

**BRETT TARMAc FAIRLOP QUARRY
INFORMATION EVENT
BRIEFING NOTE 4: HYDROGEOLOGY
APRIL 2016**

**PROPOSED EXTENSIONS OF EXISTING SAND AND GRAVEL WORKINGS ON
TO LAND WEST OF ALDBOROUGH ROAD NORTH (PHASE E) AND WEST OF
HAINAULT ROAD (PHASE F)**

1 Introduction

SLR provides specialist consultancy services to mining and minerals, waste management, planning and development businesses. Our hydrology and hydrogeologists have completed many schemes similar to those proposed for Fairlop Quarry.

2 Current setting (figure 1)

- the proposed development at Fairlop Quarry would include sand and gravel extraction across two Phases (E and F), followed by restoration back to agricultural land, and nature conservation habitats.
- the sand and gravel (up to 7.3m thick) is just below the topsoil and subsoil horizons underlain by London Clay.
- some of the mineral contains groundwater – from rain falling on Fairlop Plain and surrounding areas.
- groundwater levels and quality are routinely monitored via a network of monitoring boreholes that have been installed around the edge of Fairlop Quarry, including the proposed Phases E and F.

Groundwater flow (figure 2)

- groundwater flow directions are shown in Figure 2. Across the western and central parts of Phase E, the flow direction is westerly towards the Cran Brook. Beneath the eastern part of Phase E, it is to the east, towards Seven Kings Water. Groundwater flow across Phase F is south-westerly toward Seven Kings Water.
- the monitoring results have been analysed to identify both the groundwater and surface water conditions – and to assess any potential interaction between the proposed mineral extraction and restoration activities, and the surrounding area.

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- specific measures are identified within the proposed scheme to make sure that:
 - groundwater levels are not lowered significantly around Phase E during the dewatering of the sand and gravel before or while it is extracted
 - flood risk is not increased around Phases E and F, either during quarrying activities or following restoration
 - any potentially contaminated groundwater from the historic landfills to the north of Phase E is not drawn in to the water management systems at Fairlop Quarry
 - the quality of water removed from Phase E during quarrying and restoration activities can be adequately treated for removal of suspended solids before being released back into the surrounding environment.
- the proposed scheme has been developed to minimise any significant impacts on the surrounding water environment.

3 Phase E

Mineral extraction (Figure 3)

- before sand and gravel is extracted from Phase E a perimeter seal will be installed around the western, northern and eastern boundaries of the Phase E extraction area, so that the groundwater within the sand and gravel can be lowered by pumping to allow it to be 'worked dry'.
- pumping will only be local to each sub phase and not across the whole of Phase E at any one time.
- the perimeter seal will prevent any poor quality groundwater within the historic landfill north of Phase E from draining into the quarry during extraction.
- the perimeter seal will be a wall of bentonite mixed with cement, which will be installed through the full thickness of sand and gravel down to the London Clay, without the need for any dewatering.
- trenches will also be installed to recharge groundwater back into the sand and gravel along the southern perimeter of Phase E. This will prevent the drawdown of groundwater levels to the south of the site, particularly below St Peter's Church.

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- further tried and tested technology will be used to construct a clay wall around the southern edge of Phase E. This will extend from ground level, through the sand and gravel and down to the London Clay.
- this clay wall will also stop groundwater drawdown off site to the south of the Phase E extraction area during 'dry working' of the sand and gravel.

Restoration (figure 4)

- the quarry void will be infilled and restored back to existing ground levels, using on site materials and strictly controlled imported inert materials. These will be covered by subsoil and topsoil.
- the restoration operations will be carried out under the strict controls and requirements of an Environmental Permit, which will be issued, regulated and enforced by the Environment Agency. Strict Waste Acceptance Criteria (WAC) will make sure that only inert materials are used.
- rainfall running off the restored surface will be captured by an agricultural drainage system around the edges of the site. This system will divert surface water run off to low lying areas dug down into the remaining sand and gravel around the perimeter of Phase E.
- these low-lying areas (infiltration basins), will allow rainfall runoff to drain back into the sand and gravel. This will reduce the risk of any flooding and maintain groundwater and surface water levels and flows around the quarry.
- following completion of site restoration, the perimeter seal and clay walls installed around Phase E will not be removed. They will stay in place and form a permanent geological barrier around the inert materials placed in the void for restoration.

4 Phase F

Mineral extraction

- there will be no groundwater dewatering during sand and gravel extraction from Phase F, so the extraction void will remain flooded throughout.

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- as extraction of sand and gravel from Phase F proceeds – and extraction activities are completed – the flooded void will be used as part of the quarry water treatment/recycling system. This will allow silt to settle out from the water used to wash and process the excavated sand and gravel.

Restoration

- the part of the flooded quarry below the groundwater will be completely filled up with silt from the mineral washing process.
- The remaining void will be restored back to original ground levels, by backfilling with excavated clay materials sourced from a separate extraction phase within the Phase F area before being covered by subsoil and topsoil.
- without appropriate measures, it is likely that the silt deposited within the Phase F excavation could hinder the groundwater moving across Phase F, within the surrounding sand and gravel.
- this effect will be prevented by installing a new drainage channel along the north-eastern perimeter of the Phase F extraction. The base of this drainage channel will be connected to the sand and gravel aquifer. Groundwater will be able to move up into the drainage channel from below. It can then flow around Phase F before draining into the Hog Hill Ditch – which will continue to feed the Seven Kings Water.

Groundwater and surface water monitoring programme for Phases E and F

A groundwater monitoring programme will be carried out before, during and after the quarrying and restoration of Phases E and F. The existing network of monitoring points will be expanded, so the monitoring programme will:

- confirm the proposed mineral extraction and associated activities at Fairlop Quarry are not having – and will not have any – significant impact on water quality and water levels in the surrounding groundwater and streams, including the Cran Brook, Hog Hill Ditch and Seven Kings Water.

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- make sure the requirements of the Environmental Permit for restoration with inert materials of Phases E and F are met.

5 Enhanced restoration

The application includes proposals to enhance the restoration schemes in Phase A (east), Phase D, and the Plant Site to include new nature conservation habitats.

In all cases the proposed enhanced schemes will create new water areas that will have the ability to store any excess run off from the surrounding landforms.