

RESPONSE TO DR RIVETT REPORT

**“Response to the Hertfordshire CC consultation on
the Groundwater Management Plan”**

Prepared for: Brett Aggregates Ltd
Client Ref: Hatfield Road Quarry

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CONTENTS

EXECUTIVE SUMMARY	1
Environment Agency Advice	1
Dr Rivett's Technical Report	1
1.0 APPLICANT INTRODUCTION	3
1.1 Environment Agency Advice	3
1.2 Background on Bromate Plume Remediation	4
2.0 CONSULTATION COMMENTS AND RESPONSE	5
2.1 Comment 1	5
2.2 Comment 2	5
2.3 Comment 3	6
2.4 Comment 4	7
2.5 Comment 5	7
2.6 Comment 6	8
2.7 Comment 7	8

ATTACHMENTS

DRAWINGS

Drawing 1 Bromate Plume Plan (ES Vol 2A, Section 6/4, LQRA DWG 4).....	10
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Abbreviations used throughout this report

Agency	Environment Agency
Applicant	Brett Aggregates Ltd
AW	Affinity Water plc
EARA	Ellenbrook Area Residents Association
BR	Bishops Rise
GWMP	Groundwater Management Plan
HCC	Hertfordshire County Council
HTC	Hatfield Town Council
LMA	Lower Mineral Aquifer
LMH	Lower Mineral Horizon
mAOD	meters above ordnance datum
ML	mega litres, 1,000,000 L
PWS	Public Water Supply
TD (3), S (2)	Reference to Technical Detail and Summary sections in Dr Rivett's report

Executive Summary

The purpose of the Groundwater Management Plan (GWMP) is to satisfy two proposed planning conditions; Condition 26 - Groundwater Management Plan, and Condition 30 - A Water Management Plan, associated with the development. The GWMP must demonstrate that a high level of scrutiny, control and stakeholder liaison is in place during the operational life of the scheme.

The Environment Agency (the Agency) and Affinity Water (AW) reviewed previous draft versions so the final GWMP issued in January 2020 to Hertfordshire County Council (HCC) incorporates changes reflecting their comments.

In its response to the Applicant publishing the GWMP in January 2020, and as part of the public consultation process, Hatfield Town Council (HTC) commissioned Dr Michael Rivett to review its content and to respond on their behalf.

Environment Agency Advice

In March 2019, the Agency responded to HCC's proposed Mineral Plan with a letter containing advice concerning three mineral development locations that sat above or near the bromate plume. The advice highlighted three points that would require further work should the council take the sites forward, these being:

1. No mineral is extracted from within the existing plume of bromate and bromide groundwater pollution
2. Any activities close to the plume must not change the existing hydrogeological flow regime
3. Any activities close to the plume must not interfere with the remediation of the bromate and bromide pollution

The three points formed the basis for amendment of the GWMP and following additional discussion with the Applicant, the Agency in its letter dated 10th October 2019 to HCC said,

"The submitted information demonstrates that it will be possible to fulfil these points (referring to the Agency's points) and manage the risks posed to controlled waters by this development".

It can therefore be concluded that the intention of the Agency's points above has been met by the Applicant.

Dr Rivett's Technical Report

Although the Agency has approved the mineral application thereby indicating the intention of their *points* has been satisfied by the GWMP, Dr Rivett has incorrectly elevated the three points to "*Conditions*" and has used the points to challenge the Agency's conclusion that the Application site fulfils their requirements.

A more detailed review of Dr Rivett's report forms Section 2 of this report. We have para-phrased Dr Rivett's comments as set out below with our response;

- 1. The mineral extraction site sits within the overall capture zone of Bishops Rise Public Water Supply (BR PWS) so any mineral extraction is in breach of points 2 and 3.**

This is not the case. The bromate plume does not occur beneath the mineral excavation area and both the Agency and AW support the application so the intention of the Agency points has been met by the Applicant.

