In Parliament – Session 2021 - 2022

HS2

High Speed Rail (Crewe – Manchester)

Background information and data

Water resources and flood risk

BID WR-004-0MA08

MA08: Manchester Piccadilly Station

Water resources assessment baseline data

M322

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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1 Introduction

1.1.1 This document presents baseline data relating to the water resources assessment that has been undertaken for the Proposed Scheme.

1.1.2 The data have been collected in relation to the Manchester Piccadilly Station area (MA08).

1.1.3 The Environmental Statement[1] should be referred to for details of:

- the Water Framework Directive (WFD) compliance assessment (Volume 3, Route-wide effects and Volume 5: Appendix WR-001-00000);
- the water resources assessments and flood risk assessments that are reported per community area (Volume 5: Appendices WR-003-0MA08 and WR-005-0MA08);
- the hydraulic modelling reports that support the flood risk assessments (Volume 5: Appendix WR-006-00007); and
- a Draft water resources operation and maintenance plan (Volume 5: Appendix WR-007-00000).

1.1.4 Additional information is also included in Background Information and Data (BID) WFD compliance assessment baseline data that is reported for the Proposed Scheme (BID WR-002-00001).

1.1.5 Maps referred to throughout this document are set out in the in Volume 5, Water resources and flood risk Map Book: Map Series WR-01 and WR-02[2].

1.1.6 The Environmental Impact Assessment Scope and Methodology Report (SMR)[3] states that the spatial scope of the assessment (the study area) is based upon the identification of surface water and groundwater features within 500m of the route of the Proposed Scheme in an urban area.

[1] High Speed Two Ltd (2022, High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement. Volume 5 Water resources and flood risk Map Book*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[3] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement. Environmental Impact Assessment Scope and Methodology Report*, Volume 5, Appendix CT-001-00001. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

2 Baseline data

2.1 Surface water

2.1.1 The surface water features potentially affected by the Proposed Scheme, including their location, current overall WFD status, and future overall status objectives, are shown in Table 1. Further details are set out in the Water Framework Directive compliance assessment baseline data (BID WR-002-00001). The receptor values attributed to each individual watercourse, based on the methodologies set out in the SMR[3], are also provided.

2.1.2 Those surface water features potentially affected by groundwater interactions are described in Section 2.3.

Table 1: Surface water body receptors

Water body name and location[4]	Type (at point closest to the Proposed Scheme)	Q95 value (m^3/s)[5]	Receptor value	Parent WFD water body name and identification number[6]	Current WFD status/ objective[7]	2019 WFD Status
Tributary of River Medlock WR-01-310b - I4	Ordinary watercourse	<0.002	Moderate	Medlock (Lumb Brook to Irwell) GB112069061152	Moderate/ Moderate by 2015	Moderate
River Medlock WR-01-310b - I4	Main river	0.19	High			
Shooters Brook Downstream[8] WR-01-310b - I2	Ordinary watercourse	N/A	Low			
Rochdale Canal WR-01-310b - I2	Canal	N/A	Moderate			
Ashton Canal WR-01-310b - J3	Canal	N/A	Moderate			

[4] The feature locations are indicated by the grid coordinates on the relevant Volume 5, Water resources and flood risk Map Book, Map Series WR-01.

[5] This is the flow within the watercourse that is exceeded for 95% of the time. The Q95 has been provided as an indication of watercourse size but is only one of several criteria used to inform receptor value. Other criteria include the WFD watercourse classification which takes into account the value of any habitat which the watercourse supports. Details are provided in the SMR.

[6] The Environment Agency has attributed each surface water and groundwater body a unique water body identification (ID) number.

[7] Status and objectives are based on those set out in the current river basin management plan (RBMP). Environment Agency (2015), *River Basin Management Plan, North West River Basin District*. Available online at: https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan.

[8] Shooters Brook Downstream is culverted along its entire length within the study area. It discharges into a culverted section of the River Medlock beneath Charles Street.

