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8.80 Applicant's response to Written Questions - Water Environment

Infrastructure Planning (Examination Procedure) Rules 2010

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8.80 APPLICANT'S RESPONSE TO WRITTEN QUESTIONS - WATER ENVIRONMENT

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Contents

1 RESPONSE TO EXAMINING AUTHORITY WRITTEN QUESTIONS (WATER ENVIRONMENT)

Table 1.1: Responses to the Examining Authority's Written Questions (Water Environment)

PINS ID	Question / Response
WE.1.1	**Question:** **Hydrogeological conceptual model in the area of the infiltration tanks (Work No. 4v)** **Figure 5 [REP1-004]** does not appear to show any monitoring boreholes in the area of, or down-gradient from, the infiltration tanks (Work No. 4v), with the possible exception of borehole CPBH27. The discharge from the infiltration tanks would be into or close to dry valleys **[REP1-004, Figure 1]**. 1. The ExA notes reference to monitoring of groundwater levels in dry valleys in **[AS-031, section 20.7.18]**. Confirm what investigation of hydrogeological properties and monitoring of groundwater levels has been undertaken in these areas. If this is limited, provide an assessment of the appropriateness of extrapolating from other monitoring data in the area, given the likely variability of the properties of the Chalk over short distances and given the likely coincidence of the infiltration tanks with dry valleys. 2. It is stated that the Environment Agency (EA) has designated the dry valleys to the east and south-east of the airport as having the potential for groundwater flooding. Is there any evidence that the dry valleys within the Order Limits flood or could flood? 3. Could the location of the infiltration tanks above dry valleys lead to faster movement of effluent than the modelled average velocity used in the assessments in **Appendix 20.6 [APP-139]**? 4. Clarify the relative position (height and distance) of Netherfield Spring and whether this should be considered a potential receptor for groundwater from the area.
	Response: 1. The figure below shows the site investigation locations in the area of the infiltration tanks, which are located within the upper reaches of the dry valley which falls to the southeast. The coverage of site investigation boreholes and trial pits are across both the clay covered Chalk and the dry valley sections within the site. CPBH24 is the closest groundwater monitoring borehole to Tank 3, that was utilised in the **Hydrogeological Characterisation Report [APP-139]**, with CPBH50 and CPBH51 downgradient of the tank. CPBH50 is the closest groundwater monitoring borehole to Tank 2 (northwest of the tank; upgradient), with CPBH52 the closest site investigation borehole. Monitoring of groundwater levels (and groundwater quality) is ongoing in boreholes that remain accessible, to continue to collect information for the future project baseline. The groundwater monitoring data from the monitoring boreholes in the eastern part of the site for the period 2016 - 2020 are highlighted in the hydrograph below. These show the range of observed water level due to seasonal response, it is also noted that all of the boreholes in the vicinity show a similar pattern of groundwater level variation and indicate a connected and consistent aquifer response locally. The **Drainage Design Statement [APP-137]** is being updated for Deadline 4 and drainage design principles updated into the **Design Principles [APP-225]** document at Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO). Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles. There are a number of drainage design principles that would enable confirmation of the ground conditions at the area of the infiltration tanks, for example *'The infiltration rates at the proposed infiltration tanks are to be confirmed by site specific testing at the infiltration tank locations. The detailed design for the installation, and the specification of operation and maintenance, of the infiltration tanks will comply with bespoke environmental permits'* and would enable ongoing baseline monitoring before, during and post construction. The monitoring strategy would also be agreed with the Environment Agency, as part of the required bespoke discharge permits.be agreed with the Environment Agency, as part of the required bespoke discharge permits. It is acknowledged that there are gaps in the site investigation within the footprint of infiltration Tank 2. However, with the distribution of site investigation and characterisation immediately to the west covering the same dry valley / chalk cover system, and complimented with regional data on groundwater levels and Chalk permeability characteristics, it is considered that there is sufficient understanding to inform the outline design of the drainage system, further outlined below. For groundwater levels in the vicinity of the infiltration tanks, in addition to the site specific investigations and groundwater level monitoring data, the Environment Agency Hertfordshire Groundwater Model and the off-site Environment Agency observation boreholes network verify the general groundwater levels and gradients within the area including in proximity to dry valley systems. Regionally the permeabilities of the upper Chalk are reasonably well understood (including their variability). If further works

PINS ID	Question / Response
	identify variation from the assumed ground permeabilities, then additional measures can be implemented locally to manage the site permeabilities within the footprint of the infiltration tanks (such as drainage wells or ground improvement).

