Keuper Gas Storage Project

Preliminary Environmental Information Report – Hydrology and Flood Risk

PREPARED FOR
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ACRONYMS AND ABBREVIATIONS

Acronym	Description
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
DCO	Development Consent Order
DEMP	Decommissioning Environmental Management Plan
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EIA	Environmental Impact Assessment
ERM	Environmental Resources Management

Acronym	Description
ES	Environmental Statement
FRA	Flood Risk Assessment
GPP	Gas Processing Plant
KGSL	Keuper Gas Storage Limited
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
MC	Material Change
NPPF	National Planning Policy Framework
NPS	National Policy Statement
PEIR	Preliminary Environmental Information Report
PWS	Private Water Supply
RBMP	River Basin Management Plan
SuDS	Sustainable Drainage Systems
WFD	Water Framework Directive

7. HYDROLOGY AND FLOOD RISK

7.1 INTRODUCTION

7.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the likely significant effects in water resources and flood risk as a result of the Proposed Development.

7.1.1.1 This chapter is supported by the following figures which are referenced throughout the text where relevant:

- **Figure 7.1: Hydrology and Flood Risk Study Area**;
- **Figure 7.2: Surface Water Hydrology**;
- **Figure 7.3: Fluvial Flood Zones**;
- **Figure 7.4: Surface Water Flooding**; and
- **Figure 7.5: Reservoir Flooding**.

7.1.1.2 This chapter will also be supported by the following Technical Appendices:

- **Appendix 7A: Preliminary Flood Risk Assessment.**

7.2 LEGISLATION, POLICY AND GUIDANCE

7.2.1.1 The legislation, policy, and guidance related to hydrology and flood risk that have been considered in relation to the Proposed Development are outlined below.

7.2.2 LEGISLATION

7.2.2.1 The Water Framework Directive (WFD, 2000/60/EC) establishes the framework for the protection, improvement and sustainable use of all water environments. Its objectives are to protect, enhance, and restore Europe's waters. This directive resulted in the Water Environment (Water Framework Directive) (England and Wales) Regulations 2023, which transposed the WFD into law in England and Wales.

7.2.2.2 The other main legislation taken into consideration in this assessment are the:

- Water Act 2014;
- Land Drainage Act 1991;
- Water Industry Act 1991;
- Water Resources Act 1991;
- Environmental Permitting (England and Wales) Regulations 2016;
- Control of Pollution (Oil Storage) (England) Regulations 2001;
- Environmental Damage (Prevention and Remediation) (England) (Amendment) Regulations 2017;
- The Groundwater (England and Wales) Regulations 2009;
- The EC Nitrates Directive (91/676/EEC);
- The Conservation of Habitats and Species Regulations 2010;

- The Flood Risk (England and Wales) Regulations 2009;
- Flood and Water Management Act 2010;
- Environment Act 2021;
- The Environmental Targets (Water) (England) Regulations 2023;
- Flood and Water Management Act 2010;
- The Water Supply (Water Quality) Regulations 2016; and
- The Private Water Supplies (England) (Amendment) Regulations 2018.

7.2.3 NATIONAL POLICY

- Overarching National Policy Statement for Energy (NPS EN-1) (2024).
- National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2023).
- The National Planning Policy Framework (NPPF).

7.2.4 LOCAL PLANNING POLICY

7.2.4.1 The Proposed Development lies within the administrative boundary of Cheshire West and Chester. Therefore, planning policy of relevance to the assessment includes:

- Cheshire West and Chester Local Plan (Part One) Strategic Policies.
- Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies.

7.2.5 GUIDANCE

- Construction Industry Research and Information Association (CIRIA) Control of Water Pollution from Construction Sites.
- CIRIA Development and flood risk: guidance to the construction industry, C624D.
- British Standard Code of Practice for Earthworks BS 6031 200928.
- CIRIA The Sustainable Drainage Systems (SuDS) Manual (C753).
- CIRIA Environmental Good Practice on Site (C741).
- UK Government. Flood risk and coastal change guidance.
- National Highways' Design Manual for Roads and Bridges (DMRB) LA 113 - Road drainage and the water environment.
- National Flood and Coastal Erosion Risk Management Strategy for England.
- Environment Agency (EA) Peak River flow climate change allowances by management catchment.
- EA Peak Rainfall Climate Change Allowances by Management Catchment.
- Discharges to Surface Water and Groundwater: Environment Permits.

- EA Guidance on Applying for a Water Abstraction or Impounding License.
- NetRegs. Guidance for Pollution Prevention Documents.
- The EA's Approach to Groundwater Protection.

7.3 CONSULTATION

7.3.1.1 This section provides a summary of the consultation undertaken to date regarding the Proposed Development.

7.3.2 EIA SCOPING

7.3.2.1 A Scoping Opinion was sought from the Planning Inspectorate to determine the content of the assessment, as well as the approach and methods to be used, which was set out in the Scoping Report submitted to the Planning Inspectorate on 22 April 2025.

7.3.2.2 A Scoping Opinion was received from the Planning Inspectorate on 5 June 2025.

7.3.2.3 **Table 7.1** summarises how the key issues raised in the Scoping Opinion related to hydrology and flood risk have been addressed.

