

Appendix 7C

Hydromorphology Desk Based Study and Site Survey

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7. Overview

7.1 Introduction

- 7.1.1 This document provides a summary of the Hydromorphology Desk Based Study and associated screening exercise that was undertaken by WSP UK Ltd to identify sensitive watercourses that require further assessment through field survey. Additionally, the results from the field assessment are provided.
- 7.1.2 The desk-based study was undertaken during April 2023 in consultation with the Environment Agency (EA) to identify key watercourse crossings to be visited and surveyed in the field. The outcome of the desk based study identified 13 EA Main River water body crossings that required further hydromorphology surveys with site walkovers subsequently undertaken in August 2023.
- 7.1.3 A list of all the watercourses crossed by the Project is provided in **Annex 7C1** alongside their watercourse type, hydromorphological designation and other designations relating to hydromorphology under the WFD.
- 7.1.4 **Annex 7C2** contains details on the desk based study methodology and how further site surveys were determined for hydromorphologically sensitive receptors
- 7.1.5 **Annex 7C3** contains the results of the desk based study.
- 7.1.6 **Annex 7C4** contains further details and site observations of the 13 watercourses scoped in for field survey.
- 7.1.7 Further studies undertaken as part of **Chapter 5: Biodiversity** have also been utilised to aid the understanding of the existing hydromorphological condition, namely:
- River Condition Assessment Surveys.
 - Drone Surveys.
- 7.1.8 Full details of these surveys can be found in **Chapter 5: Biodiversity** and **Appendix 5K**.
- 7.1.9 The findings of the hydromorphology study have also been carried forward into the Water Framework Directive (WFD) Assessment provided in **Appendix 7E: Water Framework Directive Assessment** of **Chapter 7: Water Environment**.

7.2 Future Baseline

7.2.1 It is acknowledged that the hydromorphological conditions will be significantly influenced by climate change. These impacts are summarised in **Table 7C.1** below, which is adapted from the Climate Change Adaption Manual (NE751)¹.

Table 7C.1: Potential Impacts of climate change on hydromorphology

Cause	Consequence	Potential Impacts
Hotter summers and milder winters	Increased vegetation growth	Disruption to natural processes such as reduced sediment transport and deposition through a reduction in flow volumes
Drier summers	Reduced water levels and stream power in watercourses. Vegetation loss. Drying out of peat deposits. Increased risk of wildfires	Sediments and soils become more vulnerable to erosion. Vegetation loss may increase vulnerability to soil erosion, in turn leading to greater sediment transport and deposition. The drying out of peat also increases its vulnerability to transport. Fires result in further vegetation loss and increase the vulnerability of soil erosion.
Wetter winters	Increased water levels and stream power in watercourses. Increased flow in streams and rivers	Flooding may alter the landscape by washing away soils, changing the position of river channels (both laterally and vertically), and initiating the formation of new hydromorphological features. Changes to flow regime and frequency may change in sediment transport regime, including the size of sediment transported and deposited.
Increased frequency of extreme events	Highly concentrated rainfall episodes. Water logging of soils and sediments	Erosion of exposed soils. Flooding may wash away soils and alter the landscape (e.g. change the position of river channels both vertically and laterally). Increases in erosion may lead to changes to sediment transport and depositional regimes.

¹ Natural England (2020) Climate Change Adaptation Manual (NE751). (Online). Available at: <https://publications.naturalengland.org.uk/publication/5679197848862720> (accessed July 2024)

Cause	Consequence	Potential Impacts
Human responses to climate change	Hard engineering schemes, such as river bank defences, flood barriers, and drainage schemes	Alteration to natural processes (e.g. disruption of sediment transport, disconnecting the channel from its floodplain) may increase the severity of climate related problems in the future.

7.3 Hydromorphology Desk Based Study

7.3.1 The Project includes 110 individual watercourse crossings as follows:

- 42 River crossings;
- 58 Stream / ditch crossings; and
- 10 canal crossings.

