

Decision Statement

Statement of our decision made with respect to an application for a new full abstraction licence under the Water Resources Act 1991 (as amended) and the Environment Act 1995.

Executive Summary

Roxane UK Limited propose to abstract groundwater from the Lower Greensand near Luton. We cannot grant a licence in this case because:

- i) The assessment of the investigation and evidence gathering carried out as part of this application has concluded that the effects of the proposed abstraction make it unsustainable. The proposal would increase the impact of abstraction on an aquifer and a river that are already failing to meet their water quantity related environmental targets under the Water Framework Directive (WFD) because of groundwater abstraction. Issuing this licence would risk deterioration in the WFD Invertebrate WFD element of the Broughton Brook waterbody and could compromise measures being put in place to reduce the impact of existing abstraction on the Broughton Brook. Issuing this licence would also increase the risk of deterioration in status of the Upper Bedford Ouse Woburn Sands groundwater body.
- ii) The proposed abstraction targets the Lower Greensand (LGS) aquifer, which is present in South-East England, deposited in two basins North and South of the London platform. The Northern aquifer is known as the Woburn Sands, particularly along its outcrop in the Cambridgeshire/Bedfordshire, part of the Environment Agency's (EA's) East Anglia (EAN) Area. The aquifer dips by a few degrees towards the South East. The outcrop extends in a thin, South-West to North-East trending band, with the majority of the aquifer being confined by an increasing thickness of Gault Clay. As it thickens, the Gault Clay acts as an aquitard, effectively separating the LGS from the Chalk above. Recharge to the aquifer, and interaction with surface water, occurs primarily on the outcrop. The boundary of the Upper Bedford Ouse Woburn Sands groundwater body is defined by the outcrop, but abstraction in the confined zone produces impacts across the aquifer, which will affect rivers and wetlands on the outcrop.
- iii) Across the outcrop, rivers and wetlands depend on base-flow from the LGS and/or groundwater levels. Abstraction from the LGS aquifer will affect these features. Impacts on the Broughton Brook are of particular significance, as flows are currently failing to meet environmental flow thresholds, and we have required Anglian Water to put in place measures to mitigate the impact of its abstraction on this river. Elsewhere, we are restricting licences to their peak historical use on renewal to reduce the risk of deterioration in flows.

We have decided to refuse this application based on all information provided.

1. Summary of the proposal

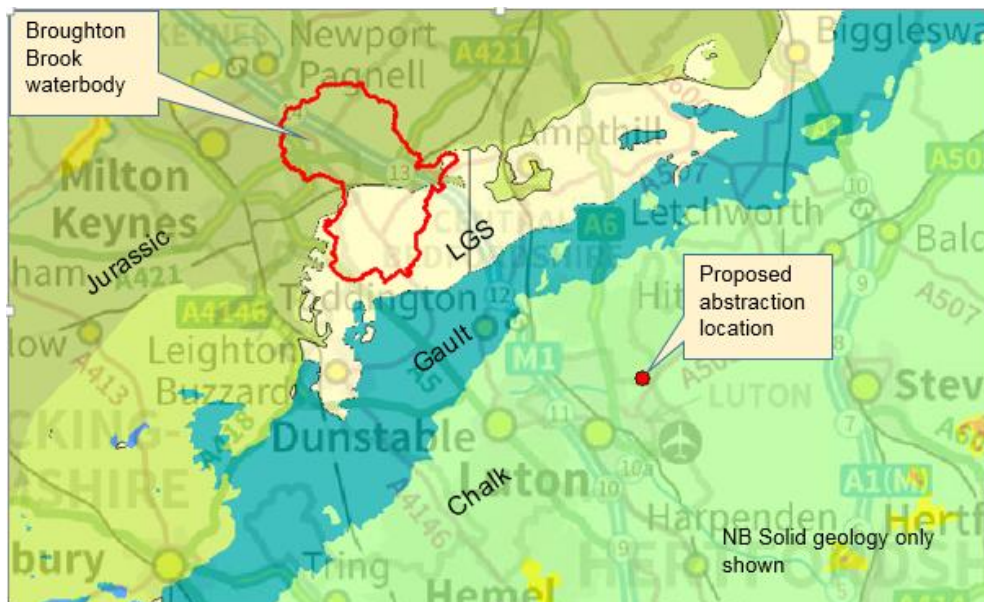
Roxane UK Limited. has applied for a licence to abstract from the Lower Greensand (LGS) at Butterfield Business Park, North East Luton for the purpose of water bottling. At this location the LGS is a confined aquifer overlain by the Gault Clay and above that, the Chalk.

The point of abstraction falls within the Upper Lee Abstraction Licensing Strategy (ALS). The Upper Lee ALS (Feb. 2019) does not specifically refer to the LGS. Historically the EA has not received many enquiries to abstract from the aquifer in this location and there are

very few licensed abstractions from it. This has meant we have not needed to develop any particular licensing strategies to manage adverse impacts that might result. At the proposed point of abstraction the LGS is deeply confined and does not represent an issue for the surface water features directly above this abstraction point. The policy position has historically been to consider each application on its own merits.

As there has been limited historical interest/investigation into abstracting from the deeply confined aquifer in this part of the EA's Hertfordshire and North London (HNL) Area the EA did not initially have enough evidence to assess the full extent of the sustainability of the proposal. In such cases, it is appropriate to grant consent to investigate a groundwater source (GIC) allowing a prospective applicant to drill a borehole and carry out tests. Consequently, Roxane applied for and in 2017 was granted a GIC. This stipulated the drilling and monitoring of an observation borehole approximately 200 metres from the point of abstraction, which is not commonly requested in GICs, but was necessary in this case because of the potential for the impact of abstraction to be distant from the point of abstraction. The grant of a GIC is not a guarantee that an abstraction licence will be issued. The data gathered from the pumping test and monitoring borehole has been used alongside the Cam and Bedford Ouse (CBO) groundwater numerical computer model to inform our decision. This data indicated a need to consider the environmental implications of the abstraction on the unconfined LGS.

The confined LGS becomes unconfined approximately 15km North West of the proposed abstraction point. The Upper Ouse & Bedford Ouse ALS applies to the unconfined and confined LGS abstractions that demonstrably have an impact on it. This includes the Broughton Brook, a surface water feature approximately 17km from the proposed abstraction point, which passes over the Unconfined LGS, with which there exists hydraulic connection.



MAP 1

The flow in the Broughton Brook is failing to support Good Ecological Potential under the Water Framework Directive (WFD) due to abstraction from the unconfined LGS.

The EA assesses the impact of abstraction on WFD groundwater bodies, as well as their dependent surface water features, through the groundwater balance test. The Upper Bedford Ouse Woburn Sands groundwater body is currently very close to deterioration if further water is abstracted from it. There is a high risk this could occur from existing licensed water which is currently unused. By granting this proposal, and a similar proposal nearby, it is highly likely the abstraction from the groundwater body would increase leading to deterioration of the groundwater balance test element, prohibiting us from maintaining the Good status of this test element, which we consider unacceptable.

Measures specifically aimed at improving the water dependent environment have been developed and implemented. These include capping time-limited licences to recent maximum peak abstraction, and agreeing improvement measures with Anglian Water, such as licence reduction, pumping water into the river to support flows and river habitat restoration. We have a duty to prevent deterioration in the hydrological status of ground and surface water bodies under the WFD and therefore need to ensure that issuing any abstraction licence does not cause deterioration and/or compromise measures to get water bodies back to supporting Good Ecological Status.

The evidence collected through the GIC, coupled with evidence from the use of the CBO groundwater model (referred to in section 7.2) leads us to conclude that granting the proposed licence would pose unacceptable environmental impact.

On 13 January 2020 we advised Zenith Global Ltd, the agent acting on behalf of Roxane, of the findings of physical groundwater investigations linked to the neighbouring proposal (made by Affinity Water) which demonstrated that the hydraulic impacts of that proposal continue into East Anglia. The abstraction quantities of this neighbouring proposal were comparable with the quantities sought in the application submitted by Roxane. Zenith were then informed in writing that, following further consideration of the Affinity Water GIC and groundwater model evidence, the confined LGS at the proposed point of abstraction was closed to new abstraction.

Roxane nevertheless wanted to conclude its groundwater investigations, so sought an extension to the GIC, which the EA agreed to on 31 January 2020, making it valid from 1 February to 30 April 2020. Roxane concluded its groundwater investigations under the extended GIC and then submitted the results of the GIC with its application for an abstraction licence.

1.1 Departures from application forms

None.

1.2 Details of proposal

Administrative details	
New licence number	TH/038/0002/007
Existing licence number	N/A
Application reference number	NPS/WR/033836
Applicant name and address	Roxane UK Limited. Hangers 3, 4 & 5, Wood End Lane Fradley Park Lichfield Staffordshire. WS13 8EL
Application contact details	Mr. Thomas Kelly Zenith Global 7 Kingsmead Square Bath. BA1 2AB
Catchment	Upper Ouse & Bedford Ouse ALS
EA Areas	HNL & EAN
Administratively complete date	21/05/2020
Relevant date	11/06/2020
Determination date	11/10/2020
Agreed extended determination date	11/06/2021 (revised date agreed 25/05/2021)

Applicant entitled to apply	Yes. See Right of Access section 7.9
Supplementary reports	<p>The following supplementary reports and documents were submitted:</p> <ul style="list-style-type: none"> • Drawing entitled Proposed Site Plan, Ref. 1367-JSA-XX-XX-DR-A-01202 dated 29/10/2019 (rev. P6). • Exclusivity Agreement between Henry Boot Developments and Roxane UK Limited dated 04/09/2019 and relating to proposed sale and subsequent development of warehouse facility and ancillary offices Butterfield Business Park Luton Bedfordshire. Signed by one party only (Roxane UK Limited). • Butterfield Business Park HIA – Part A. Hydrogeological Impact Assessment in Support of Abstraction Licence Application. Dated 19/05/2020 Part A – Groundwater Investigation. • Butterfield Business Park HIA – Part B. Hydrogeological Impact Assessment in Support of Abstraction Licence Application. Dated 19/05/2020 Part B – Hydrogeological Impact Assessment (12161 r1b). • Map (undated and untitled) indicating area of land outlined in red where the Applicant intends to have right of access.

Abstraction details	
Location of abstraction	Butterfield Business Park, Luton.
Source of supply	Lower Greensand (LGS)
Point of abstraction	510422 224872 (TL1042224872)
Purpose of abstraction	Water bottling
Period of abstraction	All year
Quantities and rates	120 m ³ /hr 2,880 m ³ /d 848,448 m ³ /yr 33.333 l/s
Aggregate conditions	none
Means of abstraction	pump
Measurement of abstraction	meter
Other details	Borehole details: Stainless lining to a depth of 201.00m. ø340.00mm Stainless wire-wound slotted lining to a depth 259.00m. ø219.00mm.

2. Case history

Date	Event
02/10/2017	Groundwater Investigation Consent (GIC) first granted.
13/01/2020	The applicant was informed of a change in licensing policy affecting likely licensing decision.
31/01/2020	Extension to groundwater consent TP 17/006new, providing an extension of 01/02/2020 - 20/04/2020. This letter reiterated that this extension did not represent a change in our stance that an application was unlikely to be successful.
10/07/2020	Advertised.
11/07/2020	Representation received (x2)
06/08/2020	RoA agreement template sent to Zenith
11/11/2020	Zenith were advised that the EA was minded to refuse.
19/11/2020	Sent to Zenith Global: Wood Environment & Infrastructure Solutions UK Ltd. Technical Note: Butterfield Business Park Application Review.
11/02/2021	Receipt of Zenith's response to Wood Ltd. Technical Note: Butterfield Business Park Application Review.

3. Water Resources (Environmental Impact Assessment Regulations) 2003 as amended by the Water Resources (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2006

We have confirmed that the proposal is not a “relevant project”, as defined by the Regulations. No environmental statement is therefore required to be submitted in respect of this application and project proposal.

4. Justification of requirements

The Applicant's HIA Part A report supplied in support of the application states that the annual quantities are based upon predicted market growth up to 2030 and the daily, hourly and instantaneous quantities align with the planned production line capacity.

The 2019 Roxane accounts available through Companies House show increases in 2017-18 Turnover (+17%), Profits (+16%), Shareholder Funds (+12%) and Ave. Number of Employees (106 people, an increase +17% on previous year). This assessment does indicate that the company is performing and production, profits and employment numbers are on the increase.

This appears to be the case for the industry generally. The most recently published figures available through the British Soft Drinks Association (BSDA) would indicate bottled water has increased its market share in the soft drinks market by between 3-4% over a five year period and in 2019 represented 20.6% of this market. Also, whilst the BSDA figures in 2019 show volume (water) figures were between 4-5% lower than on the previous year, growth in volume production, year-on-year, over a 5 year period, has fluctuated between +4.5 and +10%. The most recent figures from the industry association would therefore generally indicate that the market for bottled water is expanding and that volume demand is increasing also.

Further details regarding company forecasts and projections and additional information was not requested, as the company accounts submitted to and published by Companies House, together with industry sector performance, as indicated on the industry association website, were deemed clear enough to demonstrate that the applied-for quantities were justified.

4.1 Water efficiency

The proposed water bottling facility is planned to have an efficiency of 95%, which will be measured as part of company's Key Performance Indicators on water and energy usage.

