High Speed Rail (West Midlands - Crewe)

Supplementary Environmental Statement and Additional Provision Environmental Statement

Volume 5: Technical appendices

Water Framework Directive compliance assessment addendum (WR-001-000)

March 2018

G30

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Department for Transport

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Contents

List of tables

1 Introduction

1.1 Background

1.1.1 This document is an appendix, which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision Environmental Statement (AP ES).

1.1.2 This appendix provides an update to the Water Framework Directive (WFD) compliance assessment presented in the High Speed Rail (West Midlands - Crewe) Environmental Statement (ES)[1] published in July 2017 (the main ES) as a result of the SES changes and AP amendments, which are assessed and reported in the SES and AP ES. This update should be read in conjunction with Volume 5: Appendix WR-001-000 of the main ES.

1.1.3 This appendix has considered the following community areas (CA):

- CA1: Fradley to Colton;
- CA2: Colwich to Yarlet;
- CA3: Stone and Swynnerton;
- CA4: Whitmore Heath to Madeley; and
- CA5: South Cheshire.

1.1.4 In order to differentiate between the proposals originally described in the main ES and subsequent changes, the following terms are used:

- 'the original scheme' - the Bill scheme submitted to Parliament in July 2017, which was assessed in the main ES;
- 'the SES scheme' – the original scheme with the changes described in the SES that are within the existing powers of the Bill; and
- 'the AP revised scheme' – the original scheme as amended by the SES changes and AP amendments.

1.2 Purpose of this addendum

1.2.1 The AP revised scheme will cross a number of surface water bodies and groundwater bodies. An assessment of the original scheme's compliance against the objectives of the Water Framework Directive (WFD) 2000/60/EC[2] was undertaken as part of the water resources and flood risk chapter of the main ES (Route-wide Water Framework Directive compliance assessment, Volume 5: Appendix WR-001-000, referred to hereafter as 'the original WFD Assessment').

[1] HS2 Ltd (2017), *High Speed Rail (West Midlands-Crewe) Environmental Statement*, https://www.gov.uk/government/collections/hs2-phase-2a-environmental-statement.
[2] Water Framework Directive - *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*. Strasbourg, European Parliament and European Council

1.2.2 The purpose of this addendum is to report any changes or updates to environmental information and scheme design or assumptions that have occurred since the main ES, which will result in a change in effects and/or the introduction of new effects on WFD status and status objectives from those reported in the original WFD Assessment.

1.3 Assessment methodology

1.3.1 The assessment method for deriving effects on WFD status and status objectives is outlined in Section 3 and Annex B of the original WFD Assessment.

2 Supplementary Environmental Statement

2.1 New environmental baseline information relevant to WFD

2.1.1 No new environmental baseline data that is relevant to the WFD has been derived that were not reported in the main ES.

2.2 Changes to design or construction assumptions which do not require changes to the Bill

2.2.1 Since submission of the Bill, the need to make changes to the design or construction assumptions has been identified. The changes that do not require a change to the Bill are detailed in Part 1 of the relevant SES and AP ES Volume 2, community area reports. No SES changes relevant to WFD have been identified.

3 Additional Provisions

3.1 Summary of changes to scheme design and construction assumptions relevant to WFD

3.1.1 In the Stone and Swynnerton area (CA3), the following types of amendments are proposed in the AP revised scheme:

- engineering amendments;
- minor utility amendments; and
- other amendments requiring changes to Bill powers.

3.1.2 A summary of these amendments, followed by a detailed description of the engineering amendments, is provided in Section 4 and Section 5 of the SES and AP ES Volume 2, Stone and Swynnerton community area (CA3) report.

Additional Provision changes relevant to WFD

3.1.3 A total of six scheme components were scoped in as having the potential to have effects on WFD status and status objectives.

3.1.4 Five of the scheme components scoped in are located on the Filly Brook and one on a previously unassessed tributary (known as 'Unnamed tributary of Filly Brook 3', (located on the south side of the Norton Bridge to Stone Railway). Both of these watercourses are located within the 'Trent from Tittensor to River Sow' (GB104028053272) WFD surface water body.

3.1.5 Table 1 summarises the scheme components proposed under the AP revised scheme on Filly Brook and the previously unassessed tributary, which have the potential to impact upon the WFD status and status objectives of the Trent from Tittensor to River Sow (GB104028053272) water body. The table includes both scheme components that have remained the same as the original scheme and those that are newly proposed. The table also summarises those scheme components from the original scheme that will no longer be provided under the AP revised scheme.

Changes on Filly Brook

3.1.6 The scheme components on Filly Brook include the addition of two new culverts, the Filly Brook culvert and Filly Brook West culvert, which replace the Filly Brook viaduct and the Filly Brook West underbridge proposed under the original scheme, respectively. As a result of the addition of these culverts, the length of the proposed realignment of the watercourse has increased by approximately 175m at this location. These changes are shown in SES and AP ES Volume 2: Map CT-06-222 in the CA3 Map Book.