7.3.2 The full crossing schedule, with WFD catchments and associated hydromorphology are listed in **Annex 7C1 – Watercourse crossings with WFD hydromorphology designations**.

7.3.3 Thirty one of the waterbodies crossed are classified as EA Main Rivers. These fall under the management of the EA, while the remaining waterbodies crossed are classified as ordinary watercourses, which are managed by Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs) where applicable.

7.3.4 Through consultation with the EA, an approach was agreed on 25 October 2023 that an initial desk based study should be undertaken to identify the most natural and hydromorphologically diverse watercourses. These watercourses are deemed to hold higher hydromorphological conservation values than other rivers and thus require further field surveys to understand site-specific hydromorphological conditions. Field survey allowed further understanding of conditions at EA Main River crossing sites and provided detailed information on both conservation value/sensitivity to disturbance and sediment dynamics.

7.3.5 A desk based study methodology was developed in consultation with the Environment Agency (EA), and is detailed in **Annex 7C2**.

7.3.6 The type and morphology of watercourses that are proposed to be crossed by the Project, range from artificial land drainage ditches with homogenous flow conditions and flow regimes to significant hydromorphologically diverse and dynamic watercourses, displaying a range of flow conditions and hydromorphological features. These may serve as habitats for a broad range of aquatic flora and fauna and are of particular interest and importance. Screened-in sites of interest were subject to further site visit surveys.

- 7.3.7 The outcomes of the desk based study concluded that 13 EA Main River water body crossings should be scoped in for field survey, with conservation values of 4 or greater. A summary of the desk based study results are shown in **Table 7C.2**. Full desk based study results are outlined in **Annex 7C3**. Details of the findings of the survey of the 13 crossings that have been visited is outlined in **Annex 7C4**.

Table 7C.2 Hydromorphology desk based study results

#	Corridor	Line	Crossing Reference ID	NGR	Waterbody Name / Name on OS mapping	WFD Catchment ID	Conservation Value	Site visit: Screen IN/OUT
1	West	1	RVX-01-00-00-001	SJ4674075272	Hapsford Brook	GB112068060330	3	OUT
2	West	1	RVX-01-00-00-002	SJ4692275342	West Central Drain	GB112068060330	2	OUT
3	West	1	RVX-01-00-00-003	SJ4735975511	Unnamed Watercourse	GB112068060330	2	OUT
4	West	1	RVX-01-00-00-004	SJ4780275774	Hornsmill Brook	GB112068060330	3	IN
5	West	1	RVX-01-00-00-005	SJ4807375994	Unnamed Watercourse	GB112068060330	2	IN
6	West	1	RVX-01-00-00-006	SJ4902576962	Unnamed Watercourse	GB112068060500	2	OUT
7	West	1	RVX-01-00-00-008	SJ4989377582	Unnamed Watercourse	GB112068060500	2	OUT
8	West	1	RVX-01-00-00-009	SJ5000177563	Unnamed Watercourse	GB112068060500	2	OUT
9	West	1	RVX-01-00-00-010	SJ5051177876	Unnamed Watercourse	GB112068060500	2	OUT
10	West	1	RVX-01-00-00-012	SJ5107778015	Unnamed Watercourse	GB112068060500	2	OUT

#	Corridor	Line	Crossing Reference ID	NGR	Waterbody Name / Name on OS mapping	WFD Catchment ID	Conservation Value	Site visit: Screen IN/OUT
11	West	1	RVX-01-00-00-013	SJ5126878246	Unnamed Watercourse	GB112068060500	2	OUT
12	West	1	RVX-01-00-00-014	SJ5174578636	Unnamed Watercourse	GB112068060500	2	OUT
13	West	1	RVX-01-00-00-015	SJ5225178989	Unnamed Watercourse	GB112068060500	2	OUT
14	West	1	RVX-01-00-00-016	SJ5246379132	River Weaver	GB112068060500	4	IN
15	South	2	RVX-02-00-00-001	SJ5980576178	River Weaver	GB112068060500	1 (Navigable)	OUT
16	South	2	RVX-02-00-00-004	SJ6428970718	River Weaver	GB112068060463	1 (Navigable)	OUT
17	South	2	RVX-02-00-00-005	SJ6776669366	River Dane	GB112068060470	7	IN
18	South	2	RVX-02-00-00-006	SJ6882169771	Puddinglake Brook	GB112068060220	6	IN
19	East	3	RVX-03-00-00-001	SJ6086778336	Whitley Brook	GB112068060510	5	IN
20	East	3	RVX-03-00-00-002	SJ6541781247	Gale Brook	GB112068060420	2	OUT