The first point of measurement will be at the boreholes which will be fitted with pressure and flow meters. The delivery pipes will then convey the water to the above ground external storage tanks which again will be fitted with flow meters. These readings will be fed into the facility electronic control device (PID controller- this being an instrument used to regulate flows, pressures, speeds and other process variables). Any discrepancy between readings would be highlighted and investigated as part of operational procedures.

From here, the entire system is above ground and closed circuit. The only lost water will be on Cleaning-in-place (CIP) and Cleaning-out-of-place (COP). These are systems used in all food and beverage facilities to maintain cleanliness. The CIP process cleans equipment internals on a closed loop system. Waste effluent is minimised and consumption is approximately 25m³ of water per cycle. COP cleans equipment externals on open loop (running to surface drains), consumption is approximately 10m³ of water per cycle. The cleaning is undertaken once a week, or every time the production lines are stopped for more than 8 hours.

All pumps throughout the facility are driven by the latest generation inverters, which gives accurate control of flows and pressures. The bottle filling machine is equipped with flow meters to ensure that bottles are filled accurately with no spillage. Any leakage would be automatically detected by the vision system (automated quality control cameras) which would auto stop the equipment for investigation.

5. Advertising

The press notice with details of the application was made public for 28 days on the Gov.UK website and advertised in the 10th July 2020 edition of the Daily Express newspaper. The press notice included directions to where further information could be obtained.

Application was advertised	
Date when advertised	10/07/2020
Name of newspaper	Daily Express
The local paper with circulation appropriate to the area where impact might be seen had closed its offices due to present circumstances. Other local papers each have partial coverage of the area possibly impacted by the proposal, but not the whole area. For this reason the press notice was published in a national newspaper and appeared in the 10 July edition of the Daily Express.	
Representations were received and these are addressed in section 5.1.	

The recommended paper for this grid reference is the Luton Herald and Post but this has ceased publishing at the moment. The next paper for the best circulation is the Luton News & Dunstable Gazette. Refer Map 2, below.



MAP 2

The **Dunstable Gazette** is a weekly tabloid newspaper sold in and around the town of Dunstable in southern Bedfordshire, including the neighbouring smaller town of Houghton Regis and villages in the area.

There is a sister title for Luton, the Luton News, and Premier's freesheet for the area, the Herald & Post.

Circulation: 3,000
 Audit Body: Publishers Statement
 Circulation Type: Paid for

The Regional circulation information below is supplied by Jicreg.

Region	Circulation	Readership	Households	%
Bedfordshire	4171	20325	270256	1.54
Dunstable	1344	6750	38860	3.46
Luton	2827	13575	80172	3.53

As the application was advertised, Statutory Notification was served upon:

Statutory Bodies	Date
Internal Drainage Board (IDB)	N/A
Navigation Authority (NA)	N/A
Harbour Authority (HA)	N/A
Conservancy Authority (CA)	N/A
Statutory Water Undertaker (SWU) – Anglian Water	08/07/2020
Statutory Water Undertaker (SWU) – Affinity Water	08/07/2020

5.1. Representations and decision document

The representation window opened for 28 days when publication of the press notice first appeared on the EA website and the Daily Express newspaper on 10 July 2020. Two

representations were received, one on 17 July and the second on 7 August. The representation window closed on 7th August, so both representations were received within time.

A further 11 number of representations were received out of time.

1st representation

The first representation questioned whether the proposal would interfere with supply from their local borehole, located near Flitwick.

The LGS does outcrop as the Unconfined LGS between Milton Keynes and Biggleswade with which Flitwick is, to some degree, hydraulically connected. There would be a mechanism for impact if the borehole were within this area or the adjacent Flitwick area or another with some hydraulic connection. The location of the borehole was not given however, pump test results and the ground water model indicate that there will be no appreciable lowering in levels brought about by abstraction of the proposed quantities at Butterfield, so further details were not needed. Supply from the borehole is not expected to be in any way impacted through this proposal.

2nd representation

The second representation expressed the view that water bottling was not essential, that shortages in water supplies were in future likely and that better use of the water could be made if used for public water supply. The concern regarding shortage of water was put in the context of population growth, rainfall and climate change. A further concern was expressed regarding the single-use nature and disposal of plastic bottles.

The combined impacts of climate change and population growth will likely place additional pressure on supplies in future and measures are being taken to meet these challenges. These measures are planned and documented in each water company Water Resource Management Plan (WRMP). The introduction of the National Framework for Water Resources¹ and the associated Regional Water Resources Plans will consider the measures required to secure sustainable water supplies into the 2050s and beyond. As environmental regulator, the EA takes a key role in the development and implementation of these plans and programmes.

It is through assessment of impact and availability of water in the catchment, balancing the needs of people and the environment and business, that determination of applications for abstraction licences are made. This is the case here, where we assess applications by applying section 38(3)(b) of the Water Resources Act 1991, having regard to the applicant's requirements, in so far as we consider them to be reasonable. In this instance, it is whether the rate of abstraction applied for is justified with respect to Roxane's operation.

The use and disposal of plastic bottles is beyond the considerations of this report.

Information Request

An information request was received from Luton Borough Council who were undertaking an assessment to understand any impacts that might arise through a proposed extension of the Vale Cemetery into a parcel of land within 250m of the borehole proposed as the point of abstraction in this application. A minimum distance of 250m between burial site and source of water for human consumption is required.

On 24 June 2020 a preliminary advice letter was sent to the Council advising the Gault clay layer would provide complete isolation. The advice letter gave further advice on planning matters and consideration of Source Protection Zone and any nearby watercourses. Further

¹ <https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources>

correspondence followed on 13 November 2020 involving the Council's consultant. No further action was taken.

Out of time representations

An environmental awareness group further raised public awareness through on-line publication of an article on the proposal. Following this, 10 representations were received from groups and individuals, all in opposition.

The concerns that were expressed relate to:

- 1) Increased traffic and pollution
- 2) Noise entering nearby cemetery causing distress
- 3) Exploiting water resource for financial gain
- 4) Impact on wetlands and rivers
- 5) Impact on public water supplies
- 6) Production and disposal of plastic bottles (pollution)
- 7) Impact on chalk streams
- 8) Impacts on chalk aquifers

Points 1&2. Increased traffic, pollution and noise are matters that would be considered as part of a planning application and are beyond the scope of this abstraction licence determination.

Point 3. The economic benefit to the Applicant, as well as jobs and wealth creation for the local community, are considered in section 8 of this determination report.

Point 4. Where impacts on watercourses are found to be unacceptable or that which is being proposed unsustainable, mitigation measures may be put in place, or the application refused when there is no alternative. This proposal is deemed to have an unacceptable environmental impact and the application refused for this reason.

Point 5. Other abstractors including those for public water supplies are assessed to ensure that there is no derogation. The proposal is not expected to impact on public water supplies or plans for future developments of public water supplies.

Point 6. The use and disposal of plastic bottles is beyond the considerations of this report.

Points 7 &8. There is no anticipated impact on chalk streams or aquifers as these are hydraulically isolated from the LGS.

6. External consultation

In accordance with our obligations, we have consulted the following bodies about the proposal:

Statutory Consultee	Date
National Park Authority (NPA)	n/a
Natural England (NE)	11/08/2020
NE have been consulted via an Appendix 4. Please see section 7.6 for further information. No response received.	
Broads Authority (Anglian areas only)	n/a
Others, where relevant, e.g. IDB, English Heritage, Local Authority	n/a

7. Technical assessment of the proposal

Water Framework Directive (WFD) status information

This is a groundwater abstraction that affects the Upper Bedford Ouse Woburn Sands groundwater body (GB40501G402200). The aquifer at the point of abstraction is not a formal WFD groundwater body and neither is it in direct hydraulic continuity with the surface waters immediately above it, due to the confining Gault Clay. There is no known pathway for the abstraction to impact the Upper Lee Chalk GWB (GB40601G602900) which overlies the Gault Clay at this location. In addition, there is no known pathway for the abstraction to impact the Upper Bedford Ouse Chalk (GB40601G603000) which overlies the LGS aquifer further to the North. Consequently, the Chalk groundwater bodies will not be assessed further in the course of this determination.

The LGS aquifer is unconfined where it outcrops, becoming confined by the overlying Gault Clay. Change in the pressure head of the confined LGS as a result of this proposed abstraction will increase the groundwater flow gradient into the confined portion of the aquifer, and this increased flow into the confined portion of the aquifer will result in a reduction in base flow into receiving surface waters across the outcrop. Of greatest concern is the Broughton Brook, waterbody number GB105033037930, in which flows are currently failing to support Good Ecological Potential due to the impacts of abstraction from the Upper Bedford Ouse Unconfined LGS aquifer.

Having the right flow in our water bodies is essential to supporting a healthy ecology. The UK Technical Advisory Group (UKTAG) is responsible for developing environmental standards and conditions for achieving WFD requirements for rivers and lakes. The standards vary by river type and flow, with stricter standards at lower flows and for water body types considered more sensitive to abstraction. These standards identify percentage change from natural flow for differing river 'types' and at different flows.

We translate the UKTAG river flow standards into the Environmental Flow Indicators (EFI) for use in England. The EFI is set at a level to support Good Ecological Status/Potential (GES/P). Whilst the EFI allows for regulatory environmental flow targets to be set for rivers anywhere in England, it can be overridden by local data and investigation. This produces a Local Flow Constraint (LFC). An LFC of 1.5 Ml/d (0.017 m³/s) has been derived as the target flow for the Broughton Brook, based on the minimum velocity and depth thought to be required to support bullhead fish (a Habitats and Species regulations annex ii protected species) in this habitat. This LFC is used to derive the hydrological regime of surface water bodies under the WFD.

This determination has taken into account the impacts this proposal may have on the groundwater status and surface waters across the outcropping aquifer. The predominant effects are on the Upper Bedford Ouse Woburn Sands groundwater body, and the associated surface water bodies that are in hydraulic continuity with it. Broughton Brook is the most sensitive of the linked surface water bodies.

Consideration	Upper Bedford Ouse Woburn Sands groundwater body (GB40501G402200) Status		
	Baseline status (Anglian River Basin Management plan 2015)	Current status (2019)	Objective (Anglian River Basin Management plan 2015)
Overall WB status	Poor	Poor	Poor by 2027
Quantitative status	Poor	Poor	
Dependent SW Body	Poor	Poor	Good by 2027

GW Dependent Terrestrial Ecosystems	Good	Good	Good
Saline Intrusion	Good	Good	Good
Water Balance	Poor	Good	Poor by 2027
Chemical	Poor	Good	Poor by 2027

The dependent surface water body Test is failing due to groundwater abstraction for Public Water Supply (PWS) and spray irrigation. The surface water body driving this failure is Broughton Brook. The proposed abstraction is of a similar rate to Public Water Supply (PWS) and so can realistically be considered as detrimental to the groundwater body achieving its 'Good by 2027' objective.

The groundwater Balance test was previously poor in the 2015 classification and is now deemed to be at Good status. This status change needs to be treated with caution due to a change in methodology. The previous 2015 test compared cumulative groundwater abstraction impacts on low river flows (average Q70-Q95), across rivers draining the groundwater body. The basis of this test is that there is a naturally available low flow resource which if abstracted would not cause ecological harm. However if abstraction impacts exceed this naturally available low flow resource then the water body is deemed to be in deficit and to be failing. Choosing such a sensitive low flow statistic made this a precautionary test which gave an indication of whether there may be flow failures in individual water bodies.

Since 2019, the test methodology has been revised² to compare water coming into the groundwater body (recharge & discharges to the environment) with that leaving the groundwater body (abstraction and base flow to rivers). The current methodology assesses if groundwater abstraction impacts exceed an environmental flow allocation assessed at average flow conditions (Q50), which is less precautionary than the initial test due to comparing groundwater abstraction impact on flows at average conditions not low summer flow conditions. The new Groundwater Balance Test, when combined with the other 3 tests, provides:

- A clear narrative linking WFD measures with sustainability objectives;
- Better understanding of current and future risks; and,
- A robust framework for no deterioration investigations.

Therefore, the new Groundwater Balance test will meet our objectives to better interpret the WFD assessment, protect the environment and create a more transparent framework for licensing, policy setting and stakeholder engagement.

The Groundwater Balance Test used in RBMP Cycles 1 and 2 does not provide this level of protection and transparency. As this test is now less precautionary we place more of an emphasis on ensuring that Good status is maintained. The technical figures of this test, compared to the additional impact of this abstraction proposal, are presented in section 7.7. The Broughton Brook has been designated as a Heavily Modified Water Body (HMWB), as the physical environment has been altered to such a degree that the attainment of Good Ecological Status (GES) is not deemed possible without having a significant adverse impact on the protected uses of Land Drainage and Urbanisation which impact the waterbody. Consequently, the WFD objective is to achieve Good Ecological Potential (GEP) instead.

² https://defra.sharepoint.com/:w:/r/sites/def-contentcloud/_layouts/15/Doc.aspx?sourcedoc=%7B06a6aa18-073d-49a8-8771-359ed4aa38fd%7D&action=default&mobileredirect=true

Broughton Brook is classed as a Heavily Modified water body for the reasons of:

- Land Drainage, e.g. straightening, deepening and embanking river channels, and
- Urbanisation e.g. culverting and diversion to allow construction of urban developments.

A heavily modified water body is at Good Ecological Potential when the hydro-morphological characteristics have been improved to the fullest extent i.e. where all appropriate mitigation is 'in place'.

