

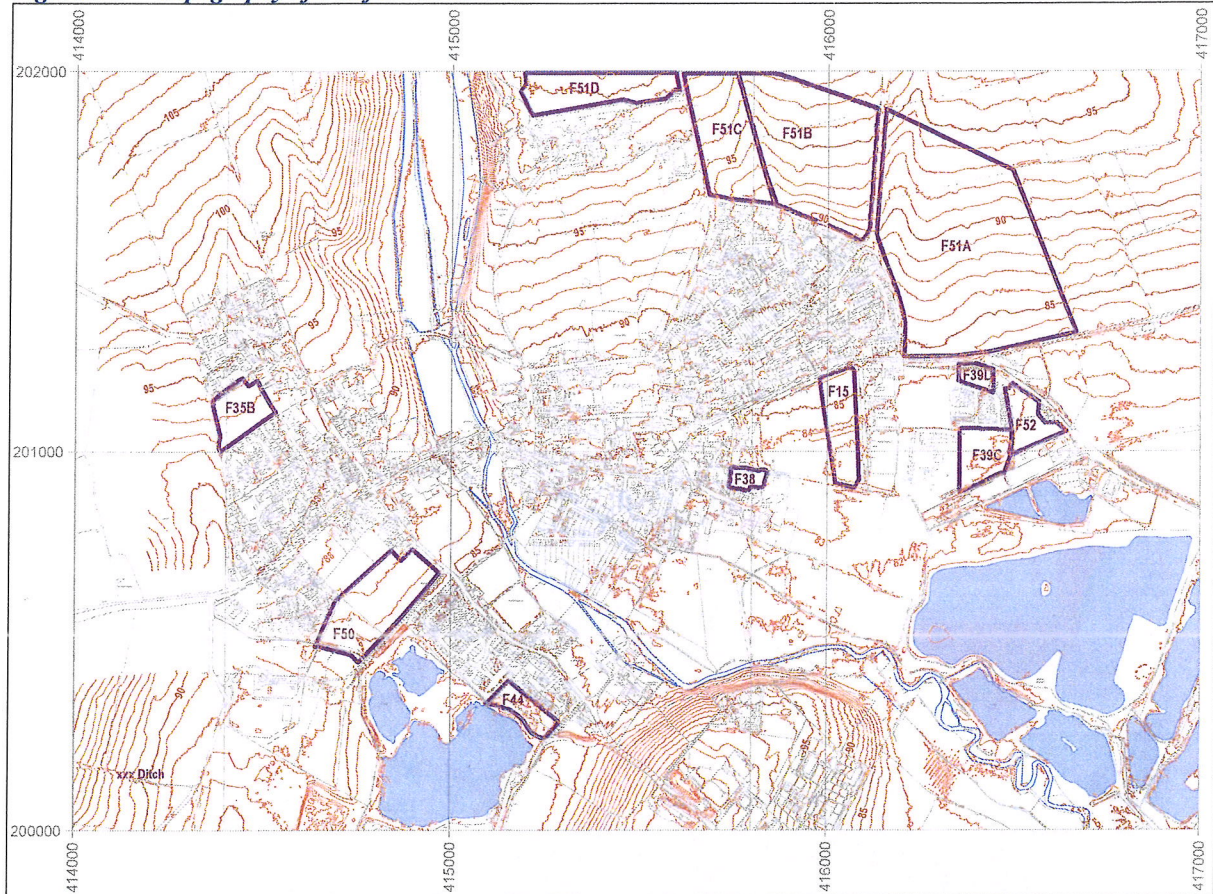
2 Reconnaissance, Mapping and Well Inventory

2-1 Topographic Mapping

Use was made of LiDAR data and geological mapping to investigate lineaments and micro-relief of the town area which would help in locating monitoring sites and characteristics of proposed development sites.

The relevant LiDAR data-tiles were downloaded from the Environment Agency website and processed using GIS software to produce a digital terrain model and contouring for the study area. Together with Ordnance Survey Mastermap data, this topographic information provides a base-map for the investigation and is shown in [Figure 2-1](#), using a 1 m contour interval.

Figure 2-1 Topography of Fairford Town Area



2-2 Rainfall and Recharge

Various types of hydrological data were acquired from the British Geological Survey and Environment Agency with a view to supplementing the local information obtained by observation during the 6-month project monitoring period, Mar-Aug 2018. Location of the monitoring sites is shown in [Figure 2-2](#).

