Ellenbrook Area Residents Association – Response to Brett's Drainage Technical Memorandum August 2023

1. Introduction

The Local Lead Flood Authority requested additional information from Brett Aggregates regarding their drainage strategy. The technical memorandum submitted is the response from Brett. The following extract is the request from the LLFA.

SLR/Brett Technical Memorandum for the HCC, LLFA (Lead Local Flood Authority) project No 403 009885 00024.

This report has been requested by the LLFA (19th May 2023) in response to Brett's Drainage Strategy as being inadequate for the purpose of quarrying minerals on Ellenbrook Fields. The report has been compiled by SLR Consulting Limited. Churchill Way, Cardiff, CF10 2HE.

The detailed report is aimed at preventing flooding in accordance with NPPF guidance in paragraph 167,169, and 174 through management of surface water flow paths, through storage, and disposal of surface water from the site in a range of rainfall events and ensuring the Sustainable Drainage System (SuDS) proposed operates as designed for the lifetime of the development.
It should contain detailed drainage plans, location of SuDS and attenuation provided by lagoons in the event of 1 in 100 year + 40% (climate change) storm event, statistical analysis (FEH22 data) of rainfall events and maintenance schedules.

The LLFA will lift their objection once they are satisfied with the Technical Memorandum from Brett Aggregates.

Ellenbrook Area Residents Association (EARA) were asked by HCC to review this new document as they were part of the Rule 6 parties at the Planning Appeal in November 2021. EARA were concerned about potential flooding arising from the Quarry and submitted a document at the appeal: 019 EARA presentation APP/M1900/W/21/3278097.

The following is a quote from the EARA Inquiry objection.
"*We are still very critical of the surface drainage proposed by Brett Aggregates as this may impact on a large area **downstream** of the quarry workings. The areas directly affected are the University of Hertfordshire, the busy A1057 road and a large housing estate called Ellenbrook. From our document you can see clearly that the Nast culvert and the Ellen brook are a principal stream dewatering the Ellenbrook Fields."*
Ellenbrook residents EARA

2. The Technical Memorandum

The Technical Memorandum is in three parts: Estimate of Greenfield Runoff Rate, Hydraulic Analysis, Maintenance Requirements and Schedules.

Estimate of Greenfield Runoff Rate – extract from the Technical Memorandum

*"The predevelopment Greenfield runoff rate has been estimated using the ReFH2 methodology1. This provides an estimated runoff rate of **1.7ls-1ha-1**, or an allowable discharge of **122ls-1** for the **71.91ha** that will drain to the restored lagoon"*

This is a rural estimate for a generic area and not associated with an active quarry. This runoff model outputs 1.7 Litres in 1 second for 1 hectare. This example suggests 71.9 hectares for the site (site 87.1 hectares); therefore, the discharge would be 122 Litres in 1 second.

122L = 0.122 cubic meters
0.122 x 60 x 60 = **439.2m^3/hour**

This runoff rate seems very low compared with other calculations not using ReFH2 estimates - EARA

- These simulated 1% AEP * runoff rates are designed for greenfield conditions today and not during the 40 years of quarry activity – *this is the period that concerns us.*
- For the restoration period, post quarry simulation using (2022) ReFH2 methodology will be out of date by the year 2063 and cannot be used here to predict future events.
- Infill of 4m tonnes of inert fill will be used in the upper mineral horizon displacing the sand and gravel void. This action will change the hydrological nature of the whole area and we cannot calculate the runoff and dispersion with any degree of accuracy. *EARA*

Looking at the ReFH2 methodology, it isn't even suitable for calculations of runoff during the operation of the quarry. The first statement of that technical guide states *"Greenfield sites are typically located on the periphery of existing developments and are sites with no urban development and hence can be assumed to be completely rural (fully pervious)."* Clearly, the site has been developed and in many places is nearly impervious, hence the flooding!... EARA

