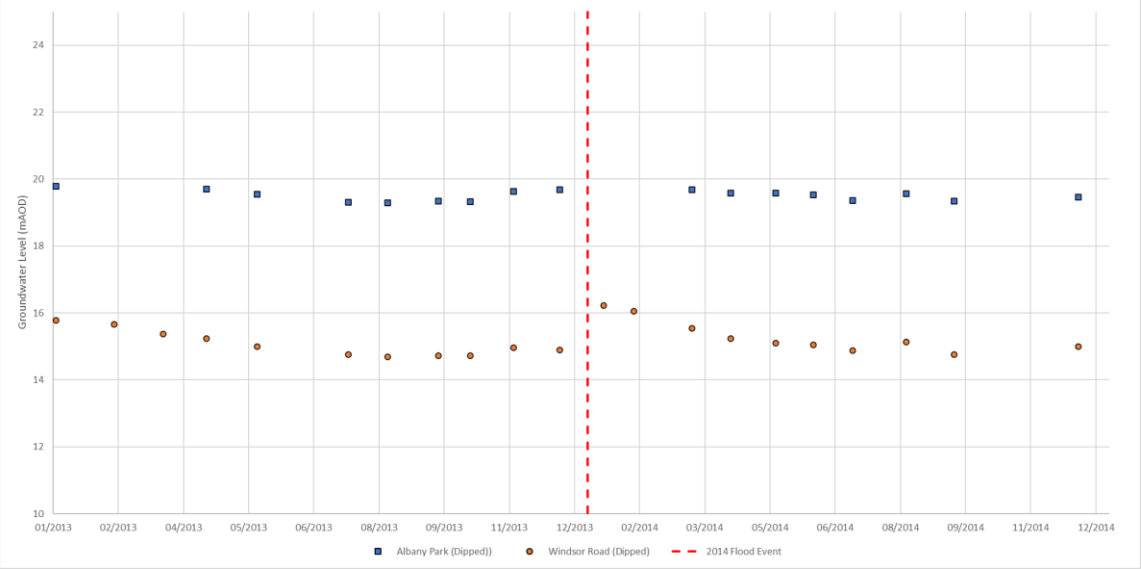


Figure 3-17. Groundwater Level Time Series in Gravels with Known Major Flood Event

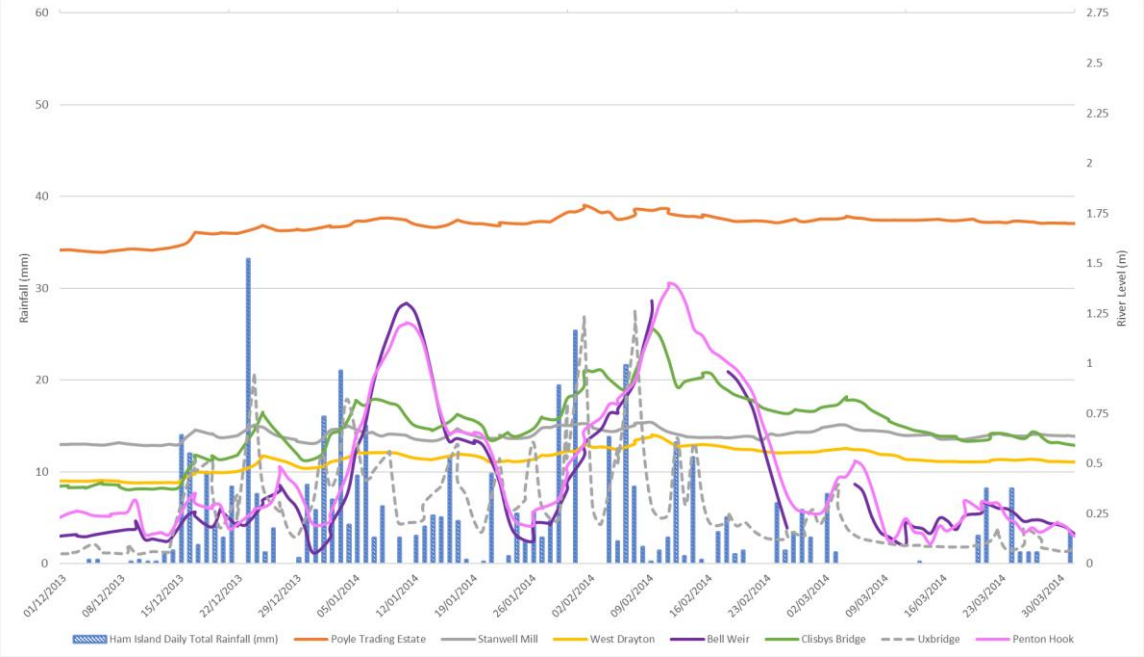


Figure 3-18. Hydrograph of Ham Island Rainfall again River Levels

An analysis of the river hydrograph during floods demonstrates that the rivers are influenced by rainfall in the catchments of the River Colne and Poyle Channel, but the levels rise at varying amplitudes