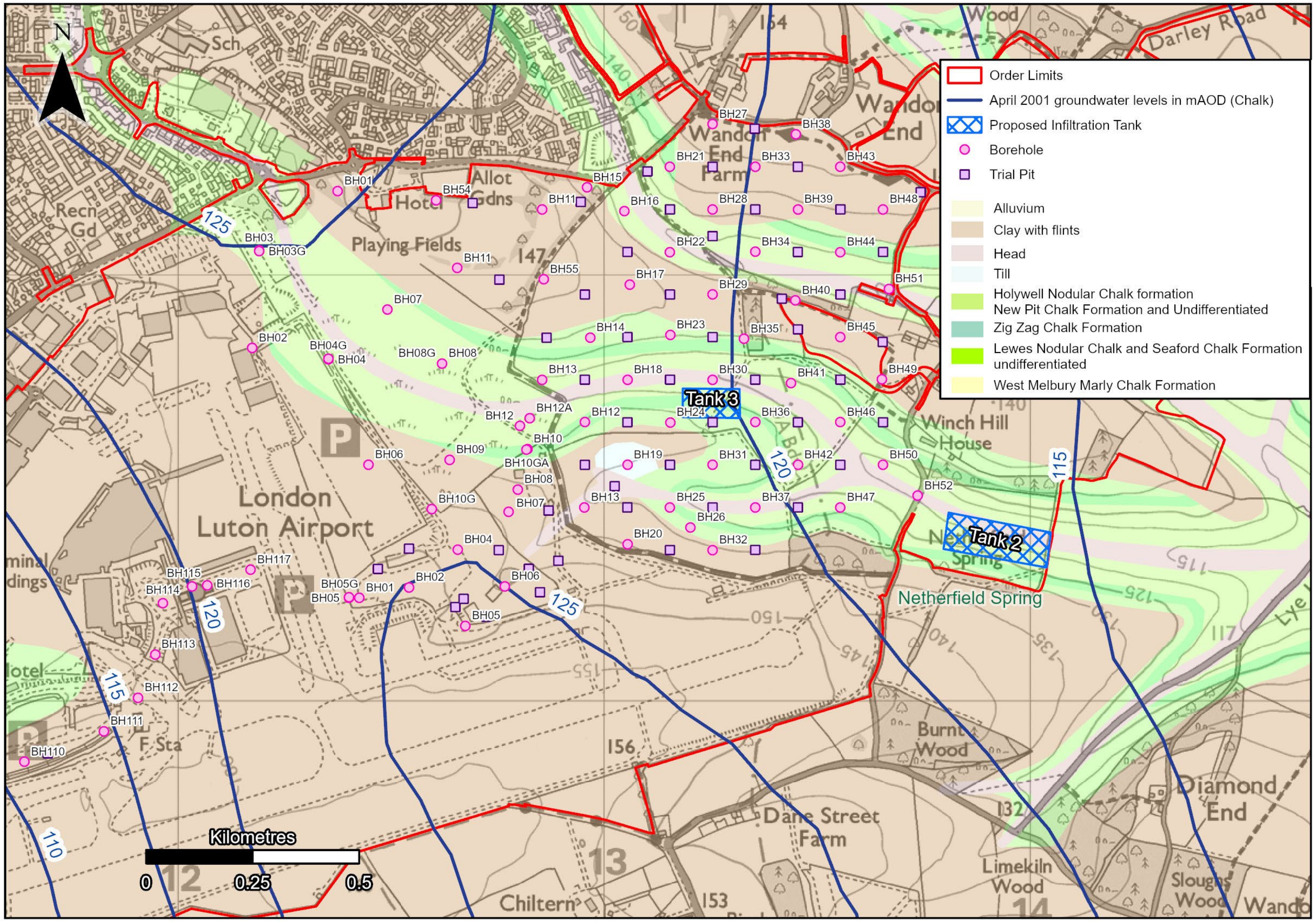
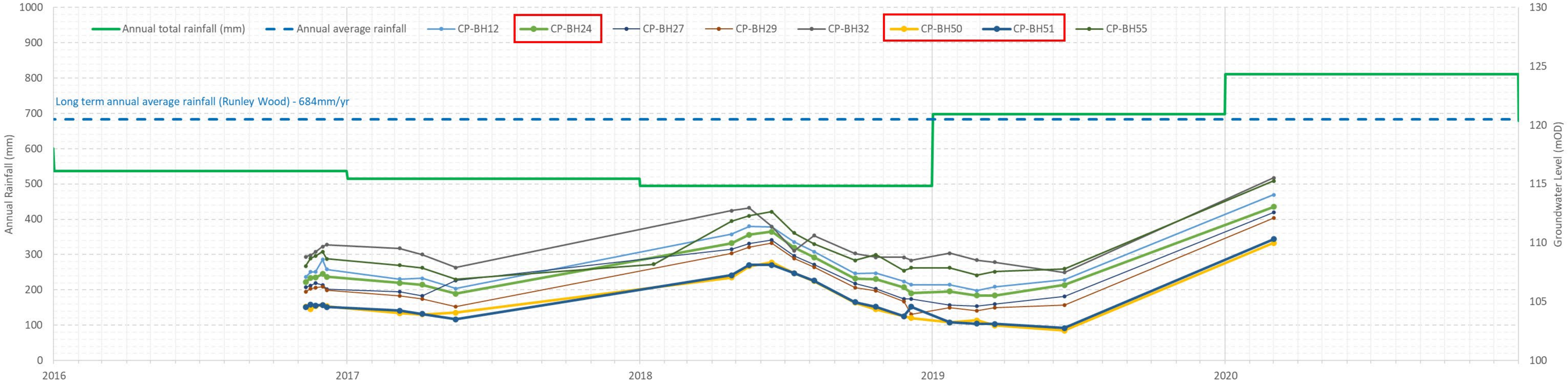


Figure showing the location of proposed infiltration tank 2 and infiltration tank 3 with the coverage of site investigation (boreholes and trial pits, including for areas of dry valley) and monitoring, with the maximum April 2001 groundwater levels from the Environment Agency Hertfordshire groundwater model.