TABLE 7.1 – SCOPING OPINION RESPONSES

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
Environment Agency	Any land raising or increases in built footprint within the design flood extent (1 in 100 year plus an appt. allowance for climate change) can lead to increases in flood risk elsewhere. Floodplain compensation would be needed for any loss of floodplain storage within this flood extent. Where required, the Flood Risk Assessment (FRA) should consider floodplain compensation on a level for level, volume for volume basis.	A FRA will be submitted as part of the ES and will discuss any potential need for floodplain compensation.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).
Environment Agency	In accordance with NPPF and the sequential test, development should apply a sequential, risk based approach to the location of development, taking into account all sources of flood risk and the current and future impact of climate change, to avoid (where possible) flood risk to people and property. The project should take a sequential approach where it can, if there are any opportunities for development to be	A FRA will be submitted as part of the ES. The outcomes of the FRA will guide the final layout and design of the Proposed Development.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
	located outside of flood zones 2 and 3 and into flood zone 1, this should be prioritised.		the Environmental Statement (ES).
Environment Agency	As the proposal develops, proposed watercourse crossings should be confirmed. It may be beneficial to have a Crossing Register with the proposed crossing placement and type. We would generally oppose the culverting of any watercourses and instead recommend the installation of a clear-span bridge crossing.	No new watercourse crossings are proposed as part of the Material Change / Proposed Development.	New watercourse crossings are not relevant to the Proposed Development and are not discussed further in this PEIR. Existing crossings will be modelled as part of the FRA and will be discussed further in **Appendix 7A: Flood Risk Assessment** which will be provided as part of the ES.
Environment Agency and The Planning Inspectorate	Please refer to the latest published Flood Map for Planning and Risk of Flooding from Surface Water datasets available.	Noted. These datasets have been consulted as part of the baseline of this PEIR chapter and will be used to inform the FRA.	Section 7.8 of this chapter.

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
Environment Agency	Paragraph B.3.3.6 (of the Scoping Report) refers to flood defenses in terms of natural high ground along the banks of Puddinglake Brook with a standard of protection of 20%. Ensure that these elevations are appropriately captured to understand when and where flooding occurs to inform the Proposed Development and any mitigation measures.	A detailed topographical survey is being undertaken as part of the FRA.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).
Environment Agency	Paragraph B.3.3.7 refers to the presence of drainage ditches in the Study Area along with areas of ponding and other flow paths. Ensure that these drainage features are appropriately represented within any hydraulic modelling to understand when and where flooding occurs to inform the Proposed Development of any mitigation measures.	A detailed topographical survey is being undertaken as part of the FRA. In addition, ERM hydrologists will conduct a Site survey. Combined with the use of Light Detection and Ranging (LiDAR) for the Site, this will ensure all flow paths and drainage ditches are identified and included in the hydraulic modelling where relevant.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
Environment Agency	Ensure that any existing modelling used is assessed for suitability and updates made to appropriately represent current and future flood risk. This may include updates to peak flow estimates and the hydraulic model and should consider additional data and changes to methods and software.	Updated flood modelling and peak flow analysis will be undertaken as part of the ES.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).
Environment Agency and The Planning Inspectorate	The Applicant should carry out a WFD Assessment.	Noted. An assessment will be carried out as part of the ES.	**Appendix 7B: WFD Assessment** which will be provided as part of the ES.
	We have not been able to find any reference to proposed utility crossings as part of the Proposed Development. No detail is provided on installation method, however it is presumed these would be carried out via trenchless methods (e.g., horizontal directional drilling. The Applicant should provide details of proposed trenchless crossings of surface water bodies incl.	No new watercourse crossings are proposed as part of the Material Change / Proposed Development.	New watercourse crossings are not relevant to the Proposed Development and are not discussed further in this PEIR. Existing crossings will be modelled as part of

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
	anticipated maximum design parameters and proposed mitigation.		the FRA and will be discussed further in **Appendix 7A: Flood Risk Assessment** which will be provided as part of the ES.
Environment Agency	The report makes no reference to a wheel wash area. Provide a plan to prevent/mitigate sediment pollution to surface waters from vehicle movements on Site.	Chapter 12: Traffic and Transport of the Consented Development ES stated suitable wheel washing facilities would be secured through a S106 agreement and be supported by the Construction Environmental Management Plan (CEMP). Sedimentation has been scoped into this assessment and the need for wheel washing is reiterated in Section 7.9.2 of this chapter.	Section 7.10.2 of this chapter.

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
Environment Agency	No assessment of whether discharge permit needed for removal of x2 ponds. The Applicant must provide details of how pond water will be disposed of/discharged and assess whether a discharge permit is needed.	It has not been confirmed at this stage if the pond water will be discharged to an onsite watercourse or disposed of off-Site. Depending on the method selected the relevant mitigation will be outlined in the EA. This will include consideration of the relevant consent/permits/licenses which the Applicant will need to obtain.	Section 7.15 of this chapter discusses the mitigation and Section 7.17 the assessment of effect in relation to the ponds.
Environment Agency	Operational water demands have not been identified; however associated development identifies the need for further saturation of weak brine from initial excavation. It is assumed that volumes abstracted are also within the quantities licensed above. We recommend early engagement with the National permitting service pre-application service should there be any uncertainty about whether the licenses cover the intended uses of water.	Approximately 22,000 m^3 per day of water will be supplied from current EA licensed abstraction points for use in the solution mining to the underground gas storage caverns. The abstraction will take place under existing consents for water abstraction, namely 25/68/003/085	Section 7.19.1.2 of this chapter.

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
		and 25/068/002/145, held by IEL. At the time of the DCO application, it was confirmed by the Applicant (KGSL) that there is sufficient water availability to meet the Project's abstraction requirements.	
	We recommend a basic water supply strategy to clarify all consumptive activities and to options appraise the sources of supply available to the project. This will also help inform of any license changes or new applications required.	The anticipated water consumption of the construction, operation and decommissioning of the Proposed Development will be set out in the ES.	The anticipated water consumption of the construction, operation and decommissioning of the Proposed Development will be set out in the ES.
Environment Agency	The quantity of water required to decommission the Proposed Development is unclear and volumes stated do not correspond to licensed amounts available to the scheme. We consider that a future source of supply should be clarified at DCO stage rather than left undetermined until decommissioning	Details of water consumption for all stages of the Proposed Development will be set out in the ES and be considered alongside the existing known abstraction rates.	Details of water consumption for all stages of the Proposed Development will be set out in the ES and be considered alongside the existing

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
			known abstraction rates.
The Planning Inspectorate	The ES should distinguish between flood zones 3a and 3b to determine which parts of the Proposed Development are in areas of 'high probability of flooding' and 'functional floodplain'. This should be shown on a figure which also specifies what infrastructure would be in which flood risk zones.	Noted. The ES will distinguish between flood zones 3a and 3b and produce a figure showing this along with what infrastructure would be in which flood risk zones.	This figure will be produced and presented along with the ES.
The Planning Inspectorate	The Applicant should make efforts to agree the scope of the FRA with relevant consultation bodies, including the EA. The results of the FRA should inform the ES.	Relevant consultation bodies, including the EA will be contacted to discuss the scope of the FRA. The ES will be informed by the results of the FRA.	**Appendix 7A, Flood Risk Assessment** will accompany the ES as a Technical Appendix. The ES will provide evidence of consultation with relevant bodies.