In the example hydrograph (Figure 3-18) the Poyle Channel seems largely unaffected by rainfall events, however downstream of the Colnbrook (Penton Hook and Bell Weir), the rise in river levels is more dramatic with a slight lag between the rise and rainfall . The high amplitude response is likely due to these river level stations being in the convergence of Coln tributaries. Interestingly, Uxbridge Station in the upper catchment is almost instantaneous in its response to rainfall.

The main recharge during the flood events is likely to be in the upper part of the catchment (outside of the Study Area) to the chalk where outcropping in the north, hence the quicker response time in stations higher up the catchment. Across the Study Area in the lower part of the catchment the chalk is present at depth and

not hydraulically connected to the surface watercourses therefore the watercourses in the Study Area show a muted response to rainfall.

Additionally, upstream of the monitoring points are a number of lake features which likely act as flood storage areas in times of high flow; however, this is not confirmed and would require further investigation. This may explain the more damped response in West Drayton and Stanwell Mill since flow between Clisbys Bridge and these stations is passed through lakes and splits just before Staines Reservoir, thereby reducing volume in the river. Water could be stored further up in the catchment during times of high flow before being released slowly after the main peak had occurred to reduce flood risk downstream.

3.4 Flood impact and protection measures

The flood conceptualisation section will describe the detail of the chronology of the 2014 flood event, as this is the only flood event that there are details for (in the Section 19 report (Slough Borough Council, 2015)). Additionally, it is the only recorded flood event for which there is datasets for all variables (i.e. rainfall, groundwater levels, and river levels). In advance, as context, it is worth identifying that measures have been put in place in Colnbrook over the years in response to flooding.

3.4.1 Sewerage and stormwater system

Limited information is known about the sewerage system and stormwater system within the Study Area. However, it is known that no surface water sewers are present in the Colnbrook/Poyle area to the east of Springfield road and the area is drained via soakaways (where possible) (Slough Borough Council, 2012a). Methods for dealing with surface water runoff are extremely restricted within the Study Area due to the high groundwater table, with new development footprints needed to be reduced to provide space for infiltration/attenuation of surface water.

There is a known problem of infiltration of groundwater into foul sewers which affects the capacity of the network and increases the risk of sewer flooding in Poyle and parts of Colnbrook (Slough Borough Council, 2012a).

3.4.2 Basement flooding

No developments with basements are permitted in the area due to high groundwater levels (Slough Borough Council, 2012a). However, during the 2014 flood event it was noted that internal flooding of properties in Cottesbrook Close, in South Colnbrook, was predominantly caused by groundwater.

3.4.3 Direct inundation from fluvial flood waters

In normal conditions the Colne Brook flows adjacent to the West Lakes, however in times of flooding the brook can overtop its embankments and flow into the West Lakes utilising them as additional storage. This reduces the volumes flowing downstream towards Colnbrook and Poyle, hence reducing the flood risk. Water can be held in these lakes during storm events with discharge back into the river system controlled with a pen stock at the southern end of Colnbrook West Lake. However, it is noted that during the 2014 event (reported to occur between January and February 2014, though first reported to Slough Borough Council on 31 January 2014) this system failed and the pen stocks were thought to have remained open throughout the flood event and were at times overtopped by flow (Slough Borough Council, 2015).

After large flood events in 2000 and 2003, predominantly caused by fluvial flooding, Cottesbrooke Ditch was constructed (note, the SFRA or Section 19 Flood Investigation Report could not specify exact dates for flooding). The ditch directs water south through Albany Park and discharges water back into Colne Brook south of Cottesbrooke Close, bypassing Colnbrook. This was mainly to reduce fluvial flooding.

Within the Study Area there are areas of built development identified as functional floodplain which are located mainly in western Colnbrook. These include the areas of Crown Meadow, Popes Close, Moreland Avenue, Willow Close, the western end of the High Street, Hunstanton Close, and western half of Vicarage Way. Other areas of built development in the functional floodplain include the southern part of Cottesbrooke Close, Poyle New Cottages, the confluence of the Colne Brook and County Ditch, and alongside the Poyle Channel. These areas are likely to be prone to flooding from fluvial flood waters.