- 2. Removal of mineral and replacement by clay fill will cause considerable changes to the Lower Mineral Horizon (LMH) flow regime, including divergence in flow**

The placement of clay fill in the excavated LMH will locally alter shallow groundwater flow in the part of the LMH excavated only. Shallow groundwater flow (not the plume) approaching from the north west will be directed east in the dominant natural groundwater flow direction, and shallow flow from the west will be directed south.

However, after passing the site, flow will continue its original course with the BR scavenging operation unaffected by the scheme.

3. Clay fill will ‘push’ the bromate plume away from the Site, potentially beyond capture by BR and to other water supply wells (assumed, Roestock)

This will not happen for the same easterly groundwater flow arguments explained in the previous section, but also because the bromate plume is not present along the site’s NW boundary. Affinity Water supports this conclusion stating:

“... we consider that the risk of the bromate plume migrating to other public water supply source because of Brett’s proposed operations is being effectively managed through the very strict operating rules as set out both in the GWMP enforced by HCC and in the undertaking provided to us by Brett Aggregates”.

4. A critical flow line connecting the main plume near the source to BR must not be interfered and it is probable that BR has pulled an older on-Site plume laterally off-Site

Dr Rivett claims it is probable that the plume was previously on-Site and that the BR scavenger well possibly helped to pull the plume off-Site. There is no evidence in eight years of study on this site to support this was ever the case, so is uncorroborated and speculative.

5. Dr Rivett states that BR will be shielded to some extent from direct plume access in the LMH and that flow could take a northern route, or less likely a split to the southern route (west of the Application site).

The clay fill will not compromise BR’s ability to reach north beyond the extent of mineral excavation. Reasons include a lack of conceptualisation by Dr Rivett of the lateral extent of the LMH to the north of the site, and because flow paths to BR will continue to ‘wrap around’ all sides and beneath the clay fill.

Finally, the chalk is the key scavenging target for BR and Dr Rivett and we agree it will be unaffected by the clay fill.

6. Conceptually, pumping at BR exerts control on bromate occurrence on the Application site with viability of the mineral development placed upon AW, not the Applicant. Optimal plume capture at pumping rates of 4 – 5 ML/d will lead to bromate plume migration into the LMH and concentrations can be expected to increase

Examination of pumping records and groundwater testing results for bromate across two periods of pumping (5 yrs. and 1.5 yrs.) at an optimal abstraction rates does not indicate that the plume has changed its location on the eastern side of the site. The outcome described by Dr Rivett is not supported by the available evidence.

7. Insufficient monitoring data – suggestions are made for additional monitoring locations

The current groundwater monitoring network enables an understanding of the hydrogeological regime and confirms the location of the bromate plume east of the site and its absence on the mineral extraction area. This statement is supported by AW in its response to questions by EARA in 2019:

“Considering the amount of data collected by all interested parties and the monitoring frequency, we believe that adequate data is available for a robust risk assessment regarding the proposed quarrying activity” (AW, 18/07/2019)

Upon Planning Permission approval and in accordance with the GWMP, additional perimeter monitoring wells will be installed and monitored plus phase by phase monitoring wells to be informed by regular stakeholder meetings.

Conclusion

In conclusion, we have seriously considered all the points raised by Dr Rivett, but his report does not change the conclusions and mitigation strategies in the GWMP previously submitted to HCC, and which have been ratified by the Agency and AW in their own consultation responses.

1.0 Applicant Introduction

The purpose of the Groundwater Management Plan (GWMP) is to satisfy two proposed planning conditions; Condition 26 - Groundwater Management Plan, and Condition 30 - A Water Management Plan, associated with the development. The GWMP must demonstrate that a high level of scrutiny and control is in place during the operational life of the scheme. The GWMP lays out the methods of monitoring, reporting and operational processes to be adopted including regular liaison meetings with Hertfordshire County Council (HCC), Affinity Water plc (AW) and the Environment Agency (the Agency).

