

COLNEY HEATH GROUP

Statement of Case – Hydrogeology

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Submitted to the Appeal at the request of the Inspector reference
APP/M1900/W/24/3346607, Land at former Hatfield Aerodrome.

Summary

1. Given that the impact from the bromate plume being drawn onto the quarry site is high and that the eradication of the plume is currently problematic, the site should not be used for quarrying and should be left as a country park.
2. The quarry site is too close to the edge of the bromate plume to categorically guarantee that bromate is not already present under the dig site due to the absence of boreholes and the gap between BH104 and 106
3. The scavenge operation at Bishops Rise has failed to significantly remove the bromate.
4. There needs to be a detailed understanding of the impact on the plume when operating at the highest pumping rates at Bishops Rise.
5. The infill of inert material may alter the groundwater trajectory and potentially have an impact on the plume.
6. There does not appear to be an operational requirement for the lower mineral horizon lagoon now that the conditions say that no pumping is allowed.

Background

7. Ellenbrook Area Residents Association (EARA) raised concerns about the bromate pollution as far back as 2017 culminating in a meeting with Herts CC and Affinity Water
8. EARA produced a document at this time highlighting our concerns about the bromate plume including Environment Agency (EA) data. This document pointed out the extent of the bromate pollution near to the quarry site (over 1000µg/l). We were concerned that the plume was getting bigger after reviewing the report by Ciara Marie Fitzpatrick PhD document “The Hydrogeology of Bromate Contamination in Hertfordshire Chalk”
9. Since the initial concerns were raised EARA have attended meetings with the Environment Agency, HCC officers, Affinity Water and the Director of Public Health about Ellenbrook Fields concerning public health and bromate contamination. EARA have in the past liaised with Dr Rivett (a contaminant

hydrogeologist) over technical matters relating to the cause and effect of the bromate contamination.

10. EARA have continued to voice their concerns since 2017 about the bromate groundwater pollution underlying Ellenbrook Fields specifically in the context of quarry and the potential effect on the plume.
11. In the 2016 Brett application to quarry on Ellenbrook Fields there was only one mention of bromate in all the Brett planning application documents. Bromate and bromide contamination was not even assessed as a risk in the Brett Aggregates Risk Assessment document 2016 despite the fact that in 2012 Brett discussed the contamination with the EA and installed a number of test boreholes in 2013.

The origins and current position of the bromate plume

12. Ellenbrook Fields overlies an area of subsurface chalk rock, sands and gravels containing groundwater contaminated by bromate, a known carcinogen. This contamination has occurred as a result of a major historical chemical release at a factory in the 1970s resulting in a bromate plume which has travelled underground from Sandridge to the New North River, extending to over 20 km, a portion of which underlies Ellenbrook Fields and the wider Hatfield area. The unprecedented length of the groundwater plume causes the contamination to be considered by experts to be the worst groundwater contamination event in Europe.
13. The proposed quarry site is less than 100m away from the theoretical / modelled edge of the bromate plume. Map 1 shows how close it is. Although a rough outline of the plume has been identified by borehole readings, clearly the bromate does not travel in straight lines and does not recognise map boundaries. Bromate migration predominantly through fissures in the chalk rock that can be quite heterogeneous and varying continuity cause the exact occurrence of contamination to be uncertain.
14. Bromate is extremely difficult to eradicate. Once it is in the chalk aquifer it can take decades, even centuries to remove. Although bromate moves quickly through fissures at close to the velocity of groundwater causing the long km-scale plume, significant bromate mass may diffuse into and accumulate in the porous chalk matrix where flow is very slow. This diffused mass is very slowly released and sustains the plume over decades. Significant bromate mass may also accumulate in the clay layers existing between the sand and gravel horizons proposed for quarrying.
15. The bromate plume is currently managed by a scavenge operation at Bishops Rise (HATF – former Hatfield Public Water Supply (PWS) where effectively the bromate is drawn from the plume and treated using up to 9 million litres of water per day (Ml/d). Bromate is treated with ferrous chloride and converted to bromide which is disposed of down special drains. Despite this operation

being in place for over 10 years, the plume has not diminished in size. Rather, the scavenger well serves to draw the plume away from the Essendon PWS and partially contain the plume from wider spread downstream, but not completely so by any means. It is typically pumped at around half its licensed rate to achieve the former optimally (i.e. Essendon PWS protection), but not optimally protect PWS further down plume for which operation at the full licensed rates would be preferable (see further below).

Is there bromate and bromide under the actual quarry site?