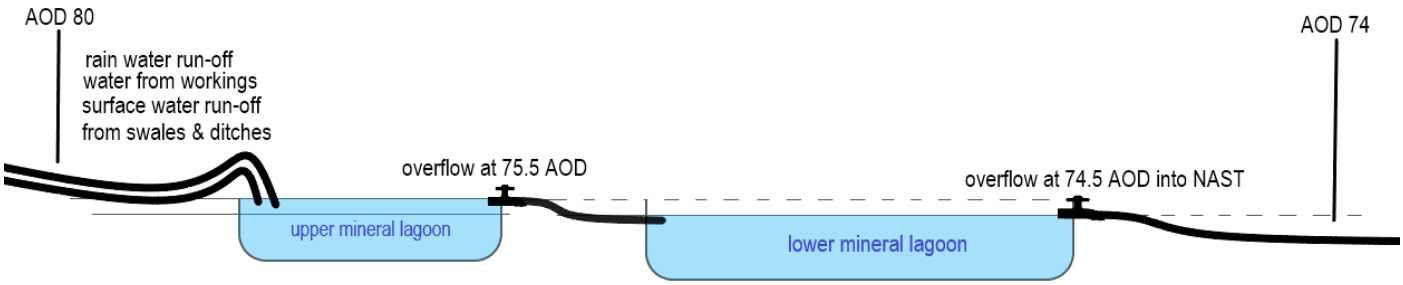
Hydraulic Analysis

The section "PRINCIPAL DRAINAGE CATCHMENTS" involves drainage of the post quarry site using swales, culverts, pipes to drains 10 catchment areas. The reinstated Nast (river) drains the N.W area. The lagoons now become one big lake and acts as an attenuation body and infiltrates water back into the aquifer.

Lagoons

"It is proposed to manage rainfall using the Upper Mineral Horizon (UMH) lagoon, as well as to manage any potential increase in groundwater levels. The Lower Mineral Horizon (LMH) lagoon is then proposed to manage extreme events and prolonged rainfall by receiving overflows from the UMH lagoon."

Lead Local Flood Authority 23 November 2021



The LLFA and the Environment Agency have asked for details of the lagoon construction details.

We cannot find any details of the lagoon's volume capacity - *"the lagoons are sized to provide the required attenuation in 1 in 100 year (plus 40% climate change) storm event"*

LLFA 19th May 2023

The two lagoons are to be constructed in the south-east corner of the site, nominated UML Northern recharge Lagoon, and LML Southern recharge Lagoon. Their infiltration capacity is 725-1400m^3 and 6,000-9,500m^3/day respectively. The LML or SRL is constructed to a depth of 10m, that breaks through the interburden clay barrier, and now it is in **direct contact with the lower mineral horizon aquifer LMA where bromate contamination exists nearby.** *EARA*

Operational Predicted Water Volumes:

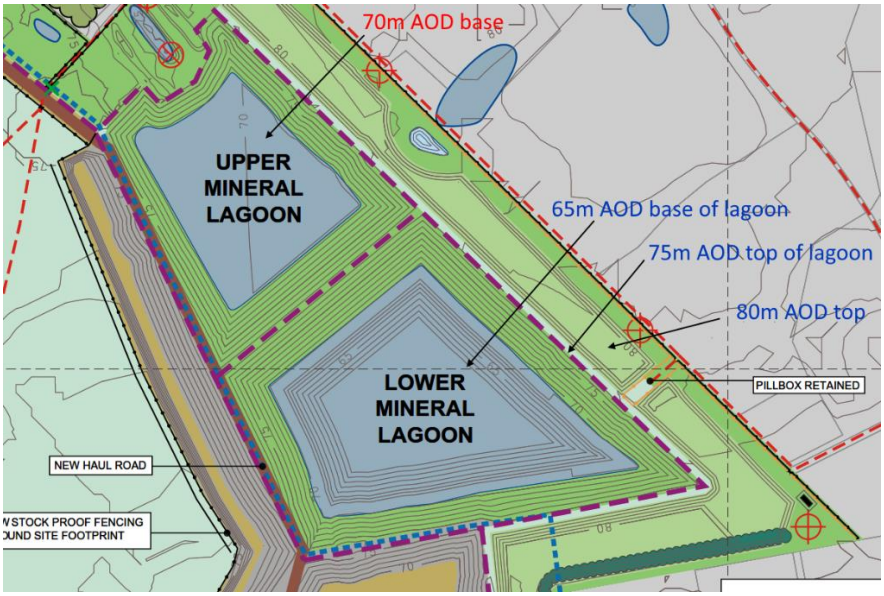
UMH or NRL: clay buttress construction; back drain flow; groundwater; rainfall, discharge = 1,100 – 1,800m^3/day
capacity to infiltrate back into UMA aquifer = 725 – 1,400m^3/day

