Gatwick Airport Northern Runway Project

Environmental Statement
Appendix 11.9.5: Groundwater Assessment

Book 5

VERSION: 1.0

DATE: JULY 2023

Application Document Ref: 5.3

PINS Reference Number: TR020005

APFP Regulations 5(2)(a) **Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009**

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0 Executive Summary

0.1.1 The proposal to make best use of London Gatwick Airport's existing runways and infrastructure will include elements that could interact with groundwater resources. These modifications could require dewatering that could impact on groundwater flows and levels. These in turn could impact secondary receptors such as GWDTEs or surface water, affect the existing built environment with differential settlement impacts, or re-direct contamination in groundwater.

0.1.2 This appendix provides the supporting technical information that supports the assessment of impact of dewatering on the groundwater regime and any associated receptors reported in **Environmental Statement Chapter 11: Water Environment** (Doc Ref 5.1).

1 Introduction

1.1 General

1.1.1 This document forms Appendix 11.9.5 of the Environmental Statement (ES) prepared on behalf of Gatwick Airport Limited (GAL) for the proposal to make best use of existing runways and infrastructure at London Gatwick Airport (Gatwick), referred to within this report as 'the Project'.

1.1.2 This document contains the groundwater dewatering assessment undertaken for the Project including an assessment of environmental effects from proposed dewatering including effects on the groundwater regime and any associated receptors. Results from this assessment are summarised in **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

1.2 Assumptions and Limitations

1.2.1 The water environment study area is identified in **ES Water Environment Figure 11.4.1** (Doc Ref. 5.2) of **ES Chapter 11: Water Environment** (Doc Ref. 5.1) and is generally defined by a 2 km radius beyond the Project site boundary.

1.2.2 Groundwater impacts have been evaluated based on desk study information including British Geological Survey (BGS) mapping, data from limited Ground Investigations (GI) undertaken at Gatwick between 2006 to 2018, and two Project specific GI undertaken in 2022. See **ES Chapter 11: Water Environment** (Doc Ref. 5.1) for detail of the hydrogeological Conceptual Site Model (CSM).

1.2.3 Minimum recorded groundwater depths are shown in **ES Water Environment Figure 11.6.3** (Doc Ref. 5.2) of **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

1.2.4 Information on private water supplies was requested from the relevant local authorities on private water supplies but no response had been received at the time of writing. However, a previous study, Desk Based Preliminary Risk Assessment (PRA) for Per- and Polyfluoroalkyl Substances (PFAS) (Arcadis, 2023), indicates one (1) private water supply (PWS) registered with Reigate & Banstead Borough Council is located approximately 350 metres outside of the Project site Boundary at TQ 29508 42108 with use indicated as 1 to >1000 cubic metres per day for gardening use.

2 Dewatering assessment

2.1 Introduction

2.1.1 This section provides an assessment of the potential dewatering impacts on groundwater receptors including surface water features, groundwater abstractions, Groundwater Dependent Terrestrial Ecosystems (GWDTE) and buildings/infrastructure present within the Project study area in support of **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

2.1.2 Groundwater dewatering impacts could occur as a result of earthworks and excavations associated with features such as flood compensation areas, drainage attenuation ponds, and excavation for foundations or piling that penetrate below the water table.

2.2 Assumptions and Limitations

2.2.1 Based on the CSM and information presented in the baseline of **ES Chapter 11: Water Environment** (Doc Ref. 5.1), Section 11.6.44, groundwater levels have been observed at shallow depths within the superficial deposits, between around 0.8 mbgl and 3 mbgl (metres below ground level). Groundwater was also encountered within the weathered layers of the Weald Clay Formation, between shallow depths of 1 mbgl to 2 mbgl up to 8 mbgl. Maximum groundwater levels are conservatively assumed to be 1 mbgl for locations without site specific groundwater level data.

2.2.2 Excavations considered in this assessment include Project elements where the current design (see **ES Chapter 5: Project Description** (Doc Ref. 5.1)) indicates either:

- a requirement for an excavation deeper than 1 mbgl or
- proposed structures to a depth of greater than 1 mbgl.