16. As there are no boreholes under the dig site itself it can be assumed that we don't categorically know for certain.
17. The site peripheral boreholes have exhibited sporadic bromate but BH104 has been over 2µg/l in the chalk. As the aquifer is part of the Lower Mineral Horizon then this is significant and cannot be ignored.
18. The other related contaminant bromide has been detected in most cases over 125µg/l.
19. Critically, a major 800m gap exists in the N.E section of the proposed quarry site edge closest to the bromate plume. This is between boreholes BH104 and BH106 and could allow unmonitored ingress of contamination through to the dig site which given heterogeneity in the geological conditions is possible. Pre-commencing condition allows for two extra boreholes to be sunk to try to "plug the gap". This is still quite sparse monitoring for the key 'line of defence' for the site in our opinion.
20. Brett/SLR released a borehole data set "SLR February 2019 LMA bromate concentration showing Hatfield quality data spanning 2013 to 2019". The borehole diagram DWG No 2 reported all the on-site boreholes as ND (not detected). This was challenged at the Appeal, and it was pointed out that it did not correlate to the accompanied chart data set.
In fact, the sentinel boreholes BH104 showed over 2µg/l, and BH106 sporadically 5.4µg/l in Feb18 and later 7.4µg/l.
21. Overall, it is surprising to us that the baseline monitoring for establishing the baseline bromate condition which is likely quite heterogeneous spatially was not much more robust along the edge of the proposed site and within the actual dig site itself to provide a much clearer picture of the contamination condition rather than inferring those conditions from sparse monitoring of the most critical area. Especially given the very high bromate concentrations to the very immediate northeast towards the main plume body (see below).

Borehole readings and WHO guidelines

22. Known readings from Brett Dwg No 2 Feb 2019 show borehole BH201 within 100m of the quarry perimeter at 92.6 µg/l, 9 times greater than the WHO

levels, and within 500m borehole BH108 227.3 µg/l. Borehole BH 104 is just inside the perimeter of the quarry site and shows a reading of 2.5 µg/l (in the chalk) and BH106 7.4 µg/l, also inside the perimeter of the site.

23. At present the only boreholes monitoring the gap between known bromate contamination in the N.E sector are BH104 and BH106, there is a gap of 800 metres between these two boreholes. This gap is exceedingly large given expected spatial heterogeneity (variability) in both the geology and the contamination by bromate.
24. One of the differences between the 2021 application and 2016 application was for the standoff for mineral extraction operations in the LMH to the bromate plume to be increased from 50m to 100m, to (in theory) provide more of a gap between the potential edge of the plume and the dig site. Given that the edge of the plume is unknown, does not have a true “edge”, and that the plume has travelled from Sandridge and is now 20km long, it is difficult to establish how significant this relatively small difference in distance is and is not helped by the sparseness in monitoring along the plume edge.
25. There have been no updated bromate and bromide figures supplied by Brett to us since 2021. Their baseline data do not establish the impact on the quarry site groundwater bromate on operating the Bishop’s Rise HATF abstraction at its full licensed rate where we have significant concerns that bromate will be drawn across the site (see below).
26. Bromide (a precursor to bromate) is also present on the site. The most recent figures show extremely high concentrations of bromide around the perimeter of the site. These high levels should not be ignored.
27. We believe that the levels of bromate readings around the site are sporadic and should not be ignored in the decision making as to whether Ellenbrook Fields is a suitable site for quarrying
28. The primary decision making factors should be
- (i) the potential risk to the water supply and
 - (ii) the eradication of the bromate plume.
- These issues should be given the highest weighting above the requirement for a supply of sand and gravel.

Bishops Rise Pumping Station

29. A remediation plan to deal with the bromate pollution was established over 20 years ago and managed by the EA. This has failed to significantly reduce the levels of bromate. A new remediation plan has not been published but it is expected that the way forward is likely to be a continuation of the existing plan ie continue to pump at Bishops Rise..

30. With the exception of a brief period of Bishop's Rise (HTAF) abstraction at a higher rate towards its licensed rate, the majority of the monitoring baseline data have been collected when the scavenger well has been operated at around half (~4.5 MI/d) of its licensed rate of 9 MI/d. That rate being governed by the optimal protection of the Essendon PWS. There is significant concern that if Bishop's Rise was operated at its full licensed rate (which would usefully provide greater protection of the PWS down-plume to the east, including the Thames Water operated PWS), that the bromate plume would be increasingly drawn across the proposed quarry site. As this is largely a sideways, side-step migration of the plume, this would gradually occur over months to low years and be slower in the sand and gravel aquifer than the chalk. Baseline monitoring data have not been collected to establish this probable impact, operation at higher abstraction rates during the baseline was far too short to assess this.
31. In the absence of the applicant actively pumping from the LMH sands and gravels in their proposed quarrying activity, the increased abstraction by Bishop's Rise probably represents the key means by which bromate contamination may be further drawn into the quarry site groundwater.
32. The applicant has no authority to influence the rates of abstraction operated at Bishop's Rise which are set by Affinity Water presumably in collaboration with the Environment Agency to provide effective bromate plume management and safeguard of their local public water supply (PWS) to the north and partially protect their PWS and those of others (e.g. Thames Water) down plume, much further to the east.
33. A reasonable inference is that the viability of the quarry is dictated by the operation of the Bishop's Rise at low to moderate abstraction rates at the discretion of Affinity Water rather than operating at moderate to the high (full license) abstraction rates it is entitled to operate at
34. Should the proposed quarry site groundwater become contaminated due to operation of Bishop's Rise at the higher licensed abstraction rates, then as the works of the quarry operation are not directly responsible for such contamination, the Applicant would have no measures to employ to reduce those concentrations other than to appeal to Affinity Water to reduce their abstraction rates that would allow the plume to slowly laterally drift back northwards away from their quarry site.
35. There is also concern that Brett Aggregate extracting gravel from the LMH and subsequent in-fill of the void with inert material may alter the groundwater trajectory, as well as the extraction or de-watering the plume from Bishops Rise. If this is allowed to happen then Bishops Rise will have less influence on scavenging operation and the plume could spread southward into Roestock and Tyttenhanger PWS shutting them down if the bromate levels breach WHO