3.1.7 Two new, small culverts have also been included within a newly proposed replacement floodplain storage feature located upstream of Yarnfield Lane. These culverts through a proposed bund at the south end of the replacement floodplain storage area are at the same location: one set at the current bed level of Filly Brook and one raised 0.6m above the bed level. These structures have therefore been

considered as one scheme component in this assessment. Upstream of the culverts, through the replacement floodplain storage area, the existing Filly Brook channel will be realigned and improved over approximately 238m (in conjunction with the wetland habitat creation proposed here). These changes are shown in SES and AP ES Volume 2: Map CT-06-223, in the CA3 Map Book.

Changes on Unnamed tributary of Filly Brook 3

3.1.8 The scheme component on the previous unassessed Unnamed tributary of Filly Brook 3 watercourse involves the removal of the existing culvert underneath the Norton Bridge to Stone Railway at the existing confluence with Filly Brook (at approximately SJ8884133405) and the diversion of the watercourse along the southern side of the Norton Bridge to Stone Railway to join Filly Brook, further to the north-east (at approximately SJ8899333469). These proposals are shown in SES and AP ES Volume 2: Map CT-06-222 in the CA3 Map Book.

Table 1: Summary of scheme components proposed under the AP revised scheme on Filly Brook and Unnamed tributary of Filly Brook 3, with the potential to effect WFD status and status objectives

Watercourse	Scheme Component Type	Scheme Component Name	Details	Location (NGR)	SES and AP ES WFD Assessment Addendum ID	Scheme component new, modified or retained from original scheme?	Scheme component as per original scheme (ID)	Comments
Filly Brook	Extension of existing railway culvert	Filly Brook culvert extension	Approx. existing culvert length: 30m; Approx. length of culvert expansion: 50m; Approx. existing culvert dimensions: 1.68m width x 1.5m height	SJ8899833463	n/a	Retained	Extension of existing railway culvert (WFD-TTS-T-08-01)	No change from original scheme
	Culvert (on realigned channel; see WFD-AP1-03)	Filly Brook culvert	Approx. culvert length: 95m; Approx. culvert diameter: 0.9m	SJ8820133183	WFD-AP1-01	New	Filly Brook viaduct (WFD-TTS-T-08-02)	Viaduct replaced with embankment and culvert
	Culvert (on realigned channel; see WFD-AP1-03)	Filly Brook West culvert	Approx. culvert length: 80m; Approx. culvert dimensions: 1.35m width x 1.35m height.	SJ8808733097	WFD-AP1-02	New	Filly Brook West underbridge (WFD-TTS-T-08-03)	Underbridge replaced with embankment and culvert
	Realignment (with removal of existing culvert)	-	Approx. total length of new realigned channel: 210m; Approx. length of existing culvert: 300m; Approx. existing culvert diameter: 1.2m; Total net gain of open river channel: 210m	SJ8791133127	WFD-AP1-03	Modified	Realignment (with removal of existing culvert) (WFD-TTS-T-08-04)	Realignment length reduced due to the addition of Filly Brook culvert and Filly Brook West culvert
	Realignment	-	Approx. total length of new realigned channel: 285m; Approx. total length of existing channel: 285m; No loss/gain of river channel	SJ8773333221	n/a	Retained	Realignment (WFD-TTS-T-08-05)	No change from original scheme

Watercourse	Scheme Component Type	Scheme Component Name	Details	Location (NGR)	SES and AP ES WFD Assessment Addendum ID	Scheme component new, modified or retained from original scheme?	Scheme component as per original scheme (ID)	Comments
	Highway Realignment Culvert (replacement of existing highway culvert)	-	Approx. culvert length: 70m; Approx. culvert diameter: 0.9m; Approx. existing culvert length: 67m; Approx. existing culvert dimensions: unknown (restricted access).	SJ8760733344	n/a	Retained	Highway Realignment Culvert (replacement of existing highway culvert) (WFD-TTS-T-08-06)	No change from original scheme
	Access road culvert	-	Approx. culvert length: 10m; Approx. culvert diameter: 0.9m	SJ8756833398	n/a	Retained	Access road culvert (WFD-TTS-T-08-07)	No change from original scheme
	Realignment	-	Approx. total length of new realigned channel: 190m; Approx. total length of existing channel: 200m; Total net loss of river channel: 10m	SJ8748233532	n/a	Retained	Realignment (WFD-TTS-T-08-08)	No change from original scheme
	Flood bund culverts	-	Twin culverts; Approx. culvert length: 7.5m; Approx. culvert diameter: 0.6m	SJ8733133777	WFD-AP1-04	New	n/a	No scheme component present at this location under original scheme
	Realignment (through flood storage area)	-	Approx. total length of new realigned channel: 238m; Approx. total length of existing channel: 238m[3]; Total net gain/loss in river channel: 0m	SJ8731533921	WFD-AP1-05	New	n/a	No scheme component present at this location under original scheme

[3] Assumed that the realigned channel through the flood storage area will be of equal length of the existing channel, as a minimum. Design details to be confirmed at detailed design stage.