The Agency and AW reviewed previous draft versions so the final GWMP issued in January 2020 to HCC incorporates changes reflecting their comments.

In its response to the Applicant publishing the GWMP in January 2020, and as part of the public consultation process, Hatfield Town Council (HTC) commissioned Dr Michael Rivett to review its content and to respond on their behalf. The Applicant has now received a copy of Dr Rivett's review (included in Appendix A).

1.1 Environment Agency Advice

In March 2019, the Agency responded to Hertfordshire County Council's proposed Mineral Plan with a letter containing advice concerning the three mineral development locations that sat above or near the bromate plume. The advice highlighted three points that would require further work should the council take the sites forward, these being:

1. No mineral is extracted from within the existing plume of bromate and bromide groundwater pollution
2. Any activities close to the plume must not change the existing hydrogeological flow regime
3. Any activities close to the plume must not interfere with the remediation of the bromate and bromide pollution

In the same correspondence, the Agency added that:

"The bromate plume will require an additional level of scrutiny at the application stage, and subsequently additional work for the applicants to ensure that the activities do not cause the situation to worsen. We believe that these areas can currently be worked if sufficient precautions are taken"

The three points raised by the Agency in conjunction with their comment above formed the basis of the work required for the final GWMP, which is to satisfy two proposed planning conditions associated with the development and, in doing so, demonstrate that a high level of scrutiny and control is in place during the operational life of the scheme.

Following additional work and discussion with the Applicant, the Agency In its letter dated 10th October 2019 to HCC says,

"The submitted information demonstrates that it will be possible to fulfil these points (referring to the Agency's points) and manage the risks posed to controlled waters by this development".

In the same letter the Agency clarified that the proposed development will be acceptable if a planning condition requiring the submission of a GWMP formed part of a planning permission. The Agency also usefully set out further advice on what it would expect the GWMP to contain. The GWMP that has been prepared by the applicant addresses the requirements of the proposed condition and the advice of the Agency.

In its response to questions raised by EARA dated 18 July 2019, AW says,

"Following the further work undertaken by SLR (consultants acting on behalf of Brett Aggregates), the revised groundwater management plan submitted by Brett Aggregates which is enforceable by HCC, and the undertaking

provided by Brett Aggregates to us, we believe that the appropriate strict controls are in place to ensure no risk is present, so we have now removed our objection”

It must therefore be concluded that the intention of the Agency’s points has been met by the Applicant.

1.2 Background on Bromate Plume Remediation

This section provides a background to the bromate plume and its remediation by AW, which provides some context for the understanding of the technical arguments being discussed in Section 2.

Chalk bedrock underlies the site and surrounding area and contains a major, regional aquifer. Locally, the chalk is overlain by mineral deposits and in places the water level extends into the mineral deposits. Where this occurs, the chalk and the saturated mineral forms a single continuous water body. The effective thickness of this continuous water body (chalk and mineral) is c. 60m to 70m. The c.5m – 6m of saturated mineral is therefore a fraction of the total aquifer thickness.

Regionally, the bromate plume is principally found within the chalk aquifer and sometimes in the overlying mineral where 1) the mineral is physically present, and 2) if the groundwater level in the chalk aquifer rests in the overlying sand and gravel. However, when present, the bulk of the plume is in the chalk. The plumes lateral and vertical extent is a function of groundwater flow.

The Bromate Plume originates in Sandridge in the chalk and flows southeast and then east with groundwater flow and is primarily located northeast and east of the applicant’s site. The plumes core is located c.800m east of the eastern site boundary. The plume does not lie within or below the mineral extraction boundary.

The key remedial intervention being applied to the bromate plume is the operation of a “plume scavenging system”, operated by AW at its BR PWS borehole site. The objective of pumping groundwater from the chalk aquifer is to capture the bromate plume and reduce the plumes impact on other hydraulically down gradient PWS locations (principally Essendon PWS, but also others), as well as removing contaminant mass from the chalk. Bromate impacted groundwater is then treated and discharged in the foul sewer.