PINS ID	Question / Response



Hydrograph of groundwater levels from Chalk monitoring boreholes in the eastern part of the site in the vicinity of the proposed infiltration tanks with annual rainfall for the period 2016 – 2020.

2. During consultation and engagement with Host Authorities, the risk of historical groundwater flooding was raised which occurred during an extreme event in the 2000/2001 winter period, down gradient of the site. Based on an assessment of the historic winter rainfall record from Runley Woods rainfall gauge, the amount of rainfall that occurred in the winter recharge period (October to March) of 2000/2001 was 662mm, the highest recorded over the period of available data (1990 to 2022), and nearly 80% higher than the average winter rainfall. Over the same 32 year period, the next wettest winter had nearly 110mm of rainfall less than the 2000/2001 event, highlighting the extreme nature of the 2000/2001 rainfall, and by proxy, the observed groundwater levels, and flooding that occurred. During the 2000/2001 event, the historical River Kym(e) reappeared within the dry valley system east of the site and flowed downgradient towards Kimpton (located circa 5km southeast of the Order Limits). The exact location where the River Kym(e) reemerged is not clear, but based on the Environment Agency Hertfordshire Groundwater Model simulations for April 2001 groundwater level contours and local reporting, it is understood that this occurred further downgradient of the site in the area of confluence from two dry valleys. Limited mapping from online sources indicates that the location of the re-emergence was around 750m downgradient of the site, close to Lye Hill Road. However, it is unclear how accurate this information is. Given the extreme nature of the 2000/2001 rainfall, and the distance from the site at which groundwater emerged at the surface, it is considered unlikely that the dry valleys at the site are at risk from groundwater flooding.

3. The Chalk aquifer is a dual porosity system whereby the majority of advective groundwater flow occurs within fissures and fractures rather than the matrix porosity. As a result, permeability tends to be better developed in areas of concentrated run off and infiltration, or where there are structural features (fractures/faults) in the bedrock. Dry valleys often exhibit higher permeability than interfluve areas because of the reasons outlined above. Should the permeability of the Chalk be higher than assumed in the **Hydrogeological Risk Assessment: Drainage [APP-139]** at the location of the infiltration basins, then this could lead to faster movement of the effluent than the assumed average velocity.

   A revised **Hydrogeological Risk Assessment: Drainage [APP-139]** has been updated for Deadline 4 of the DCO examination in response to comments and ongoing engagement with the Environment Agency and also to reflect a proposed change to the preferred drainage arrangements set out in the change notification **[AS-152].** As described in the updated **Hydrogeological Risk Assessment: Drainage [APP-139]**, a sensitivity assessment of the hydraulic conductivity was undertaken to evaluate the effect of increased permeability below the infiltration tanks. The results of this showed that an increased permeability would potentially lead to effluent reaching the water table and compliance/monitoring points quicker but had a limited effect on the effluent concentration. This limited effect on the concentrations is as a result of there being relatively limited retardation or degradation of the contaminants, reaching the compliance points at concentrations similar to those discharged at the infiltration tank. As a result, altering the average velocity utilised in the **Hydrogeological Risk Assessment: Drainage [APP-139]** is considered not to have a significant impact on the overall conclusions presented in the hydrogeological risk assessment.

4. Netherfield spring is marked on OS maps (shown also on the Figure above) as the woodland to the south of the proposed Tank 2 (within the Order Limits), and is located at a topographical elevation of circa 130mOD. Netherfield spring is considered as a potential receptor to the project in Table 20.14 of **Chapter 20 Water Resources and Flood**