Watercourse	Scheme Component Type	Scheme Component Name	Details	Location (NGR)	SES and AP ES WFD Assessment Addendum ID	Scheme component new, modified or retained from original scheme?	Scheme component as per original scheme (ID)	Comments
	Viaduct	-	Approx. viaduct width: 15m; Approx. viaduct length: 186m; Approx. viaduct height: 14m	SJ8706334703	n/a	Retained	M6 Meaford viaduct (WFD-TTS-T-08-09)	No change from original scheme
	Realignment	-	Approx. total length of new realigned channel: 210m; Approx. total length of existing channel: 200m; Total net gain in river channel: 10m	SJ8708734773	n/a	Retained	Realignment (WFD-TTS-T-08-10)	No change from original scheme
Unnamed tributary of Filly Brook 3	Diversion	-	Approx. total length of new diverted channel: 430m; Approx. total length of existing channel: 245m (225m open channel / 20m culverted)[4]; Total net gain in open river channel: 205m	SJ8892633437	WFD-AP1-06	New	n/a	Scheme component not assessed under original WFD Assessment

[4] Length of existing channel and culvert estimated from available Ordnance Survey mapping and aerial photography. Watercourse not surveyed as part of original WFD Assessment.

3.2 Assessment of effects on WFD surface water bodies

Existing baseline

3.2.1 Filly Brook and the Unnamed tributary of Filly Brook 3 are located within the Trent from Tittensor to River Sow (GB104028053272) surface water body. The WFD status and status objectives of the water body are summarised in Section 4, Table 7 of the original WFD Assessment.

Filly Brook

3.2.2 Filly Brook flows south from SJ8707734788, immediately to the west of the M6, before passing underneath the motorway in a culvert at SJ8784733137. The watercourse then flows eastward and enters an approximately 300m long culvert located immediately south of Pool House Farm. Downstream of this culvert, the watercourse flows north-east alongside the northern edge of the Norton Bridge to Stone Railway, before passing underneath the railway in a culvert at SJ8898533478. From here, the watercourse flows eastward through Stone to its confluence with the River Trent.

3.2.3 The baseline condition of the watercourse, at and upstream of Pool House Farm, are summarised in Appendix C2 of the original WFD Assessment. Access to the mid and lower reaches of the watercourse was restricted.

Unnamed tributary of Filly Brook 3

3.2.4 The Unnamed tributary of Filly Brook 3 flows from Micklow House Farm, at SJ8884632674, northward to the Norton Bridge to Stone Railway. The watercourse passes underneath the railway in a culvert to join the Filly Brook at approximately SJ8884133405.

3.2.5 The watercourse was not assessed as part of the main ES and the existing condition is currently unknown. The watercourse has therefore been scoped in for detailed impact assessment in this WFD Assessment Addendum on a precautionary basis.

Embedded mitigation

3.2.6 Mitigation has been embedded within the design, construction methodology and operational phase of the original scheme in order to minimise any effects on the water environment and to ensure that the scheme is, where possible, inherently compliant with the objectives of the WFD for both surface water and groundwater bodies. This is described in Section 6.2 of the original WFD Assessment.

3.2.7 A number of additional measures have been embedded within the AP revised scheme proposals along Filly Brook to mitigate flood risk. These are outlined in Section 5.2 of the SES and AP ES Volume 2, Stone and Swynnerton (CA3) community area report.

Effects on current status

3.2.8 A detailed impact assessment has been undertaken to identify the magnitude of the effects of the AP revised scheme on the current status of the quality elements of the Trent from Tittensor to River Sow (GB104028053272) water body. A revised detailed impact assessment table for the Filly Brook and the Unnamed tributary of Filly Brook 3

is provided in Annex A of this addendum. The table highlights in red any difference from the original WFD Assessment.

3.2.9 The AP revised scheme is not expected to introduce any new risks to the deterioration of the current status of any of the quality elements of the Trent from Tittensor to River Sow (GB104028053272) water body.

3.2.10 An overall minor, localised beneficial (blue) effect on a number of the quality elements of the Trent from Tittensor to River Sow (GB104028053272) water body was reported in the WFD Assessment which accompanied the main ES. This overall minor, localised beneficial (blue) effect at the water body scale is expected to remain under the AP revised scheme. The AP revised scheme is expected to result in a 13.5m net reduction of culverted channel at the water body scale. The AP revised scheme will also create approximately 1,703m of new, realigned or diverted river channel with associated embedded hydromorphological and riparian enhancements (resulting in an estimated net gain of approximately 400m of improved channel and riparian zone habitat at the water body scale).

Filly Brook

3.2.11 The AP revised scheme is anticipated to have a net beneficial effect on WFD quality elements along Filly Brook relative to the existing condition.

3.2.12 The AP revised scheme will result in the creation of approximately 1,133m of new and improved realigned channel along the mid and upper reaches of the watercourse (where hydromorphological and aquatic habitat conditions are currently degraded).

3.2.13 A net gain in open river channel of approximately 140m is estimated relative to the existing condition, as a result of the combination of proposed realignments, culverts, and the removal of existing culverts (as set out in Table 1). This includes an estimated net reduction in culverted channel along the watercourse of approximately 55m, relative to the existing condition, as a result of the scheme (owning to the removal of the approximately 300m long existing culvert adjacent to Pool House Farm).

3.2.14 The AP revised scheme will result in a lower net gain in open river channel and lower net reduction in culverted channel along the watercourse compared to the original scheme. This is due to the introduction of Filly Brook culvert, Filly Brook West culvert and two Swale culverts, and an associated reduction in the length of new realigned channel downstream of the M6.