In surface water bodies, where the flow conditions pass their environmental flow targets, the water body potential is determined simply by whether all mitigation measures are in place or not. In the Broughton Brook, where the flow conditions fail to meet their environmental flow targets (hydrological regime) the water body potential is still determined by the worst of any of the other elements such as Fish, Invertebrates or Macrophytes and Phytobenthos. In the case of the Broughton Brook, the worst element is Macrophytes (Poor).

Consideration	Status Broughton Brook (GB105033037930) surface water body		
	Baseline status (Anglian River Basin Management plan 2015)	Current status (2019)	Objective (Anglian River Basin Management plan 2015)
Overall WB status	Poor	Poor	Good by 2027
Ecological potential	Poor	Poor	Good by 2027
Invertebrates	Good	Good	Good by 2015
Macrophytes	Poor	Poor	Not set
Phytobenthos	Moderate	Moderate	Not set
Hydrological regime	Does not support Good Ecological Potential (DNSG)	DNSG	Support Good Ecological Potential by 2027
Mitigation measures	Good	Good	Good by 2015
Physico-chemical	Moderate	Moderate	Good by 2015
Specific pollutants	High	High	
Chemical	Good	Fail ³	Not set

Reasons For Not Achieving Good (RNAG)

The Hydrological regime of the Broughton Brook does not support good (DNSG) ecological potential and groundwater abstraction for public water supply and agriculture have been confirmed as the reasons for this failure. The proposed new abstraction will reduce baseflow at this point and as such have the potential to prevent the waterbody from meeting its objective of 'Support Good Ecological Potential by 2027'.

³ In 2019 new substances (and new standards and methods) were introduced when assessing Chemical status, in this instance the most likely cause of failure is due to inclusion

External ID	Pressure	SWMI (significant water management issues)	Activity	Category/Sector
RNAG	CPS_RFF_UID_72930	Flow	Groundwater Abstraction (suspected)	Water Industry/water supply
RNAG	CPS_RFF_UID_72931	Flow	Groundwater Abstraction (suspected)	Agriculture and rural land management/agriculture - Arable

Other RNAG – Macrophyte and Phytobenthos combined, attributed to physical modification of the watercourse and point and diffuse source pollution. The abstraction will not directly contribute to these, but reduced baseflow may impact on water quality and exacerbate existing pressures from phosphates on the element (phosphate being the cause of failure for the Physico-chemical quality elements too).

Licensing Strategy:

The abstraction point is within the Upper Lee ALS (February 2019). As explained above, this does not specifically include the LGS. In Hertfordshire and North London (HNL) the LGS is deeply confined and does not represent an issue for the surface water features directly above these abstraction points. The policy position has historically been to consider each application on its own merits and potential impacts.

Following consideration of the applicant’s investigation evidence (set out in section 7.2 below), including evidence from physical groundwater investigations linked to a neighbouring proposal of comparable abstraction quantity to the Roxane proposal, it has been confirmed that the confined LGS in the Luton area is hydraulically linked to the Upper Bedford Ouse river basin as published in the Upper Ouse and Bedford Ouse ALS. This has resulted in a joint approach to managing abstraction from the LGS aquifer across two EA Areas.

This application is located within the confined Lower Greensands and the abstraction is predicted to influence the Upper Bedford Ouse LGS groundwater body to the North. The Upper Bedford Ouse Woburn Sands groundwater body has unsustainable levels of groundwater abstraction and has a water availability as set out in the Upper Ouse and Bedford Ouse ALS (May 2017) of “Water not available for licensing”. The Upper Bedford Ouse LGS groundwater body is overlain by a surface water body, the Broughton Brook, which has been assessed as failing to meet its environmental flow target under a historic levels of abstraction. This scenario, referred to as the “Recent Actual” abstraction scenario, looks at the average annual level of actual abstraction that has been taken historically. The recent actual level of abstraction is a lower level of abstraction than if all licences took their full licensed quantity.

One of the considerations when determining the sustainability of applications for new groundwater abstractions is how they relate to the existing situation. Whilst abstraction under some licences may on its own change the compliance of a surface and/or groundwater body sustainability, there will also be a general impact on a river, due to the in-combination effects of multiple groundwater abstractions. Some of these groundwater abstractions will have individual impacts that on their own wouldn’t be a problem, or perhaps would not even be discernible through monitoring, but together can lead to a significant level of impact.

This principle of the in-combination effects of abstraction applies to the flow in surface water bodies like Broughton Brook, where the main impact on flow is through large quantities abstracted under some licences (in this case Public Water Supply and agriculture), but where there is a background level of in-combination impact from a range of other groundwater licences. Our assessment cannot just look at the impact of the Roxane proposal on its own, but needs to consider how the proposal will contribute to the existing problems caused by the

in-combination effects of groundwater abstraction from the aquifer. We also need take into account the existing WFD hydrology failure on the Broughton Brook, at the recent actual (historical average) level of abstraction, and the fact that this would get worse under the present full licensed rates of abstraction, i.e. before Roxane's proposed abstraction is considered. Roxane's proposed level of abstraction represents an increase greater than 10% of the historic actual abstraction quantity used to derive the WFD hydrology regime compliance.

Over-abstraction in these waterbodies therefore needs to be addressed, as well as the risk of Water Framework Directive deterioration. The hydrological system was failing to support Good Ecological Potential at the historical levels of abstraction (i.e. pre-2015) and any increase in abstraction above those levels will:

- Make the existing hydrological failure worse e.g. in the Broughton Brook thereby risking deterioration in the ecology; and/or
- Compromise the measures that are being taken to get the hydrology of the Broughton Brook surface waterbody back to Supporting Good Potential. On this point, it must be noted that the measures to get the surface water back to supporting Good Ecological Potential assume that the overall level of abstraction does not increase above historic levels.

Our licensing approach recognises that as the ground and surface water bodies that the proposed new abstraction will affect are already failing and need remedial measures, any increase in impact is not desirable.

The Water Abstraction Plan⁴ published by Government in 2017 sets out the priorities for managing water resources and in particular, dealing with the effects of unsustainable abstraction. Section 2 of the plan states:

“Addressing unsustainable abstraction

We want to end damaging abstraction of water from rivers and groundwater wherever it is cost-effective to do so. Latest data show that 82% of surface water bodies and 72% of groundwater bodies have enough water to protect the environment, for example, providing good support to fish and other aquatic life.”

And goes on to specifically identify the risks from new abstractions:

“As well as improving the environment we need to make sure that increases in abstraction do not bring about new pressures. 5% of surface water bodies and 15% of groundwater bodies are at risk from increasing water use by current licence holders that could damage the environment. This risk needs to be managed closely.”

Our national licensing policy⁵ is that we will not allow abstraction that would bring flows below the EFI/LFC or that would contribute to deterioration of any of the 4 groundwater tests. The only exception is if the abstraction licence applicant can prove there will be no deterioration or impact on ecological status.

The Upper Ouse and Bedford Ouse ALS licensing policy is that there is no new groundwater available. The groundwater bodies associated with this ALS are already over licensed and we are therefore taking measures to reduce abstraction pressure on the environment caused by historic over-licensing in East Anglia Area. These measures include:

⁴ <https://www.gov.uk/government/publications/water-abstraction-plan-2017/water-abstraction-plan>

⁵ <https://www.gov.uk/government/publications/managing-water-abstraction/managing-water-abstraction>

- Revoking licences that have not been used for 4 or more years where there is no continued justification of need.
- Removing unused licensed “headroom” on abstraction licences by capping them to their historic maximum uptake upon renewal, to ensure that the potential for growth within previously licenced ‘headroom’ is removed.
- Considering ‘licence trading’ only when the proposed quantities for trade have been recently used, rather than historically unused (as might be the case with older non time-limited licences).

The EA renewals approach, covering the Cambridgeshire and Bedfordshire part of East Anglia Area was applied to circa 400 licence renewals in 2018. The EA received two appeals over this period, both challenging the licence capping approach (Reference numbers APP/WAT/534 and APP/WAT/537). In each case the EA’s decision to cap abstraction quantities was upheld.

Granting this application would go against the licensing approaches being employed across the East Anglian Area to order to address the unsustainable impact of existing licensed abstraction. We regard granting new water for abstraction as unfair to individuals and businesses that need to adapt to abstracting less water in result of these measures.

7.1 Designated and protected conservation sites and species

Impacts of abstraction will be upon the LGS where it becomes unconfined, known as the Woburn Sands. There are two Sites of Special Scientific Interest (SSSI) in the Woburn Sands and a Bullhead fish, a Habitats and Species Regulations annex ii protected species.

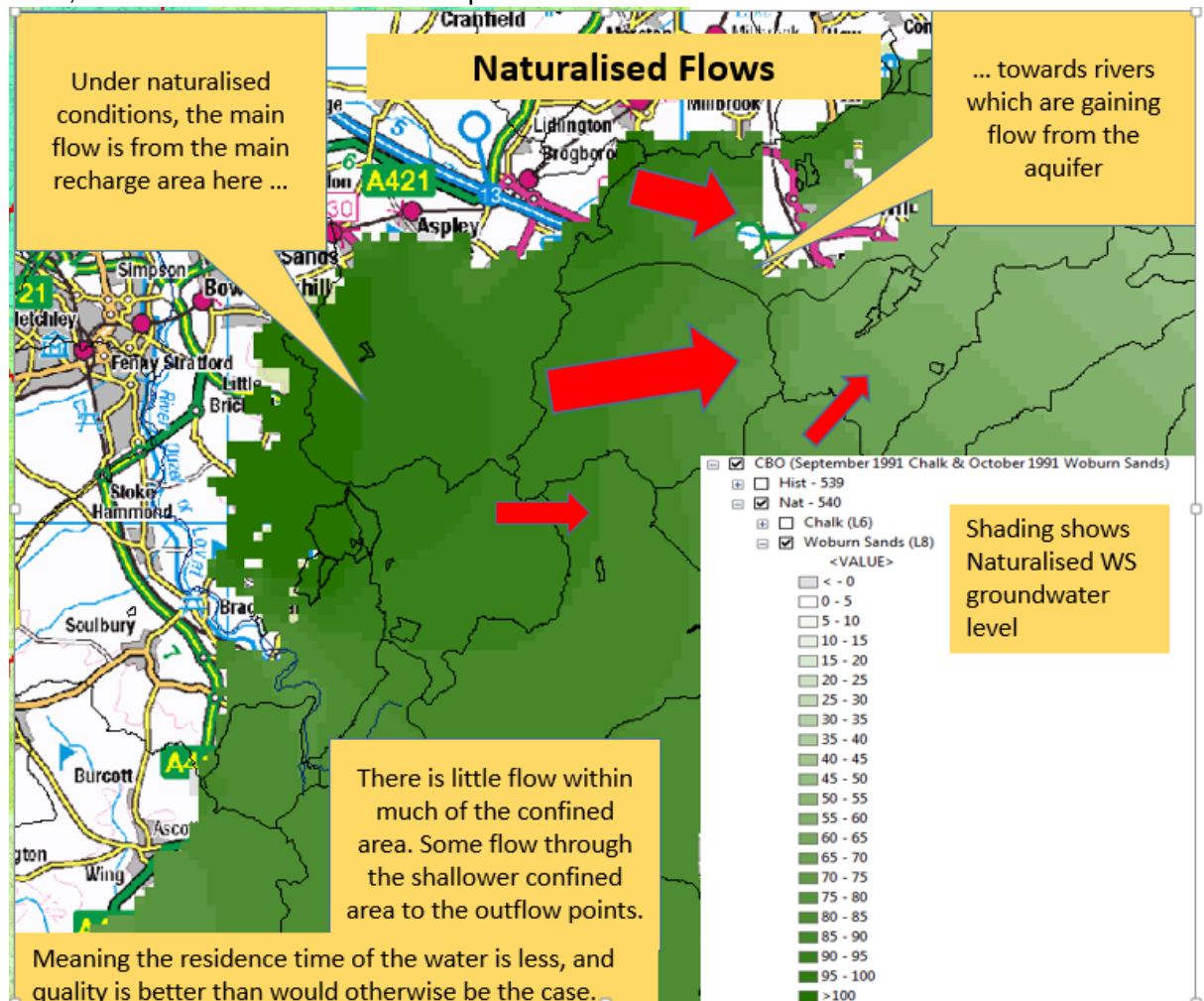
Nearest conservation sites		
Designation types	Name of site	Distance and direction
Special Areas of Conservation (SACs)	none	-
Ramsar sites	none	-
Special Protection Areas (SPAs)	none	-
Sites of Special Scientific Interest (SSSIs)	Flitwick Moor Wavendon Heath Ponds	11.35km NW 19.15km NW
Protected species	Bullhead fish	Broughton Brook 15km NW

The impact of this proposal on the sites and species listed in the table above will be assessed in sections 7.2-7.7.

7.2 Hydrogeology and impact on groundwater and surface water flows

The abstraction proposal is targeting the confined part of the LGS aquifer which outcrops in East Anglia (Map 1) where it is delineated on the basis of the outcrop area only as the Upper Bedford Ouse Woburn Sands groundwater body. At the proposed abstraction site, the aquifer being targeted is overlain by 94 m of Gault clay, above which is the Chalk. This thickness of Gault Clay would be expected to form an aquitard, separating the LGS and Chalk aquifers. The borehole is cased to 218 metres below datum, near the bottom of the Gault Clay layer recorded in the borehole log. This construction should ensure there is no flow pathway created between the two aquifers. The borehole site is within the area covered by the Upper Lee ALS, but abstraction in the confined portion of the LGS will have impacts on the outcrop area in the Upper Ouse and Bedford Ouse ALS in East Anglia, where the policy for the unconfined LGS (Woburn Sands) is ‘No Water Available’.