PINS ID	Question / Response
	Risk of the ES [AS-031] (under groundwater-surface water interactions). The groundwater data from the Environment Agency Hertfordshire Groundwater Model and site monitoring indicates that the groundwater level at this location is several metres below 130m OD (i.e. any spring is not dependent on the Chalk aquifer during normal conditions).
WE.1.2	**Question:** **Maximum groundwater levels** The discussion of the effect of climate change on groundwater levels in **Section 5.10 [REP1-004]** is noted. 1. Please confirm whether the potential increases in levels from climate change are included in the modelling of maximum groundwater levels? 2. If not, provide an assessment of the implications of this for the thickness of the unsaturated zone over the long term. 3. Does the 40% allowance for climate change referred to in section 6.2.8 of [REP1-004] refer to groundwater levels or surface water runoff? In relation to the maximum groundwater levels **[REP1-004]**: 4. The use of an 'uplifted' dataset to reproduce the high groundwater levels in 2001 is acknowledged (section 5.8 and Appendix D). How have these been validated for the area around the infiltration tanks if there is limited groundwater monitoring? 5. Section 5.8.11 [REP1-004] states that the outputs from the contour mapping are conservative because mounding is occurring due to the current soakaways on site. It is acknowledged that the location of the soakaways would be different from Phase 2 onwards, but groundwater mounding would still occur. How is the infiltration from the new basins incorporated in the predicted maximum levels and the uplift modelling? Appendix 20.3 [REP1-004, section 5.4.3] states that the groundwater flooding event of February 2001 is the only recorded historical event within the dry valleys downgradient of the Proposed Development and that such flooding is only associated with extreme groundwater levels. 6. Does climate change make these events more likely?
	Response: 1 and 2. As discussed in **Section 5.10 [REP1-004]**, the effects of climate change on localised groundwater levels are inconclusive. Climate predictions indicate an increase in winter rainfall, decrease in summer rainfall and an overall increase in extreme weather events. However, how this corresponds to the local groundwater levels on site is difficult to quantify. The Environment Agency Hertfordshire Groundwater Model (as available during DCO preparation) does not include model runs for future climate scenarios, and the closest Chalk borehole assessed as part of the Future Flows project (Ref 1) was Therfield Rectory (a groundwater monitoring borehole with records back to 1883) located 25km north east of the site which showed a range of potential future groundwater level changes (both potential future increases and decreases) dependent on the climate scenario assessed. The range of fluctuation was +3.0m to -1.0m in winter and spring months, or +2.5m to -1.5m in summer months by 2050. Since the 1950's the groundwater level in Therfield Rectory has fluctuated by circa 25m, with seasonal fluctuations in the order of 5 to 10m. The maximum groundwater levels used in the **Hydrogeological Characterisation Report [REP1-004]** are informed by the historical record, with a particular focus on the significantly wetter than average 2000/2001 winter (see WE1.1 response). Taking into consideration projected rainfall changes due to climate change (drier summers and wetter winters), the 2000/2001 winter would still be a significantly wetter than average year. The likelihood of extreme events such as the 2000/2001 occurring may increase as a result of changes to the climate, however it is unlikely that magnitude would be significantly greater, given how exceptionally above average the 2000/2001 rainfall was. Based on the above, an additional uplift to groundwater levels as a result of climate change has not been included in the modelling of maximum groundwater levels. Impacts of climate change are likely to be variable between catchments, and influenced by local hydrogeological conditions and anthropogenic factors (such as future abstraction licensing). The airport is at the upper end of the catchment, and as such groundwater levels will in part be influenced by the drainage of the airport. The airport's drainage is designed for a 1 in 100 rainfall scenario with 40% uplift for climate change, and to discharge at greenfield runoff rates. Any climatic changes to groundwater levels are likely to vary seasonally and annually (e.g. lower groundwater levels during droughts and higher levels during wetter periods). During periods of very high groundwater levels, this would reduce the unsaturated thickness below the infiltration tanks. Within the DCO proposed drainage

PINS ID	Question / Response
	system there is significant storage and attenuation capacity to manage infiltration rates to ground that is not currently available. The effects of climate change are and will become increasingly better understood as the maturity of approach and nature of effects start to manifest as a basis for the detailed design of the infiltration tanks would be carried out in the 2030's. It is noted that **Hydrogeological Risk Assessment: Drainage [APP-139]** has been updated for the Deadline 4 submission, following continuing engagement with the Environment Agency, to include multiple unsaturated thickness scenarios (including a groundwater level scenarios of 1.0m unsaturated thickness) 3. The 40% allowance for climate change refers to surface water runoff only, for the reasons noted above. 4. Groundwater monitoring has been undertaken in a number of monitoring boreholes around Tank 3 (as discussed in the response to WE1.1), where potentially treated water would be discharged. This monitoring is ongoing where boreholes are still accessible to inform the future project baseline. At Tank 2, the closest monitoring borehole is at circa 60m distance. This site-specific data together with the Environment Agency Hertfordshire Groundwater Modelling is considered sufficient to provide a reasonable estimation of the groundwater levels at Tank 2 and inform the concept design. The groundwater levels would be verified at the Tank 2 location, as secured by the **Design Principles [APP-225]** (as submitted at Deadline 5 and which are to be certified by the Secretary of State under article 50 of the DCO and where Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles), which require additional site investigation at the Tank locations. In addition, the design principles require the detailed design of the tanks to include at least 1.0m clearance from maximum potential groundwater levels. 5. The predicted maximum groundwater level contours do not specifically take into account groundwater mounding from the proposed tanks. However, the maximum groundwater levels calculated do take into account the mounding from the existing and long-standing central soakaway, which has raised the groundwater levels locally by several metres. The existing central soakaway comprises two brick lined gravel filled pits, whilst the new infiltration tank 2 and infiltration tank 3 will comprise upstream attenuation storage and engineered tanks to improve the infiltration distribution and performance with better control of the discharge to ground. The **Design Principles [APP-225]** (as submitted at Deadline 5 and which are to be certified by the Secretary of State under article 50 of the DCO and where Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles) include a requirement that the detailed drainage design is to consider the impacts of groundwater mounding, to ensure that the infiltration tanks do not result in groundwater flooding downstream. of groundwater mounding, to ensure that the infiltration tanks do not result in groundwater flooding downstream. 6. As noted in the response to questions 1 and 2, the future climatic impact on local groundwater levels is inconclusive which makes it difficult to quantify the likelihood of groundwater flooding as seen in 2000/2001 occurring more frequently in the future. Groundwater levels will be controlled by longer term (seasonal/annual) recharge conditions opposed to short term extreme rainfall events. Climate projections indicate increased annual precipitation rates and winter recharge, but significantly reduced summer recharge. However the existing soakaway drainage which was part of the up catchment conditions during 2000/2001, will in the proposed DCO drainage be replaced with engineered infiltration tanks with significant on-site storage and attenuation (including also for water to be diverted for reuse on site) to manage discharge to ground to manage the rates of recharge to the aquifer.
WE.1.3	**Question:** **Groundwater mounding and flooding** The Hantush equation has been applied to calculate the height of groundwater mounding from the discharge beneath the infiltration tanks **[REP1-004, Appendix E]**. It is noted that the modelling assumes that discharge from the infiltration tanks is for a single day. 1. Does this reflect the likely pattern of discharge from the tanks? 2. If discharge was continuous or very regular, is this an appropriate model and duration to use? If not, please re-assess the likely effect of the infiltration tanks on water levels in the area. 3. It is noted that the storage in the unsaturated zone has not been included **[REP1-004, section 6.2.15]**. How long would it take before the unsaturated zone storage is 'used up' and the underlying ground saturated?