Operation of the plume scavenging project must achieve a balance between maximising capture of the plume core and contaminant mass reduction, while avoiding unnecessary expansion of the capture zone into the adjacent Roestock PWS catchment. This leads to improved remedial efficiency and preserves seasonal sewer capacity. It also influences the maximum abstraction rate for any given groundwater level, which is unlikely to significantly change. These operational issues have been successfully managed by AW for over 10 years and a stable balance has been achieved.

2.0 Consultation Comments and Response

Although the title to Dr Rivett's report is headed as 'Expert Opinion', it is then caveated at the beginning with the following statement:

"GroundH2O Plus Ltd will not be responsible for any loss, however arising, from the use of, or reliance on, the information contained in this report, nor do they assume responsibility or liability for errors or omissions in this report."

In his report, Dr Rivett has elevated the three points to "Conditions" and makes very little comment on the GWMP, instead, it's focus is largely conceptual in nature and he uses his interpretation of the Agency's points to assess and challenge the Agency's conclusion that the Application site fulfils their requirements, and that AW is wrong in its assessment of risk.

Our specific response to Dr Rivett's consultation comments are presented below. We have para-phrased his comments in order that the reader can understand the comment being made and the response.

2.1 Comment 1

Gravel extraction from the LMH will lead to breaching points (2) and (3)

Ref: TD (3), S (2)

Response:

The site is situated within an area hydraulically influenced by the BR boreholes so it is impossible to say there will be no effect on points 2 and 3 in absolute terms, however, the effect will be local to the application site only and, fundamentally, insignificant to the wider regional flow regime and the plume scavenging operation. Statements made by the Agency as quoted in Section A of this report confirm that the intention of the advice can be met and risks managed; and by AW who in response to questions by EARA (18/07/2019), stated:

"...the revised GWMP submitted by Brett Aggregates which is enforceable by HCC and the undertaking by Brett Aggregates to us, we believe that the appropriate strict controls are in place to ensure no risk is present..."

It must therefore be concluded that the intention of Agency points 2 and 3 are not breached by the gravel extraction process in this location.

2.2 Comment 2

Removal of mineral and replacement by clay fill will cause considerable changes to the LMH flow regime, including divergence in flow and change in plume capture by BR.

Ref: TD (4 & 5), S (3)

Response:

This will not be the case. Groundwater in the LMH is hydraulically connected with the underlying chalk aquifer. The workings will only remove mineral and replace it with clay within the top few metres of the aquifer. Within the extraction area minor changes in groundwater levels caused by the fill material in the upper 5m of the 70m aquifer will quickly dissipate.

Groundwater flow on the application site in the LMH (not the underlying chalk from where AW is abstracting) will be locally influenced by clay fill. However, there are influencing factors, not referenced by Dr Rivett, that will result in the dominant flow direction approaching the site from the north west being unaffected and continuing towards the east.

- The natural and dominant flow direction in the chalk north of the site is approximately west to east and has resulted in the plume core being located 800m north east of the site. A previously submitted regional plume drawing¹ prepared on behalf of the Applicant has not been referenced by Dr Rivett but illustrates a distinct dogleg in the plume north west of CEMEX resulting in the core of the chalk plume being where described. Although pumping groundwater from BR is designed to overcome this flow direction, the plume will always be dominated by this eastward natural flow line.
- The direction of groundwater flow is defined by the piezometric contours with the flow direction being perpendicular to the contours. Upon restoration, flow approaching the north west boundary of the extraction area is angled such that flow in the upper c.5m of LMH (not the chalk) will be directed east and then southeast towards BR – i.e., it will continue to be captured by BR and therefore unimpeded by the development;
- Upon restoration, clean (unimpacted by bromate) groundwater in the upper 5m of the LMA approaching the site from the west will also honour the piezometric contours, splitting flow to the east across the northern fill boundary and then south parallel to the clay fill. Upon reaching the south west corner of the site the flow will continue to honour the piezometric contours towards BR as implied by Dr Rivett's Fig 1a.
- There are two parts of Dr Rivett's conceptual model that he has not explained on Fig 1b, 1) The model suggests the LMH is both present and saturated 2km north of the site, and 2) the flow lines take no account of the regional piezometric surface that is directing the plume core 800m north east of the site. Without real data, or at least conceptualisation of the piezometric surface, there is no evidence for Dr Rivett's southwest flow path directed towards the adjacent catchment.