The current conceptual understanding (which the applicant has questioned) is that the confined aquifer from which the abstraction will take place receives significant recharge from the nearest outcrop in East Anglia. The recharge area includes the Broughton Brook catchment (refer Map 1 above). In a situation where there is no abstraction (represented by the Naturalised model scenario), significant flows would be limited to the outcrop and shallow confined area in East Anglia, rather than back into the deeper confined aquifer. Confined abstraction induces flows from the outcrop into the deeper confined aquifer. We would expect an observable response within a few days at confined boreholes from pumping in the confined zone, which will then become more dispersed and less observable in the unconfined zone.



Map 3

This was demonstrated during the 72 hour constant rate pumping test undertaken by the applicant. This showed an impact of a reduction in groundwater head of 0.3 metres extending to the confined LGS borehole at Oughtonhead (Figure 1), which confirms our conceptual understanding of the response of the aquifer to abstraction in the confined zone.

A gradually rising groundwater head trend was seen in confined observation boreholes after significant LGS abstractions for industry in the Luton area ended in the 1970s. The recovery occurred until at least the early years of this century, when confined heads began to reach a new equilibrium. The increase is the equivalent to a very small volume of recharge (less than 1 mm per year over the entire aquifer) and therefore the effects of abstraction will spread a long way until they are balanced by recharge, to achieve equilibrium in groundwater conditions.

When abstraction at Affinity Water's Runley Wood source resumed in 2003 (1.77 MI/d at a location 5 km to the South West of the proposed abstraction), a circa 2 metre drop in the head at the Leagrave Common observation well was observed (Map 4), reversing the previous trend of rising groundwater levels noted above.

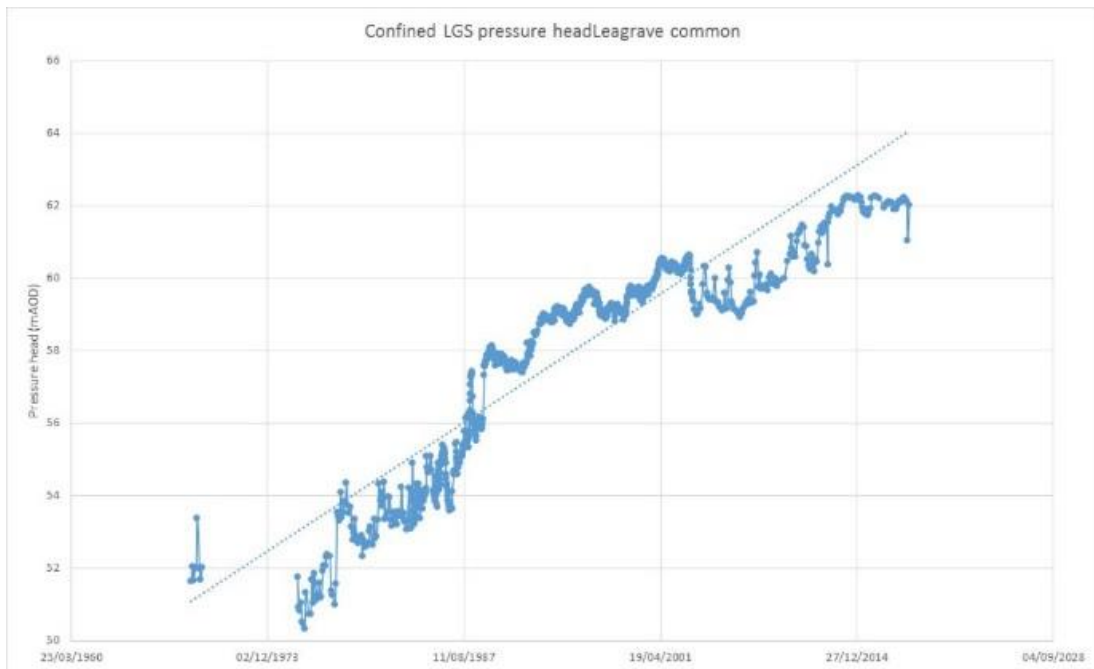
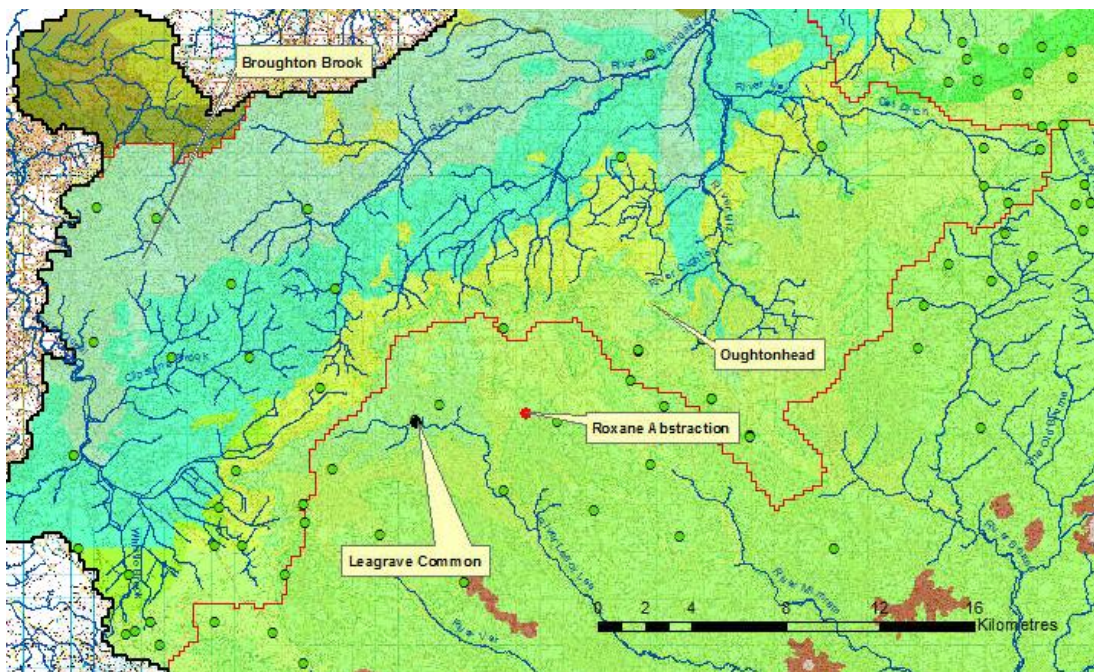


Figure 1



MAP 4

Confined storage coefficients⁶ in the LGS are several orders of magnitude lower than the specific yields measured in the unconfined aquifer. Confined head impacts are likely to reach

⁶ The confined storage coefficient, or specific storage (dimensionless), is the amount of water released from a unit volume of aquifer for a unit change in pressure head. In aquifers, water is released from

the outcrop in a dispersed way, with each individual abstraction causing small changes in level⁷ and flow across a wide area.

Given the dispersed nature of individual impacts, and the length of time it may take for the full impact to appear on river flows and other receptors, groundwater modelling is the best available tool to assess the risk of abstraction changes. In an aquifer where the EA are actively pursuing reductions in groundwater abstraction to mitigate impacts on the environment, in light (amongst other things) of the EA's duties under the Water Framework Directive a precautionary starting point has to be taken that abstraction in the confined aquifer will be at the expense of groundwater flow to receptors on the outcrop. Measures to mitigate abstraction impact on the Broughton Brook are described in section 7.7 below.

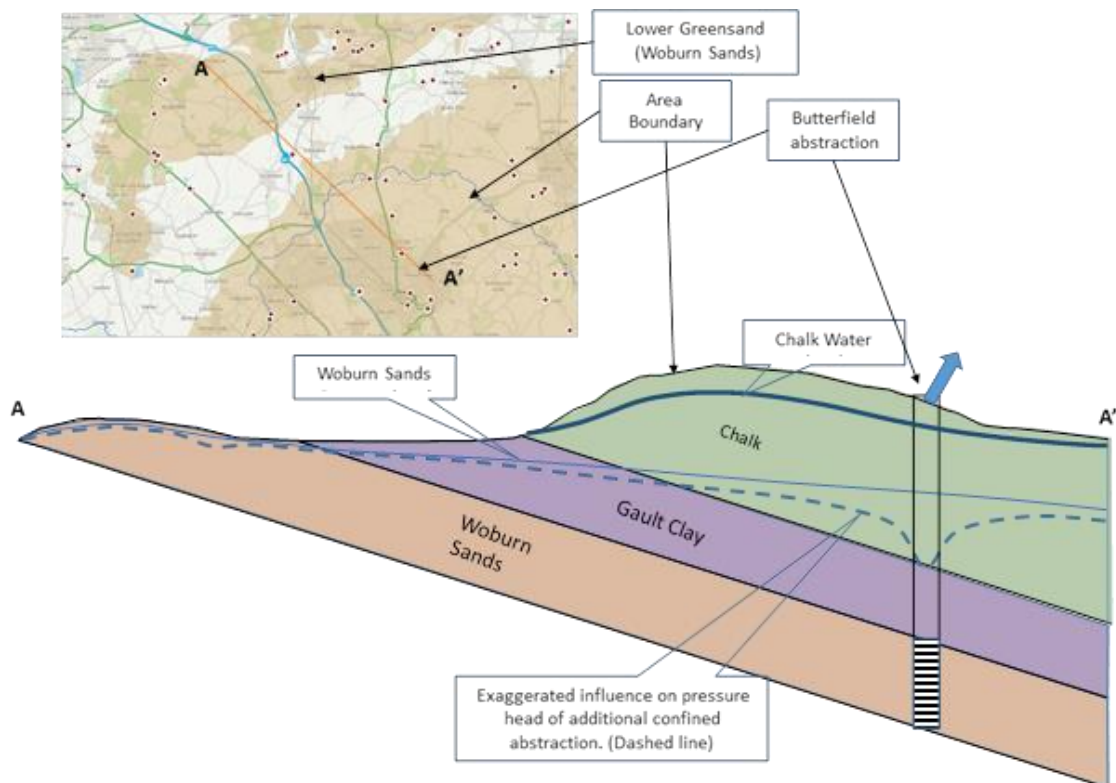


Figure 2: Simplified conceptualisation of the application.

storage by a couple of mechanisms: drop in pressure head (and aquifer compression), which dominates in confined aquifers, and actual drainage of the aquifer matrix in unconfined aquifers. An analogy of letting air out of a car tyre has been used to explain the effect of abstraction from confined aquifers - the tyre remains full of air even when pressure is reduced in the same way that the aquifer remains saturated, although the piezometric head above the confining layer will reduce, often dramatically. Water will flow from a higher to a lower pressure head, so as water is removed, and pressure lowered in the confined aquifer, the conditions are created that allow flow from the outcrop into the confined zone

⁷ The pressure change caused by confined abstraction will be distributed across the margin of the confined zone. There may be little or no observable change in water levels in unconfined boreholes on the outcrop, but the head differences are still set up which allow flow back into the confined aquifer, and cause the impacts on receptors. So, you can have minimal change in unconfined groundwater level, but significant changes in flow direction. This is why a short term abstraction and monitoring would not be advisable.

Review of applicant's Hydrological Impact Assessment (HIA) - Butterfield Business Park HIA – Part A and B 19 May 2020.

In support of the application a Hydrogeological Impact Assessment (HIA) was submitted. A constant rate pump test was undertaken as part of the HIA and the results of this constant rate test (see below) demonstrated that groundwater head impacts extended radially from the point of abstraction into the portion of aquifer that is in the Upper Ouse and Bedford Ouse ALS.

The HIA correctly identifies (at section 2.2.3) that this area of the Upper Ouse and Bedford Ouse ALS has an abstraction licence status of no water available. Furthermore the applicant's HIA has demonstrated that the effects of the proposed abstraction stretch into EAN, where the applicant is aware that the licensing strategy for that part of EAN is 'no water available'. The focus and emphasis of the HIA is on the surface water features, with little assessment of the overall or individual groundwater status elements, and deterioration in groundwater elements considered.

The 3 day constant rate pump test involved monitoring at other confined boreholes in the same geological strata as the proposed abstraction, to help obtain distance drawdown and time drawn characteristics to identify the hydraulic aquifer properties. The test identified a range of values for the Transmissivity and Storativity summarised in Table 5-3 of the HIA. The key finding of the pump test was that Head impacts materialised over 7km away at the Oughton Head monitoring well, experiencing a drawdown of 0.3metres. This highlights the high likelihood that head impacts would traverse to the outcrop of the aquifer and diffusely impact flows and the overall aquifer water balance element test for the WFD groundwater body. The Storativity value increases the closer you get to the unconfined portion of the aquifer. This is a key consideration for monitoring, as what would be a 1metre change in head in a very low Storativity aquifer could be less than 1cm where the aquifer becomes unconfined, and the storage coefficient increases considerably; making monitoring at the outcrop incredibly difficult to achieve, and modelling to be of huge benefit.