2.2.3 Final excavation depths and areas would be confirmed at the detailed design phase. For purposes of this assessment, unless otherwise specified, information on expected final depth of structures (plus 0.5 metre) was used as an estimate of the total excavation depth.

2.2.4 Limited information on the footprint of excavations is available and is to be confirmed at the detailed design phase.

2.2.5 Project elements in the design with anticipated excavations of less than 1 metre have been scoped out as they are not anticipated to encounter groundwater.

2.2.6 Project elements where depth of excavation or depth of completed works has not been specified have not been included in this assessment. A dewatering review at the detailed design phase may be required if it is determined that subsurface excavations will be required. This will be secured as a requirement in Schedule 2 of the DCO (Doc Ref. 2.1)

2.2.7 It is assumed that any abstracted water will be tested, disposed of in accordance with best practices in the Code of Construction Practice (CoCP) and permitting requirements. See also **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) (which includes groundwater quality).

2.2.8 It is assumed works in the vicinity of potential soil or groundwater contamination would include water quality testing to ensure compliance with appropriate disposal requirements, and if required amend the discharge strategy.

2.2.9 Additional GI will be undertaken at the detailed design phase to further inform the design considerations for subsurface structures including foundations. This will be secured as a requirement in Schedule 2 of the DCO (Doc Ref. 2.1)

2.2.10 No excavations are assumed to penetrate into the Tunbridge Wells Sands as this formation lies at depth below the Weald Clay confining layer which may extend to greater than 20 mbgl. Excavations are generally on the order of less than 10 metres deep.

2.3 Methodology

2.3.1 The Sichardt empirical formula from Groundwater Control: Design and Practice (Preene, Roberts and Powrie, 2016) was used to estimate the dewatering radius of influence around each excavation expected to intercept groundwater. This was applied using the estimated drawdown of groundwater levels to the base of the excavation. For this initial review step the maximum depth within the proposed excavation has been applied to the whole excavation, although in most cases depth varies across the footprint of the excavation. A calibration factor of C=3000 is assumed for radial flow as per Groundwater Control: Design and Practice (Preene, Roberts and Powrie, 2016).

2.3.2 Where the zone of influence estimated using the Sichardt equation is less than approximately 30 metres, the method is considered to be unreliable as per Groundwater Lowering in Construction (Cashman and Preene, 2021). Therefore, in order to ensure a suitable conservative assessment, a minimum zone of influence of 25 metres has been assumed and applied in the review.

2.3.3 Minimum and maximum hydraulic conductivity values are based on literature values from Groundwater (Freeze and. Cherry, 1979) and Physical and Chemical Hydrogeology (Domenico and Schwartz 1990) of 1.6e-04 m/s for silty sand/sands (representing Alluvium / River Terrace Deposits (RTD) in Secondary A aquifer materials) and 2.4e-09 m/s for clay (representing the Weald clay formation classed as unproductive aquifer material).

2.3.4 The geologic model assumed for this analysis is as follows:

- Made ground from 0 mbgl to 1 mbgl (i.e. above the water table).
- For the maximum design case (i.e. excavations with potential to encounter superficial aquifer deposits) it is assumed Alluvium/ RTD are encountered from a depth of 1 mbgl to 5 mbgl and Weald Clay encountered below 5 mbgl. An effective hydraulic conductivity is applied for excavations greater than 5 metres based on these assumed thicknesses.
- For the minimum design case (i.e. excavations not expected to encounter superficial aquifer deposits) it is assumed Weald Clay is encountered from a depth of 1 mbgl to 15 mbgl.

2.3.5 For additional detail on the conceptual geological model for the site, see the groundwater baseline in **ES Chapter 11: Water Environment** (Doc Ref. 5.1) and **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1) (which includes groundwater quality).

2.4 Results

2.4.1 The maximum radius of influence for Project elements included in the assessment is summarised in Table 1 of **Annex 1**.

2.4.2 Based on the Sichardt method, all Project elements located in areas overlaying the mapped Weald Clay with no mapped superficial aquifer deposits present are anticipated to have a radius of influence of less than the minimum of 25 metres and are therefore scoped out of the assessment.