In summary, the placement of clay fill in the excavated LMH will locally direct flow from the north west towards the east, and flow from the west will be directed to the south and then towards the south east. Fundamentally, the development will not therefore affect plume capture by BR.

2.3 Comment 3

Clay fill will 'push' the bromate plume away from the Site, potentially beyond capture by BR and to other water supply wells (assumed, Roestock)

Ref: TD (6), S (4)

Response:

Dr Rivett states that the clay fill will push parts of the plume away from the site potentially beyond the influence of BR. This will not happen for the flow path arguments explained in the previous section, but also because the bromate plume is not present along the site's north west boundary. This conclusion is supported by AW's response to EARA Questions 12 & 13 on 18 July 2019 which makes it clear they do not believe the lateral spread of the plume into the adjacent catchment is a risk:

"... we consider that the risk of the bromate plume migrating to other public water supply source because of Brett's proposed operations is being effectively managed through the very strict operating rules as set out both in the GWMP enforced by HCC and in the undertaking provided to us by Brett Aggregates".

¹ ES Vol 2A, Section 6, Appendix 6/4, Land Quality Risk Assessment, Drawing 4

2.4 Comment 4

A critical flow line connecting the main plume near the source to BR must not be interfered and it is probable that BR has pulled an older on-Site plume laterally off-Site

Ref: TD (6)

Response:

Dr Rivett claims it is probable that the plume was previously on-Site and refers to a straight flow line clipping the eastern side of the Application site linking the plume source at Sandridge to the BR pumping well, and that the Bishops Rise scavenger well possibly helped to pull the plume off-Site. This is not the case and there is no evidence in 8 years of study on this site to support or even suggest that this was ever the case. It is uncorroborated and a speculative statement.

2.5 Comment 5

Dr Rivett states that BR will be shielded to some extent from direct plume access in the LMH and that flow could take a northern route, or less likely a split to the southern route (west of the Application site).

Ref: TD (6), S (4)

Response:

Dr Rivett is suggesting that clay fill will shield capture of the plume in the LMH overlying the chalk northwest of the site.

For shielding to occur the chalk plume and the overlying mineral need to be present and the piezometric surface must be within the overlying mineral. Dr Rivett has recognised this but has not explained or illustrated where this might occur. The LMH is, in fact, discontinuous to the north of the site for a combination of reasons – the chalk surface rises, minerals are absent through non-deposition or previous mineral extraction operations, and in places the mineral may simply be unsaturated. A previously submitted drawing² prepared on behalf of the Applicant has not been referenced by Dr Rivett but illustrates the absence of mineral deposits north west of the Application site.

- The shallow clay fill does have different hydraulic properties to the mineral surrounding it on all sides and underneath. However, it only represents a small percentage of the effective aquifer thickness in an area where the plume is also absent in the LMH and the chalk.
- Groundwater Flow will pass around and beneath the clay fill. The flow from the northwest will still be directed eastward and continue its flow path towards BR.
- Most importantly, the chalk is the scavenging target for BR pumping and will be unaffected by the clay fill.

We do not accept the conceptual position relating to the significance of plume shielding based on the points made above and on the basis that the objective of BR scavenging pumping is not compromised by the placement of clay fill.