Part B of the HIA Figure 1-18 estimates the scale of the proposed abstraction relative to the flow through the aquifer. Essentially it demonstrates that a 2448m³/day abstraction would consume the entire flow flowing through a 3.7km width of aquifer. Given the 12km distance to the outcrop of the aquifer we consider this significant. The EA has to consider this proposed abstraction in combination with all other existing abstractions to reach a conclusion on the sustainability. For context, the proposed abstraction is greater than 10% of the historic average annual abstraction scenario used to derive the ground and surface water body WFD classifications.

A further conceptual assessment of the water balance of this abstraction can be considered using Storativity (volume of water released per unit change in head) values and recharge circles. For this method, the likely aquifer recharge volume can be compared with the abstraction volume to estimate the area of recharge required to balance demands (total abstraction) with supply (aquifer recharge). If there is no or insufficient recharge abstraction will gradually 'mine' groundwater until the aquifer is emptied. This is highly unlikely in this case, as we consider a source of recharge to be the local outcrop in East Anglia Area. In this case the proposed abstraction of 2448m³/day will in time become balanced by recharge from the LGS outcrop. This will be at cost of diffuse baseflow reductions to the Broughton Brook surface water feature. The Leagrave Common borehole is geographically well placed for use as a surrogate measure of recharge and has a good period of continuous record. The period 2003 to 2013 the measurements of pressure head rose by a maximum 3.2m. Knowing the Storativity of around 9×10^{-5} this equates to a potential recharge of less than 1mm per year.

As noted above, even a recharge value of 1mm per year suggests that for this abstraction to be sustained by an equal recharge volume, the area needed to supply this recharge will be large and, represented by a radius, will intersect with the unconfined portion of the aquifer (shown conceptually in Figure 2 and geographically in Map 1). The applicant's point (HIA Part B) that there is a long term upward trend in groundwater level following reductions in historic industrial abstraction needs to be viewed in the context that the upward trend is caused by a relatively small amount of recharge, and the recovery has taken multiple decades to happen. The key consideration is whether this proposed abstraction of 2448m³/day will be sustainable alone and in combination with all other licensed abstractions. Our assessment of the proposed abstraction's effect on the groundwater body and surface water body WFD classifications concludes that it will not be sustainable.

Groundwater modelling was undertaken by the applicant and reported in HIA Part B. This work was reviewed by the EA and consultants Wood Ltd and summarised in the 'Technical Note: Butterfield Business Park Application Review' that was provided to the applicant in November 2020. The note stated that the impacts of abstraction in the confined LGS interact to produce effects on surface water features (e.g. rivers). Groundwater modelling is the only feasible way to isolate and assess individual abstraction impacts on surface water features for a proposal of this kind and to help address long term water balance sustainability.

The HIA Part B draws the conclusion that recharge of the confined LGS is not made through the unconfined LGS alone, but that contributions are also made from other sources. One chemical testing sample, taken from the Butterfield borehole during pump testing, has been presented as evidence that there is additional recharge from other aquifers. The applicant speculates that this additional recharge could be significant enough to offset some of the effects of its proposed abstraction on surface water features in the unconfined LGS, e.g. Broughton Brook. We do not agree. The applicant has not presented quantifiable evidence to support this assertion. However, if we were to accept this hypothetical situation and model its effect, this notional additional recharge does not remove the impact of the proposed abstraction on the surface water features in the Broughton Brook, it only reduces it by approximately 50%.

The EA monitors groundwater quality at a monitoring point TL03003S and the water quality is of a similar composition to that of the applicant's Butterfield sample. Our monitoring point is only 2 km from the unconfined aquifer and therefore the water is likely to be representative of more recent unconfined aquifer recharge than the Butterfield site. Therefore, the applicant's interpretation that the chemical sample from its monitoring point in the confined aquifer demonstrates there is an alternative source of recharge to the confined aquifer is not conclusive. Figure 1-13 in HIA part B would suggest the sample point at TL03003S being closer to the unconfined portion of the aquifer would be less likely to have these additional inflows. They have, however, a similar chemical composition. We do not believe the applicant has considered other equally plausible reasons for this chemical result. Therefore using the applicant's chemical sample is not adequate evidence to prove that an additional source of recharge exists that would support this proposed abstraction.

Under the WFD, the flow regime is a supporting element for the target of achieving Good Ecological Status/Potential (GES/P) for surface water bodies (rivers, lakes, estuaries/transitional and coastal). In order to assess whether flows for a water body are meeting the requirements for GES/P, they are compared with Environmental Flow Indicators (EFIs). EFIs are flow thresholds that are set with reference to natural flow conditions, and aim to ensure that water resources activities do not cause or contribute to the failure of WFD objectives. Where available, EFIs can be overridden by locally derived Local Flow Constraint (LFC) which is a bespoke flow target for an individual water body.

Modelling was undertaken by both the EA when assessing the original proposal, and by the applicant in Part B of its HIA. Both used the CBO groundwater model to assess the impact of the proposed abstraction, albeit with some differences in quantities. Both sets of modelling used the Recent Actual scenario as a baseline (representing current historical levels of average actual abstraction).

In the CBO model, the nearest source of water to the confined LGS aquifer around Luton is the unconfined portion of the aquifer to the North West (See Map 1). The EA model runs therefore sought to identify impacts from the proposed abstraction on baseflow to rivers across the unconfined LGS outcrop. The impact of the proposed abstraction on LGS baseflow is most significant in the upper reaches of the Broughton Brook, but flow compliance is assessed at the waterbody outflow point. After the Broughton Brook crosses onto the Jurassic Clay dominated area (see Map 1), there is little further groundwater/surface water interaction. At the Broughton Brook waterbody outflow point, the CBO model estimates that Naturalised flow would be 8.01 MI/d. The Q95 EFI at this point is 6.81 MI/d. Recent Actual abstraction impact means that flows reduce to 3.85 MI/d, and were all licences to abstract at their maximum licensed rate (the Fully Licensed scenario), this would decrease further to 2.49 MI/d. The EA modelling shows an impact of 0.066 MI/d, or just under 2% of the Q95⁸ RA Environmental Flow Indicator (EFI) flow (3.85 MI/d), at the outflow point of the Broughton Brook waterbody. This would reduce the flow from 3.85 MI/d to 3.78 MI/d. The lower reaches of Broughton Brook, where the outflow point is located, are less sensitive to abstraction, and so an alternative flow target, based on the requirements of Bullhead fish (*Cottus gobio*) was developed. This flow target of 1.5 MI/d is around 14 km upstream of the outflow point, in the reaches that are more sensitive to abstraction, and where there is a pathway for abstraction impact to affect baseflow, as the river crosses the LGS outcrop. As a percentage of this flow target, the impact estimated from modelling of the proposed abstraction is more significant (4.4%).

There has been a technical discussion on the CBO groundwater model between Zenith (on behalf of the applicant), the EA and Wood consultants (on behalf of the EA). Modelling reports⁹ and the numerical model files¹⁰ have been provided to the applicant, enabling it to undertake its own work. The following bullet points summarise the discussion:

⁸ The Q95 flow is the flow that is exceeded 95% of the time for a given period of record (in this case 1990 To 2012). This flow is an industry standard for expressing low river flows. It is also the flow percentile at which the WFD hydrology regime compliance assessments are made.

⁹ Modelling reports provided to the applicant: Environment Agency Cam and Bedford Ouse Groundwater Investigation Final Report: Ouzel and Ivel Catchments, Amec Foster Wheeler Environment & Infrastructure UK Limited (Referred to herein as "AMEC") June 2016
Cam and Bedford Ouse CBO Model Validation Report

British Geological Survey (BGS) report, commissioned by the EA: Geological and hydrogeological report to accompany the Lower Greensand Group (Hitchin to Slough) GSI3D model

¹⁰ Cam and Bedford Ouse (CBO) Numerical model files provided to the applicant: The MODFLOW input files (Basic Package File- .bas, Block Centred Flow Package File- .bcf, Drain Package File- .drn, General Head Boundary Package File- .ghb, Output Control Package File- .oc, Preconditioned Conjugate Gradient Package File- .pcg, Recharge Package File- .rch, Stream Package File- .str, Well Package File- .wel, Evapotranspiration Package File- .evt, Rule Package File- .rul). The MODFLOW output files (Output Summary Description File- .out, Binary Heads File- .hds, Cell Budget Output Drain Package File- .cbd, Binary Cell-by-Cell Components Flow File- .cbb, Cell Budget Output General Head Boundary Package File- .cbg, Binary Recharge Budget File- .cbr, Binary Stream Flow File- .cs1, Cell Budget Output Well Package File- .cbw, Binary Evapotranspiration Budget File- .cbe, Rule Package Output File- .rul.out). MODFLOW Control File (.nam) and MODFLOW executable (.crl) for the Historical CBO660, the Naturalised CBO661, the Recent Actual CBO662, and the Fully Licensed CBO663 scenarios

- The unmodified CBO model represents inflow to the confined LGS as coming from the outcrop in East Anglia Area (see Map 1). Other boundaries (the base and sides of the confined aquifer) are represented as having no flow across them. Zenith have proposed that significant flow does occur across some of these other boundaries, via Jurassic formations, and have modified the CBO model to represent these notional inflows.
- These modifications to the CBO model reduced the impacts on key receptors, for example, the Broughton Brook, by roughly half, but it did not remove them. This extract from the applicant's HIA (2.6.2 of section B) describes the changes: *'The simulated flow at Q95 (extreme low flow conditions) is 3,600m³/d. The maximum simulated impact under the original model is 115m³/d and the revised model is 60m³/d (3.2% and 1.6% of low flows respectively).'*
- The regulatory version of the CBO model has been described as both 'conservative' and 'overly conservative' by Zenith. The EA and Wood agree with the former, but not the latter description. The applicant has not provided evidence to support or quantify the conceptual understanding of additional groundwater from older strata entering the LGS. The EA therefore concludes that it is justifiable to keep the current no flow boundaries.
- Zenith has used data from its pumping test to adjust the model (Table 2-1 HIA Part B). The main adjustments were to change the aquifer parameters (Transmissivity and Storativity) local to the proposed source. Alterations to the modelled Transmissivity of the LGS change the timing but not the scale of the impacts. Impacts arrive more quickly or slowly, but still affect the same receptors located on the significant area of LGS outcrop in East Anglia. The other main adjustment was to add additional and hypothetical inflows (additional sources of recharge), but Zenith has not provided quantitative evidence to support this additional recharge assumption.
- When the CBO model was constructed, the impact of abstraction in the confined zone, including around Luton, was an important consideration. Efforts were made to represent the abstraction history, which is not that well recorded, as closely as possible, in order to reproduce the observed rise in groundwater levels. The EA therefore considers that CBO model is an appropriate tool to use in the assessment of abstractions around Luton.
- Model instability in some locations does not invalidate the potential impacts generated by the model. None of the cells where the model demonstrated instability are in the vicinity of the site of the proposed abstraction and none of these cells are in Layer 8, representing the LGS (Woburn Sands). Model instability is acknowledged further north, namely along the Chalk feather edge and the Chalk pinch out zone, and also along the north-eastern boundary of the CBO model, but this does not jeopardise the overall applicability of the CBO model for the Roxane site.
- The view of the EA and Wood is that the CBO tool remains the best available tool for assessing the impact of abstraction in the confined LGS on the linked aquifer/surface water system, including abstraction from the confined area around Luton. The applicant's view is that the CBO model is the best available tool for a regional groundwater assessment but that it does not represent inflows to the LGS, which they consider to be significant; and that it therefore over-estimates the level of impact on flows in the Broughton Brook.

The technical discussions between the EA, Wood, the applicant and its consultants Zenith, has been fully documented in reports. The bullet points above summarise these discussions. Following the provision of model files to the applicant, and the refinements by Zenith to

investigate the notional inflows described above, Zenith produced its two volume Hydrogeological Impact Assessment (HIA). Part A concentrated on the pumping test, while part B reviewed the impact on environmental receptors, and reviewed evidence from the unmodified and modified versions of the model (May 2020). Wood produced a technical note to accompany the EA's response to the applicant's HIA, concentrating on part B, and references to modelling in part A (September 2020). Zenith in turn responded to this technical note with a document of its own (February 2021), reviewing the technical note and restating its position regarding the weight that should be given to model evidence. Our position is that this latest document from Zenith has not provided any information which changes our position, and our response to it remains as set out in the summary points above.

7.3 Impact on water quality

There are no water quality concerns arising through this proposal.

7.4 Impact on geomorphology

No impacts on geomorphology.

7.5 Impact on ecology (including fish)

Focusing on the main surface water feature of interest - Broughton Brook:

The two routine monitoring sites on Broughton Brook used for Water Framework Directive (WFD) classification for invertebrates are based at Salford and Broughton. We also hold a small amount of data from sites in the upper reaches of Broughton Brook in the vicinity of Husborne Crawley. A review of the ecological communities recorded at these sites shows that a number of species sensitive to low flow velocities are present within Broughton Brook, including the mayfly *Baetis vernus*, the freshwater shrimp *Gammarus pulex*, the caddisfly *Plectrocnemia conspersa* and the riffle beetle *Elmis aenea*. As flow velocity declines, such species become unable to persist, reducing in abundance and sometimes being lost from the watercourse. Another impact of reduced flow velocity is the accumulation of fine sediment on the bed of the watercourse. This can block interstitial habitats between larger substrates such as gravel, reducing the overall habitat complexity at a site, and thus limiting invertebrate colonisation and resulting in an impaired invertebrate community.