PINS ID	Question / Response
	4. Could continuous or regular discharge below the infiltration tanks cause the properties of the subsurface to change? If so, how could this affect the effectiveness of the discharge and risk of groundwater flooding? **Chapter 20 [AS-031, section 20.13.6]** states that *'there will be monitoring of levels to ensure no significant flood risk in the area surrounding the infiltration tanks'*. Where is this monitoring detailed and secured in the draft DCO?
	Response: 1. Tank 2 (the main infiltration tank) has been sized so that it remains mostly dry in all but the most severe rainfall events. The actual volumes and durations of discharge are likely to vary significantly, based on rainfall events. A 1-day continuous discharge was modelled to provide a reasonable indication of potential mounding from the infiltration tanks, and does not take into account the unsaturated zone which will limit mounding. 2. The drainage related design principles will be updated into the **Design Principles [APP-225]** document at Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO), where Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles. These drainage related principles require the detailed design to consider the impacts of groundwater mounding, to ensure no potential increase in groundwater flood risk downstream. At the detailed design stage, a more detailed understanding of the temporal and volumetric variations in discharge (taking into consideration rainwater harvesting and reuse etc.) can be confirmed to inform the mounding assessment. As noted above, the tanks have been sized such that they remain mostly dry in all but the most severe rainfall event. As such, it is not envisioned that discharge will be continuous from the tanks. Modelling of a longer timescale (in addition to excluding the unsaturated zone) is considered likely to result in a conservative estimation of groundwater mounding below the tanks. 3. The groundwater table fluctuates seasonally and annually at the tank locations, and the unsaturated thickness may range between 1.0m and 12.0m at Tank 2, and between 1.0m and 15.0m at Tank 3 (1 in 100-year groundwater level to 2017 lowest monitored groundwater level). As noted previously, the Chalk is a dual porosity aquifer comprising both matrix and fracture storage potential. Assuming an effective porosity of 20%, for each 1.0m of unsaturated Chalk there is volumetric capacity for 6,240m^3 of water beneath Tank 2 and 1,440m^3 beneath Tank 3. Water would continually drain through the unsaturated zone to the water table, and then laterally away from below the tank. Assuming the unsaturated zone did not drain, and utilising an infiltration rate of 0.085m/h, one metre of unsaturated storage beneath Tank 2 would fill within 2-3 hours. 4. Continuous or regular discharge below the infiltration tanks has the potential to cause alteration of the hydrogeological properties of the underlying Chalk. Fines within the discharge could gradually infill voids and reduce the permeability of the subsurface whilst dissolution of the Chalk rock could locally increase the permeability. Fines infilling voids can be addressed through maintenance of the infiltration basins, to prevent reduced infiltration impacting the performance of the soakaways. The Chalk in the area is relatively hard, and as such dissolution is not as prevalent as in other areas of the country. The rate at which chalk dissolution would occur below the infiltration tanks, given the intermittent nature of infiltration and the geochemistry of the chalk, is expected to be low. Over the design life of the infiltration tanks it is unlikely that significant dissolution would be apparent. However, should dissolution occur, the permeability of the chalk would likely increase which would reduce groundwater mounding (allow faster dispersion of groundwater) but also reduce the travel time of contaminants to compliance points (this is discussed further in the response to WE.1.1). Maintenance and periodic inspection of the infiltration tanks will need to ensure any dissolution is limited and will not have an impact on the integrity of the tanks. Monitoring of groundwater levels is secured in the drainage related Design Principles which will be updated into the **Design Principles [APP-225]** document at Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO), where Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles. *'The detailed design will include specification of operation and maintenance of the Proposed Development, including monitoring of groundwater levels and quality which would be undertaken throughout the operational lifecycle to prevent deterioration of the aquifer or significant flood risk in the area surrounding the infiltration basins'*