7.3.3 OTHER CONSULTATION

7.3.3.1 Details of consultation to date undertaken outside of the Scoping Opinion are summarised below in **Table 7.2**.

TABLE 7.2 – SUMMARY OF OTHER CONSULTATION

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
Environment Agency (call on 23 July 2025)	A sensitivity test is needed on the climate change uplift used in the hydraulic modelling. As well as modelling the 67% climate change allowance, the upper limit 106% uplift should also be modelled.	This will be incorporated into the hydraulic model runs as part of the FRA for the ES.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).
	Watercourse crossings should be taken into account. It was agreed on the call that modelling the current watercourse crossings will be a conservative approach as any upgrades will need to be designed to accommodate the 1 in 100-year (1% annual probability) flood.	Watercourse crossings will be modelled with blockage scenarios.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).

Consultee	Issue Raised	How it has been addressed	Where it's addressed in the PEIR
	The Proposed Development should be designed to remain operational without increasing flood risk elsewhere to the 1 in 100-year (1% annual probability) flood, including an allowance for climate change. The appropriate climate change allowance for the Proposed Development is the Higher Central. The FRA should also consider the Upper Climate Change Allowance.	Both climate change allowances will be incorporated into the hydraulic model runs as part of the FRA. The FRA will set out how the Proposed Development will be designed to remain operational without increasing flood risk elsewhere to the 1 in 100 year (1% annual probability) flood, including an allowance for climate change.	**Appendix 7A: Preliminary Flood Risk Assessment** has been provided as part of the PEIR. The full detailed flood risk assessment (FRA) will be provided in **Appendix 7A: Flood Risk Assessment** of the Environmental Statement (ES).

7.4 BASIS OF THE ASSESSMENT

7.4.1.1 **Chapter 2: Proposed Development** presents a summary of the material changes for the Proposed Development compared to the Consented Development.

7.4.1.2 An assessment of effect has only been made where the Proposed Development is likely to result in new impacts compared to the Consented Development.

7.4.2 GENERAL CONSIDERATIONS

7.4.2.1 Modifications to the Consented Development which are likely to give risk to impacts on hydrology and flood risk are:

- Increase in Gas Processing Plant (GPP) plot area;
- Construction of a utility compound; and
- Maintenance storage building which will hold spare parts and equipment.

7.4.3 CONSTRUCTION

7.4.3.1 The construction of the above elements of the Proposed Development will require excavation which will generate sediment which could be washed towards watercourses, and are located within the floodplain so could be at risk of flooding during construction

7.4.4 OPERATION AND MAINTENANCE

7.4.4.1 The Proposed Development will introduce greater areas of hardstanding and thus run-off, which may impact downstream flood risk. They are also located in the floodplain of the Puddinglake Brook and are potentially at risk of flooding.

7.4.5 DECOMMISSIONING

7.4.5.1 Decommissioning is not considered to be materially different from the Consented Development.

7.5 ASSESSMENT METHODOLOGY

7.5.1.1 This section sets out the scope and methodology for the assessment of the impacts of the Proposed Development on hydrology and flood risk from the construction, operation and maintenance, and decommissioning phases.

7.5.2 SCOPE OF ASSESSMENT

7.5.2.1 In line with the Scoping Report and those issues raised through the Scoping Opinion, this chapter will consider the following potential effects on hydrology and flood risk as a result of the Proposed Development:

- Reduction in surface water quality as a result of sedimentation and resulting implications to WFD watercourses;

- Changes to water quantity/run-off as a result of increased areas of hardstanding (areas provided in **Chapter 2: Proposed Development Description**) and thus changes in flood risk; and
- Consideration of the effects associated with the removal of two onsite ponds.

7.5.3 ELEMENTS SCOPED OUT OF ASSESSMENT

7.5.3.1 In line with **Appendix 1A: EIA Scoping Report** and **Appendix 1B: EIA Scoping Opinion** the following issues have been scoped out of assessment:

- Accidental spills or leaks and use of construction vehicles which could lead to direct or indirect surface water contamination. As per the Consented Development ES, with implementation of the appropriate pollution prevention mitigation measures which would be set out in the CEMP, and the use of wheel washing facilities, no significant impacts are anticipated. The changes forming the Proposed Development do not alter these conclusions.
- Potential spill or accidental leakage of drilling fluids and/or process water which could contaminate surface waterbodies. As per the Consented Development ES, with implementation of the appropriate pollution prevention mitigation measures which would be set out in the CEMP, no significant impacts are anticipated. The changes forming the Proposed Development do not alter these conclusions.
- Pollution risks during operation from the Proposed Development. As per the Consented Development ES, with implementation of the appropriate pollution prevention mitigation measures (as set out in Section 7.5.8 of the Consented Development ES), no significant impacts are anticipated as a result of this material change forming the Proposed Development.
- Discharge of foul water from welfare facilities and disposal of process water which could negatively impact surface waterbodies. As per the Consented Development ES and **Chapter 2: Development Description** of this PEIR, a Waste Management Plan will be in place and all waste will be transported off-Site and disposed of at a suitable and licensed waste management facility.