2.4.3 Any Project elements overlaying the mapped Weald Clay but located within 25 metres of mapped superficial deposits are conservatively scoped in.

2.4.4 As shown in Table 1 of **Annex 1**, the maximum radius of influence calculated for proposed excavations with potential to encounter alluvium/RTD is as follows:

- Less than 25 metres for excavations up to 1.5 metre in depth and are therefore scoped out of further assessment.
- 25 metres to 150 metres for excavations greater than 1.5 metre and up to 5 metres in depth
- 150 metres to 250 metres for excavations greater than 5 metres and up to 10.5 metres in depth

2.4.5 The radius of influence calculated as part of this assessment is considered conservative as the limited depth, extent and connectivity of the superficial aquifer units is expected to introduce barrier effects and thus reduce the radius of influence. For locations with superficial deposits comprised primarily of alluvium, the permeability is likely to be lower than the conservative value assumed for this assessment which would also reduce the radius of influence.

2.5 Assessment of effects

2.5.1 Potentially sensitive features that could be impacted by groundwater dewatering include superficial and bedrock aquifers, airport infrastructure (e.g. runways, underground storage facilities), transport infrastructure, Listed Buildings/Scheduled monuments, residential and commercial properties, surface water features; licensed or unlicensed groundwater abstractions and GWDTEs. The proximity to potential groundwater and land contamination sources is also considered.

2.5.2 As indicated in **ES Chapter 11: Water Environment** (Doc Ref. 5.1):

- There are no Source Protection Zones (SPZ) for public water supplies within the groundwater study area, and no drinking water safeguard zones.
- Only one licensed groundwater abstraction for general use has been identified at a distance of approximately 1km from the boundary of the Project and most likely abstracts from the Tunbridge Wells Sand Formation, which is found at depth below the Weald Clay confining layer.
- There is one (1) PWS located approximately 350 metres to the north / northwest of the ST Roundabout expansion, which (as indicated in Table 1) is outside of the ROI of the proposed dewatering at this location. Therefore, no impacts to this PWS are anticipated from dewatering.
- No potential GWDTE have been identified within the study area. See **ES Chapter 9: Ecology and Nature Conservation** (Doc Ref. 5.1).
- There are no natural lakes or ponds identified within the Project site boundary that are classified Water Framework Directive (WFD) surface water bodies. Other surface water features (rivers and streams) are discussed in Section 2.5.5.

2.5.3 Due to the limited depth, extent and connectivity, and potential for poor water quality of the superficial aquifers, the impacts of any construction dewatering on the high sensitivity Secondary A aquifers and medium sensitivity secondary undifferentiated aquifers are expected to be localised and short-term in duration and are therefore considered low adverse. This would therefore result in **minor adverse** effects for both Secondary A and undifferentiated aquifers and which would not be significant.

2.5.4 The bedrock (Weald Clay) is considered an unproductive strata of negligible sensitivity. For dewatering occurring within the Weald Clay there is likely to be only minimal groundwater seepage into any excavation and any impacts from dewatering are considered to be negligible adverse. Effects would therefore be **negligible adverse**, which would not be significant.

2.5.5 Surface water features within the zone of influence of potential dewatering works are summarised in Table 2 and Table 3 of **Annex 1**. These include the River Mole, Gatwick Stream, and Crawter's Brook which are all considered high sensitivity. Due to the generally low permeability of the bedrock, there is not expected to be any significant connection between the bedrock materials and the surface water. There is likely to be a good hydraulic connectivity between groundwater in superficial

deposits and the surface watercourses but this may vary locally depending on the nature of superficials (i.e. ranging from clay layers within the Alluvium to RTD). As indicated in Table 3 of **Annex 1**, due to conservatisms in the analysis as well as the limited depth, extent, and connectivity of the superficial deposits, any impacts are expected to be localised and short-term in duration and are therefore considered negligible adverse to low adverse. This would result in **minor adverse** effects which would not be significant.