Unnamed tributary of Filly Brook 3

3.2.15 The AP revised scheme is anticipated to have a net beneficial effect on WFD quality elements along the Unnamed tributary of Filly Brook 3 relative to the existing condition.

3.2.16 The AP revised scheme will result in the creation of approximately 430m of new river channel as a result of the proposed diversion of the watercourse along the southern side of the Norton Bridge to Stone Railway (as set out in Table 1). A net gain in open river channel of approximately 205m is estimated to result along this watercourse, relative to the existing condition. This includes the removal of the approximately 20m long existing culvert beneath the Norton Bridge to Stone Railway as part of the proposed diversion.

Effects on status objectives

3.2.17 The Environment Agency has identified a 'reason for not achieving good status' (RNAG) for the Trent from Tittensor to River Sow (GB104028053272) water body relating to urban and transport physical modifications causing barriers to fish migration, which are deemed to be contributing to fish failing their good status objective.

3.2.18 The AP revised scheme components outlined in Table 1 have been considered in terms of their potential to inhibit the Trent from Tittensor to River Sow (GB104028053272) water body from achieving good status for fish in the future as a result of introducing significant barriers to fish migration.

3.2.19 The AP revised scheme will result in a 74.5m net reduction in culvert along Filly Brook and the Unnamed tributary of Filly Brook 3 watercourse, relative to the existing condition. This includes the removal of the approximately 300m long culvert at Pool House Farm. However, the AP revised scheme will introduce a number of long culverts on the watercourse, which due to their length may present a permanent barrier to fish passage. This includes the 95m long Filly Brook culvert and 80m long Filly Brook West culvert, as well as the 70m long Yarnfield culvert and 50m long Norton Bridge to Stone Railway culvert extension retained from the original scheme. Each of the culverts will be subject to the embedded mitigation (see Section 6.2, Table 24 of the original WFD Assessment) to minimise potential adverse effects on biological continuity.

3.2.20 The AP revised scheme will also divert and extend the Unnamed tributary of Filly Brook 3 to join the Filly Brook immediately downstream of the existing Norton Bridge to Stone Railway culvert. This is expected to improve fish passage from Filly Brook to this tributary, whilst also improving the hydromorphological and aquatic habitat condition along the watercourse.

3.2.21 Baseline field surveys undertaken along the upper Filly Brook as part of the main ES have identified limited fish habitat potential, including spawning habitat potential, at and upstream of the locations of the proposed culverts. Accordingly, and when considered against the embedded mitigation, the proposed culverts on Filly Brook are not expected to prevent the Trent from Tittensor to River Sow (GB104028053272) water body from achieving its good status objective for fish in the future as a result of exacerbating pressures on fish migration.

3.2.22 However, due to access restrictions, there is currently a lack of available field survey data concerning the hydromorphological and fish habitat condition of the approximately 600m reach of Filly Brook immediately upstream of the existing Norton Bridge to Stone Railway culvert. As such, it is recommended that further field survey assessment is undertaken in order to establish fish habitat potential (including potential spawning habitat) along this reach of the watercourse. Where necessary, the outcome of this assessment should be used in consultation with the Environment Agency to inform the development of the detailed design of the proposed Norton Bridge to Stone Railway culvert extension, including any additional mitigation requirements to reduce potential future impacts on fish passage to the reach upstream.

Additional mitigation requirements to reduce risk of deterioration of current status

3.2.23 No additional mitigation is deemed required to reduce the risk of deterioration of current status of the Trent from Tittensor to River Sow (GB104028053272) water body as a result of the AP revised scheme.

Additional mitigation requirements to reduce risk of prevention of status objectives

3.2.24 No additional mitigation is deemed required to reduce the risk of prevention of status objectives of the Trent from Tittensor to River Sow (GB104028053272) water body as a result of the AP revised scheme.

3.2.25 However, further baseline field survey assessment is recommended to establish fish habitat potential (including potential spawning habitat) along the reach of Filly Brook immediately upstream of the existing Norton Bridge to Stone Railway culvert (see Section 3.2.22). This data should be used to inform design development of the proposed Norton Bridge to Stone Railway culvert extension to minimise any potential impacts on fish passage.

3.3 WFD compliance

No deterioration of current status

3.3.1 The assessment has identified a number of minor, localised adverse (yellow) and minor, localised beneficial (light blue) effects on Filly Brook and the Unnamed tributary of Filly Brook 3 watercourse within the Trent from Tittensor to River Sow (GB104028053272) water body, as a result of the AP revised scheme. These effects are not anticipated to cause a deterioration in current status of the water body.

3.3.2 The AP revised scheme is therefore considered to be compliant with the no deterioration of current status objective of the WFD.

No prevention of future status objectives

3.3.3 The assessment has screened the AP revised scheme against the relevant RNAG for the Trent from Tittensor to River Sow (GB104028053272) water body. The AP revised scheme is not anticipated to significantly exacerbate pressures identified by the Environment Agency that are currently restricting the water body from achieving its good status objective.

3.3.4 The AP revised scheme is therefore considered to be compliant with the no prevention of future status objective of the WFD.