7.5.4 STUDY AREA

7.5.4.1 The Study Area for hydrology and flood risk comprises the Site boundary (the same as the Consented Development ES). Any water resources not within the Study Area but which are hydrologically connected to the Proposed Development will be discussed where relevant. The Study Area is shown on **Figure 7.1: Hydrology and Flood Risk Study Area**.

Site Boundary

Proposed Development Infrastructure

LACH DENNIS AND LOSTOCK GREEN CP

BYLEY CP

0 100 200 300 400 500

Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: BMcl
DATE: 20/08/2025	APPROVED:

Figure 7.1
Hydrology and Flood Risk Study Area

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C7 - Hydrology and Flood Risk Study Area - A01

7.5.5 BASELINE DESKTOP METHODOLOGY

7.5.5.1 The hydrology and flood risk baseline within the Study Area have been established using the following datasets:

- OS Mapping;
- EA Catchment Data Explorer;
- EA Flood Map for Planning;
- EA Surface water Map;
- EA Reservoirs Map;
- EA Recorded Flood Outlines;
- EA Historic Flood Map;
- EA AIMS Spatial Flood Defenses; and
- Hydraulic modelling undertaken as part of this assessment.

7.5.6 BASELINE SURVEY METHODOLOGY

7.5.6.1 A Site walkover was conducted by two suitably qualified ERM hydrologists on the 29 July 2025 to groundtruth the desktop baseline water environment and capture any additional hydrological constraints.

7.5.7 FLOOD RISK ASSESSMENT METHODOLOGY

7.5.7.1 The NPPF requires all possible forms of flood risk to be considered within FRAs and lists six forms of flooding that should be assessed. As such, **Appendix 7A, Preliminary Flood Risk Assessment** has been submitted as part of the PEIR, and the full detailed assessment will be completed as part of **Appendix 7A: Flood Risk Assessment** within the ES.

7.5.7.2 The FRA will assess the risk of flooding in the Study Area and the potential to increase flood risk elsewhere in relation to each of the different forms of flooding listed within the NPPF; fluvial, surface water, tidal, groundwater, sewers and artificial bodies.

7.5.7.3 The fluvial flood risk from the Puddinglake Brook will be assessed using a hydraulic model to identify the critical flood level from the watercourse for a 1 in 100-year plus climate change scenario. The hydraulic modelling approach will be set out in a method statement which will be provided to the EA and Lead Local Flood Authorities (LLFAs) and provided as an appendix to the FRA.

7.5.7.4 The FRA will assess the potential risk of flooding which accounts for increases in rainfall and river levels due to climate change. The climate change allowance for the catchment which the Study Area is located within is 67%.

7.5.7.5 The Proposed Development will be designed to remain operational without resulting in an increase in flood risk elsewhere in a 1 in 100-year plus climate change event, using outputs from flood modelling of an appropriate level of detail based on EA guidance. Where there is a

potential increase in flood risk elsewhere or a reduction in floodplain storage capacity suitable flood storage mitigation measures will be incorporated into the design and quantifiably assessed if required.

7.5.7.6 As part of the FRA the sequential design approach will be applied to locate infrastructure within Flood Zone 1 where feasible, however it is possible that some areas comprising infrastructure will be located within Flood Zone 2 and 3. Where it is not possible to locate infrastructure within Flood Zone 1, hydraulic modelling outputs will be used to identify flood extents and ensure infrastructure is not located within Flood Zone 3b (where modelling results provide flood extents for a 1 in 30-year event).

7.5.7.7 Where infrastructure is located within Flood Zone 2 or 3, the FRA will include a suitable assessment to outline how the requirements of the sequential and exception test have been satisfied.

7.5.8 METHODOLOGY FOR ASSESSMENT OF EFFECTS

7.5.8.1 The assessment methodology uses a source-pathway-receptor approach and the assessment of effect is based on the identification of receptor sensitivity, magnitude of impact, and resulting significance of effect as set out in the following sections.

Sensitivity of Receptors

7.5.8.2 The sensitivity of hydrological receptors to impacts has been assessed in line professional judgement, best practice guidance, and legislation.

7.5.8.3 The framework for assigning an overall level of sensitivity is outlined in **Table 7.3**.

TABLE 7.3 – FRAMEWORK FOR DETERMINING THE SENSITIVITY OF RECEPTORS

Sensitivity	Receptor
High	The receptor is of international or national importance, is of high environmental value, with limited ability to absorb change without altering its present character.
Medium	The receptor is of regional importance, has a medium environmental value, and some ability to absorb change without altering its present character.
Low	The receptor is of local importance and scale, tolerant of change without detriment to its character, and is of low environmental value and rarity.

Magnitude of Impact

7.5.8.4 The magnitude of potential impacts will be identified through consideration of the activities associated with the Proposed Development, the degree of change to baseline conditions it affects, and the duration and reversibility of a resultant effect, in accordance with best practice guidance and legislation. The magnitude of impact on the receptors is presented in **Table 7.4**.

TABLE 7.4 – FRAMEWORK FOR DETERMINING THE MAGNITUDE OF IMPACT

Magnitude of Change (Impact)	Description
High	Results in a substantial loss or change of quality and quantity and the integrity of the resource. Following development, the baseline situation is fundamentally changed.
Medium	Change to the quality and quantity of the resource but it is not fundamentally changed.
Low	Following development, the baseline situation is largely unchanged with barely discernible differences to resources.
Negligible	Impacts unlikely to be detectable.

Significance of Effect

7.5.8.5 The significance of effect is determined by assessing the potential magnitude of impact on the receptors against the sensitivity of the receptor **Table 7.5** presents the matrix showing the significance of effects. Moderate or Major effects are considered Significant in EIA terms.

TABLE 7.5 – FRAMEWORK FOR DETERMINING THE SIGNIFICANCE OF EFFECT

Receptor Sensitivity	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

7.5.9 ADDRESSING UNCERTAINTY

7.5.9.1 The baseline conditions have been collated from various publicly available sources, which are assumed to be accurate and up to date.