3.4.4 Gardens and outbuildings

Information on flooding of gardens and outbuildings is limited. However, during the 2014 flood event several gardens around Cottesbrook Close were recorded to be flooded. The main cause of flooding in this area was determined to be groundwater (Slough Borough Council, 2015).

4. Flood conceptualisation, mechanisms and sequencing

4.1 Flood conceptualisation

Figure 4-1 is a Conceptual Site Model (CSM) which summarises the mechanisms of flooding in Colnbrook. The figure shows a cross section from west to east through Colnbrook and Poyle, with Figure 4-2 showing the transect location.

There is limited information on flood events in Colnbrook, however all known events have occurred in winter months where rainfall tends to be higher.

Fluvial flooding occurs from the overtopping of multiple watercourses including Horton Brook, Colne Brook, Poyle Channel and various ditches. When these watercourses overtop, they flood the functional floodplain which in some cases is located under residential areas, especially in Western Colnbrook. Control measures are in place at Hawthorn Ditch, Poyle Channel and downstream at Horton Brook, however even these can be overcome in times of flooding and in some cases if not functioning correctly can amount to flooding upstream of them.

In addition to the fluvial flooding, it is understood that the river and underlying aquifers are hydraulically linked. Therefore, when the river levels rise it is likely that flow paths are reversed and the river could recharge the aquifer. This leads to elevated groundwater levels and groundwater emergence at surface in areas where fluvial flooding does not reach (i.e. outside of the floodplain). Anthropogenic changes in the area due to gravel and sand workings and landfills have led to changes in groundwater levels and flows throughout the Study Area, and where overlying alluvium has been removed has created preferential pathways into the gravels directly from the surface. Given the shallow nature of the bedrock and its composition acting as a barrier to downwards movement, when the gravel aquifers becomes saturated groundwater emerges at the surface throughout the Study Area. It is unclear from various reporting if any mitigation specifically for groundwater flooding has been put in place (i.e. shallow boreholes with pumps).