2.1.3 There are no licensed surface water abstractions within the study area. Records of private unlicensed surface water abstractions, that comprise those for quantities less than 20m^3 per day, have been obtained from the local authorities. These data indicate that there are no registered private unlicensed surface water abstractions within the study area. As there is no obligation to register private water supplies, unregistered private surface water supplies may be present. Private water supplies will be assessed as high value receptors unless details obtained from the owner indicate otherwise.

2.1.4 There are five permitted discharges to surface water potentially affected by the Proposed Scheme, as shown in Table 2, two of which are within the land required for the construction of the Proposed Scheme. These have been assessed as low value receptors.

Table 2: Permitted discharges to surface water

Permit identifier (and map grid square)[2]	Distance and direction from route	Discharge type	Receiving water body
016983280 WR-01-310b – J4	450m north-east of the route of the Proposed Scheme (50m south-east of the land required for construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	River Medlock
016982730 WR-01-310b – I3	70m south-west of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	River Medlock
016982729 WR-01-310b – I3	390m south-west of the route of the Proposed Scheme (80m east of the land required for construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	River Medlock
01MAN0162 WR-01-310b – I2	370m south-west of the route of the Proposed Scheme (180m south-west of the land required for construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	Shooters Brook Downstream
016982994 WR-01-310b – I3	180m north-east of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	Shooters Brook Downstream

2.2 Groundwater

2.2.1 The groundwater features crossed by the Proposed Scheme within this study area, including their location, current overall WFD status and future overall status objectives, are shown in Table 3. The information contained within Table 3 is also contained within the Environmental Statement, Volume 2, Community Area report: Manchester Piccadilly Station area (MA08),

Section 10, Land quality[9] and the route-wide WFD compliance assessment (Environmental Statement, Volume 5: Appendix WR-001-00000). The receptor values attributed to each individual feature are based on the methodologies set out in the SMR[3].

2.2.2 Volume 5, Water resources assessment and flood risk Map Book: map WR-02-308[2] shows the superficial and bedrock formations within MA08.

Table 3: Summary of geology and hydrogeology in the study area

Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status[10]/2019 status	WFD objective[11]	Receptor value
Superficial deposits[12]						
Alluvium	Along the valley of the River Medlock	Clay, silt, sand and gravel	Secondary (Undifferentiated)	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Glacial till	Across much of the study area	Sandy silty clay	Secondary (Undifferentiated)	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Bedrock						
Sherwood Sandstone Group – Chester Formation	Underlies the route of the Proposed Scheme	Pebbly sandstone	Principal	Manchester and East Cheshire Permo-Triassic Sandstone Aquifer (GB41201G101100) Poor/Poor	Good by 2021	High
Cumbrian Coast Group – Manchester Marls Formation	Up to 200m wide bands north and south of the route of the Proposed Scheme	Mudstone	Secondary B	Manchester and East Cheshire Permo-Triassic Sandstone Aquifer (GB41201G101100)	Good by 2021	Moderate

[9] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 2, Community Area report: Manchester Piccadilly Station (MA08), Section 10 Land quality.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

[10] Based on the 2015 RBMP. Note that where the Environment Agency has not assigned an individual water body ID to a unit, it has been assumed that it is connected to the overlying water body.

[11] Status and objectives are based on those set out in the 2015 RBMP.

[12] Superficial deposits are not necessarily listed in the order of superposition. Other superficial deposits may be present between the deposits shown in the table and bedrock, including deposits that do not appear in the table.

Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status[10]/2019 status	WFD objective[11]	Receptor value
				Poor/Poor		
Appleby Group – Collyhurst Sandstone Formation	A band, up to 200m wide, north of the route of the Proposed Scheme	Sandstone	Principal	Manchester and East Cheshire Permo-Triassic Sandstone Aquifer (GB41201G101100) Poor/Poor	Good by 2021	High
Warwickshire Group – Halesowen Formation	Small area north of the route of the Proposed Scheme	Mudstone, sandstone and siltstone	Secondary A	Manchester and East Cheshire Permo-Triassic Sandstone Aquifer (GB41201G101100) Poor/Poor	Good by 2021	Moderate

2.2.3 The alluvium, present along the valley of the River Medlock in the study area, and the glacial till, occurring across most of the study area, are designated as Secondary (Undifferentiated) aquifers by the Environment Agency.