7.5.9.2 This assessment relies on the assumption that the schedule of good practice measures set out in this chapter, supporting technical appendices, and those in the Consented Development ES will be implemented through the Updated Detailed CEMP for the Proposed Development and other supporting environmental management plans.

7.6 BASELINE

7.6.1.1 The following sections outline any changes in the baseline hydrology and flood risk conditions within the Study Area since submission of the Consented Development ES.

7.6.1.2 Where there have been no changes to the baseline conditions these have not been discussed further in this PEIR.

7.6.2 SITE WALKOVER

7.6.2.1 A Site walkover was conducted by two ERM hydrologists on the 29 July 2025. Conditions on the day were overcast with a light drizzle of rain.

7.6.3 SITE CONTEXT

7.6.3.1 The Site is located approximately 1 km northeast from the village of Byley in a rural area with the Stublach Gas Storage adjacent to the Site. The topography of the Site generally falls from east to west and varies from approximately 30 m Above Ordnance Datum (AOD) in the northwest to 40 m AOD in the east, with the surrounding area being relatively flat-lying.

7.6.4 HYDROLOGY

7.6.4.1 The hydrology of the Study Area remains as per Section 7.3.33 of Chapter 7 of the Consented Development ES.

7.6.4.2 The Site sits within the Weaver Gowy (Puddinglake Brook and Wade Brook) WFD catchments, with the Puddinglake Brook being the EA ‘Main River’ which flows through the centre of the Site into which several ‘Ordinary Rivers’ discharge.

7.6.4.3 Since submission of the Consented Development the status of the Puddinglake Brook which runs through the Study Area has been downgraded from Moderate to Poor ecological status and has a chemical status of "Fail" under the 2022 EA River Basin Management Plan (RBMP).

7.6.4.4 The Puddinglake Brook was found to be overgrown, incised, and low flowing at the time of the Site visit. Further details on the watercourse will be provided in the ES.

7.6.4.5 There are also several small ponds on Site. The ponds are fenced off within the agricultural fields and varied in size and depth. Further details will be provided in the ES.

7.6.4.6 The hydrology of the Study Area is shown in **Figure 7.2: Surface Water Hydrology**.

Site Boundary
Proposed Development Infrastructure
Surface Watercourses
Surface Waterbodies
Surface Water 50 m Buffer
Waterbody Status:
Bad
Poor
Moderate

Puddinglake Brook
Dane (Wheelock to Weaver)
River Dane (Cow Brook to Wheelock)
River Wheelock (Fowle Brook to Dane)
River Croco

0 200 400 600 800 1,000
Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: BMcl
DATE: 20/08/2025	APPROVED:

Figure 7.2
Surface Water Hydrology

ERM
storengy
A company of ENGIE

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C7 - Surface Water Hydrology - A01

7.6.5 FLOOD RISK

7.6.5.1 The EA river flood maps were updated in May 2025. They show that the Site falls within Flood Zones 2 and 3 (**Figure 7.3: Fluvial Flood Zones**). Flood Zone 2 is defined as land that has an annual probability of flooding every year of 1 in 100 to 1 in 1,000 and Flood Zone 3 is defined as land that has an annual probability of flooding every year of 1 in 100 or less.

7.6.5.2 The EA spatial flood defences dataset indicates that along the banks of Puddinglake Brook there are flood defences which are categorised as natural high ground. The defences are identified as having a standard of protection of 20%, indicating the natural high ground provides protection against flood events with a 20% annual occurrence probability.

7.6.5.3 The EA surface water map indicates the Study Area is at risk of pluvial flooding (**Figure 7.4: Surface Water Flooding**). In some areas the indicative flood extents follow the course of the Puddinglake Brook and other drainage ditches in the Study Area, however there are areas of ponding and other flowpaths across the Study Area indicated in the mapping.

7.6.5.4 The Study Area is underlain by a low productivity aquifer with bedrock of mudstone, siltstone, and sandstone, and the overlying superficial geology is glacial till deposits. The hydrogeological baseline of the Study Area is covered in more detail in **Chapter 6: Geology and Ground Conditions**. As per the FRA submitted as part of the Consented Development ES, the Study Area is not considered at risk of groundwater flooding.

7.6.5.5 The EA reservoirs map shows potential risk of reservoir flooding from the former quarries at Allostock which now form large lakes following the end of extraction (**Figure 7.5: Reservoir Flooding**). The indicative inundation area is north of and outside of the Study Area, therefore the Study Area is not anticipated to be at risk of flooding from this source.

7.6.6 WATER RESOURCES

7.6.6.1 Groundwater abstractions are discussed in **Chapter 6: Geology and Ground Conditions**.

7.6.6.2 It is anticipated that no Private Water Supplies (PWSs) exist within the Study Area, as residential properties are predominantly located along primary transport routes with public sewerage infrastructure. Given the urban context and presence of established sewerage infrastructure, these properties are assumed to be served by the public water and wastewater network, provided by United Utilities, the statutory water undertaker for the region. This will be confirmed within the ES and details of surface water supplies will be supplied where relevant.