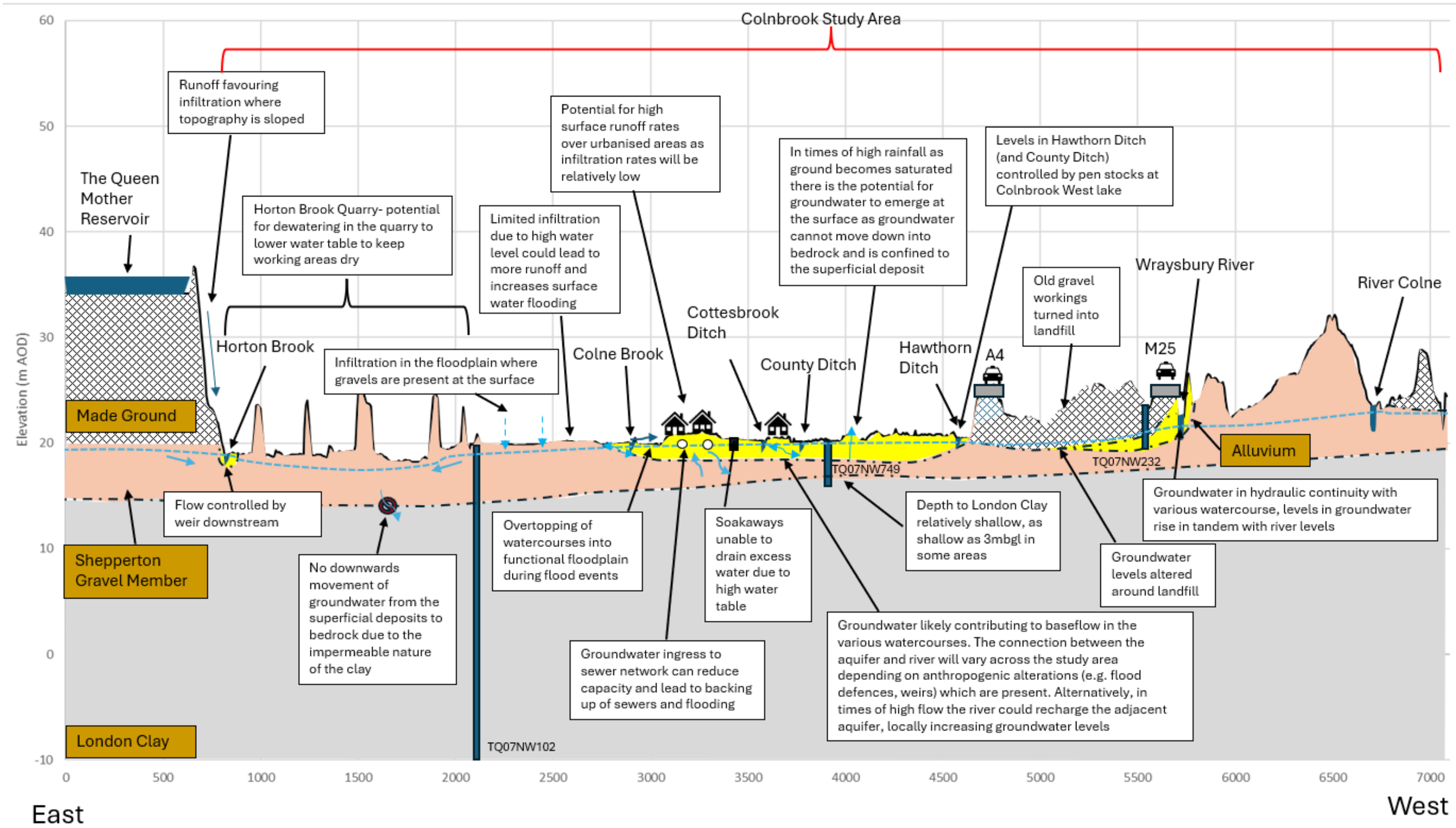


Figure 4-1. Conceptual Site Model Showing Flood Mechanisms

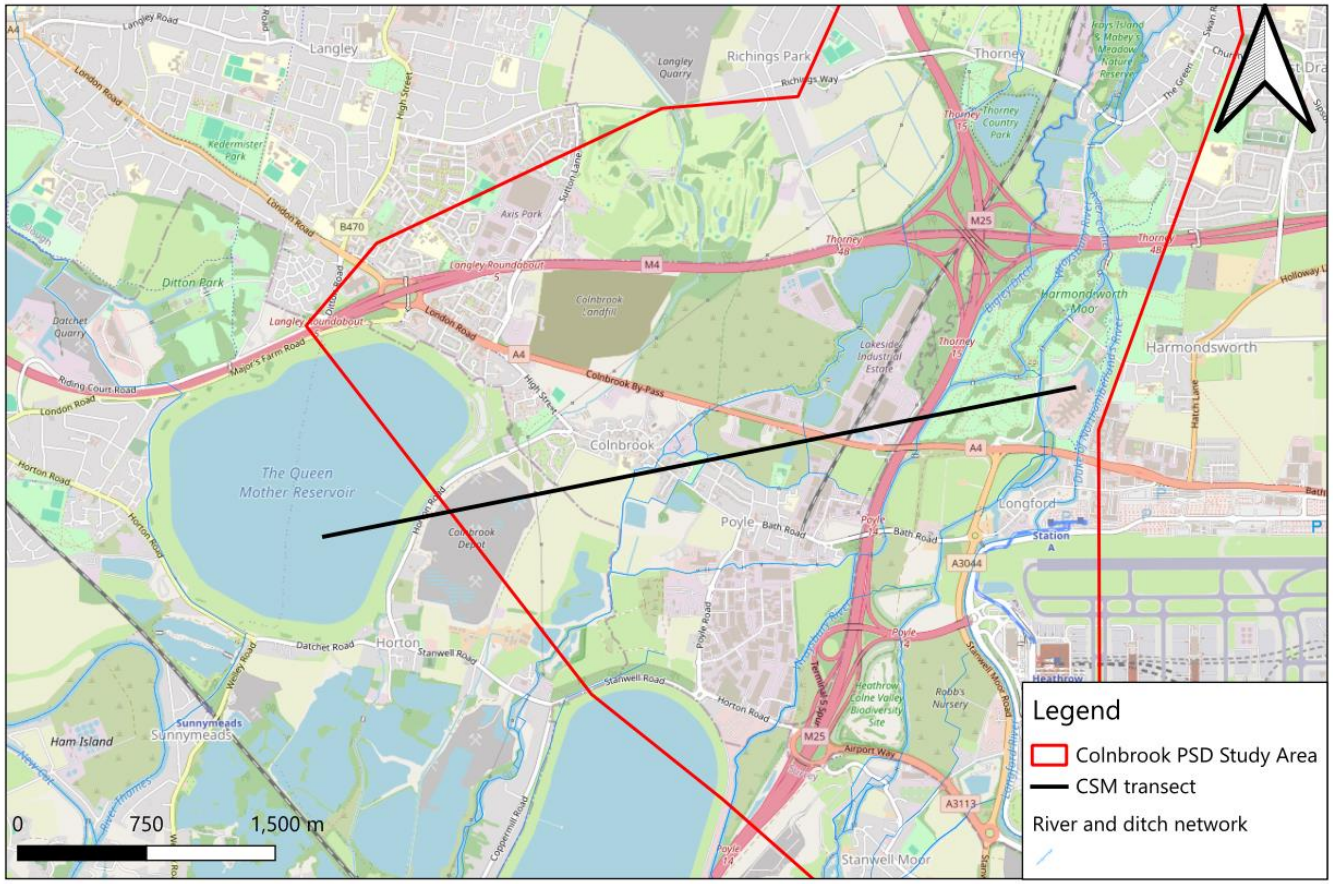


Figure 4-2. CSM Transect Through Study Area

4.2 Further detail on mechanisms and sequencing

Only one flood event in 2014 in the Study Area has available details on flood sequencing, therefore it is difficult at this time to comment on the sequencing of a typical flood event in Colnbrook. However, from the data above it is likely that the main driver is rainfall which in turn leads to increased river levels in the various watercourses causing overtopping into the functional floodplains. Additionally, given the highly permeable nature of the gravels a rise in river levels likely reverses the flow paths and drives groundwater levels up with limited downwards movement permitted due to the low permeability London Clay hence emergence of groundwater at the surface. Due to the limited downwards movement of groundwater it is likely that the groundwater levels remain high until the river levels reduce and allow groundwater discharge to them.

4.3 Knowledge gaps

Improvements could be made to the conceptualisation of the flooding in Colnbrook. The objectives of this would be to:

- Understand how groundwater in the gravels act during flood events,
- Understand key hotspots of flooding from local residents,
- Understand the sequencing of events during flooding events as there is only detailed information available for one flood event in 2014, and;
- Reduce uncertainties such as; lag times between river level rises and groundwater level rises, how local groundwater levels respond during high rainfall events and flood events.

4.4 Recommendations

Recommendations to reduce gaps in knowledge include:

- A monitoring network within the area could be set up monitoring both surface water levels (in the various watercourses and ditches around Poyle and Colnbrook) and groundwater levels in areas of known flooding. This could help to improve the understanding of the relationship between surface water levels and groundwater levels in more detail. Additionally, a monitoring network specifically to look at levels during flooding could be used to determine threshold levels for a flood alert scheme.
- A monitoring network in the gravels to understand locally how they respond in flood events and also to allow contour mapping to be produced to determine flow directions of the groundwater in the gravels.