2.2.4 There are four bedrock aquifers in the study area. The Sherwood Sandstone Group (comprising the Chester Formation in the study area) and the Appleby Group (comprising the Collyhurst Sandstone Formation in the study area) are classified as Principal aquifers by the Environment Agency. The Manchester Marls Formation of the Cumbrian Coast Group is classified as a Secondary B aquifer. The Warwickshire Group, locally comprising the Halesowen Formation, is classified as a Secondary A aquifer.

2.2.5 The structural geology of the study area is complex, with a series of north-west to south-east trending major faults traversing the study area, some of which have vertical displacements of over 200m in places.

2.2.6 There are two Environment Agency observation boreholes that are understood to monitor groundwater levels in the Sherwood Sandstone Group, Chester Formation within the study area. The boreholes are:

- Hallidays: 20m north of the route of the Proposed Scheme; and
- High School: 430m south-west of the route of the Proposed Scheme.

2.2.7 The location of the two monitoring boreholes is shown in Figure 1. There is a distance of approximately 1,200m between the boreholes. Figure 2 presents the time series of available groundwater level monitoring data from these boreholes. For ease of comparison, the two graphs are plotted with the same range of years, from 1960 to 2020. Both graphs also have

the same level range from 25-30mAOD. There was a gap in the record for both boreholes in the period 1975 to 1981.

2.2.8 Overall, groundwater levels at Hallidays recovered from the start of the record in 1968 to approximately 2000, likely due to reductions in groundwater abstraction in the area. After 2000, groundwater levels were reasonably constant at approximately 29mAOD. This is a few metres below the water level in the River Medlock (approximately 33mAOD), located approximately 250m north west of the site. A marked increase in recorded groundwater level for the last two data points in 2015 are likely to be the result of measurement error, rather than an abrupt rise in groundwater level, as the records indicate access was not available to the site in late 2014 and early 2015.

2.2.9 Groundwater levels recorded at High School during the early 1970s were less than 25.5mAOD. The aquifer appears to have recovered from a reduction in abstraction in the area during the 1970s. Since the 1980s, the groundwater level at High School appears to have stabilised in the range of 27-28mAOD.

2.2.10 Although the overall range of groundwater levels in the two boreholes is similar, there are significant local variations over the period of record. Groundwater levels rose rapidly at High School in the 1970s, potentially as a result of a greater proximity to abstraction sources. However, at the Hallidays borehole, the recovery continued in to 2000, whereas at High School water levels remained relatively stable between 1980 and 2000. Groundwater levels at Hallidays are typically 1 to 2m above the water levels at High School. This is consistent with wider patterns of groundwater flow in the Principal aquifer from east to west (British Geological Society (1989))[13]. At both sites, groundwater levels have been reasonably stable over the ten years prior to the end of the available record, with variations in level of up to approximately 0.5m in the two boreholes.

[13] British Geological Survey (1989), *Hydrogeological map of Clwyd and the Cheshire Basin including parts of the hydrometric areas 54, 65, 66, 67, 68 69 and 70.* Available online at: https://webapps.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=11567.