Site Boundary
Proposed Development Infrastructure
Flood Map Zone 2
Flood Map Zone 3

0 200 400 600 800 1,000
Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: BMcl
DATE: 20/08/2025	APPROVED:

Figure 7.3
Flood Risk: Fluvial

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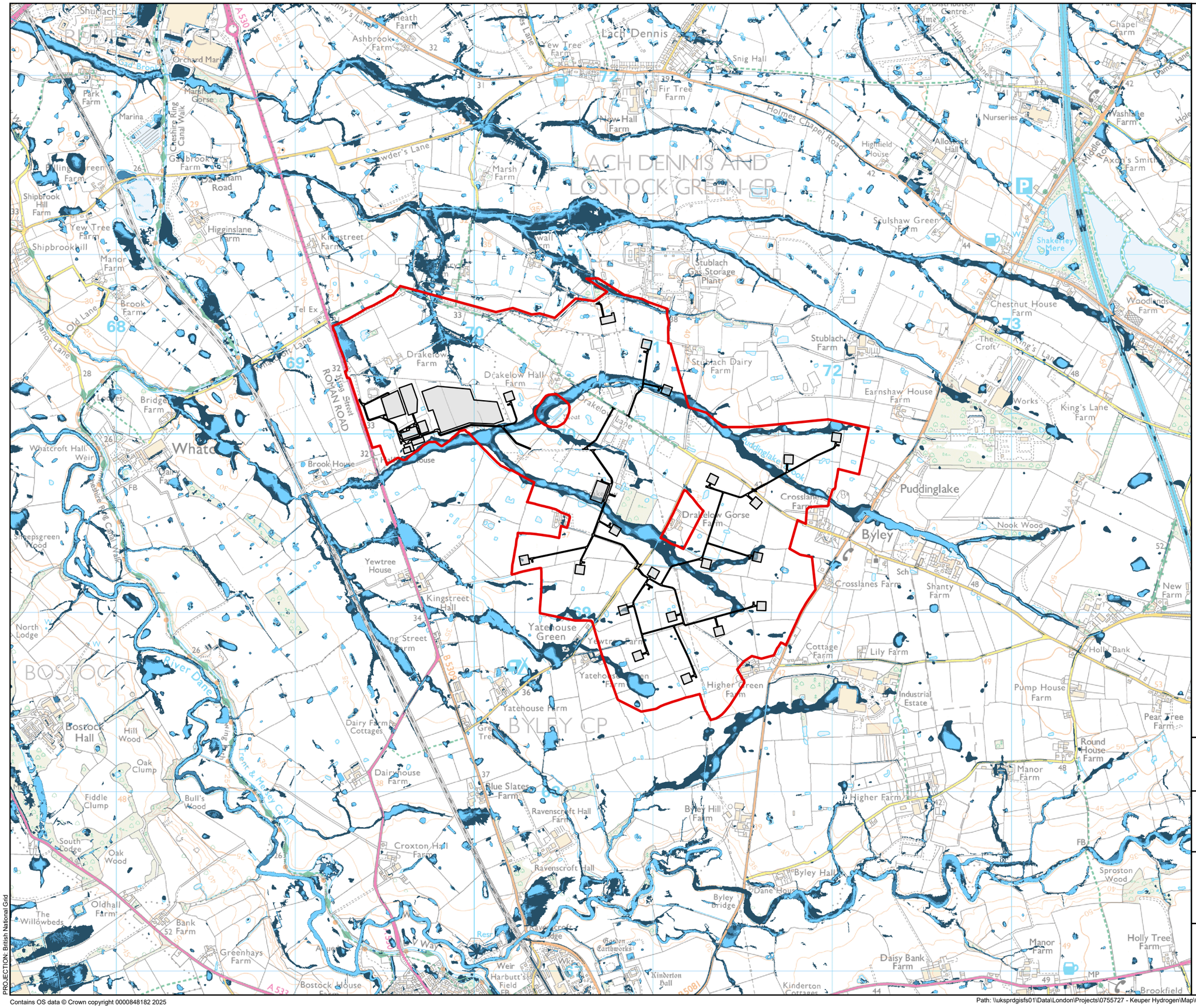
PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C7 - Flood Risk Fluvial - A01



SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: BMcl
DATE: 20/08/2025	APPROVED:

Figure 7.4
Flood Risk: Pluvial

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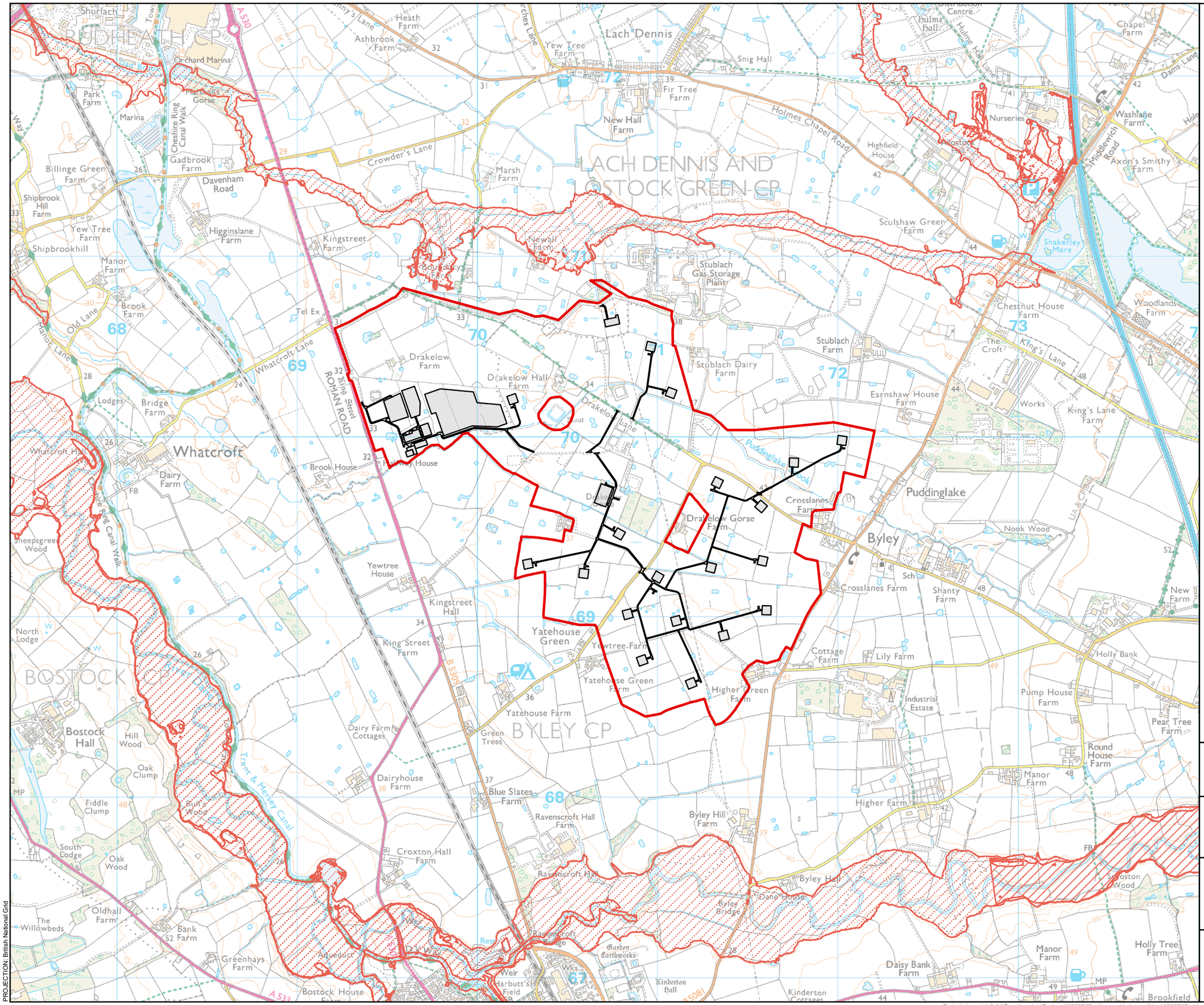
PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C7 - Flood Risk Pluvial - A01



SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: BMcl
DATE: 20/08/2025	APPROVED:

Figure 7.5
Flood Risk: Reservoir Inundation

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C7 - Flood Risk Reservoir Inundation - A01

7.7 MITIGATION

7.7.1.1 The mitigation set out in Chapter 7 of the Consented Development ES will be followed. A brief summary is given in the following sections, plus any additional mitigation required as a result of the Material Changes.

7.7.2 CONSTRUCTION

7.7.2.1 The mitigation set out in Section 7.5.2 onwards of the Consented Development ES will be followed. This includes the update of the CEMP and any other supporting environmental management plans that will be updated and adhered to on Site. The CEMP will detail the specific measures to be in place to control surface water run-off, drainage, and sedimentation and erosion control measures needed during the construction phase of the Proposed Development.

7.7.2.2 Runoff from the Site will be controlled through on-Site drainage systems which will be based on SuDS design principles. SuDS replicate natural drainage patterns and have a number of benefits including:

- Attenuating run-off and thus reducing peak flows and potential downstream flooding issues; and
- Treating run-off to reduce sediment loads and pollution volumes in run-off before it is discharged back into natural drainage network.

7.7.2.3 A vegetation strip will be maintained along all watercourses and where vegetation has been removed it will be re-instated or re-seeded as soon as practicable. Maintenance of vegetation acts to slow runoff from the Site and reduce sedimentation of watercourses.

7.7.2.4 As set out in Chapter 12: Traffic and Transport of the Consented Development ES appropriate best practice mitigation will be in place to prevent sediment being transported and washed towards watercourses, and will be secured through the existing S106 agreement and the CEMP.

7.7.2.5 Two ponds on Site are to be infilled. It is assumed the water from the ponds will either be disposed of off-Site at an appropriate waste management facility or be discharged to an on-Site watercourse. The Applicant will be responsible for obtaining the necessary consent/ permits/ licenses for disposal of this water. The Applicant will also be responsible for testing water quality, treating contaminated water, or reducing the sediment load of water as required before discharge into watercourses. Details of what is required in each case will be outlined further in the ES.

7.7.2.6 Major works will be minimised during storm events where there is a risk of flooding. The contractor will sign up to EA Floodline alerts and a wet weather / flood risk protocol will be in place with works to cease during prolonged rainfall or where flood risk is high. Temporary bunding will be provided, as required, to reduce the risk of sediment

transport to watercourses during storm events, and vegetation strips will be maintained along all watercourses which will act as a natural sediment capture during construction.

7.7.3 OPERATION AND MAINTENANCE

7.7.3.1 The operational mitigation set out in Section 7.5.8 of the Consented Development ES will be followed.

7.7.3.2 The Proposed Development will include a surface water drainage strategy which will be designed in accordance with SuDS principles and best practice guidance to attenuate surface water runoff from hardstanding surfaces, and control runoff from the Proposed Development so that there is not an increase in runoff rates compared to the existing greenfield runoff. An Outline Surface Water Drainage Strategy will be provided as part of the ES.

7.7.4 DECOMMISSIONING

7.7.4.1 As set out in **Chapter 4: EIA Methodology** of this PEIR, the decommissioning activities are expected to be very similar to those proposed during the construction phase of the Proposed Development, and will be carried out in accordance with management and mitigation measures outlined in the Decommissioning Plan (including a Decommissioning Environmental Management Plan (DEMP)), it is generally assumed that the environmental effects associated with decommissioning will be of equal (or lesser) significance than those expected to occur during construction, unless otherwise stated.

7.7.4.2 The mitigation measures in the DEMP would adhere to all relevant guidance and legislation in relation to hydrology and flood risk that is in place at the time of decommissioning, noting this may be different from current standards.

7.8 ASSESSMENT OF EFFECTS

7.8.1.1 As set out in Section 7.5.2, assessment of effect has been made in relation to those impacts that are anticipated to be materially different to the Consented Development.

7.8.1.2 The assessment of effect takes into consideration the mitigation outlined above.

7.8.2 CONSTRUCTION

Sedimentation

7.8.2.2 Sediment loading because of construction activity has the potential to negatively impact on-Site watercourses (including the WFD designated Puddinglake Brook) impacting water quality, aquatic ecology and/or the watercourse geomorphology.