PINS ID	Question / Response
WE.1.4	**Question:** **Design of infiltration tanks 2 (southern) and 3 (northern)** The infiltration rate for both infiltration basins has been assumed to be 0.085 m/hour **[APP-137, Figure LLADCO-3C-CAP-INF-DRN-DR-CE-5510]**. 1. Has this infiltration rate been based on samples from the proposed location of the infiltration tanks? 2. If not, where are the infiltration data derived from? How much confidence is there in this value given the variability of the Chalk? 3. If the infiltration rate in this area, which could potentially vary over orders of magnitude, is less than that used in the modelling, could this have significant implications for the size of the infiltration basin required?
	Response: The infiltration rate has been based on testing across the site within the upper 20m of the Chalk, however these samples were primarily located in the ground investigation boreholes around the landfill area. Additional site investigation is to be undertaken at the location of the infiltration tanks to validate the design assumptions (as secured by the drainage related design principles to be incorporated into the Design Principles **[APP-225]** at Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO), where Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles). The site and regional understanding of the Chalk permeability is considered to provide sufficient confidence for the concept design. As noted in the response to WE.1.1, if the infiltration rate is identified as being lower or higher than assumed in the concept design, additional works can be undertaken locally to alter the permeability (such as acidisation). If the infiltration rate is higher (as can be the case towards dry valleys where the infiltration basins are proposed), then the infiltration basins will work more effectively. In addition to the above, with the preferred design option now for foul and contaminated surface water to discharge to Thames Water, there is potentially additional capacity for attenuation and discharge (as some of the run-off volume would be discharged to Thames Water opposed to ground). Based on the above, it is considered that there are no significant implications on the size of the infiltration basins required.
WE.1.5	**Question:** **Modular tank system** The modular tank system has been developed '*cognisant of the risk of chalk degradation as a result of infiltration'* **[AS-031, section 20.8.20]**. The same section states that the tanks would be perforated rather than granular backfilled to reduce erosion potential. 1. Explain what is meant by 'chalk degradation as a result of infiltration'. 2. Explain why perforated tanks would reduce erosion potential compared to granular backfill.
	Response: 1. Degradation in this instance is referring to potential erosion or dissolution of the underlying chalk by infiltration, as discussed in the response to WE 1.3, Question 4. 2. Granular back fill can collapse creating a void particularly in the wet conditions. This could create voids and new water pathways that can cause further collapse or erosion of the backfill and underlying chalk. This risk is mitigated by the use of perforated tanks. In addition, perforated tanks enable easier inspection and maintenance of the chalk.
WE.1.6	**[The Applicant notes that this question is directed to Thames Water, however the Applicant considers that a response from the Applicant will help provide further clarification]** **Question:** **Thames Water capacity during Phase 1** It is intended that numerous discharge streams, including contaminated surface water and discharge from the long stay car park (P5) would be diverted during Phase 1 to Thames Water infrastructure **[AS-031, section 20.8** and the **Drainage Design Statement, APP-137]**. Please confirm that you are content to take all the flows as described and that you would have sufficient capacity available from the beginning of Phase 1?
	Response:

PINS ID	Question / Response
	In assessment Phase 1, the area of the existing long stay car park (P5) will be reduced by approximately 64,000m^2 to accommodate the proposed apron. There will not be any increase in runoff from P5. There will be further reduction in surface water runoff to Thames Water network from Terminal 1 through collecting and re-cycling of roof rainwater by the proposed rainwater harvesting system. However, a new paved area will be constructed for a new carpark (P7) and apron. The combination of the above factor means a net contributing area increase to the TW network of 11,500m^2. An additional storage tank will be provided under the proposed P7 (8,750m^3) to attenuate the surface runoff from the additional area to a flow rate to 5l/s/ha. The Applicant is awaiting written confirmation from Thames Water that the discharge of 5l/s/ha into the Thames Water network would be acceptable. From the DCO Phase 1 works, only contaminated surface water from the proposed apron would discharge to Thames Water network. An attenuation tank (1,080m^3) will be provided to reduce the flow to Thames Water network.
WE.1.7	**[The Applicant notes that this question is directed to Thames Water, however the Applicant considers that a response from the Applicant will help provide further clarification]** **Question:** **Thames Water capacity during Phase 2** Please confirm (or not) that foul sewage from the Proposed Development would be classified as '*domestic* foul sewage' under Section 94 of the Water Industry Act 1991. If consent were to be granted in 2024, when would funding approval likely be sought from Ofwat for upgrades to meet your statutory obligations and in which Asset Management Plan cycle is the funding likely to fall? Thames Water's D3 response **[REP3-142]** states that '*upgrades at similar sized STWs to accommodate increased flows can take between 5 and 15 years to deliver in full*'. When would this timescale begin? Is this, for example, from the point that the funding becomes available? Your response at D3 **[REP3-142]** states that 'non-domestic foul sewage', including contaminated surface water, could potentially be accepted through a Trade Effluent Consent. 1. The statutory obligation to consider future increase to trade effluent flows discharging into the public sewer is noted. What does 'consider' mean in terms of delivery of the necessary infrastructure? 2. Have the volumes that would need to be discharged under a Trade Effluent Agreement been discussed and/ or agreed with the Applicant? If so, are Thames Water able to accommodate the volumes and, if additional works are required, over what timescale is this likely to be? 3. If additional infrastructure works were necessary, would the Applicant be required to fund these?
	Response: In a letter dated 1 September 2023, Thames Water acknowledged their statutory duty under Section 94 of the Water Industry Act 1991 to use their Permitted Development rights for the necessary sewer network upgrades to accommodate the proposed increase to domestic foul flows within Thames Water network. In the Applicant's meeting with Thames Water, the 'domestic foul flows' noted have been in reference to the foul water from the Terminal and auxiliary buildings facilities, it has not included contaminated surface water. Thames Water is continuing to work with the Applicant to understand the latter's trade effluent requirements, including contaminated surface water runoff. Thames Water is using a standard approach to assess the discharge of any Trade Effluent (including contaminated surface water runoff) from the airport, in having regard to existing and likely future discharges of Trade Effluent. This work is ongoing with initial results disseminated on Friday 20th October 2023. Any infrastructure improvement required by Thames Water is to be assessed as part of the work mentioned above.
WE.1.8	**Question:** **Water supply**