4 Conclusion

4.1.1 This WFD Assessment Addendum provides an indication of the likely compliance of the AP revised scheme at the time the assessment was prepared.

4.1.2 The assessment has concluded that the AP revised scheme will not cause a deterioration of the current status of the Trent from Tittensor to River Sow (GB104028053272) water body or prevent the water body from achieving its status objectives. The AP Revised scheme will therefore be compliant with the objectives of the WFD.

4.1.3 No instances where an Article 4.7 test is required have been identified in this assessment.

5 References

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Strasbourg, European Parliament and European Council

HS2 Ltd (2017), *High Speed Rail (West Midlands-Crewe) Environmental Statement*. Available online at: https://www.gov.uk/government/collections/hs2-phase-2a-environmental-statement.

Annex A: Revised Detailed Impact Assessment Tables

HS2 Phase 2a: Environmental Statement Volume 5 - Route-wide WFD Compliance Assessment - AP1 Addendum, Annex A

Table 2: Detailed Impact Assessment - Potential for deterioration of current status of quality elements

Surface water body: Trent from Tittensor to River Sow

Detailed Impact Assessment

WFD Classification Elements		2015 Status	Status Objective
Biological Quality Elements	Macrophytes and Phytobenthos - combined	[illegible]	[illegible]
	Macroinvertebrates	Moderate	Good by 2027
	Fish	Bad	Poor by 2027
Physicochemical Quality Elements	Dissolved oxygen	High	Good by 2015
	pH	High	Good by 2015
	Phosphate	Poor	Good by 2027
	Ammonia	Good	Good by 2015
	Temperature	High	Good by 2015
Specific Pollutants	2,4-dichlorophenol, Ammonia (Annex 8), Copper, Dimethoate, Linuron, Mecoprop, Toluene, Triclosan, Zinc	High	High by 2015
Hydromorphological Quality Elements	Quantity and dynamics of water flow	Supports Good	Supports good by 2015
	Connection to groundwater bodies		
	River continuity		
	River depth and width variation		
	Structure and substrate of the river bed		
	Structure of the riparian zone		

Unnamed tributary of River Trent 1 (T to RS) (Moderate)

Element	WFD-TTS-T-01-01 Realignment: Footprint	WFD-TTS-T-01-01: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	WFD-TTS-T-01-01: Creation of new habitats
Dissolved oxygen	Creation of 120m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. However negligible effect anticipated on dissolved oxygen concentrations. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and dissolved oxygen concentrations upstream and downstream. **No measureable change in quality element.**	Creation of 120m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. However negligible effect anticipated on dissolved oxygen concentrations. **No measureable change in quality element.**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Creation of 120m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. Potential localised reductions in fine sediment inputs and nutrient loading. However negligible effect anticipated on phosphate concentrations. **No measureable change in quality element.**
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Creation of 120m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. Potential localised reductions in fine sediment inputs and nutrient loading. However negligible effect anticipated on ammonia concentrations. **No measureable change in quality element.**
Temperature	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component		
Quantity and dynamics of water flow	Creation of 120m of new realigned channel, with incorporated hydromorphological improvements (resulting in 5m net gain of river channel). Localised improvement in flow dynamics, but **no change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and quantity and dynamics of flow upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Connection to groundwater bodies	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
River continuity	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation	Creation of 120m of new realigned channel, with incorporated hydromorphological improvements (resulting in 5m net gain of river channel). However negligible effect anticipated on river depth and width. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and river depth and width upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Structure and substrate of the river bed	Creation of 120m of new realigned channel, with incorporated hydromorphological improvements (resulting in 5m net gain of river channel). However negligible effect anticipated on structure and substrate of river bed. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes structure and substrate of river bed upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Structure of the riparian zone	Creation of 120m of new realigned channel, with incorporated riparian improvements (resulting in 5m net gain of river channel). Localised improvement, but **no change in quality element.**	Element is insensitive to impact	Creation of 120m of new realigned channel, with incorporated riparian improvements (resulting in 5m net gain of river channel). Localised improvement, but **no change in quality element.**

Element	WFD-TTS-T-01-02 Culvert: Footprint	WFD-TTS-T-01-02: Shading	WFD-TTS-T-01-02: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream
Dissolved oxygen	Element is insensitive to impact	Localised but permanent shading of culverted section of channel. Potential to lead to minor and localised impact on dissolved oxygen concentrations (due to reduced photosynthetic activity by aquatic flora). Localised adverse effects anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and dissolved oxygen upstream and downstream of culvert. **No measureable change in quality element.**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Temperature	Element is insensitive to impact	Localised but permanent shading of culverted section of channel. Potential to lead to minor and localised impact on water temperature. Localised adverse effects anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component		
Quantity and dynamics of water flow	Localised but permanent changes to hydromorphology regime. Localised adverse effects on flow dynamics (including potential localised increases in flow velocity) anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and quantity and dynamics of flow upstream and downstream. **No measureable change in quality element**
Connection to groundwater bodies	Localised but permanent loss of connection to surrounding shallow groundwater within superficial deposits. However no likely effect anticipated on connection to groundwater bodies. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River continuity	Localised but permanent changes to hydromorphology regime. Localised adverse effects on river continuity anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation	Localised but permanent changes to hydromorphology regime. Localised adverse effects on river depth and width anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and river depth and variation upstream and downstream. **No measureable change in quality element**
Structure and substrate of the river bed	Localised but permanent changes to hydromorphology regime. Localised adverse effects on structure of river bed anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme .**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and structure and substrate of river bed upstream and downstream. **No measureable change in quality element**
Structure of the riparian zone	Localised but permanent loss of riparian zone. Localised adverse effects on structure of riparian zone anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Element is insensitive to impact