2.5.6 Project elements with potentially high to very high sensitive structures within the radius of influence are listed in Table 2 of **Annex 1**. At this stage potential impacts to the structures (which include airport infrastructure, highways and rail infrastructure, commercial buildings, and listed buildings) cannot be ruled out. Settlement effects from dewatering on structures could range from negligible to low adverse impacts resulting in **minor** to **moderate adverse** effects. A settlement analysis would be undertaken as an additional mitigation during the detailed design phase once additional GI data is available which will inform construction methodologies and any asset protection measures (such as, but not limited to, ground re-enforcement), to ensure that there is no significant residual differential impacts on the existing built environment. Taking this into account the effect will likely be reduced to **minor adverse** which would not be significant.

2.5.7 Locations with proximity to potential land contamination sources are summarised in Table 2 of **Annex 1**. Due to the localised estimated radius of influence (<250 metres) for the Project elements, no significant change to existing groundwater quality is expected to result from dewatering in areas with potential for land contamination. However, the quality of the abstracted groundwater, if poor, could pause a risk to the surface water quality where the abstracted groundwater may be discharged. Groundwater exceedances of Environmental Quality Standards (EQS) have been identified at the Fire Training Ground, MA1 Main Contractor Compound, Taxiway Victor and Charlie Box (see **ES Appendix 11.9.1: Geomorphology Assessment** (Doc Ref. 5.3)). The **ES Appendix 5.3.2: Code of Construction Practice (CoCP)** (Doc Ref. 5.3) indicates embedded mitigation measures which would include the following and are considered sufficient to mitigate any impacts:

- ensuring dewatering does not mobilise existing contamination;
- ensuring dewatering takes place in line with any permitting requirements; and
- ensuring the drainage system has adequate capacity to store any additional surface water runoff or groundwater required to be pumped out of excavations.

2.5.8 It is assumed works in the vicinity of potential soil or groundwater contamination would include water quality testing to ensure compliance with appropriate disposal requirements, and if required amend the discharge strategy. Based on the expected localised and short-term effects and proposed mitigation measures, impacts from contamination sources are considered to be negligible which would result in a **minor adverse** effect which is not significant.

3 References

Arcadis (2023), Desk Based Preliminary Risk Assessment (PRA) for Per- and Polyfluoroalkyl Substances (PFAS). Gatwick Airport, West Sussex. Document Reference: 10055474-ARC-XX-XX-RP-ZZ-0001-02, Rev FINAL 02.

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SOCOTEC UK Limited (2022b), Gatwick Northern Runway Project, Highways, D2001-22/2

4 Glossary

4.1 Glossary of terms

Table 4.1.1: Glossary of terms

Term	Description
bgl	(metres) below ground level
BGS	British Geological Society
CoCP	Code of Construction Practice
CSM	Conceptual Site Model
EQS	Environmental Quality Standards
ES	Environmental Statement
GI	Ground Investigation
GWDTE	Groundwater Dependent Terrestrial Ecosystem
PWS	Private water supply
ROI	Radius of influence
RTD	River Terrace Deposits
WFD	Water Framework Directive