PINS ID	Question / Response
	The catchment has 'no water available' **[REP1-004, Section 4.2.6]**. It is stated that additional water would not be required as part of the development, apart from short term phases during construction. Affinity Water has expressed concerns about being able to supply additional water **[REP1-030]**. 1. Is the commitment to not seek additional water secured in the draft DCO? If not, should it be and can you provide a preferred form of drafting? 2. Have there been discussions between Affinity Water and the Applicant to understand whether the additional water during construction can be provided? Would there need to be any controls on what is required and for how long? 3. If additional water was needed above that agreed between Affinity Water and the Applicant, how would this be addressed?
	Response: The Applicant is aware of the significance of the water resources issues in the region and in Affinity Water's supply area, as expressed by Affinity Water and others, and including the designation by the Environment Agency in 2013 and again in 2021 as an area of 'serious water stress'. The Applicant has, therefore, developed **Drainage Design Statement [APP-137,** being updated for Deadline 4**]** and the **Water Cycle Study [APP-138,** being updated for Deadline 4**]** to respond to this context and help mitigate the impact of the Proposed Development by providing water reduction targets and an approach for addressing the achievement of these targets. The responses below to the ExA Written Question reflect and expand on this approach. 1. Drainage design principles will be updated into the **Design Principles [APP-225]** document that will be submitted for Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO), and Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles. These principles currently include a requirement that 'the detailed design will incorporate water efficiency measures with the aim of minimising any net increase in Affinity Water's supply requirement to the Terminals resulting from the operation of the expanded airport'. The monitoring of water consumption associated with the Proposed Development would be maintained by the Applicant and their agents during operation. The Applicant has discussed with Affinity Water this principle to seek to maintain potable water demand at a given baseline (2019), and is in ongoing discussions with Affinity about a further commitment (within the Side Agreement and/or Protective Provisions and/or Drainage Design Principles), should there be a requirement for an increase, to keep Affinity Water informed and discuss this requirement, and how to address it, with them. 2. Construction water demand has been discussed between the Applicant and Affinity Water. Affinity Water has asked that the Applicant and/or their Contractor notify Affinity Water of the amount of water required for construction and any subsequent variation. Affinity Water has also expressed its desire that prior to making an application, the Applicant and its Contractor endeavour to assess and validate the required demands, as well as demonstrate measures to minimise the demand. Water demand requirements during construction are outlined in the **Construction Method Statement and Programme Report** provided as Appendix 4.1 Construction Method Statement and Programme Report of the ES **[AS-082]**. Construction water use is discussed in section 7.11, which indicates use of a variety of water supply sources, and commits to using sources such as rainwater harvesting to offset mains or tankered water supplies, together with water efficiency through the use of water saving toilets and taps within all temporary site accommodation. This is in line with the overall operational water cycle strategy which aims to reduce potable water use, although it is acknowledged in the discussions between the Parties that construction demands are likely to be different to operational demands. The **Code of Construction Practice [APP-049]** secured by Requirement 8 of Schedule 2 of the Draft DCO sets out commitments to water efficiency during construction within Section 17.6. In addition to the measures highlighted above, this includes: • The lead contractor undertaking a water use profiling exercise in advance of all works, to understand the volumes and quality of the water required, identify potential water sources and align them with the key water demands. As part of the water use profiling exercise, the lead contractor will liaise with Affinity Water Ltd. The volumes of water used will be agreed with Affinity Water Ltd and monitored. Discussions are continuing on this issue and confirmation is expected to be reflected within the Side Agreement and/or Protective Provisions and/or Drainage Design Principles. Required controls and the length of these controls would be discussed as part of this process and incorporated into the construction programme and delivery methods.