Element	WFD-TTS-T-01-03 Realignment: Footprint	WFD-TTS-T-01-03: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	WFD-TTS-T-01-03: Creation of new habitats
Macrophytes and Phytobenthos - combined	[illegible]	[illegible]	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (resulting in 20m net loss of river channel). Localised improvement in macrophytes and phytobenthos habitat, but **no change in quality element.**
Macroinvertebrates	[illegible]	[illegible]	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (resulting in 20m net loss of river channel). Localised improvement in macroinvertebrate habitat, but **no change in quality element.**
Fish	[illegible]	[illegible]	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (resulting in 20m net loss of river channel). Localised improvement in fish habitat, but **no change in quality element.**
Dissolved oxygen	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. However negligible effect anticipated on dissolved oxygen concentrations. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and dissolved oxygen concentrations upstream and downstream. **No measureable change in quality element.**	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. However negligible effect anticipated on dissolved oxygen concentrations. **No measureable change in quality element.**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. Potential localised reductions in fine sediment inputs and nutrient loading. However negligible effect anticipated on phosphate concentrations. **No measureable change in quality element.**
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Creation of 40m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements. Potential localised reductions in fine sediment inputs and nutrient loading. However negligible effect anticipated on ammonia concentrations. **No measureable change in quality element.**
Temperature	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component		
Quantity and dynamics of water flow	Creation of 40m of new realigned channel, with incorporated hydromorphological improvements (resulting in 20m net loss of river channel). Localised improvement in flow dynamics, but **no change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and quantity and dynamics of flow upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Connection to groundwater bodies	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
River continuity	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation	Creation of 40m of new realigned channel, with incorporated hydromorphological improvements (resulting in 20m net loss of river channel). However negligible effect anticipated on river depth and width. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes and river depth and width upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Structure and substrate of the river bed	Creation of 40m of new realigned channel, with incorporated hydromorphological improvements (resulting in 20m net loss of river channel). However negligible effect anticipated on structure and substrate of river bed. **No measureable change in quality element.**	Localised but permanent change to hydromorphological regime. However negligible effect anticipated on river processes structure and substrate of river bed upstream and downstream. **No measureable change in quality element.**	Element is insensitive to impact
Structure of the riparian zone	Creation of 40m of new realigned channel, with incorporated riparian improvements (resulting in 20m net loss of river channel). Localised improvement, but **no change in quality element.**	Element is insensitive to impact	Creation of 120m of new realigned channel, with incorporated riparian improvements (resulting in 5m net gain of river channel). Localised improvement, but **no change in quality element.**

River Trent (Very high)