The local data-gathering was put into context using rainfall records from Lechlade [1913-2018], Kempsford [1961-2018], and the Thames model rainfall and infiltration simulation for the Cotswold-West area [1920-2018]. Relevant characteristics are shown in [Table 2-1](#) and listing of all sites is provided in [Appendix B-2](#).

Total winter percolation in the Oct-Mar period, which conditions the start-point of monitoring, totalled 276.1 mm compared with 306.5 mm in an average year and 7.8 mm in a dry winter. Likewise, model rainfall of 420.8 mm is close to the long-term mean of 432.4 mm for the same 6-month period. This confirms that groundwater levels during the 2017-2018 recharge period would be expected to be close to or slightly below-average. Groundwater recession during the period of project monitoring would therefore have provided a

reasonable representation of water level variation. It was only from June onwards that the region suffered a prolonged period of zero or low rainfall which would affect groundwater levels through the summer.

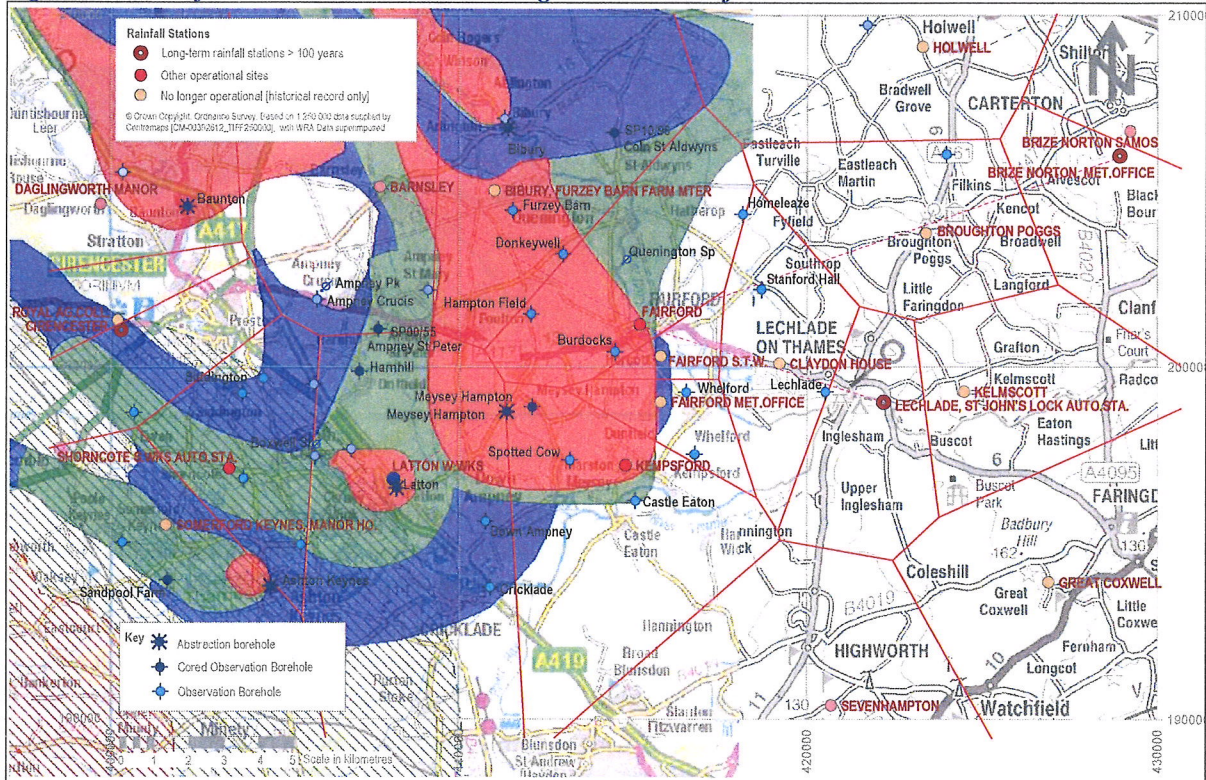
Table 2-1 Rainfall and Infiltration Statistics affecting the Monitoring Period