#	Corridor	Line	Crossing Reference ID	NGR	Waterbody Name / Name on OS mapping	WFD Catchment ID	Conservation Value	Site visit: Screen IN/OUT
21	East	3	RVX-03-00-00-003	SJ6766982728	Crowley Brook	GB112068060430	2	OUT
22	East	3	RVX-03-00-00-004	SJ7177887879	Agden Brook	GB112069061382	4	IN
23	East	3	RVX-03-00-00-005	SJ7179187906	River Bollin	GB112069061382	4	IN
24	East	3	RVX-03-00-00-006	SJ7204888193	Old Bollin	GB112069061382	3	OUT
25	East	3	RVX-03-00-00-007	SJ7298590256	Caldwell Brook	GB112069060980	6	IN
26	East	3	RVX-03-00-00-008	SJ7302790517	Sinderland Brook	GB112069060980	6	IN
27	North	4	RVX-04-00-00-002	SJ5697685845	Unnamed Watercourse	-	2	OUT
28	North	4	RVX-04-00-00-003	SJ5629886572	River Mersey	-	7	IN
29	North	4	RVX-04-00-00-004	SJ5466587579	Unnamed Watercourse	-	3	OUT
30	North	5	RVX-05-00-00-001	SJ5021791242	Pendlebury Brook	GB112069061170	5	IN

#	Corridor	Line	Crossing Reference ID	NGR	Waterbody Name / Name on OS mapping	WFD Catchment ID	Conservation Value	Site visit: Screen IN/OUT
31	North	5.1	RVX-05-01- 00-001	SJ5083790977	Pendlebury Brook	GB112069061170	4	IN

7.4 Site Survey Results

- 7.4.1 Field walkover surveys were undertaken at the proposed pipeline crossings and upstream and downstream in areas of interest where access could be arranged.
- 7.4.2 The field survey adds more detailed data to the parameters collated during the desk based study. Observations were made on:
- Sediment sources;
 - Sediment transport;
 - Sediment storage;
 - Channel geometry;
 - Flow hydraulics and diversity;
 - Presence and diversity of in channel macrophytes;
 - Riparian corridor species diversity and coverage;
 - Channel shading conditions; and
 - Invasive Non-Native Species (INNS) presence.
- 7.4.3 Detailed notes and annotated figures from each of the field survey notes are displayed in **Annex 7C4**.
- 7.4.4 The fluvial audit survey extents focused on the pipeline crossing points of the scoped in EA main crossings, with pre-identified sections of reach upstream and downstream of the proposed crossing also covered. Survey reach extents were limited due to land access constraints. The full reach extents and areas of accessibility along the survey reaches are shown in Figures in **Annex 7C4**.
- 7.4.5 The fluvial audit surveys were conducted from the banktop to identify and categorise the river channel and banktop features including bedforms, bank form, areas of erosion and deposition, bed materials and aquatic vegetation extent (marginal, submerged, both macrophytes and algae) as well as any barriers to fish passage.
- 7.4.6 The surveys were conducted from 07 to 11 August 2023, during hot, dry, and sunny weather following a dry July. The water level at the Sinderland Brook gauge at Partington, within one of the surveyed reaches, had been falling since 05 August and continued to fall throughout the week. Ideally, surveys are conducted in late spring or early summer when vegetation is present, but growth is not sufficient to obscure channel, bank and riparian features. However, these surveys were delayed due to land access restrictions. August surveys should be conducted under low flow conditions for maximum visibility of channel hydromorphological features and safe conditions without high flow risks. These surveys validate desk based study, allow for the

understanding of hydromorphological pressures and inform construction mitigation for WFD compliance.