Annex 1

Dewatering assessment

Table 1: Dewatering assessment – Results of analysis and initial screening

Project Element	Assumed Excavation Depth (i.e. depth of structure + 0.5 metre) (mbgl)	Depth to Groundwater (mbgl)	Drawdown (metres)	Maximum ROI	Scoped In/Out
Relocate Larkins Road Phase 2 (Utilities diversion)	1.2	1	0.2	8	Out – ROI <25 metres and <1 metre predicted drawdown
Additional Stands Pier 7 Apron (Option 1 – Code E)/(Option 2 – Code C)	1.5	1	0.5	19	
Additional stands (Oscar)	1.5	1	0.5	19	
Noise Bund Reconfiguration	6	1	5	25	Out – overlying Weald Clay, no superficial deposits within 25 metres
Treatment Works and connection to Gatwick Stream	3.5	1	2.5	25	
40 rising main upgrade	1.7	1	0.7	25	
North Terminal Roundabout expansion (attenuation pond)	3	1	2	25	
Museum Field Flood Compensation Area	3.1	2	1.1	25	
Relocate Substation J	3.5	1	2.5	25	
Oscar - MT Phase 1 – relocate elements of existing facility to landside operation	5.5	1	4.5	25	
Relocation of fire training ground	5.5	1	4.5	25	
Oscar - MT Phase 2 - relocation	5.5	1	4.5	25	
Additional South Terminal Coaching Gates	10.5	1	9.5	25	
New hangar	10.5	1	9.5	25	
Longbridge Roundabout (attenuation ponds x2)	3	2	1	38	In – overlying Weald Clay but within 25 metres of superficial deposits
Car Park X flood storage area	2.5	1	1.5	57	In – predominantly overlying Weald Clay with localised zones of RTD deposits
ST Roundabout expansion (attenuation pond)	3	1	2	76	In – potential to encounter superficial aquifer deposits
Substation BK	3.5	1	2.5	95	In – potential to encounter superficial aquifer deposits
Charlie Box - clear internal area - relocation of substation BP	3.5	1	2.5	95	In – potential to encounter superficial aquifer deposits
Charlie Box - clear internal area - relocation of substation BR	3.5	1	2.5	95	In – potential to encounter superficial aquifer deposits
South Terminal Foul Capacity (PS EoR)	3.5	1	2.5	95	In – overlying Weald Clay but within 25 metres of mapped superficial deposits
PS6 to PS7a pump and sewer capacity	3.6	1	2.6	98	In – potential to encounter superficial aquifer deposits
Relocate Larkins Road Phase 1 (Utilities)	4	1	3	113	In – potential to encounter superficial aquifer deposits
Runway realignment	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
Construct landside CARE facility	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
Hangar 7 – relocate NE facilities	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
Airfield Foul Water	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
Charlie Box	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
Expand and consolidate CARE in landside site	5.5	1	4.5	145	In – potential to encounter superficial aquifer deposits
North Terminal Foul Capacity (PS7a)	6.5	1	5.5	163	In – potential to encounter superficial aquifer deposits
Airfield Foul Water PS2a	10.5	1	9.5	222	In – potential to encounter superficial aquifer deposits
Car Park Y Storage	10.5	1	9.5	222	In – potential to encounter superficial aquifer deposits
Taxiway Juliet East (Code E – Uniform to Sierra)	10.5	1	9.5	222	In – potential to encounter superficial aquifer deposits

Table 2: Potentially sensitive receptors within maximum ROI for Scoped In works

Project Element	Maximum ROI (metres)	Potentially sensitive receptors within maximum ROI		Potential land contamination with maximum ROI (1)
		Structures	Surface water bodies	
Longbridge Roundabout (attenuation ponds x2)	38	Local roads, bridges	River Mole (approx.. 25 metres)	Esso/Texaco PFS (ID19, ID20)
Car Park X flood storage area	57	Lowfield Hall Grade II, Charlwood House Grade II* (approx 50 metres), Commercial	Crawter's Brook (approx.. 50 metres)	
ST Roundabout expansion (attenuation pond)	76	Highway		
Substation BK	95	Runway	River Mole (approx.. 95 metres)	Reservoir/pond (ID41)
Charlie Box - clear internal area - relocation of substation BP	95	Runway		Stand 130 to 136; Stand 140 to 145 (ID9)
Charlie Box - clear internal area - relocation of substation BR	95	Runway		Stand 130 to 136; Stand 140 to 145 (ID9)
South Terminal Foul Capacity (PS EoR)	95	Railway	Gatwick Stream (approx.. 75 metres)	Railway siding (ID24), Electricity substation (ID70, 71), Tank (ID30)
PS6 to PS7a pump and sewer capacity	98	Aircraft parking/tarmac, Commercial		Electricity substation (ID46), TCR (ID11), Pond (ID36), Electricity substation (ID63, 64)
Relocate Larkins Road Phase 1 (Utilities)	113	Aircraft parking/tarmac, Commercial		Electricity substation (ID60)
Runway realignment (2 No. syphons)	145	Runway	Crawter's Brook (125 metres)	Electricity substations (ID 43) and (ID57)
Construct landside CARE facility	145	Commercial		Electricity substation (ID46), TCR (ID11), Pond (ID36)
Hangar 7 – relocate NE facilities	145	Commercial		
Airfield Foul Water	145	Runway, Commercial		Fire station (ID10), Pond (ID37), Electricity substation (ID61), Electricity substation (ID47), Pond (ID38), Electricity substation (ID62), Stand 130 to 136; Stand 140 to 145 (ID9)
Charlie Box	145	Runway, Commercial		Stand 130 to 136; Stand 140 to 145 (ID9)
Expand and consolidate CARE in landside site	145	Commercial		Electricity substation (ID46), TCR (ID11), Pond (ID36)
North Terminal Foul Capacity (PS7a)	163	Aircraft parking/tarmac, Commercial		Electricity substation (ID63, 64)
Airfield Foul Water PS2a	222	Runway, Commercial		Fire station (ID10), Pond (ID37), Electricity substation (ID61), Electricity substation (ID47), Pond (ID38), Electricity substation (ID62), Stand 130 to 136; Stand 140 to 145 (ID9)
Car Park Y Storage	222	Highway, Commercial	Gatwick Stream (approx. 95 metres)	ESO PFS(ID19), Pit (ID42), Balancing pond (ID40), Shell PFS (ID7), Tank (ID27)
Taxiway Juliet East (Code E – Uniform to Sierra)	222	Runway, Commercial		Reservoir/pond (ID41), Oscar remote stands (ID16), electricity substation (ID45), Pond (ID37), fire station (ID10), electricity substation (ID61)