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Lechlade													
2017	69.1	31.3	40.2	6.5	72.6	29.0	79.6	41.4	47.6	21.9	52.2	97.3	588.7
2018	66.1	25.8	93.5	50.8	62.4								
min	7.2	2.1	3.1	1.0	5.3	5.9	2.7	1.1	6.6	4.4	6.8	11.9	358.6
max	157.1	116.3	158.0	147.3	153.2	151.6	176.1	147.2	142.2	150.3	182.6	130.8	992.4
mean	60.6	44.8	47.4	46.2	55.8	50.0	54.0	60.3	53.2	62.6	64.1	64.9	659.6
Rainfall for Cotswold West													
2017	75.4	41.0	51.6	11.0	62.7	69.4	74.1	53.7	62.6	33.0	56.1	107.9	698.5
2018	77.5	32.7	113.6	55.6	82.5	2.9							364.8
min	8.3	2.8	2.1	2.5	5.6	2.9	5.6	2.7	4.0	6.7	8.5	13.3	364.8
max	210.0	164.4	168.0	171.3	181.5	159.1	201.4	161.7	162.1	163.9	215.6	200.8	1157.5
mean	79.5	56.6	56.6	55.7	65.3	57.3	62.7	70.2	67.1	75.4	82.4	82.0	806.3
Areal Infiltration for Cotswold West													
2017	69.4	28.2	27.6	0.5	5.2	5.7	6.7	3.0	5.5	3.6	7.8	92.7	255.9
2018	72.0	24.9	75.1	20.0	8.8	0.0							200.8
min	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.8	1.8	101.6
max	202.9	146.3	148.0	101.6	106.3	49.7	109.3	58.1	109.1	139.4	180.5	188.9	679.3
mean	72.6	45.7	30.5	16.4	10.1	7.3	7.3	8.2	14.7	26.8	59.1	71.9	368.6

Note: The Cotswold-West model cell is referenced as 6010 in EA Thames Region water resources situation reports and data-sets.

Key: Winter recharge period Project monitoring period

Figure 2-2 Rainfall and Groundwater Monitoring Sites in the Fairford Area



Groundwater source protection zones shown by colour shading: 1 red, 2 green, 3 blue. [Ampey Crucis and Whelford unaffected by abstraction]

2-3 Geology of the Fairford Town Area

2-3-1 Mapping and Formations

The solid geology of the Fairford town area consists of the following units:

- Oxford Clay Formation - mudstone.
- Kellaways Sand Member - sandstone and siltstone, interbedded.
- Kellaways Clay Member - mudstone.
- Cornbrash Limestone.
- Forest Marble Formation predominantly mudstone, greenish grey, variably calcareous and intercalated with sandy cross-bedded limestone lower in the sequence.

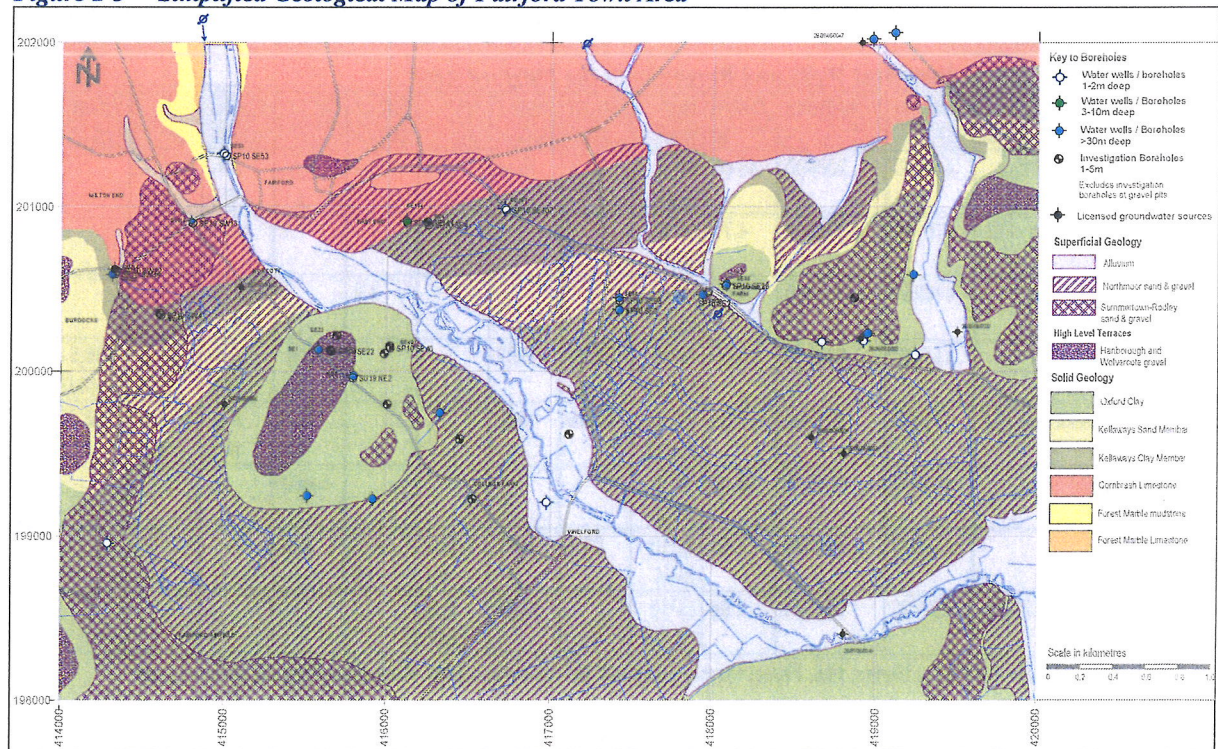
The hydrogeology of the Fairford town area is dominated by the Cornbrash Formation and the interaction of river and groundwater level in the various sand and gravel deposits. The geological boundary between the Cornbrash limestones and Kellaway Clay Formation is located just south of town, roughly travelling south where the sand and gravel deposits begin. The outcrop of different geologies is shown in [Figure 2-3](#).