LML or SRL: designed to dewater LMH; discharge = ???????????
capacity to infiltrate back into LMA aquifer = 6,000 – 9,500m^3/day

Groundwater and Water Management Plan, V 6.1, table 2.3.3

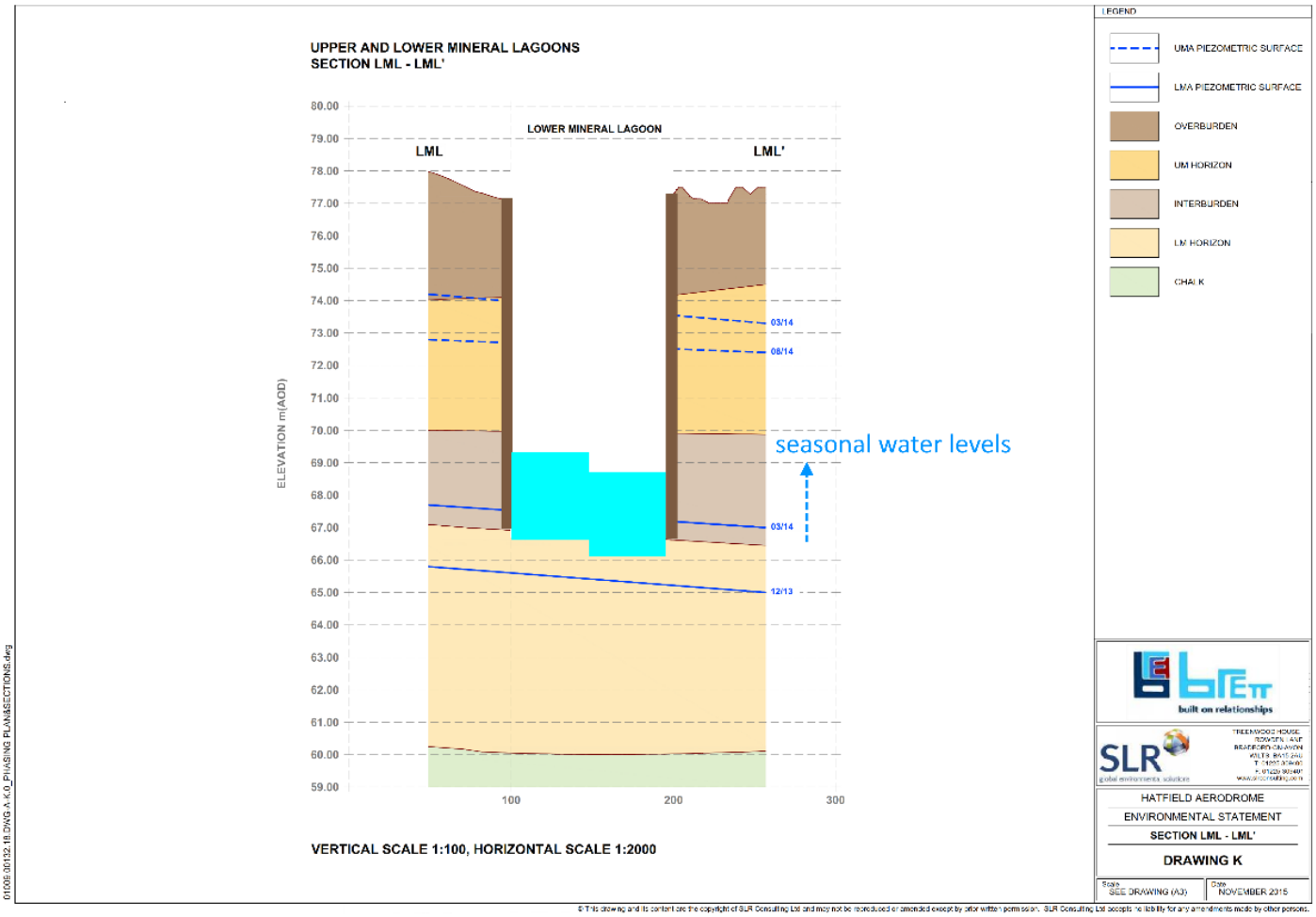
The infiltration rates for the UMH lagoon are not fast enough in the event of a storm. In the event of a storm, the surge in rainwater runoff of 439.2m^3/hour would exceed the infiltration capacity of the lagoon and eventually start to overfill the lagoon.
In our example, 50mm of rain falling on The Plant Site (11ha) for two hours would produce 9250m^3 runoff. This event would be a tipping point and eventually overwhelm the already filled lagoons.