Our knowledge of the fish species composition on the Broughton Brook is derived from one site sampled in 2013 near Broughton, and appears appropriate for the watercourse, being composed of both rheophilic and generalist species. From the species identified, bullhead, gudgeon and dace are typical of fairly fast flowing watercourses with sand and gravel substrates, whilst minnow are more widespread in their distribution but must still have access to clean gravel areas for spawning. These species would be impacted by reduced flow velocities and fine sediment accumulation. Bullhead and stone loach have oxygen requirements which are broadly similar to brown trout and therefore may be susceptible to low flows which often result in reduced dissolved oxygen levels in the watercourse. The remaining generalist species found in Broughton Brook are frequently found within the middle to lower reaches of a river, with roach being particularly capable of exploiting a wide variety of both riverine and still water habitats.

The Brook is currently at Good status under WFD for invertebrates (not classified for fish) but has been below Good in previous cycles, when flow pressure along with channel modification and signal crayfish impacts were all identified as reasons for ecological failure. Based on the species present, there is a risk of the Invertebrate element deteriorating below Good status under WFD should the flows be negatively impacted by increased abstraction impacts. This is an unacceptable level of risk because the Invertebrate classification has been below Good (Moderate in 2009) status in previous RBMPs at historic levels of actual abstraction. The

current Invertebrate classification (2019) is based on expert assessment¹¹ of the biological sample data from the Broughton Brook using the methodology set out. The results of this analysis are converted into confidence levels as to the Classification. The 2019 results are:

- 62% confidence of Good Status
- 32% confidence of Moderate Status
- 6% confidence of High Status

Should the Moderate confidence go above 50%, then the overall Invertebrate classification would go from Good to Moderate.

There is already a risk of the Invertebrate element deteriorating due to increases in abstraction from existing licences utilising up to their full licensed quantities. The historical level of combined actual abstraction from the groundwater body is approximately 20 MI/d. Roxane's proposed abstraction would add 2.7 MI/d to the levels of existing actual abstraction from the groundwater body, representing a 13.5% increase. The existing combined full licensed quantity from the groundwater body is approximately 40 MI/d, meaning that there is already a risk of uptake from full licensed quantities of approximately 20 MI/d. Issuing the licence to Roxane will increase full licensed abstraction by 6.75% therefore adding to the existing risk that deterioration may occur. This is in the context that Roxane has firm plans to fully utilise its licence if issued.

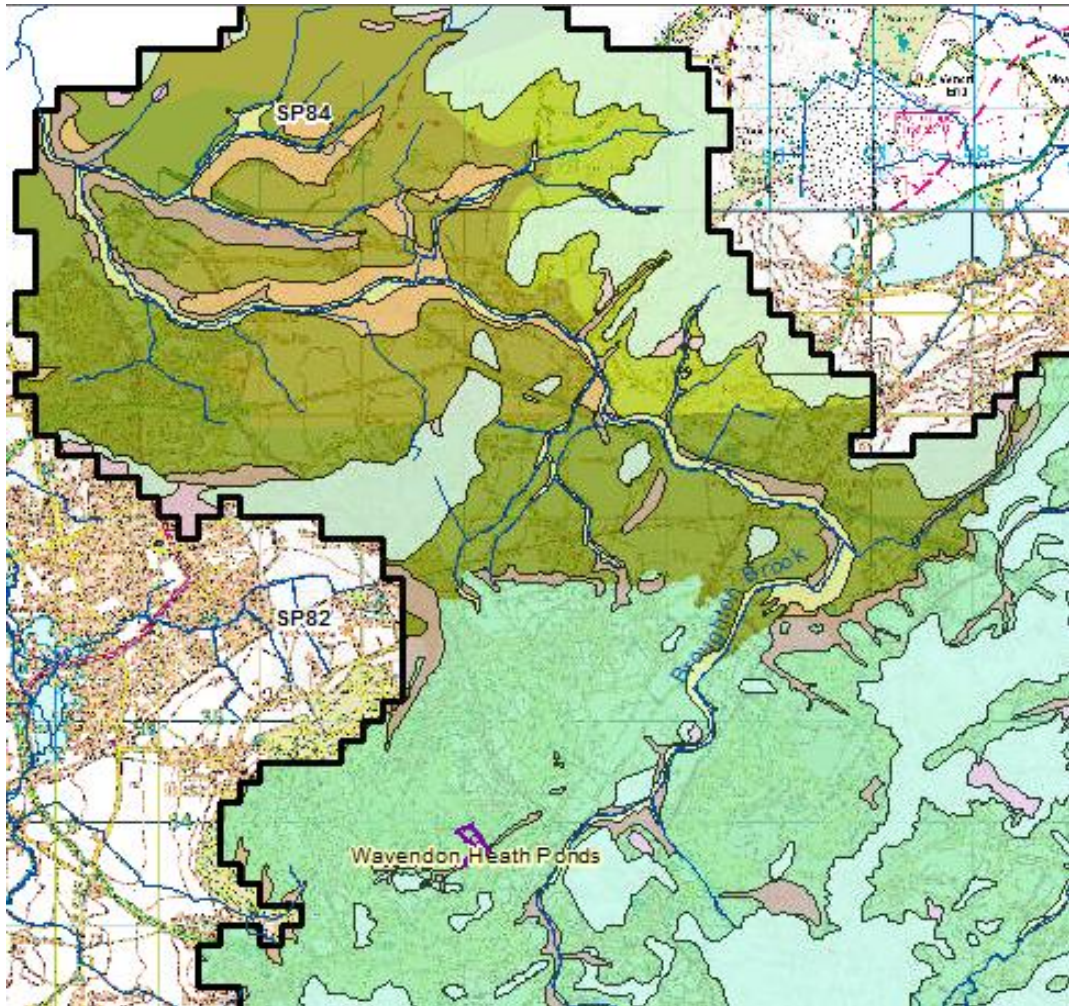
Although flows are presently not supporting Good Ecological Potential GEP (because of failure to meet the LFC), and the Invertebrates are at Good status, there is no scientifically robust tool to predict hydroecological response at higher levels of abstraction (i.e. the hydroecological response which would result from lower flows). Therefore, we can only use the LFC as a guide as to whether the ecology would suffer at higher levels of abstraction. If flows do not support the LFC, then we take a precautionary approach that the ecology would be likely to deteriorate. For the Broughton Brook, the ecology (the Invertebrate element) was below Good status under historical levels of abstraction, and consists of species that are sensitive to reduction in flow velocities, so there is concern over any worsening of flows.

7.6 Conservation of Habitats and Species Regulations 2017 and Wildlife and Countryside Act 1981

Wavendon Heath Ponds SSSI

A 4.7 ha site in the upper Broughton Brook catchment. The important wetland feature (acidic mire) is in the northern part of the site, where 3 ponds created by dams capture seepage flow.

¹¹ <http://www.wfduk.org/resources%20/recommendations-surface-water-classification-schemes>

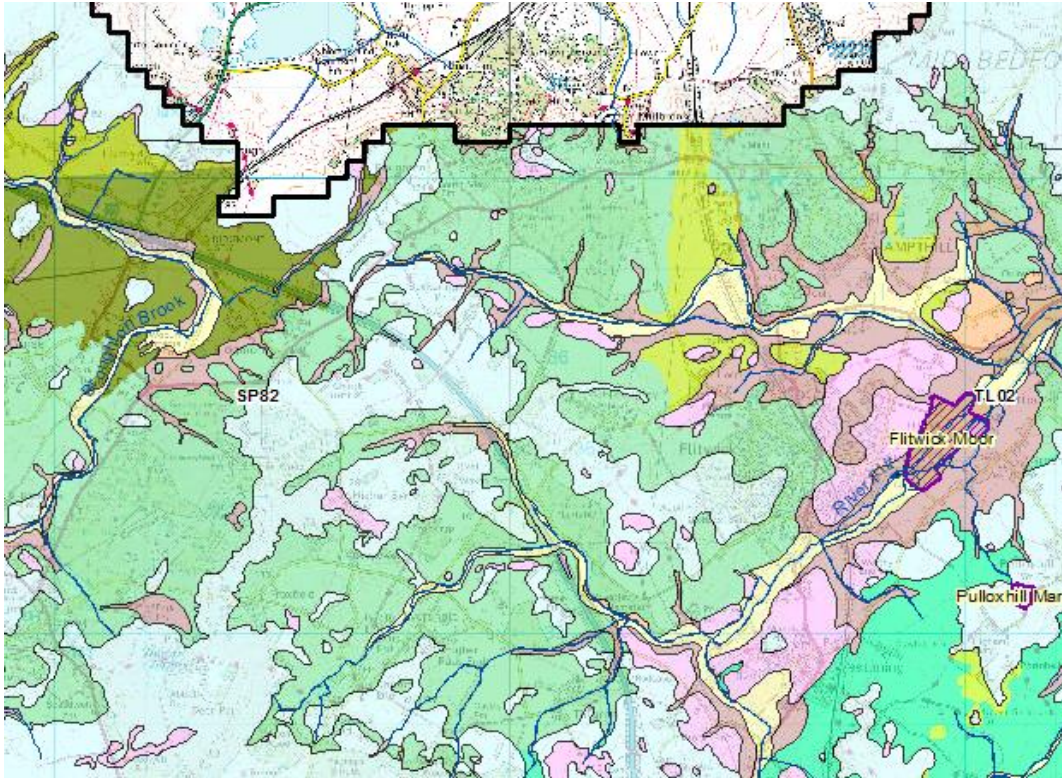


MAP 5

The site is on the LGS (Woburn Sands) outcrop. Some less permeable Till and Fuller's Earth material provides a lining to the ponds, and limits the hydraulic continuity in the southern part of the site. The seepage flow is almost certainly dependent on the LGS groundwater level, although there is no on-site groundwater monitoring to confirm this. Assessment of the site under the Restoring Sustainable Abstraction (RSA) programme concluded that the ecological interest had not been adversely affected by historical levels of abstraction, and a threshold was therefore set, based on the lowest modelled summer groundwater level (97.13 m AOD). Fully Licensed abstraction, including resumption of abstraction at the Pulloxhill source, did not increase the number of threshold breaches, nor change the hydrological functioning of the site, and so was judged to be acceptable.

Flitwick Moor SSSI

Flitwick Moor is a 58.8 ha site, alongside the River Flit, which later joins the River Ivel. The site is on the LGS (Woburn Sands) outcrop, with mixed superficial cover, generally a few metres deep, in the Flit valley. Upwelling groundwater and seepage from the LGS sustain areas of more acid fen, while alkaline fen conditions predominate on the rest of the site. This groundwater flow is important in maintaining the diversity of habitat across the site. Flitwick Moor was assessed under the EAs RSA programme, with the aim of maintaining a continued adequate supply of 'moderately base-poor' or 'intermediate base status' groundwater to the acid fen parts of the site. A primary criterion of soil moisture content above field capacity was used for non-drought summers, with the minimum modelled water table level being used for drought summers. There was no evidence that historical levels of abstraction had caused an adverse impact on the ecology of the site, and Fully Licensed abstraction would not change this.



MAP 6 - Potential impacts from confined LGS abstractions

Assessment of both sites under the RSA programme looked primarily at groundwater level. The level would not be expected to change significantly due to Roxane's proposal, but flows from groundwater springs/seepages could be affected in the same way as for Broughton Brook. Model output quantifying the impact on these features of the sites has not yet been produced. An HIA of any new abstraction should include potential impacts on the two sites.

In each case Appendix 4 was sent to Natural England for consultation 11 August 2020. No comments were received.

7.7 WFD summary impact statement

As set out in earlier sections of this report, the proposed abstraction is considered to affect water bodies that are already failing to meet their water quantity related environmental targets. It is also the case that we have to consider the collective, in-combination impacts of abstraction, which when viewed collectively can lead to a significant level of impact. The applicant has asserted that as the effect of its proposed abstraction on surface water receptors many kilometres away is small, and that the abstraction would be acceptable. However, this impact would be in addition to already unsustainable and unacceptable in-combination impacts of abstraction on the surface water receptors, e.g. Broughton Brook.

Whilst we acknowledge the economic benefits that granting a licence to Roxane would create, and through bringing a production facility closer to London and the SE of England, we have to consider these against our duties to protect the environment and ensure we are meeting Government's aims for sustainable water management.

The EA assesses the impact of abstraction on WFD groundwater bodies, as well as their dependent surface water features, through four quantitative test elements, one of which is the Groundwater Balance Test. The Groundwater Balance Test assesses impacts by the 'Available Groundwater Resource (AGR) methodology, which is used to establish whether groundwater bodies are in a surplus or deficit. The calculation is:

'Available Groundwater Resource' = Long-term Average Recharge - Environmental Flow Allocation +/- Flow into or out of the groundwater body - Groundwater Abstraction.

The Groundwater Balance Test is important as it focuses on other issues not identified through the WFD classification. Such issues include impact on lakes and level dependent marshes, groundwater levels to maintain springs and river accretion, as well as discharges to the coast to maintain the saline interface and marine ecology. The Groundwater Balance Test also allows for sensitivity testing of environmental resilience during prolonged periods of dry weather. An aquifer may show a surplus using this methodology, but still have low flow problems in rivers which depend on it. The Upper Bedford Ouse Woburn Sands groundwater body is delineated on the outcrop only, but with abstractions in the confined area (i.e. not in the delineated outcropping area) included in the abstraction impact assessments that the EA undertakes.