guidelines of 10µg/l or above.

36. Bromate at HATF has not reduced by a significant amount. The last EA dataset shows bromate at HATF is on average:

278µg/l 2021

265µg/l 2022

248µg/l 2023

37. We believe that the application to quarry on Ellenbrook Fields would thereby be contrary to the provisions of the of the Hertfordshire mineral local plan (policy 17(iv)) which does not permit mineral development resulting in negative impact on the water environment and the provisions of the NPPF (par 170) for conserving and enhancing the natural environment.

Risk

38. The complexities of quarrying so close to the bromate plume have been highlighted as the applications to quarry on this site have evolved, with more scrutiny of the plans. The following changes have occurred between applications.
- There are now 6 conditions posed by the EA instead of 3
 - The excavation method has changed – there is no pumping allowed in the lower mineral horizon
 - The dig area has been moved 100m from the edge of the plume instead of 50m
39. Other local quarries don't operate using such a risky method. Brett intends to dig down to the LMH which is more likely to disturb the bromate and potentially cause it to change direction, cross contaminating the aquifers. The nearby Cemex quarry, immediately north of Smallford Village, don't touch the LMH, taking a much lower-risk approach, this is a planning condition for this neighbouring quarry.
40. The risk to public water supplies contravenes MLP policies 17 and 18. Policy 17(iv) provides that development would not be permitted if it would have a negative quantitative and/or qualitative impact on groundwater resources unless appropriate measures can be imposed to mitigate any harmful effects.
41. A zero-risk approach should be taken to manage the plume. No quarrying should take place on this site until the bromate is eradicated completely from the area.

Conditions

42. At the 2019 application, the Environment Agency initially imposed three conditions on the site to "manage" the bromate risk. This soon progressed to six much more detailed conditions, following the Inquiry.

43. Whilst the inclusion of more detailed conditions are welcomed, the fact that the bromate plume requires such management is of major concern.
44. Conditions 4 and 5 must be absolute figures of 2µg/l and 5µg/l which immediately trigger action / response plans. They must not be a “mean” value taken over time.
45. Unfortunately, some of the conditions will only be triggered once the damage is done. Once condition 5µg/l is breached then bromate is on the site.