Figure 1: Location of Environment Agency groundwater level monitoring boreholes

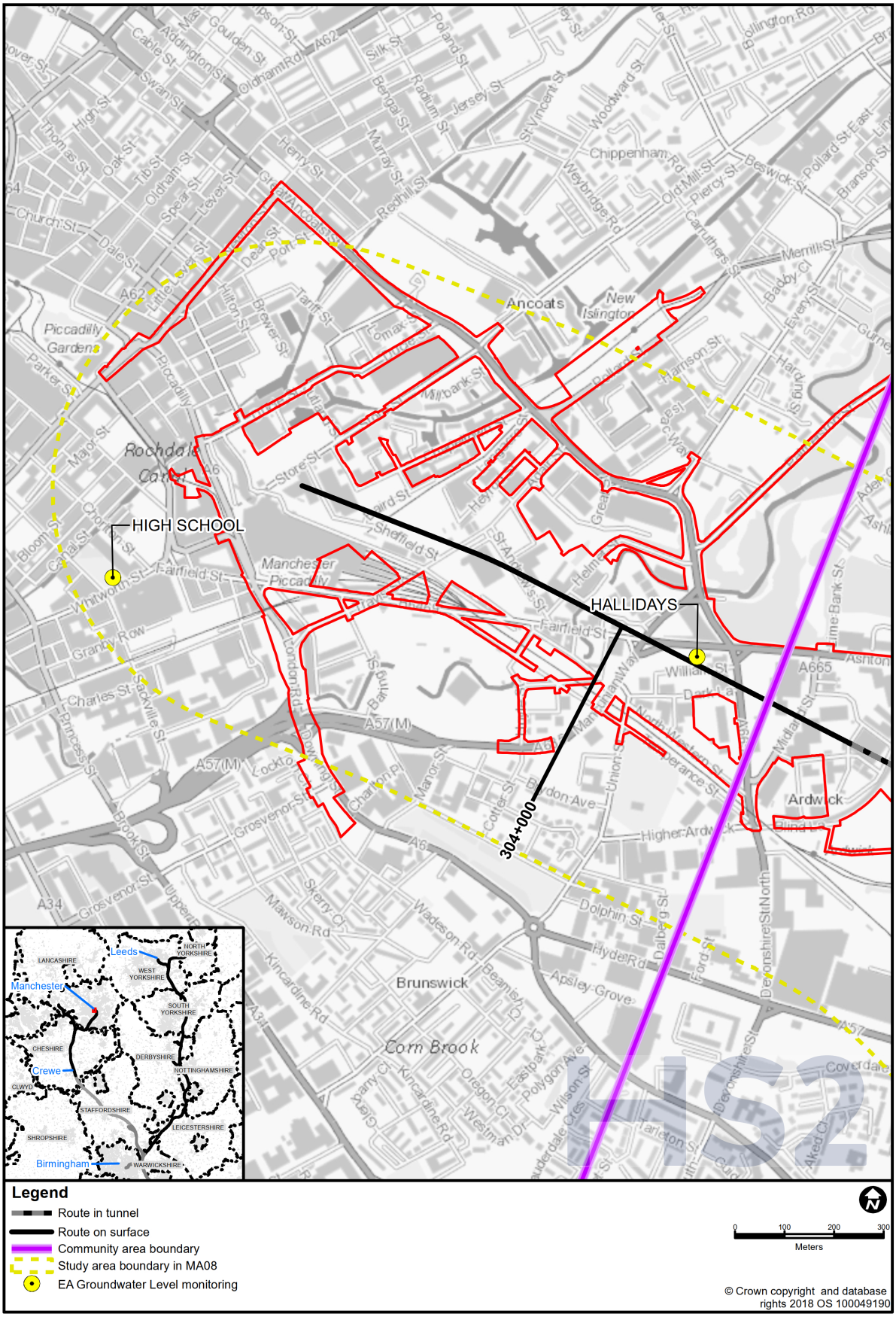
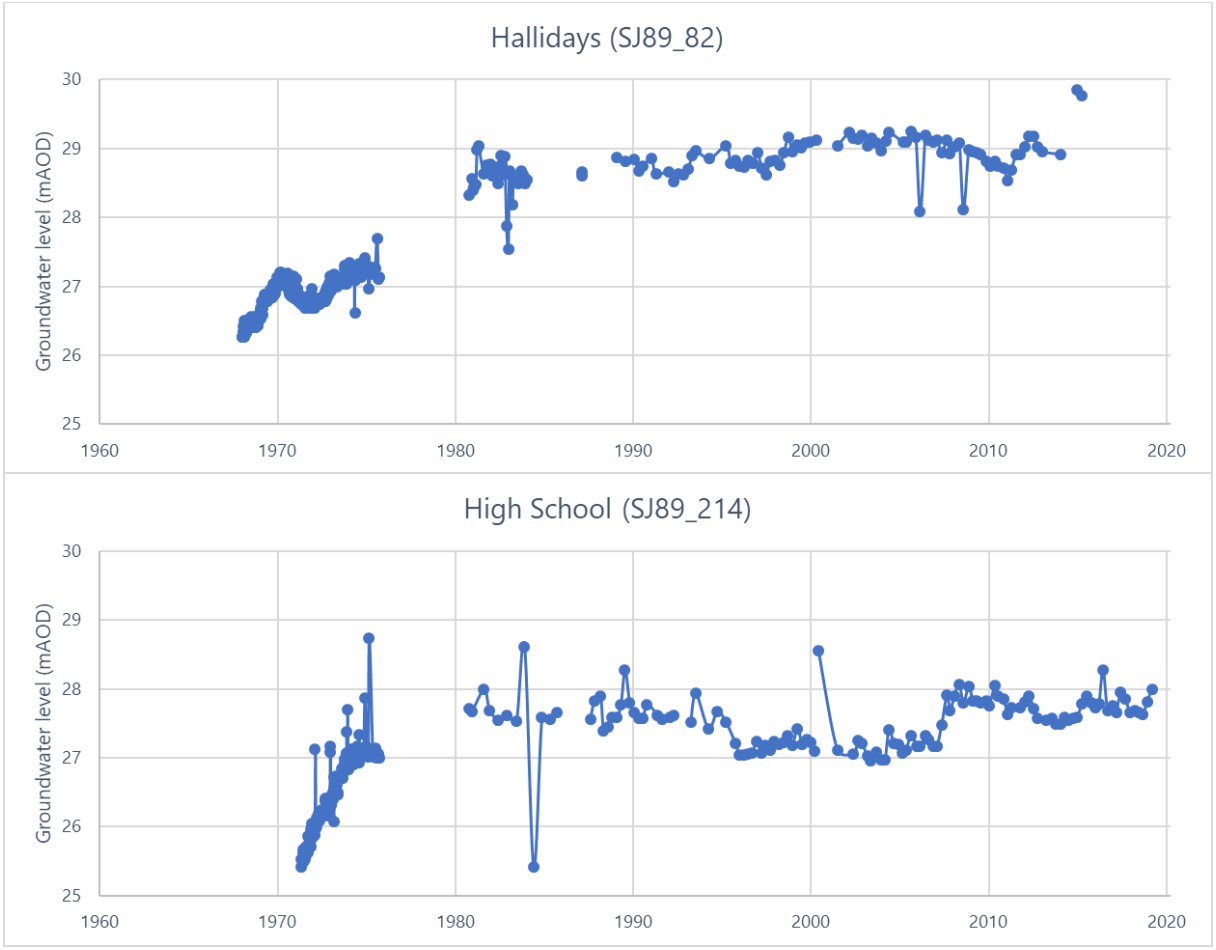