The lagoons layout in the S.E of the site. The UML base is at the top of the interburden, the LML base is below the interburden.



At the Appeal the hydrology team produced a recommendation that **no water from the LMH would be stored in the LML or SRL**.
We understand from this document that for restoration this lagoon will be filled with gravel and the depth brought up to the UML to form one large lake. This is against EA policy to prevent mixing of the aquifers.

There is no reason to have a second lagoon as no LMH water from excavation is being recharged into it. It is also a risk that nearby bromate contamination may infiltrate the lagoon itself, an issue that is against the planning conditions. *EARA*



The above graphic shows to scale the LML depth, where the seasonal variation of water only fills 1/4 of the lagoon. This lack of water will go on in time to causes dryness and cracking in the walls of the lagoon, risks leakage into the upper aquifer and contaminating it.

Water Environment 6

The highest groundwater elevation: LMH – 72.85mAOD (BH302L) northwest of application site

The lowest groundwater elevation: LMH – 63.29mAOD (BHB) east of application site

The Environment Agency states in conditions:

Condition 1
Prior to the commencement of development, the following shall be submitted to and approved in writing by the MPA:

(i) Details of the construction of the upper and lower infiltration lagoons;
(ii) Details of the water management during construction and upon restoration of infiltration lagoons;
(iii) Details of the UML back-drain upon restoration

The development shall be undertaken in accordance with the approved details. Reason: to ensure protected water sources are not adversely affected by bromate contamination as a result of mineral working. The lower mineral lagoon presents a potential pathway for surface contaminants to enter the chalk groundwater. It must be designed and constructed to minimise this risk throughout the lifetime of development, including restoration.

EA, 31st March, NE/2021/133848/02-L01

The lower mineral lagoon presents a **potential pathway for surface contaminants to enter the chalk groundwater**. It must be designed and constructed to minimise this risk throughout the lifetime of development, including restoration.

Clearly if it is being relied on to discharge water from extreme events, upper and lower groundwater tables are at risk of mixing.
In the restoration phase both lagoons are connected together to form one lake. The risk is that nearby **bromate contamination will cross contaminate** the clean water aquifers and river systems. *EARA*

The NAST
Nast is a brook but acting in two ways, first a drain for the catchment area in the N.W. of the site and secondarily as a storm overflow for the restored lagoons. It is connected to a node (junction) controlled by a "hydrobrake" (valve), so that in the event that the lake breaches 75.5m AOD excessive storm water will overflow into the brook.

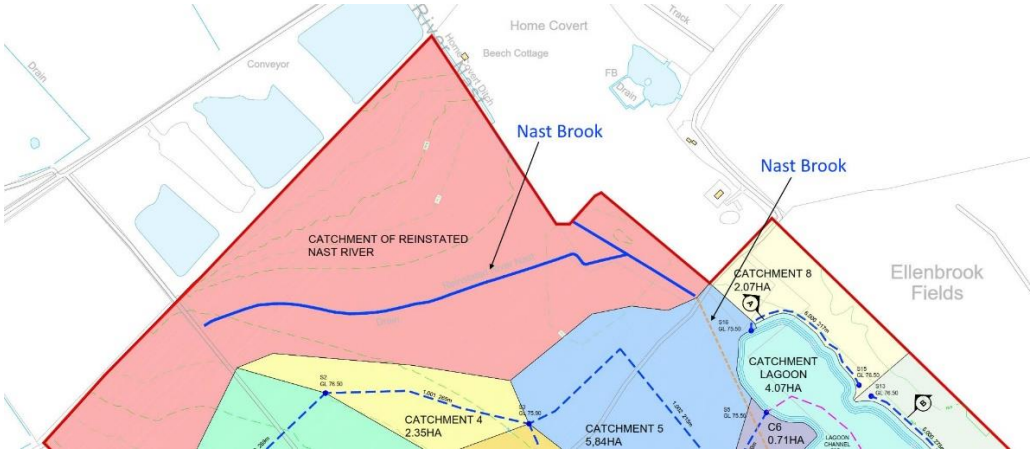
The analysis of the drainage in the event of a storm is given:
Results for 100 year +45% CC Critcal Storm Duration. Lowest mass balance: 95.30% computer simulation table shows that the discharge volume at MH1 into the Nast is 5988.3 m^3.