The Cornbrash Formation is part of the Great Oolite Group and consists of a complex sequence of limestones interbedded with marls and well-known for local anomalies which do not conform to the usual succession. The outcrop forms a well-dissected gently-sloping landscape with a fairly uniform dip of one degree.

The limestones found through drilling at Fairford are pale grey to ochreous brown, argillaceous and sandy, containing fine-grained shell debris. The drill cuttings were typically a coarse brown sand mixed with ochreous silty-clay.

It is reported that the thickness of the Cornbrash is 3 to 4.5 m. In a borehole at Meysey Hampton, the thickness is 4.4 m, and a distinction is made between a sandier upper layer and lower fine limestone layer, but the difference may not be apparent in terms of lithology at some locations. The georeference section is located at Shipton-on-Cherwell Cement Works Quarry, 4.4 km north-northwest of Kidlington, Oxfordshire, where there is a complete sequence exposed, up to about 3 m thick.

Figure 2-3 Simplified Geological Map of Fairford Town Area



Based on OS 1:50,000 scale raster base-map and simplification of geological data from various sources

The BGS lexicon of named rock units describes the lithology of the Cornbrash Formation as follows:

“Limestone, medium- to fine-grained, predominantly bioclastic wackestone and packstone with sporadic peloids; generally and characteristically intensely bioturbated and consequently poorly bedded, although better bedded, commonly somewhat arenaceous units occur in places, particularly in the upper part. Generally bluish grey when fresh, but weathers to olive or yellowish brown. Thin argillaceous partings or interbeds of calcareous mudstone may occur”.

The lower boundary is generally a sharp, disconformable non-sequence, where bioclastic limestone rests on mudstone of the Forest Marble Formation.

The superficial deposits of the Fairford town area consists of the following units:

- Alluvial deposits of clay, silt, sand and gravel form a corridor along the River Coln valley.
- Head deposits of clay, silt, sand and gravel formed in a periglacial environment fill shallow valleys on the west side of town.

These are followed in age by the following Thames river terrace deposits:

- Northmoor Sand and Gravel Member
- Summertown-Radley Sand and Gravel Member
- Hanborough Gravel Member

Most of the town area south of London Road and Horcott Road is characterised by up to 5 m of the Northmoor sand and gravels and this is the lowest of the terrace deposits. The Summertown-Radley terrace is confined to higher areas on the west side of town north and south of Cirencester Road and in the Burdocks area.

There are some remnant higher level terraces of the Hanborough and Wolvercote group on the top of Horcott and at the junction of Leafield Road and Park Street. These have little consequence for local groundwater.