² ES Vol 2A, Section 6, Appendix 6/4, Land Quality Risk Assessment, Drawing 2

2.6 Comment 6

Conceptually, pumping at Bishops Rise exerts control on bromate occurrence on the Application site and viability of the mineral development is placed upon AW, not the Applicant. Optimal plume capture at pumping rates of 4 – 5 ML/d will lead to bromate plume migration into the LMH and concentrations can be expected to increase.

Ref: TD (7), S (5 & 6)

Response

Between January 2010 and January 2015, the BR scavenging wells were abstracting groundwater at rates between 4 and 6ML/d. In January 2015 rates dropped to around 3.8ML/d and then gradually declined further to <1ML/d by December 2017. This is understood to be due to effluent discharge constraints, which were subsequently rectified, and by June 2018 abstraction rates were increased to previous levels of 4 to 6ML/d with a stable pumping rate of 4.8ML/d since June 2018.

Dr Rivett states that 4 to 5 ML/d is the optimum discharge rate for plume capture which has only recently been achieved by AW over the past 1.5 years, and he is concerned that this increased pumping rate may cause westerly creep of the plume.

In 2013 the Applicant commenced groundwater monitoring on the mineral development site at BH104 located at the northeast corner of the site, on the feather edge of the main plume but out with the extraction area. BH104 therefore provides the opportunity to compare bromate concentrations across the two pumping periods that meet or exceed the suggested optimum discharge rate, the first spanning around 5 years of pumping (2010 – 15, but using BH104 bromate data from 2014-early 2015), and the second 1.5 years (BH104 data from 08/18 to 11/19).

BH104	2010 – early 2015	2018 – 2019
LMA	<1ug/l	<1ug/l
Chalk	2.75ug/l	2.52ug/l

Average bromate concentrations are presented above for both pumping periods (2010 -2015 and 2018-2019) in the chalk and the LMA. Average detections in the LMA do not exceed detection levels, and in the chalk are recorded at similar trace levels for both pumping periods. No change in bromate concentrations at the suggested optimal pumping rate across two different pumping periods, the first period being longer than the second, indicates that plume migration has not increased with time and the plume is stable.

The outcome described by Dr Rivett is therefore not supported by the available evidence, meaning that the Applicant is not reliant upon sub-optimal pumping rates at BR.

2.7 Comment 7

Insufficient monitoring data – suggestions are made for additional monitoring locations

Ref: TD (7 iii)

Response:

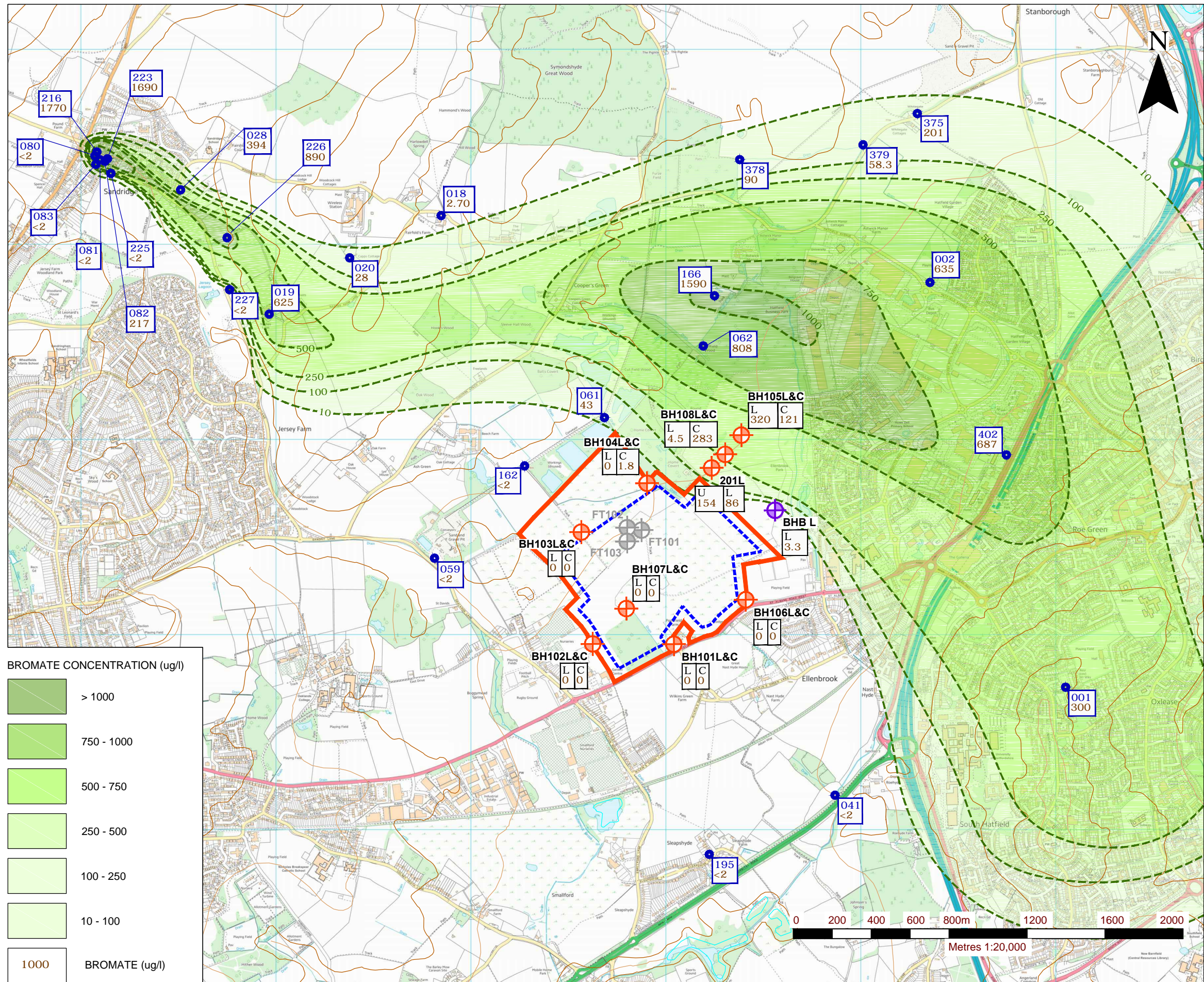
Ample boreholes have been installed and monitored in order to enable an understanding of the hydrogeological regime prior to a planning decision. The current groundwater monitoring network confirms the location of the bromate plume east of the site and its absence on the mineral extraction area.

In accordance with the GWMP and upon Planning Permission approval, three additional perimeter monitoring wells, BH303, 304, 401, will be installed and monitored over the life of the site. Other operational monitoring wells will be installed on a phase by phase basis but will be informed by the outcome of regular stakeholder meetings which will include representation by the Agency, AW and HCC.

In response to questions raised by EARA, AW made the following statement referring to the adequacy of the existing monitoring well data set:

“Considering the amount of data collected by all interested parties and the monitoring frequency, we believe that adequate data is available for a robust risk assessment regarding the proposed quarrying activity” (AW, 18/07/2019)

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LEGEND

- SITE BOUNDARY
- PROPOSED MINERAL DEVELOPMENT SITE
- WELL NUMBER (ENVIRONMENTAL AGENCY (EA) BOREHOLE)
- SLR (AUGUST 2013) DUAL MONITORING WELLS (LOWER MINERAL HORIZON AND CHALK)
- FIRE TRAINING AREA MONITORING WELL
- OLD WELLS (NON SLR) (LOWER MINERAL HORIZON)
- UPPER MINERAL HORIZON
- LOWER MINERAL HORIZON
- CHALK



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REGIONAL BROMATE PLUME
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DWG No. 4

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