The Nast is **not** a River, it is an ephemeral small brook. Below, the picture shows the Nast culvert emerging from under the A1057 roundabout (not blocked at the time)
EARA

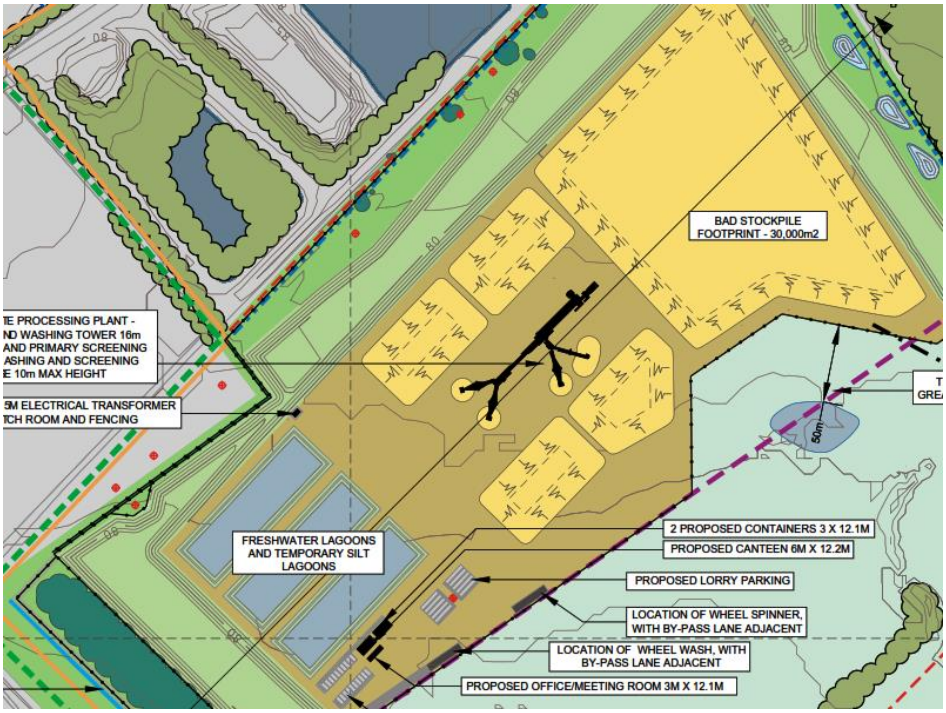
"We also note that the culverted section of the River Nast may be blocked or partially blocked, and that the upstream end of the culvert floods during heavy rainfall. As this relates to a main river, we would recommend that the applicant discusses this with the Environment Agency for their requirements."

Lead Local Flood Authority 23 November 2021

The Nast catchment area



Plant site



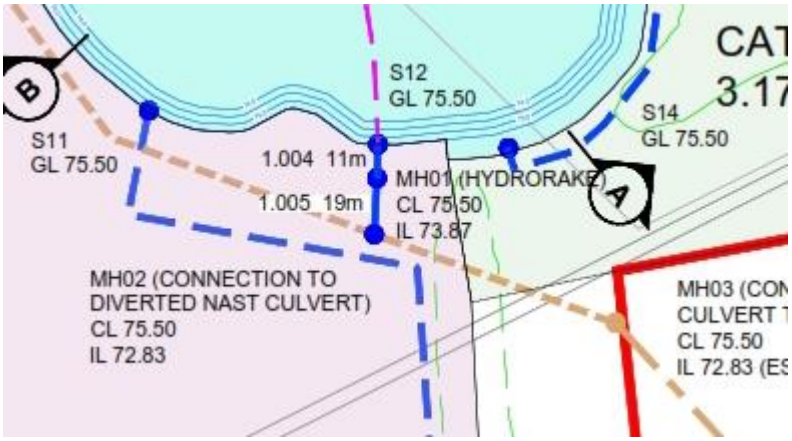
The above maps show the Nast catchment area and the proposed plant area. Drainage from this hard gravel site is given during quarry active period and before the quarry:

The catchment runoff rates for the N.W. plant site pre-quarry, active, and restoration periods *EARA*

Plant area	location	condition	rainfall	runoff
11ha	N.W.	Compact gravel	50mm	4625m^3
active			1 hour	1 hour

before quarry	location	condition	rainfall	runoff
11ha	N.W.	grass	50mm	2312m^3
non-active			1 hour	1 hour

A one hour storm produces a large amount of water runoff from the plant site, a runoff of 4625m^3, this is then made to flow unattenuated into the Nast.
In the restoration period extra water is added at point MH1 of 5988.3m^3. A connection to the Nast is made during the active phase of the quarry development and acts as an overflow in the event of a storm event.