The current Groundwater Balance Test for the Upper Bedford Ouse Woburn Sands is at Good status and shows a surplus in AGR of approximately 1.5 MI/day. This is based on an average abstraction rate from the groundwater body of approximately 19.7 MI/day. The fully licensed abstraction rate from the groundwater body rises to approximately 41.7MI/day. If this rate of abstraction occurred the groundwater body balance test would deteriorate to Poor with a deficit of approximately -20.5 MI/day. Therefore with the potential for significantly greater abstraction through uptake of historically unused licensed capacity there is currently a high risk of WFD deterioration for this element test. If further licences, were granted, the likelihood of WFD deterioration would increase, as this would draw water from the Upper Bedford Ouse Woburn Sands outcrop.

It is important to consider this proposal in line with other proposals of a similar abstraction quantity and impact when addressing WFD deterioration. The current proposal could add an additional abstraction impact of 2.3 MI/day (annual abstraction rate applied for / 365 days), if this abstraction received recharge from the WFD groundwater body, which we believe it would, then this would risk deterioration in the groundwater balance test. To put this into context, the volume applied for is approximately 12.5% of that already being abstracted from the entire groundwater body. This proposal would therefore increase the full licensed rate of abstraction and add to actual levels of abstraction sufficient to risk deterioration in the WFD balance test. We therefore consider this proposal unacceptable due to the risk it presents of maintaining the Good status of the groundwater balance test.

When considered with Affinity Water's neighbouring abstraction proposal, which is being considered in parallel, the total additional abstraction from the groundwater body could increase by approximately 5 MI/day. We are confident that a 25% increase in current average abstraction rates would lead to deterioration in the WFD groundwater balance test, which we do not consider to be an acceptable risk.

For new licence applications, we use the Environmental Flow Indicator (EFI) to assess whether flow supports Good Ecological Status/Potential taking into account the effect of the proposal. If below the EFI, then the flow is deemed not to support Good Ecological Status/Potential. If abstraction increases but flow remains above the EFI then this is not deterioration. Whereas if abstraction increases so that flow dips below or reduces further below the EFI then this could cause deterioration in the ecology. In the case of the Broughton Brook, the EFI is replaced by the bespoke Local Flow Constraint that has been derived for the water course. Flows in the Broughton Brook failed to support this LFC for the classification used to set the 2015 Anglian RBMP – the LFC flow is 1.5 MI/d and the historical actual flow scenario is 1.32 MI/d.

The effects of the proposed abstraction would cause deterioration in the hydrological regime of the Broughton Brook by making the existing failure to achieve the environmental target flows in the surface water body worse. This creates a risk of deterioration to the Invertebrate ecology element, which was below Good status (it was of Moderate status) in the 2009 RBMP classification. This failure was recorded at actual levels of abstraction. Roxane's proposed abstraction would add 2.7 MI/d to the levels of existing actual abstraction from the groundwater body, which presently is circa 20 MI/d, representing a 13.5% increase. The

additional reduction in flow from the Roxane abstraction compared to existing levels of abstraction is modelled to be 0.066 MI/d.

Our assessment of whether the risk of deterioration in the Invertebrate element is acceptable also needs to consider the potential impacts of Roxane's proposed abstraction in the context of the existing risk of deterioration from currently licensed abstractions. There is already the potential for currently licensed abstractions to increase from their historical average use to full licensed use, (by use of licensed headroom). The present full licensed quantity from the groundwater body is circa 40 MI/d, which means that there is potential for 20 MI/d of growth above historical average use to the full licensed quantity. Roxane's proposal of an additional 2.7 MI/d of abstraction would add a 6.75% increase to the licensed headroom from the groundwater body. The Q95 flow at the LFC in the Broughton Brook under the full licensed rates of existing abstraction is 0.13 MI/d, which would represent a 1.37 MI/d deficit. The modelled impact of Roxane's proposed abstraction on the Broughton Brook (0.066 MI/d) would add to the existing full licensed impact, approximately halving this fully licensed flow. There is another pending application to abstract new water from the LGS aquifer by Affinity Water and the quantities and location of abstraction are comparable to Roxane's application. Combined, the two abstractions would represent approximately an additional 4.97 MI/d of licensed abstraction from the groundwater body, or an approximate 12.5% increase in the full licensed rate.

As set out in Section 7.5, there is presently no robust scientific tool for predicting the ecological response of invertebrates to hypothetical reductions in flow. However, as also noted in section 7.5, the Broughton Brook contains a number of species sensitive to low flow velocities and the Invertebrate element has been below Good WFD Status in the past (2009 classification). Therefore, there is a risk that any worsening of the actual flow pressure on the Broughton Brook could cause the Invertebrate element to fall below Good status. This is on top of the risk that is already present from existing licences increasing their level of abstraction within fully licensed quantities.

Aside from the risk of deterioration to the Invertebrate element, the granting of this additional abstraction could compromise the measures that are being implemented by Anglian Water and the Agency to reduce the impact of its abstraction on the hydrology of the Broughton Brook and help get the hydrology of the water body back to supporting Good Ecological Potential. A summary of the measures that Anglian Water has to deliver in AMP7 (2020 to 2025) is as follows:

To avoid the risk of deterioration the EA will cap the public water supply purpose on Anglian Water's Licence 6/33/09/*G/0003 (Birchmoor) which was identified as the most significant influence on the flows in the Broughton Brook. The licence cap will result in quantities available for public water supply being lowered to the maximum peak use of the licence over the period 2005 and 2015, rounded up to nearest 1000 cubic metres per year. The Birchmoor Licence currently authorises a quantity of 2,488,935 m³/year and the proposed cap is 2,348,000 m³/year. This entails a Sustainability Change of 140,935 m³/year, which is a 5.7% reduction in licensed quantity for public water supply.

River support

Anglian Water will fund, carry out and provide river support to meet the 1.5 MI/d target flow on the Broughton Brook. Birchmoor river support will involve a 1.5 MI/d discharge into a location adjacent to Birchmoor abstraction approximately 14km upstream of the outflow on the waterbody.

River restoration

Anglian Water will fund and carry out river restoration works in the Broughton Brook surface water body to be scoped and agreed with the EA. Examples of the kind of work to be carried out include backwater/in-channel wetland and channel dredging, reduced tree shading, narrowing structures (includes flow deflectors/groynes regrading, slope mattress and

narrowing with aquatic ledges), tree planting and buffer strips, gravel augment/riffles, new channels, re-meandering, weir removal and structures to control flow split into bypass/old channel to ensure fish passage.

We acknowledge that establishing an operation in SE England that is more local to where the bottled water will be marketed may bring down transportation costs, delivery times and lead to benefits to the environment through a reduction in carbon emissions. However, the applicant does not seem to have considered alternative sites in the region, where water is available for licensing in the quantities being sought.

Having considered the effects of Roxane’s proposed abstraction, our conclusion is the environmental risks of increasing abstraction in an already over licensed catchment - where measures are being taken to reduce the level of abstraction - are not acceptable, and outweigh the economic benefits that granting the licence would bring.

7.8 Protected rights and lawful users

There are a number of nearby abstractions that are licensed to abstract water from the chalk. The chalk is in hydraulic isolation from the LGS aquifer, so there is no mechanism for impact. These these abstractions have been discounted from further assessment.

The LGS source nearest to the proposal authorises abstraction by Affinity Water Limited for the purpose of public water supply at Runleywood.

Licence number	Licence Holder	Licence type
29/38/01/0010	Affinity water Limited	Full
6/33/09/*G/0003	Anglian Water Services Ltd	Full
AN/033/0009/001/R02	Paul Lindon	Full

Confined LGS

There are 16 known protected rights within a 25km radius of the proposed abstraction point. There may also be unknown unlicensed sources, some of which may have protected rights. This is not likely due to the depth of the LGS, but acknowledged to be a small possibility.

The nearest known source is the Affinity Water site at Runleywood, approximately 5km south west of the proposed abstraction point. Licence 29/38/01/0010 which authorises abstraction for the purpose of public water supply at rates of 182m³/hour, 2,728m³/day, 995,594m³/year from LGS. The licence permits abstraction from three boreholes, though two only are operational and just one, drilled to a depth of 240 metres, is used for abstraction. The licence was first issued in 1966.

The confined sources will have a rest water level (pressure head) above the confining layer. The impact from this proposed abstraction, combined with the pumping draw-down in other sources is unlikely to lead to any derogation.

Unconfined LGS

The LGS outcrops as the Unconfined LGSs approximately 15km to the North West of the proposed point of abstraction. Modelling shows that abstraction from the LGS will impact the Unconfined LGS, although the impact will be delayed.

Modelling also indicates that abstraction of the quantities proposed by Roxane will act to lower water levels only very slightly, perhaps imperceptibly¹². Since the licensed sources (set

¹² The pressure change caused by confined abstraction will be distributed across the margin of the confined zone. There may be little or no observable change in water levels in unconfined boreholes on the outcrop, but the head differences are still set up which allow flow back into the confined aquifer, and cause the impacts on receptors. So, you can have minimal change in unconfined groundwater level, but

out below) authorise abstraction from boreholes extending many tens of metres into the Unconfined LGSs, there are no concerns that the proposal will cause derogation or impact on ability to abstract.

Anglian Water – Aspley Guise

Anglian Water hold licence 6/33/09/*G/0003 which authorises abstraction for public water supply at rates of 396m³/hour, 9.500m³/day, 2,488,935m³/year from Unconfined LGS at. The licence permits abstraction from seven boreholes ranging between 50m and 61m in depth. The licence was first issued in 1966. The pumping station is approximately 19km North West of the proposed abstraction point.

Paul Lindon - Woburn Golf Club

Paul Lindon holds licence AN/033/0009/001/R02 which authorises abstraction for filling a reservoir for subsequent spray irrigation at rates of 130m³/day, 27,820m³/year from Unconfined LGSs at SP 93725 32716. The licence permits abstraction from a single borehole drilled to a depth of 57m.

There are no concerns regarding the impact on protected rights or existing lawful use.

7.9 Other considerations

Growth duty

The proposal represents an inward investment for the UK, the benefits of which it might be hoped would include a positive contribution in levels of prosperity. Jobs would be created through for example water bottling plant construction, installation and maintenance of production equipment, with some UK fabrication possible and volume production of value added product through quality control/assurance and packaging and transportation to point of sale.

The EA is mindful of the prospect of jobs and wealth creation represented through the proposal and balancing its duty under the Deregulation Act 2015 to have regard to the desirability of promoting economic growth with duties regarding environmental regulation and sustainability. In this case, refusal of the application is deemed necessary and proportionate in order to protect the environment and meet obligations under the Water Environment (Water Framework Directive) Regulations 2017.

Right of Access (RoA)

A reasonable need to water demonstrated through land occupancy or RoA agreement (such as Deed of Grant, or similar) to the point of abstraction is sought before any licence is issued. The site that Roxane plan to establish their water bottling plant within which the point of abstraction is located is the property of The Crown Estate. Roxane planned to have right of access on 31/08/2020.

It is understood that negotiations between Roxane and The Crown Estate have taken place with a view to Roxane purchasing the site and for ownership to be transferred from The Crown Estate to Roxane, which would demonstrate entitlement to apply through occupation. Ahead of any land purchase commitment being made and before determination concluded, Roxane sought to establish RoA through an agreement between themselves and The Crown Estate such that, in the event that Roxane's licence application were successful, the agreement could be accepted as sufficient entitlement to apply for the period needed for land ownership to pass to Roxane and RoA held through occupation.

The EA's standard RoA agreement template was sent to Zenith Global on 06/08/2020 from which a number of iterative drafts resulted. Neither party were able to agree upon terms, however.

significant changes in flow direction. This is why a short term abstraction and monitoring would not be advisable.

To resolve this impasse, the legal firm acting on behalf of the Applicant enquired whether a licence might be granted without any RoA in place. It was agreed in principle that this would be possible and a licence could be granted (if the determination concluded favourably), but that RoA would need to be demonstrated within 24 months (or longer period, if agreed) for any licence to become effective. Lawyers acting for the applicant and the EA developed the following condition to include in any licence:

'The Licence Holder shall provide the Agency with documentation confirming that it has a right of access to [cross refer to condition which specifies the abstraction point] within 24 months of the grant of this licence, or such longer period as the Agency may agree in writing]. Provided that this requirement is complied with, this licence shall take effect so as to authorise abstraction when the Agency confirms in writing that it is satisfied that such a right of access has been obtained, which confirmation will not be unreasonably delayed or withheld.'

The applicant's solicitor asked for the words 'and for the avoidance of doubt the acquisition by the Licence Holder of a freehold interest in the Property shall be evidence for the purposes of this Licence that the Licence Holder has a right of access' to appear at the end of the first sentence above, but the Agency's solicitor responding by saying that the addition of these words was not necessary, and the Agency would prefer to take an unfettered view at the time of production of any documents as to whether the condition has been complied with.