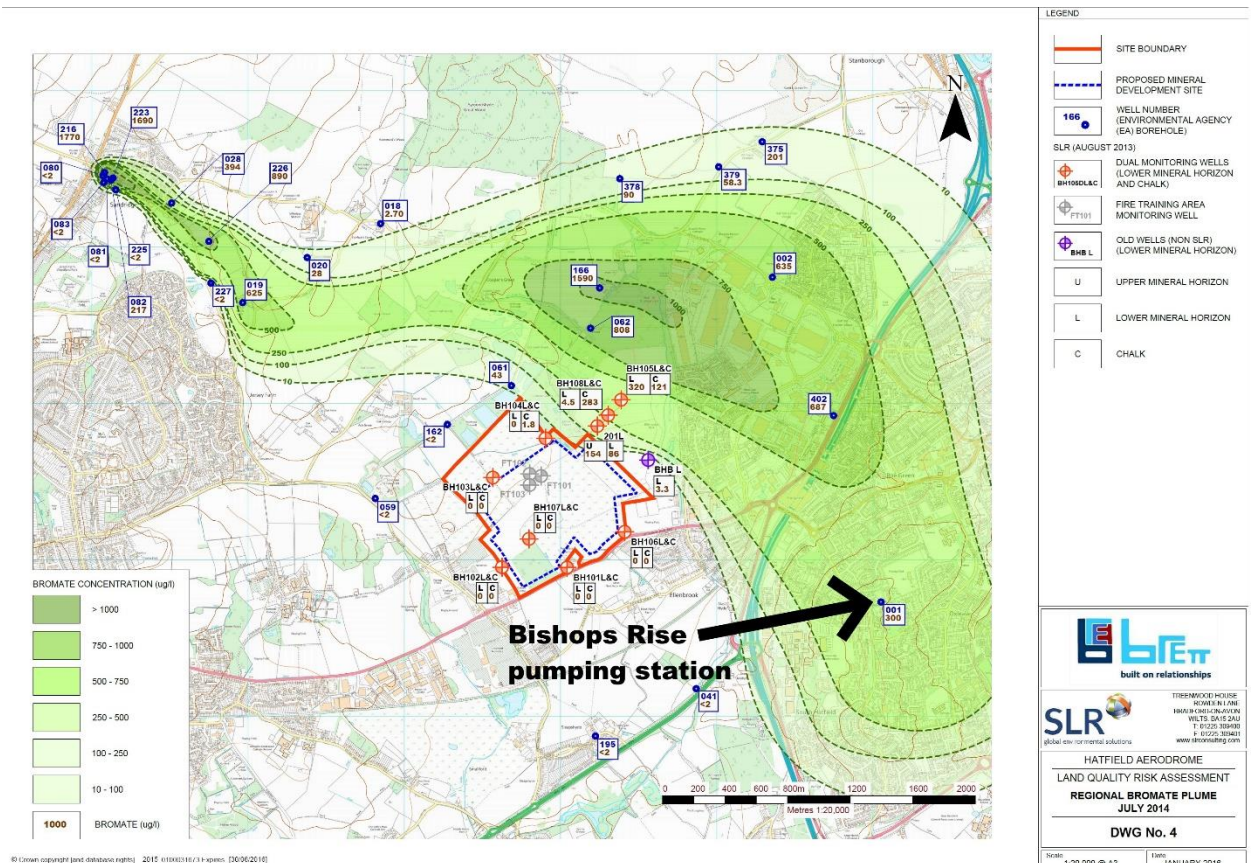
Groundwater Management Plan

46. The GWMP is a tool to manage bromate contamination entering the on-site workings on a day-by-day basis, it is designed to work after all new boreholes are operational and the excavation phase begins.
47. It cannot be used to evaluate the authenticity and judgement of whether the site is clear or contaminated before work starts, the only way is to update data from the existing boreholes and install new N.E boreholes BH303 and BH304.
48. Given that, there have already been a number of issues identified with the previous GWMP, including the major change in the pumping method. we have no confidence that this plan will guarantee the protection of public water supplies, bromate contamination of groundwater, local flooding, and safeguard EA's second remediation plan.

Lagoons

49. There are two lagoons proposed in the application
50. Paragraph 95 and 96 of the 1st Appeal, APP/M1900/W/21/3278097 decision dated 25th January 2022 of the Inspectors reports that the LMH lagoon it not necessary in the event of no pumping from the LMH. The inspector goes on to say that a lagoon of that size it not necessary, and that the “scheme would include an element of inappropriate development...” and would cause harm to the green belt.
51. Despite this comment from the previous Inspector, the LMH lagoon is still part of the 2021 application.
52. As well as the potential harm to the green belt there is a risk of drawdown from the nearby bromate plume. This lagoon (LML) at 8m deep has an estimated 300K cubic metre capacity. Water in the natural aquifer rises and falls by 3m which will be reflected in the lagoon's fill volume. There is a risk that in time the whole lake will be contaminated with bromate and bromide.

Map 1 - Ellenbrook Fields and the bromate plume



Conclusion

53. The quarry site is too close to the edge of the bromate plume to categorically guarantee that bromate is not already present under the dig site.
54. There is significant concern that if Bishop's Rise was operated at its full licensed rate (which would usefully provide greater protection of the PWS down-plume to the east, including the Thames Water operated PWS), that the bromate plume would be increasingly drawn across the proposed quarry site.
55. In the absence of the applicant actively pumping from the LMH sands and gravels in their proposed quarrying activity, the increased abstraction by Bishop's Rise probably represents the key means by which bromate contamination may be further drawn into the quarry site groundwater.
56. The infill of inert material may alter the groundwater trajectory and potentially have an impact on the plume
57. The current EA remediation plan for the bromate plume has failed to significantly reduce the plume.
58. The bromate readings within the plume, northeast of the site are still very high and of major concern

59. The fact that the bromate plume requires such management during operations (through conditions and the GWMMP) is of major concern.
60. There does not appear to an operational requirement for the lower mineral horizon lagoon now that the conditions say that no pumping is allowed.
61. Given that the impact from the bromate plume being drawn onto the quarry site is high and that the eradication of the plume is currently problematic, the site should not be used for quarrying and should be left as a country park for residents to enjoy and not endure.
62. Therefore, the appeal should be dismissed.