The Nast (unattenuated) flowing south-east now joins the overflow from the lake at MH01, contributing to potential flooding downstream.

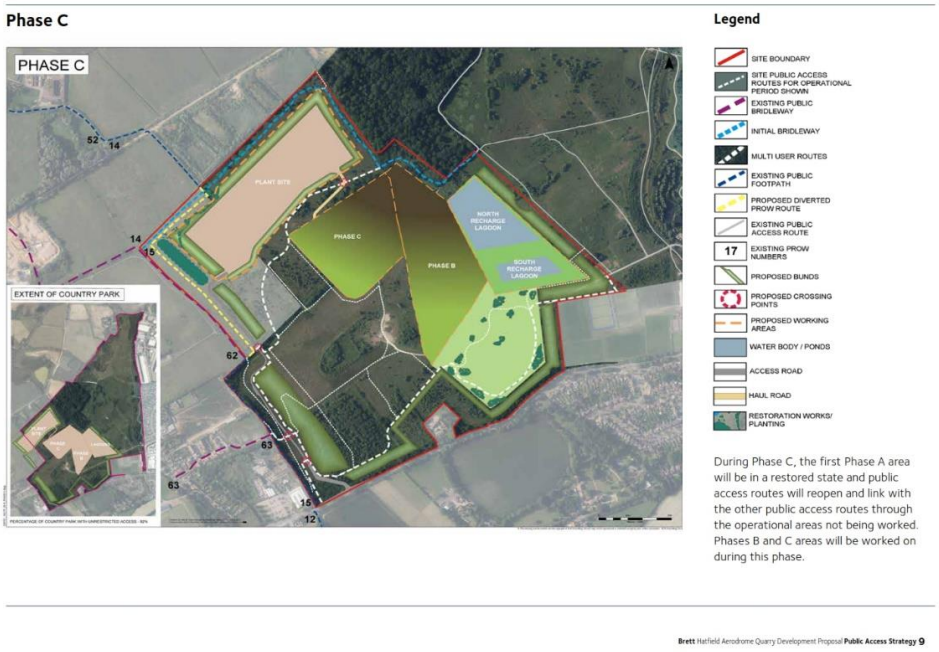
In the above diagram the runoff and combined overflow is channelled (brown dotted line) into a culvert along the A1057 road and downstream to combine with the Ellen brook in Ellenbrook Lane.
The University, A1057, and the urban area is now under threat from flooding as the small clavated section cannot take the extra water load. *EARA*

Flood Risk Activity Permit (EA)