Consideration	Comments
Flooding	No anticipated impact
Archaeology	No anticipated impact
Recreation/amenity	No anticipated impact
Subsidence and desiccation	No anticipated impact

7.10 Other permits that might be required or related to the proposal

Permits	Yes/No/TBD	Comments
Discharge permit	TBD (to be determined)	<p>Schedule 21 Water discharge activities</p> <p>3.—(1) A “water discharge activity” means any of the following—</p> <p>(a) the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any—</p> <p>(i) poisonous, noxious or polluting matter,</p> <p>(ii) waste matter, or</p> <p>(iii) trade effluent or sewage effluent</p> <p>The Applicant plans to dispose of waste water resulting from the cleaning process to the on-site surface drains. Thames Water sewer network extends to the Butterfield Business Park, so the expectation would be that if the surface drains were connected with the Thames sewer network. A water Quality Permit is not likely to be required. However, it would be necessary to confirm that this was the case.</p> <p>It is likely that the effluent would also contain cleaning agents resulting from backwashing and external and internal equipment/plant cleaning operations.</p>

		Before discharging any effluent, the Applicant would need to establish if the proposed effluent disposal was acceptable to Thames Water and whether a Thames Water Trade effluent consent were needed.
Flood defence permit	no	
Other	no	

8. Assessment of likely Costs & Benefits of proposed approach

Water Resources/ The environment	The licence application increases the risk of WFD deterioration, does not accord with local Water Resources policy and is deemed not sustainable and will be refused for these reasons.
The applicant	<p>The applicant would expect the initial costs of sinking and testing the borehole to be followed by land purchase and the construction and equipping of the water bottling facility, and would seek planning permission to do so. When in production the Applicant would expect to benefit from a reliable supply of water for processing and bottling for shipment, sale and profit.</p> <p>The Applicant has not purchased the site, so refusing the application means that the Applicant will have incurred the cost of drilling and testing for no financial benefit.</p> <p>Also see section 7.9 regarding Growth duty.</p>
The Environment Agency	In determining the licence in accordance with the local and national policy, we are fulfilling our duties as a regulator.
The economic and social wellbeing of the rural community	Jobs and wealth creation would likely follow a water bottling plant being established at this site. There are no adverse effects on the social and economic wellbeing of local communities in the rural area that are perceived as a result of this proposal.

Alternative approaches considered

<p>(1) Refuse.</p> <p>(2) Grant as applied for by applicant.</p> <p>(3) Grant with different terms than applied for by applicant.</p>

Reason for choosing preferred approach over alternative approaches

<p>The reasons for refusal are:</p> <ul style="list-style-type: none"> • The proposal will negatively impact the Unconfined LGS and risk deterioration under WFD. • The proposal will negatively impact baseflow from the LGS to surface water features across the outcrop, and these impacts are significant for the Broughton Brook, where measures are being taken to resolve an existing failure of the environmental flow target. • The proposal may compromise measures being put in place to mitigate the impact of existing abstraction on the Broughton Brook. • The proposal runs counter to the ALS, where no water is available for licensing.
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- Any abstraction from the confined LGS in the Luton area will affect receptors on the outcrop, so a licence granted on different terms would not be acceptable for the reasons given above.

Further details are given in the Executive Summary above.

A position on water rights trading and aggregation has been developed to allow the potential for some commercial development opportunities. The Applicant has been made aware of the licence trading position.

9. Time limit

There is not time limit to apply, as, in this case, the application has been refused and no licence issued.

10. Measurement of water abstracted

Regulation of abstraction at this site has been authorised through a Groundwater Investigation Consent. The GIC expired on 30/04/2020 and, as the determination of the proposal is to refuse the licence application, no metering of compliance checks are required.

11. Special agreement

There are no special agreements.

12. Enforcement – Criticality Class

As the outcome of the determination is refusal, no licence will be issued, so no Enforcement Inspections to establish licence compliance will take place. For this reason, no assessment to establish Criticality Class has been carried out.

13. Charging factors

In this case, the application has been refused and no licence issued, so there are no charges to be levied.

14. Other statutory duties

14.1 Section 4 Environment Act 1995 (pursuit of sustainable development)

We have considered whether additional requirements should be imposed in relation to our principal aim of contributing to attaining the objective of sustainable development under section 4 of the Environment Act 1995, the existing requirements are sufficient in this regard and no other appropriate requirements have been identified

We have had regard to Government guidance issued under section 4(2) of the Act, namely '*The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002)*'. Regarding the exercise of our water resources functions, we are required:

'To plan to secure the proper use of water resources by using strategic planning and effective resource management which takes into account environmental, social and economic considerations, and in particular.'

'To ensure that the abstraction of water is sustainable, and provides the right amount of water for people, agriculture, commerce and industry and an improved water-related environment; and to develop and maintain a framework of integrated water resources planning for the Agency and water users.'

14.2 Section 6(1) Environment Act 1995 (conservation duties with regard to water)

We have considered our duty to promote the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and the land associated with such waters, and the conservation of flora and fauna which are dependent on an aquatic environment and are satisfied that in refusing this application we have met this duty.

14.3 Section 6(2) Environment Act 1995

In reaching our decision we have taken all such action as we consider necessary or expedient for the purposes of conserving water resources, and securing their proper use.

14.4 Section 7 Environment Act 1995 (pursuit of conservation interests)

Section 7(1)(a) of the Environment Act 1995 places a duty on us, when considering any proposal relating to our functions, to exercise our functions so as to further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest;

Section 7(1)(c) of the Environment Act 1995 places a duty on us to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural, engineering or historic interest and to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora fauna features buildings sites or objects and any effect which the proposals would have on the economic and social well-being of local communities in rural areas and any effect which the proposals would have on the beauty or amenity of any rural area.

We have had regard to these factors as indicated (amongst others) in above and consider that we have met these duties. We have taken these factors into account as indicated in section 6.0 above.

14.5 Section 8 Environment Act 1995 and Sections 28G and 28I Wildlife and Countryside Act 1981

Under section 28G of the Wildlife and Countryside Act 1981 we have a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest (SSSI). We have taken these factors into account as indicated in section 7.6 above.

14.6 Section 39 Environment Act 1995

We have a duty under section 39 of the Environment Act 1995 to take into account the likely costs and benefits of granting the applications ('costs' being defined as including costs to the environment as well as any person). This duty, however, does not affect our obligation to discharge any duties imposed upon us in other legislative provisions. We have taken these factors into account as indicated in section 8.0 above.

14.7 Regulation 63 Conservation of Habitats and Species Regulations 2017

Under regulation 63 of these Regulations, we must, before granting any abstraction or impoundment licence, assess whether it is likely to have a significant effect on a European site (Special Areas of Conservation (SAC) or Special Protection Area (SPA), either alone or in combination with other projects; and if so undertake an appropriate assessment of the implications of the abstraction or impoundment upon that site in light of its conservation objectives. In the light of the conclusions of the assessment (and subject to regulation 64) we will only grant a licence after having ascertained that it will not adversely affect the integrity of the European site.

There are no European designated sites within the area impacted by the proposal which have features which could be affected by this application. We have taken these factors into account as indicated in section 7.6 above.

14.8 Section 21 Water Resources Act 1991 (Minimum Acceptable Flows)

No Minimum Acceptable Flow has been determined under Section 21(1) Water Resources Act 1991 for any waters related to this application. As a result, we have considered these aspects by reference to our obligations under Section 40(2) Water Resources Act 1991.

The flow in the Broughton Brook has been assessed as not meeting the flow that we would expect to be required to support Good Ecological Potential. A target flow of 1.5 MI/d (0.017 m³/s) in the Broughton Brook has been derived and is based on the minimum velocity and depth thought to be required to support bullhead fish in this habitat.

14.9 Section 39(2) Water Resources Act 1991 [groundwater] Lawful Uses

We have had regard to the existing lawful uses of water in the Lower Greensand and within the Unconfined LGSs outcrop] and are satisfied that the proposed abstraction does not impact adversely on those lawful uses. These aspects are covered in Section 7 of the determination report.

14.10 Section 40 Natural Environment and Rural Communities Act 2006

Section 40 of the Natural Environment and Rural Communities Act 2006 places a duty on us to have regard, so far as is consistent with the proper exercise of its functions, to conserving biodiversity. *‘Conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or enhancing a population or habitat.’*

We have taken these factors into account as indicated in section 7.0 above.

14.11 Regulations 3 and 33 Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

As required by regulations 3 and 33 of these Regulations, in reaching our decision we have exercised our water resources functions so as to secure compliance with the Water Framework Directive and we have had regard to the Anglian river basin district river basin management plan which has been approved under regulation 31 of these Regulations.

Our assessment is that the proposed new abstraction alone and in combination with other groundwater abstractions will contribute to:

- The risk of deterioration in the hydrological regime by making the existing failure to achieve the environmental target flows on the Broughton Brook surface water body worse. This creates an unacceptable level of risk of deterioration in the Invertebrate element, which has species present that are sensitive to reduction in flow velocities, where the element has been below Good status in previous RBMP cycles at historic levels of actual abstraction. There is already a risk of the Invertebrate element

deteriorating due to increases in abstraction from existing licences, which would be increased by the issuing of new licensed abstraction to Roxane (and Affinity Water).

- Increasing the risk of the Upper Bedford Ouse Woburn Sands groundwater body water balance element deteriorating;
- Potentially compromising the measures being implemented by Anglian Water to reduce the impact of its abstraction on the hydrology of the Broughton Brook and getting the hydrology of the water body to supporting Good Ecological Potential.
- Undermining our approach to renewing time limited licences in East Anglia Area, where licences are capped to historically used quantities.

In summary, having considered the effects of the Roxane's proposed abstraction our conclusion is that the environmental risks of increasing abstraction in an already over licensed catchment - where measures are being taken to reduce the level of abstraction - are not acceptable and outweigh the economic benefits that granting the licence would bring. We need to consider the in-combination impacts of all existing abstraction, and proposed abstraction, both large and small, in order to protect and restore the waterbodies.

14.12 Section 38(3)(b) Water Resources Act 1991

We consider our duty to have regard to the applicant's requirements, in so far as they are reasonable, under section 38(3)(b) of the Water Resources Act 1991. We have taken these factors into account as indicated in section 4.0 above.

14.13 Environmental Impact Assessment Directive 2011/92/EU

This Directive is implemented by the Town and Country Planning (Environmental Impact Assessment) Regulations 2011. These Regulations apply to applications for planning consent made to a local planning authority; they do not apply to applications for a licence made to us under the Water Resources Act 1991.

This application does not fall within the Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003 or is not a "relevant project" for the purposes of those Regulations. We have taken these factors into account as indicated in section 3.0 above.

14.14 Section 108 Deregulation Act 2015 – Growth duty

We considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this licence.

Paragraph 1.3 of the statutory guidance issued by the Department of Business, Energy and Industrial Strategy in March 2017 says:

"The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation."

We have addressed the legislative requirements and environmental standards to be set for this abstraction or impoundment in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.

We consider the requirements and standards we have set in this licence are reasonable and necessary to avoid a risk of unacceptable effects on the environment and the rights of other existing lawful water users. This also promotes growth amongst legitimate operators because

the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

14.15 Countryside and Rights of Way Act 2000

Section 85 of this Act imposes a duty on the Environment Agency to have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty (AONB). There is no AONB which could be affected by the grant of the application.

14.16 National Parks and Access to the Countryside Act 1949

Section 11A and section 5(1) imposes a duty on the Environment Agency when exercising its functions in relation to land in a National Park, to have regard to the purposes of conserving and enhancing the natural beauty, wildlife and cultural heritage of the areas, and of promoting opportunities for the understanding and enjoyment of National Parks by the public.

There is no National Park which could be affected by the application.

15. Conclusion and recommendation

Conclusion

- The EA has developed and implemented measures aimed at improving the WFD status of Broughton Brook surface water body and the Upper Bedford Ouse Woburn Sands groundwater waterbody.
- Licensing the proposed abstraction would undermine the measures (capping renewed time limited licences and seeking to revoke unused permanent licences), being employed by the EA in East Anglia Area to manage the effects of historic over licensing of abstraction.
- These measures are part of the work being carried out to meet Government's ambitions to move to sustainable abstraction regimes as set out in its Water Abstraction Plan.
- When viewed in the context of the groundwater balance test, the Upper Bedford Ouse Woburn Sands groundwater body is at Good Status at recent actual levels of abstraction, but it fails at fully licensed. The margin between Good status and failing is very small at recent actual levels of abstraction, so any increase in recent actual abstraction risks deterioration. The proposal represents an increase in over 10% of the historic actual abstraction quantity used to derive the WFD hydrology compliance.
- The proposed abstraction is predicted to affect the flows in the Broughton Brook surface water body that are already failing to achieve their environmental target flows. This creates an unacceptable level of risk that the Invertebrate ecology element could deteriorate below Good status. There is already a risk of the Invertebrate element deteriorating due to increases in abstraction from existing licences.
- The proposed abstraction also has the potential to compromise the measures Anglian Water is putting in place to reduce the adverse impact of its abstraction on the Broughton Brook, so as to achieve Good Ecological Potential for this waterbody by 2027.
- The environmental risks outweigh the economic benefits of this application.
- Issuing a licence for this abstraction would contravene the Upper Lee ALS licensing strategy, which states that groundwater abstractions from this part of the confined LGS will be treated on case by case basis. In this case, the evidence produced has not demonstrated that the abstraction will be sustainable. It would also run counter to the Upper Bedford Ouse ALS, with which the proposed abstraction is in hydraulic continuity, where there is no new groundwater available for abstraction.

For these reasons, the application is refused.

15/06/21