Figure 2: Time series of available Environment Agency groundwater level monitoring data



Data provided by the Environment Agency

2.2.11 No additional groundwater monitoring data are available for the other Principal bedrock aquifer or the Secondary A and Secondary B bedrock and superficial aquifers in the study area. Water strikes recorded on borehole logs, available via BGS, have been referred to for the purpose of the assessment.

2.2.12 Groundwater in the superficial aquifers in the study area is expected to be shallow within the River Medlock valley and at slightly greater depth in other areas. As the borehole records presented above, show that groundwater levels in the bedrock are likely to be below the base of the superficial deposits, any groundwater in the superficial deposits would be perched above low permeability horizons in the deposits, with some leakage to the bedrock aquifer below. Groundwater flow is expected to be through the intergranular matrix of more permeable horizons within the unconsolidated superficial deposits and is likely to follow the general topography. Converging groundwater flow is likely to discharge in the River Medlock valley. Where groundwater levels in the superficial deposits are not known, they have been assumed to be at or close to ground level for the purpose of a precautionary assessment.

2.2.13 Groundwater in the Sherwood Sandstone Group is expected to flow approximately east to west and the data from High School and Hallidays agree with this approximate direction of flow. Fracture flow, as well as intergranular flow, is expected to play a significant role in

groundwater flow in the Sherwood Sandstone Group. Similarly Fracture and intergranular flow are likely to have a significant role in groundwater movement in the Cumbrian Coast Group, the Appleby Group and the Warwickshire Group.