2-3-2 Local Information

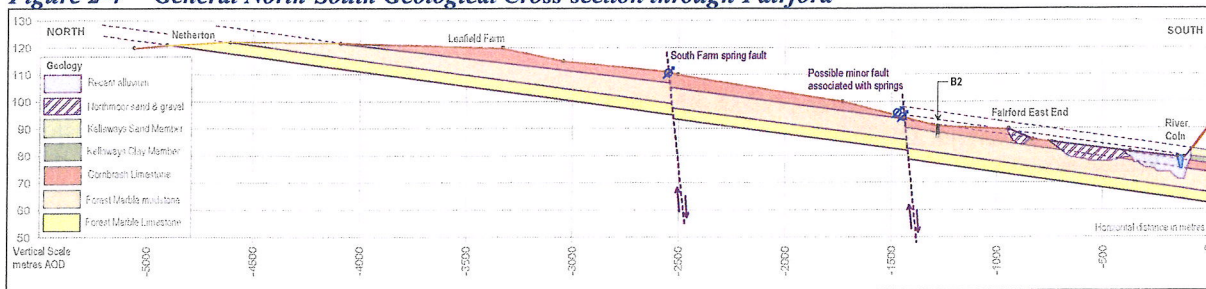
Information on lithology was obtained from the BGS archive, and some of the data from old boreholes in the area are summarised in [Table 2-1](#). This provided a number of useful references, in particular the borehole logs for the Retreat [now Coln House School], Cinder Lane and Burdocks, and further details are provided in [Appendix E](#).

Table 2-2 List of Historical Wells and Boreholes in the Fairford Area

Site name	Easting	Northing	Depth m	BGS Ref	GL m aMSL	Cons Date	Terr- ace	Kell- away	Cb	FM clay	FML l/st	White L/st	RWL mbgl
The Retreat Fairford	414800	200900	35.66	SP10 SW13	86.8	1924	1.5	n/a	0.0- 2.1	2.1- 6.4	6.4- 13.1	-	2.13
Fairford Football club	416119	200903	4.70	SP10 SE114			4.7	-	-	-	-	-	2.36
Beaumont Farm	416250	200890	4.00	SP10 SE4				4.9	-	-	-	-	
EA Burdocks geophysical log	414340	200610	79.00	SP10 SW22	88.95	1982			0.0- 6.5	6.5- 14.5	14.5- 36.5	36.5- 48.0	3.30
EA Burdocks Obs BH	414330	200590	79.00	SP10 SW34	89.45	1982			0.0- 6.5	6.5- 14.5	14.5- 36.5	36.5- 58.0	3.30
Fairford old mill	415000	201310	-2.00	SP10 SE53					spring				
Burdocks [Summertown]	414610	200340	4.60	SP10 SW4	88.7	1971	0.2- 4.1	4.1- 4.5	4.5-	-	-	-	
Fairford : New Chapel Electronics	416720	200980	3.96	SP10 SE107		1984	0.0- 3.96	-	-	-	-	-	

Key: Cb Cornbrash, FM Forest Marble, FML Forest Marble limestone, l/st Limestone, RWL Rest water level, GL Ground level

A North-South geological section from Quenington across Fairford Park through Fairford town to Horcott has been interpreted in [Figure 2-4](#). This exemplifies the thin nature of the Cornbrash Limestone and the fact that the thickness is expected to be fairly similar across the area due to the slope and dip.

Figure 2-4 General North-South Geological Cross-section through Fairford

Note. Line of cross-section shown in Appendix Figure C-1.

2-4 Historical Use of Groundwater for Supply

Part of the parish of Fairford used to be supplied by an undertaking belonging to R Barker of Fairford Park. The source of supply was a spring issuing from the Cornbrash, where it is thrown out by the Forest Marble under Fairford Old Mill. The water was piped to reservoirs and tanks at Milton End 150 m³/d, 91 m³/d, Manor Farm 6 m³/d, Fairford Park 18 m³/d, Farhill Farm 5 m³/d and Leaffield Farm 5 m³/d. The daily average quantity of water supplied by the spring was 155 m³/d [1.8 l/s]. Houses which were not included in this network supply were dependent on wells in the gravel deposits and Cornbrash across the town. In the centre of Fairford, these were reported to be 2.7 to 3 m deep and the water level reflecting changes in discharge in the River Coln [Wells and springs of Gloucestershire, p92].

On the side of Waitenhill, where gravel rests on Oxford Clay, a spring used to be exploited and the water pumped into a 10 m³ tank from where it gravitated to Burdocks and two lodges. A second spring at the locality supplied Waitenhill Farm buildings and did not fail until the drought of 1921.

Another spring was reported issuing from the Cornbrash near Barrow Elm Farm and there were numerous wells in the Cornbrash dotted about the fields. The Fairford Mill spring was used until approximately 1946. These have all been replaced by a new Thames Water groundwater supply using boreholes from deeper limestone in the Great Oolite Group, leaving the Cornbrash essentially unexploited in the present-day. Groundwater levels can therefore be expected to be at natural rest levels, except on the west side of town where groundwater abstraction will have an impact on groundwater levels beneath the Forest Marble.