(1)ID numbers reference Potential Areas of Concern identified in **ES Figure 10.6.3** (Doc Ref. 5.2) of the **ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1)

Table 3: Impact assessment – surface water features located within the maximum ROI

Project Element	Maximum ROI (metres)	Surface water bodies located within the ROI	Sensitivity of receptor	Discussion and assessment of magnitude of impacts
Longbridge Roundabout (attenuation ponds x2)	38	River Mole (approx 25 metres)	High	Conservatively included in assessment as predominantly overlying an area mapped as Weald Clay, so the estimated ROI is likely conservative. The River Mole is expected to be at the outer edge of the ROI and thus magnitude of impacts are expected to be negligible adverse.
Car Park X flood storage area	57	Crawter's Brook (approx 50 metres)	High	Car Park X predominantly overlies mapped Weald Clay with a localized zone overlying RTD; therefore, the magnitudes of any impacts are expected to be small and localized. Additionally, boundary effects are not included in the analysis and therefore the estimate of ROI likely to be conservative with Crawter's Brook expected to be located at the outer edge of the ROI. The magnitude of impacts are expected to be negligible adverse.
Substation BK	95	River Mole (approx 95 metres)	High	The River Mole is located at the outer edge of the ROI and thus the magnitude of impacts is expected to be negligible adverse.
South Terminal Foul Capacity (PS EoR)	95	Gatwick Stream (approx 75 metres)	High	These works predominantly overlay mapped Weald Clay adjacent to a localized zone of RTD; therefore, the magnitudes of any impacts are expected to be small and localized. Additionally, since boundary effects are not included in the analysis, the estimate of ROI is likely to be conservative and Gatwick Stream is expected to be located at the outer edge of the ROI. The magnitude of impacts are expected to be negligible.
Runway realignment (2 No. syphons)	145	Crawter's Brook (approx. 125 metres)	High	These works predominantly overlay mapped Weald Clay adjacent to a localized zone of RTD; therefore, the magnitudes of any impacts are expected to be small and localized. Additionally, since boundary effects are not included in the analysis the estimate of ROI is likely to be conservative with Crawter's Brook expected to be located at the outer edge of the ROI. The magnitude of impact is expected to be negligible.
Car Park Y Storage	222	Gatwick Stream (approx. 95 metres)	High	Works overlie Weald Clay and alluvium deposits of variable hydraulic conductivity (though likely to be lower than assumed in the analysis). The magnitude of any impacts to the surface water would be expected to be low adverse.