- 7.4.7 Conservation values were confirmed to align with those applied during the desk based study in all cases except for three watercourses. The rationale for the designation of these conservation values is summarised in **Table 7C.2** of **Appendix 7C**.
- 7.4.8 These watercourses were subsequently consulted on with the EA in January 2024. The EA confirmed on 07 May 2024 that they accepted the changes in conservation values but require that a field survey of the Sutton Brook crossing should be undertaken to confirm that the crossing site resembles the previously surveyed locations. This survey was undertaken on 21st August 2024.
- 7.4.9 **Table 7C.3** shows the final conservation values from the desk based study and field surveys. **Table 7C.3** also shows results from the associated River Condition Assessment further details of which are presented in **Chapter 5: Biodiversity**.

Table 7C.3: Final conservation values for 13 scoped in watercourses

Corridor	Line	Crossing ID	Waterbody Name	WFD catchment	Crossing NGR	Desk Based Conservation Value (CV)	Site Visit CV	River Type (where available) ²	River Condition Assessment Scores (where available) ²	Construction crossing type
West	1	RVX-01-00-00-003	Hornsmill Brook	Peckmill Brook, Hoolpool Gutter at Ince Marshes (GB112068060330)	SJ4780875776	3	3	K	Moderate / 3	Open Cut
West	1	RVX-01-00-00-005	Unnamed Drain	Peckmill Brook, Hoolpool Gutter at Ince Marshes (GB112068060330)	SJ 48071 75993	2	1	K	Moderate / 3	Open Cut
West	1	RVX-01-00-00-016	River Weaver	-	SJ 48071 75993	4	4	Large River	Fairly Poor / 2	Horizontal Directional Drilling
South	2	RVX-02-00-00-005	River Dane	Dane (GB112068060470)	SJ 67765 69366	7	N/A			Microtunnel
South	2	RVX-02-00-00-006	Puddinglake Brook	Puddinglake Brook (GB112068060220)	SJ 68818 69769	6	6			Open Cut
East	3	RVX-03-00-00-001	Whitley Brook	Cogshall Brook (GB112068060510)	SJ 60867 78337	5	5			Open Cut
East	3	RVX-03-00-00-004	Agden Brook	Bollin (Ashley Mill to Manchester Ship Canal) (GB112069061382)	SJ 71776 87875	4	4			Microtunnel
East	3	RVX-03-00-00-005	River Bollin	Bollin (Ashley Mill to Manchester Ship Canal) (GB112069061382)	SJ 71791 87906	4	4			Microtunnel
East	3	RVX-03-00-00-007	Caldwell Brook	Sinderland Brook (GB112069060980)	SJ 72981 90249	6	4			Open Cut
East	3	RVX-03-00-00-008	Sinderland Brook	Sinderland Brook (GB112069060980)	SJ 73027 90515	6	4			Open Cut
North	4	RVX-04-00-00-003	River Mersey	-	SJ 56297 86572	7	7			Horizontal Directional Drilling
North	5	RVX-05-00-00-001	Unnamed	Sutton Brook (GB112069061170)	SJ 50215 91248	5	4	K	Fairly Poor / 2	Open Cut
North	5	RVX-05-01-00-001	Unnamed	Sutton Brook (GB112069061170)	SJ 50840 90982	5	4			Open Cut

² River type and condition is provided where rivers have been subject to survey. Not all watercourses have been surveyed. The survey rationale is detailed in the River Condition Assessment Report presented in **Chapter 5: Biodiversity**.

Annex 7C1 – Watercourse crossings with WFD Hydromorphology Designations

Annex 7C2 – Methodology

7C3 1 Prepared by WSP UK Limited for Cadent Gas Limited

Annex 7C3 – Desk based study

Annex 7C4 – Field Survey notes