- Increase interactions with local residents in the area to understand the impacts of historical floods on the local community, to gain first-hand accounts of flooding events and to identify any flooding hotspots known to locals.
- Gather any information on groundwater abstractions from gravels in the area (likely from working quarry in the form of dewatering) to understand if these play a part in reducing groundwater levels/ risk of groundwater flooding within Colnbrook.
- Gather information on historical landfills to determine their influence on groundwater levels (i.e. are they lined with impermeable barriers or not).
- Gather information on the water treatment works upstream of the Study Area to determine how they influence water levels (i.e. are there any discharges back to watercourses).
- Gather information on if any of the upstream lakes apart from the Colnbrook West Lake act as flood storage during flood events.

- Gather information on the sewerage and stormwater systems within the area to understand impacts of flooding to/from these. Includes information on soakaways within the area.
- Improve understanding of any mitigation that is put in place to address groundwater flooding.
- LiDAR data is only to 1m resolution, higher resolution LiDAR data could allow surface water flow pathways to be identified within Colnbrook.
- Improve understanding of penstock triggers at the southern end of Colnbrook West Lake.

These recommendations would be beneficial to aid understanding of the nature of the groundwater movement through the gravels, alluvium and made ground and the interaction with the river and surface water network. There is currently very limited understanding. Any monitoring would help with understanding and would then enable mitigation measures to be quantified and installed to manage the flood risk.

The recommendations should be quantified further as to prioritise their effectiveness in providing information and this could be done as soon as possible with the highest priority measures implemented soon to pick up flooding events through the seasons in the coming years.

The risks are mainly around not implementing the monitoring network will delay the understanding and increase the risk to people, property and infrastructure from a groundwater or multi-source flood not being fully understood nor managed effectively.

The monitoring network would require funds to implement and collaboration between risk management authorities. It would give valuable insight into where measures could be installed to provide benefits and reduce/remove damage due to flooding.

5. References

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