2.2.14 There are no groundwater abstraction licences for Public Water Supply (PWS) in the study area.

2.2.15 There are no private abstractions from groundwater (licensed and unlicensed) in the study area.

2.2.16 The private water supply information has been provided by the local authorities. Information regarding deregulated abstractions has been provided by the Environment Agency. Where land access has been available, surveys have been undertaken to confirm unlicensed abstraction details. Where the exact details of an unlicensed abstraction are not known, a precautionary assessment has been undertaken.

2.2.17 There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m^3 per day and not all unlicensed abstractions are registered with the local authority. These may also need to be protected.

2.2.18 There is one permitted discharge to groundwater within the study area and this has been assessed as a low value receptor. Details of the consented discharge are provided in Table 4.

Table 4: Permitted discharge to groundwater

Permit identifier (and map grid square)[14]	Distance and direction from route	Discharge type	Receiving water body
NPSWQD004449 WR-02-308 – E5	500m south-west of the route of the Proposed Scheme (330m south-west of land required for the construction of the Proposed Scheme)	Trade discharges - cooling water	Underground strata

2.3 Groundwater – surface water interactions

2.3.1 Table 5 summarises the potential groundwater – surface water interactions identified within the study area.

2.3.2 Main surface watercourses, that could have connection with groundwater, potential springs and issues have been identified within the study area from Ordnance Survey (OS) maps and detailed river network data provided by the Environment Agency. There are no springs shown on OS maps in the study area.

[14] Volume 5, Water resources assessment and flood risk Map Book: map WR-02-308, discharges in the study area are listed from south to north.

Table 5: Groundwater – surface water interactions

Feature (and map grid square)[15]	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Watercourses				
River Medlock WR-02-308 – E6	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over the Sherwood Sandstone Group (Chester Formation), the Cumbrian Coast Group (Manchester Marls Formation), the Appleby Group (Collyhurst Sandstone Formation) and the Warwickshire Group (Halesowen Formation)	40	River Medlock is likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Shooters Brook Downstream WR-02-308 – E6	30m west of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glacial till over the Sherwood Sandstone Group (Chester Formation)	39	Watercourse is unlikely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits as it is in a brick-lined culvert. Will not be considered further.

2.4 Water dependent habitats

2.4.1 Table 6 summarises surface water dependent habitats within the study area. There are no groundwater dependent habitats in this area.

Table 6: Water dependent habitats

Name (and map grid square)[16]	Distance and direction from route	Designation	Comments
Surface water dependent habitats			
Ashton Canal (West) EC-01-526b – H4	120m north of the route of the Proposed Scheme (adjacent to land required	Site of Biological Importance (SBI)	Ashton Canal (West) SBI is located within the study area.

[15] Volume 5, Water resources assessment and flood risk Map Book: map WR-02-308. Watercourses cross several map grid squares and are labelled. Map grid squares are provided for the watercourses within the study area at the location closest to the Proposed Scheme. These features are listed from south to north.

[16] High Speed Two Ltd (2021), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5 Ecology, Map Book, Map Series EC-01.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement. Water dependent habitats often cross several grid squares. The Map grid square provided at the location closest to the Proposed Scheme.

Name (and map grid square)[16]	Distance and direction from route	Designation	Comments
	for the construction of the Proposed Scheme)		
Rochdale Canal, Stott's Lane – Ducie Street Basin EC-01-526b I4	200m north-west of the route of the Proposed Scheme (adjacent to land required for the construction of the Proposed Scheme)	SBI	Rochdale Canal, Stott's Lane – Ducie Street Basin SBI is located within the study.

3 References

British Geological Survey (1989), *Hydrogeological map of Clwyd and the Cheshire Basin including parts of the hydrometric areas 54, 65, 66, 67, 68 69 and 70.* Available online at: https://webapps.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=11567.

Environment Agency (2015), *River Basin Management Plan, North West River Basin District*. Available online at: https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan.

High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

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