7.8.2.3 Sediment loading because of erosion can occur from excavations, ground disturbance, overburden stockpiling, the mobilisation of stockpiled materials, ground compaction, access track runoff, and site traffic. Areas particularly at risk of erosion and sedimentation are those where large earthworks are taking place. In addition, water discharged from the on-Site ponds which are to be removed may contain high volumes of sediment.

7.8.2.4 Watercourses on-Site are of high sensitivity and sedimentation could result in high magnitude impacts during the construction period and thus in the absence of mitigation could result in a Major impact.

7.8.2.5 However, as set out in Section 7.15, site specific sediment management measures will be set out in the CEMP and implemented on Site to limit the potential for sedimentation of watercourses. As such, the magnitude of impact is reduced to Negligible and of Minor effect which is **Not Significant**.

Runoff and Flood Risk

7.8.2.6 The Site is at risk of river and surface water flooding during construction. In particular, the utility compound, access tracks, and flowlines are all within Flood Zone 3 and therefore at risk of flooding during construction. With a wet weather protocol in place as set out in Section 7.15.6.1 of this chapter, the risk of flooding to construction areas will be minimised such that the magnitude of impact is Low and the effect **Not Significant**.

7.8.2.7 The introduction of hard standing areas, access tracks, construction compounds, soil compaction, removal of vegetation, and trenching for gas lines has the potential to increase runoff volumes and rates through reduced infiltration. This in turn can increase peak flows in hydrologically connected watercourses to the Site which has the potential to increase flood risk downstream of the Site, as well as having effects on aquatic ecology and fluvial geomorphology.

7.8.2.8 The removal of two ponds as part of the Proposed Development may remove areas of floodplain storage. Implications of pond removal will be discussed with the EA and LLFA as part of the ES process.

7.8.2.9 With suitable drainage management measures in place the magnitude of impact on flood risk and watercourses of high sensitivity is reduced to Negligible, and therefore Minor effect which is **Not Significant**.

7.8.3 OPERATION AND MAINTENANCE

Runoff and Flood Risk

7.8.3.2 The Material Changes outlined in **Chapter 2: Proposed Development Description** and summarised in Section 7.4, will result in an overall increase in the area of impermeable surfaces on site and therefore an increase in runoff and flood risk.

7.8.3.3 **Appendix 7A: Flood Risk Assessment** to be supplied as part of the ES will assess the operational flood risk in the Study Area which will inform the detailed design. The Applicant will also produce a detailed drainage design to control runoff from the Site.

7.8.3.4 With consideration of the FRA and drainage strategy the magnitude of impact on flood risk of high sensitivity is reduced to Negligible, and therefore Minor effect which is **Not Significant**.

Operational Water Usage

7.8.3.5 Approximately 22,000 m^3 per day of water will be supplied from current EA licensed abstraction points for use in the solution mining to the underground gas storage caverns. The abstraction will take place under existing consents for water abstraction, namely 25/68/003/085 and 25/068/002/145, held by IEL. At the time of the DCO application, it was confirmed by the Applicant (KGSL) that there is sufficient water availability to meet the Project's abstraction requirements. As such the effect would be **Not Significant**.

7.8.4 DECOMMISSIONING

7.8.4.1 Decommissioning effects are expected to be very similar to those during the construction phase of the Proposed Development, and the sensitivity of receptors and potential magnitude of impact is assumed the same as during construction. Therefore, with implementation of a DEMP, it is anticipated the effects on hydrology and flood risk will be Negligible and therefore of Minor effect and **Not Significant**.

7.9 SUMMARY OF CUMULATIVE EFFECTS

7.9.1.1 The greatest potential for cumulative effects on the water environment arises when the construction phase of another development overlaps with the construction phase of the Proposed Development and is within the same hydrological catchment. The effect to the water environment during the operational phase is greatly reduced due to the reduced levels of ground disturbance following construction.

7.9.1.2 The ES will undertake a cumulative assessment on developments which are the subject of a valid consented / approved planning application and are within the same hydrological catchment as the Proposed Development.

7.9.1.3 A list of cumulative developments is provided in **Chapter 18: Cumulative Effects Assessment** (CEA). The CEA will be updated and finalised in the ES.

7.10 SUMMARY AND CONCLUSIONS

7.10.1.1 This chapter has assessed the potential effects of the Proposed Development on hydrology and flood risk. Only those effects which are anticipated to be materially different to the Consented

Development, or were not assessed through the Consented Development, have been considered.

7.10.1.2 Effects assessed are increased sedimentation and its effects on water quality, and increased flood risk as a result of increased areas of hardstanding.

7.10.1.3 Key receptors which have the potential to be directly impacted by the Proposed Development are, the WFD watercourse the Puddinglake Brook and other ordinary watercourses in the Study Area.

7.10.1.4 Mitigation relating to sedimentation and run-off will be implemented through the CEMP during construction of the Proposed Development and will reduce the potential magnitude of impact on receptors such that the significance of residual effects with respect to hydrology and flood risk is assessed as **Not Significant**.

7.10.1.5 A detailed flood risk assessment with updated peak flow analysis and hydraulic modelling will be carried out as part of the ES and will inform the final design. A detailed drainage design will also be developed in accordance with SuDS principles and best practice guidance to attenuate surface water runoff from hardstanding surfaces, and control runoff from the Proposed Development so that there is not an increase in runoff rates compared to the existing greenfield runoff. It is anticipated this will reduce the operational flood risk to Negligible and therefore **Not Significant**.

7.10.1.6 The decommissioning effects are expected to be very similar to those during the construction phase of the Proposed Development, and the sensitivity of receptors and potential magnitude of impact is assumed the same as during construction. Therefore, with implementation of a DEMP, it is anticipated the effects on hydrology and flood risk will be Negligible, and therefore **Not Significant**.

7.10.1.7 Cumulative effects will be considered further in the ES.

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