PINS ID	Question / Response
	3. As outlined above (Response 1 and Response 2), discussions are ongoing. The Applicant has proposed to Affinity Water that the applicant and/or its Agents (e.g. Contractor) would inform Affinity Water in advance if either construction demand or operational demand were likely to increase from previously agreed values, and that Affinity Water will take any request into consideration, within the prevailing water resources situation. For the construction phase, the **Construction Method Statement and Programme Report [AS-082]** indicates that other sources of water would be available, including tankered water and rainwater, and that other forms of non-potable water could also be considered on a case-by-case basis by the Contractor. Furthermore, the phased construction water needs have been set out, which provides a clear basis for the prior notification and discussions between Affinity Water and the Applicant in regard to how much water is required when. For both construction and operational phases, water efficiency and mains water minimisation would continue to be practiced to reduce the risk that additional water was needed over and above what was agreed between Affinity Water and the Applicant, and the Applicant would demonstrate this to Affinity Water through ongoing monitoring.
WE.1.9	**Question:** **Effects on surface water and groundwater catchments** **Chapter 20 [AS-031, section 20.9.19]** states that the drainage philosophy is to maintain existing net contributions from the surface water catchments to the existing groundwater catchments. However, **Section 5.3.5** of the **Drainage Design Statement [APP-137]** states that '*As a result of the proposed airside drainage infrastructure approximately 9 ha currently discharging into the River Lea catchment will be diverted to the proposed drainage systems which would ultimately discharge into the River Mimram catchment'*. Please explain this apparent anomaly.
	Response: The overall drainage philosophy has been to maintain existing net contributions from the surface water catchments to the existing groundwater catchment, wherever possible, noting also that the groundwater catchment divide is dynamic and that the surface drainage in the area has been modified by the airport and development. In general, the concept drainage design has managed to meet this criteria with the exception of the 9ha (out of 135ha of impermeable area) mentioned in the **Drainage Design Statement [APP-137]**. This exception is to ensure that potential contaminated run-off in the west of the runway is appropriately captured and managed. As part of compliance with previous planning conditions, the Airport Operator are exploring opportunities for improvements to the surface water drainage system for the 9ha catchment in question, which would render this exception to the net contribution as unnecessary. On the basis that the feasibility of these opportunities may not be confirmed before the end of the Examination, this exception was included in the DCO drainage design, to provide a fallback option to ensure that contaminated run-off would be appropriately managed.
WE.1.10	**Question:** **Landfill capping at Phase 2** **Chapter 20 [AS-031, section 20.9.19]** states that the capping layer on the landfill during Phase 2a and 2b would 'close' the potential pathway for contaminants, leading to a very low beneficial impact on the underlying aquifer. The **Drainage Design Statement [APP-137, section 5.8.1]** describes the cap as 'impermeable'. 1. Is it correct to state that no water would infiltrate a low permeability cap over the long term? 2. If not, and given that waste would remain below the ground, should the placement of a cap as being 'beneficial' to the aquifer over the long term be revised? 3. Has an assessment of the potential for increased leaching when the landfill is being excavated been considered? If so, please signpost where this can be found in the application documentation, otherwise please provide an assessment.
	Response: 1. There would always be some minimal infiltration although this would be greatly reduced by the engineered clay capping, which will reduce the generation of leachate. Section 20.9.19 of **Chapter 20 [AS-031]** states that surface water infiltration would be minimised. Clay capping for landfills is standard best practice, and it would be designed to specified degree of low permeability. In areas where there are buildings, the landfill will have concrete slab over it which is more effective at excluding gases and reducing infiltration. Based on the placement of an engineered cap being provided, this is considered a minor low beneficial impact compared to the uncapped baseline condition.

PINS ID	Question / Response
	2. As surface water infiltration would be considerably reduced by the concrete hardstanding and capping layer, it is assessed that there would still be a minor beneficial effect, to the aquifer as there would be reduced leachate generation. 3. The **Appendix 17.5 Outline Remediation Strategy (ORS) [APP-125]** notes: 6.3.1 b excavation process: the excavation process would be controlled to minimise the area of landfill exposed at any one time to reduce the risks associated with vermin, birds, dust, odours. It would also reduce the amount of rainwater which could enter the remaining in-situ waste which could mobilise contaminants. 7.5.1 GI to date have indicated limited leachate however, a leachate control system would be installed, comprising a series of strategic sump points and pipework around the area to be excavated (See ORS Figure 9 for example layout). 8.3.4 Leachate sumps would be installed as part of control measures which would be monitored on a regular basis for levels, volumes and quality such that there can be periodic removal of leachate, as required.
WE.1.11	**[The Applicant notes that this question is directed to the Environment Agency, however the Applicant considers that a response from the Applicant will help provide further clarification]** **Question:** **Landside drainage attenuation tank** It is proposed that an attenuation tank (later a rainwater harvesting tank) of 8,750 m^3 would be placed above the **landfill [APP-137, section 4.4.7]**. **Section 5.8.4** of **APP-137** states that geotechnical surveys indicate the landfill is still settling and any below ground installations would need to allow for differential settlement. Does the EA have any comments on the risks of this operation to groundwater quality, including the consequences of any future tank failure, and the suitability of the proposal?
	Response: The Applicant is continuing to engage with the Environment Agency on the drainage related design principles to ensure that risks can be adequately controlled. The drainage design principles will be updated into the **Design Principles [APP-225]** document at Deadline 5 (which are to be certified by the Secretary of State under article 50 of the DCO), and Requirement 13 provides that the Surface and Foul Water Drainage Plan, to be approved by the local authority, is to accord with the drainage principles in those design principles. Design principles have been included which relate to this matter, including: '*all below ground installations within the area of the former Eaton Green Landfill to include flexible jointing to allow for differential settlement across the site'* and '*all drainage systems (e.g., pipes and tanks) constructed within the area of the former Eaton Green Landfill will be lined with a waterproof membrane*'. The design of tanks generally '*will be designed to the latest industry standards, including but not limited to the requirements of the Building Regulations 'Part H' (Ref. 4.3) and Sewerage Sector Guidance 'Design & Construction Guidance' 2019, (Ref. 4.1) or equivalent at the time'* and '*the detailed design of underground tanks will adopt material specifications to provide chemical resistance and leak prevention*'. These measures would reduce the risk of tanks failing as a result of ongoing settlement, and leakage into the underlying landfill. Ongoing monitoring and pro-active maintenance regime during operation would be considered and discussed with the Environment Agency, during the examination, to identify an approach that mitigates the risk of undetected leakage. Moreover, the indicative location of a landside attenuation tank is shown in the outline design in the draft DCO submissions. The proposed attenuation tank in the assessment Phase 1 would be a temporary feature to be replaced by a permanent rainwater harvesting tank in the assessment Phase 2a. During the detail design, there would be opportunities to explore alternative locations for the permanent tank, either in the shallower areas of the former Eaton Green Landfill, or outside of the landfill boundary. These options could be discussed with the Environment Agency to reach an agreement or a design principle during DCO examination to capture this requirement.

REFERENCES

Ref 1 CEH Future Flows Project. [online]. [Accessed 18 June 2019]