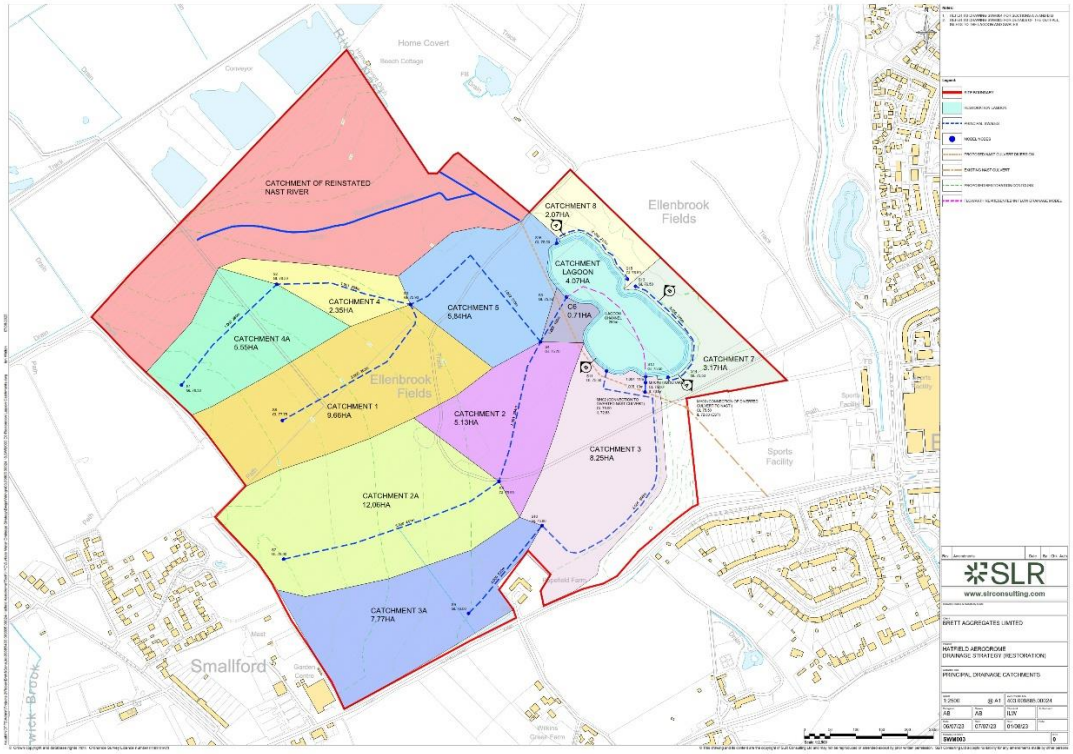
The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place:
• on or within 8 metres of a main river (16 metres if tidal)
• on or within 8 metres of a flood defence structure or culvert (16 metres if tidal)
• on or within 16 metres of a sea defence
• involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
• in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission. *EA NE/2021/133848/02-LO1 31/32023*

This permission must be granted to satisfy the EA – it seems that all these conditions cannot be met as the NAST is a nominated main river for the site and is re-routed between the lagoons and the quarry workings. *EARA*

Map of an active quarry in phase C



Plan of swales greenfield runoffs



From the two maps above the drainage cannot be complete until the last phase G is finished, and restoration begins. Meanwhile, there is a risk of flooding before restoration to the University of Hertfordshire, A1057 road and the urban areas of Ellenbrook, Hatfield.

NPPF

"To prevent flooding in accordance with National Planning Policy Framework paragraph 167, 169 and 174 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development." *LLFA Date 19 May 2023*

This policy has not been supported by the Brett's Technical Memorandum on greenfield drainage during the quarry active period *EARA*

Maintenance Requirements and Schedules

Brett Aggregates Limited will have an aftercare obligation during which time they will be responsible for the inspection and maintenance of the drainage system. Following this period, the land and all liabilities will be passed back to the landowner (ARC):
Infiltration Lagoon - Swale Operation and Maintenance - Flow Control Chamber Operation - Underground Pipe System Operation.

Again, all this is designed in the restoration period after +30 year period and when the quarry is finished and not active. *EARA*

3. Conclusion

3.1. This Technical Memorandum in response to the LLFA request shows drainage designed **after** the quarry is completed in the year 2063. It does not consider events during the active part of quarrying and therefore is not fit for purpose.

3.2. Estimate of Greenfield Runoff Rate

This Technical Memorandum study is for rural landscapes and not for an operational quarry – it only applies in RESTORATION PERIOD in 40 years' time.

3.3. Lagoons

The first lagoon will not hold enough water in the event of a 1 in 100 event storm.
Why do we need a second lagoon (SRL or LML) when no LMH water is removed during excavation. It is an unnecessary risk to have it.

3.4. NAST

The Nast is **not** a "Main River" only a brook, it cannot take excessive rainfall from the N.W. (PLANT SITE).
The Nast is also an overflow from the lagoons. It cannot take excess water in a storm event. It will result in flooding downstream.
The Nast is diverted to between the lagoons and the workings against following EA conditions:

- EA condition - involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- EA condition - in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission. EA NE/2021/133848/02-LO1 31/32023

Key

* 1 in 100 year event or 1% Annual exceedance probability

UMH - upper mineral horizon
LMH lower mineral horizon
UML or NRL northern recharge lagoon or upper mineral lagoon
LML or SRL southern recharge lagoon or lower mineral lagoon
UMA & LMA are aquifers
EARA Ellenbrook Area Residents association

Mike Hartung
On behalf of Ellenbrook Area Residents Association
30th August 2023