Element	WFD-TTS-W-01-01 Viaduct: Shading	WFD-TTS-T-08-01 Culvert (offline - extension of existing culvert): Footprint	WFD-TTS-T-08-01: Shading	WFD-TTS-T-08-01: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream
Description of scheme component	Great Haywood Viaduct; Approx. viaduct width: 15m; Approx. viaduct length: 780m; Approx. viaduct height: 16m	Filly Brook culvert extension; Approx. existing culvert Length: 30m; Approx. existing culvert dimensions: 1.68m width x 1.5m height; Approx. length of culvert expansion: 50m (same dimensions as existing)		
Summary of embedded mitigation	Clear span viaduct. Viaducts designed to cross perpendicular to river channel wherever possible to reduce shading impact.	N/a		
Macrophytes and Phytobenthos - combined	Some minor, localised and periodic shading of river channel. However negligible effect on macrophytes and phytobenthos anticipated. **No measureable change in quality element**	Localised but permanent loss of open river habitat. Localised adverse effects on macrophytes and phytobenthos anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent shading of section of river channel. Localised adverse effect on macrophytes and phytobenthos anticipated (due to a reduction in photosynthetic activity), but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and macrophytes and phytobenthos habitat upstream and downstream of culvert. **No measureable change in quality element.**
Macroinvertebrates	Some minor, localised and periodic shading of river channel. However negligible effect on macroinvertebrates anticipated. **No measureable change in quality element**	Localised but permanent loss of open river habitat. Localised adverse effects on macroinvertebrates anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent shading of section of river channel. Localised adverse effects on macroinvertebrates anticipated (including due to a reduction in/loss of riparian and aquatic vegetation), but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and macroinvertebrate habitat upstream and downstream of culvert. **No measureable change in quality element.**
Fish	Some minor, localised and periodic shading of river channel. However negligible effect on fish anticipated. **No measureable change in quality element**	Localised but permanent loss of open river habitat. Potential adverse effect on fish passage also due to length of culvert. However, baseline fish assessment and field surveys suggest poor habitat potential and limited fish spawning habitat potential upstream of culvert location. Also, existing weir and significant sections of existing culverts present upstream of the culvert location (limiting available fish habitat). Localised adverse effects on fish anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent shading of culverted section of channel. Localised adverse effects on fish anticipated (including due to a reduction in/loss of riparian and aquatic vegetation), but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and fish habitat upstream and downstream of culvert. **No measureable change in quality element.**
Dissolved oxygen	Some minor, localised and periodic shading of river channel (with potential associated reduction in photosynthetic activity by aquatic flora). However, negligible effect on dissolved oxygen concentrations anticipated. **No measureable change in quality element.**	Element is insensitive to impact	Localised but permanent shading of culverted section of channel. Potential to lead to minor and localised impact on dissolved oxygen concentrations (due to reduced photosynthetic activity by aquatic flora). Localised adverse effects anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and dissolved oxygen upstream and downstream of culvert. **No measureable change in quality element.**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Temperature	Some minor, localised and periodic shading of river channel. However, negligible effect on water temperature anticipated. **No measureable change in quality element.**	Element is insensitive to impact	Localised but permanent shading of culverted section of channel. Potential to lead to minor and localised impact on water temperature. Localised adverse effects anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component			
Quantity and dynamics of water flow	N/A - Hydromorphology effects screened out for scheme design component	Localised but permanent changes to hydromorphology regime. Localised adverse effects on flow dynamics (including potential localised increases in flow velocity) anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and quantity and dynamics of flow upstream and downstream. **No measureable change in quality element**
Connection to groundwater bodies		Localised but permanent loss of connection to surrounding shallow groundwater within superficial deposits. However no likely effect anticipated on connection to groundwater bodies. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River continuity		Localised but permanent changes to hydromorphology regime. Localised adverse effects on river continuity anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation		Localised but permanent changes to hydromorphology regime. Localised adverse effects on river depth and width anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and river depth and variation upstream and downstream. **No measureable change in quality element**
Structure and substrate of the river bed		Localised but permanent changes to hydromorphology regime. Localised adverse effects on structure of river bed anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme .**	Element is insensitive to impact	Localised but permanent changes to hydromorphology regime. However negligible effect anticipated on river processes and structure and substrate of river bed upstream and downstream. **No measureable change in quality element**
Structure of the riparian zone		Localised but permanent loss of riparian zone. Localised adverse effects on structure of riparian zone anticipated, but **no change in quality element when balanced against mitigation embedded in the scheme.**	Element is insensitive to impact	Element is insensitive to impact

Filly Brook (High)

Element	WFD-AP1-01 Culvert (on realigned channel; see WFD-AP1-03): Footprint	WFD-AP1-01: Shading	WFD-AP1-01: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream
Description of scheme component	Filly Brook culvert; Approx. culvert length: 95m; Approx. culvert diameter: 0.9m		
Summary of embedded mitigation	Culvert length has been reduced as far as reasonably practicable. Culvert sized to control flood flows and promote upstream storage.		
Macrophytes and Phytobenthos - combined	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flows. Therefore no effect anticipated on macrophyte and phytobenthos relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flows. Therefore no anticipated on macrophyte and phytobenthos relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flow. Therefore negligible effect anticipated on river processes and macrophytes and phytobenthos habitat upstream and downstream of culvert. **No measureable change in quality element.**
Macroinvertebrates	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flows. Therefore no effect anticipated on macroinvertebrates relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flows. Therefore no effect anticipated on macroinvertebrates relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flow. Therefore negligible effect anticipated on river processes and macroinvertebrate habitat upstream and downstream of culvert. **No measureable change in quality element.**
Fish	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flow. Therefore no effect anticipated on fish relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flow. Therefore no effect anticipated on fish relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise a pipe culvert designed to restrict high flow. Therefore negligible effect anticipated on river processes and fish habitat upstream and downstream of culvert. **No measureable change in quality element.**
Dissolved oxygen	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on dissolved oxygen. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river processes and dissolved oxygen upstream and downstream of culvert. **No measureable change in quality element.**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Temperature	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on water temperature. **No measureable change in quality element.**	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component		
Quantity and dynamics of water flow	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on the quantity and dynamics of water flow. **No measureable change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river processes and quantity and dynamics of flow upstream and downstream. **No measureable change in quality element.**
Connection to groundwater bodies	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. No effect anticipated on connectivity to groundwater. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River continuity	Culvert proposed on newrealigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river continuity relative to existing condition. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river depth and width variation relative to existing condition. **No measureable change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, existing watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river processes and river depth and variation upstream and downstream. **No measureable change in quality element.**
Structure and substrate of the river bed	Culvert proposed on new diverted channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on structure and substrate of river bed relative to existing condition. **No measureable change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on river processes and structure and substrate of river bed upstream and downstream. **No measureable change in quality element.**
Structure of the riparian zone	Culvert proposed on new realigned channel (see WFD-AP1-03). However, existing watercourse is currently culverted below agricultural fields at this location. No effect anticipated on structure of riparian zone. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact

Element	WFD-AP1-02 Culvert (on realigned channel; see WFD-AP1-03): Footprint	WFD-AP1-02: Shading	WFD-AP1-02: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream
Description of scheme component	Filly Brook West culvert; Approx. culvert length: 80m; Approx. culvert dimensions: 1.35m x 1.35m		
Summary of embedded mitigation	Culvert length has been reduced as far as reasonably practicable. Invert of culvert to be buried 300mm below the existing bed level to reduce disruption to sediment transfer and maintain natural substrate. Culvert sized to minimise impact on flow continuity. Detailed design to be developed in general accordance with CIRIA and Environment Agency guidance and to ensure appropriate low flow water depths and velocities for fish passage. Hydromorphological improvements to be undertaken to river channel immediately upstream and downstream of the culvert to compensate for footprint loss.		
Macrophytes and Phytobenthos - combined	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on macrophyte and phytobenthos relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on macrophyte and phytobenthos relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to ensure minimised impact on flow, sediment and biological continuity. Localised improvement in macrophyte habitat downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Macroinvertebrates	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on macroinvertebrates relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on macroinvertebrates relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to ensure minimised impact on flow, sediment and biological continuity. Localised improvement in macroinvertebrates habitat downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Fish	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on fish relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on fish relative to existing condition. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to ensure minimised impact on flow, sediment and biological continuity. Localised improvement in fish habitat downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Dissolved oxygen	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on dissolved oxygen. **No measureable change in quality element.**	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on dissolved oxygen upstream and downstream of culvert. **No measureable change in quality element**
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Temperature	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Therefore no effect anticipated on water temperature. **No measureable change in quality element.**	Element is insensitive to impact
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component		
Quantity and dynamics of water flow	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to ensure appropriate low flow water depths are maintained. Localised improvement in flow dynamics therefore anticipated relative to existing condition, but **no change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to minimise impact on flow continuity. Localised improvement in flow dynamics downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Connection to groundwater bodies	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. No effect anticipated on connectivity to groundwater. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River continuity	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise larger dimensions and design of culvert to minimise impact on flow and sediment continuity. Localised improvement in river continuity therefore anticipated relative to existing condition, but **no change in quality element.**	Element is insensitive to impact	Element is insensitive to impact
River depth and width variation	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. New culvert to comprise larger dimensions. Localised improvement in river width and depth therefore anticipated relative to existing condition, but **no change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to minimise impact on flow continuity. Localised improvement in river depth downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Structure and substrate of the river bed	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Invert of new culvert to be buried below river bed to allow for build up of natural substrate. Localised improvement in river substrate therefore anticipated relative to existing condition, but **no change in quality element.**	Element is insensitive to impact	Culvert proposed on new realigned channel (see WFD-AP1-03). However, watercourse is currently within a pipe culvert below agricultural fields at this location. Design of new culvert to minimise impact on flow and sediment continuity. Localised improvement in river substrate downstream therefore anticipated relative to existing condition, but **no change in quality element.**
Structure of the riparian zone	Culvert proposed on new realigned channel (see WFD-AP1-03). However, existing watercourse is currently culverted below agricultural fields at this location. No effect anticipated on structure of riparian zone. **No measureable change in quality element.**	Element is insensitive to impact	Element is insensitive to impact

Element	WFD-AP1-03 Realignment (with removal of existing culvert): Footprint	WFD-AP1-03: Shading	WFD-AP1-03: Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	WFD-AP1-03: Creation of new habitats
Description of scheme component	Approx. existing culvert length: 300m (estimated) ; Existing approx. culvert diameter: 1.2m; Approx. total length of new realigned channel: 210m; Total net gain in open river channel: 210m			
Summary of embedded mitigation	Reinstatement of river channel form equivalent to reaches upstream and downstream of existing culvert. Design of the new channel will also ensure the equivalent hydraulic capacity and incorporation of appropriate features. Design will aim to enhance hydromorphological condition over the existing condition where reasonably practicable (provided this is compatible with the watercourses' flood risk and land drainage functions). In addition, the design of the new channel will allow for a 10m wide buffer zone for the implementation of marginal/riparian improvements.			
Macrophytes and Phytobenthos - combined	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Localised improvement in macrophyte and phytobenthos habitat anticipated, but **no change in quality element.**	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Localised improvement in macrophyte and phytobenthos habitat anticipated, but **no change in quality element.**	Localised but permanent improvement to hydromorphological regime (including removal of approx. 300m existing culvert). However negligible effect anticipated on river processes and macrophyte and phytobenthos habitat upstream and downstream. **No measureable change in quality element.**	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Localised improvement in macrophyte and phytobenthos habitat anticipated, but **no change in quality element.**
Macroinvertebrates	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Localised improvement in macroinvertebrate habitat anticipated, but **no change in quality element.**	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Localised improvement in macroinvertebrate habitat anticipated (including due to a increase in riparian and aquatic vegetation), but **no change in quality element.**	Localised but permanent improvement to hydromorphological regime (including removal of approx. 300m existing culvert). However negligible effect anticipated on river processes and macroinvertebrate habitat upstream and downstream. **No measureable change in quality element.**	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Localised improvement in macroinvertebrate habitat anticipated, but **no change in quality element.**
Fish	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Removal of significant existing barrier to fish passage also. Localised improvement in fish habitat, but **no change in quality element.**	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Localised improvement in fish habitat anticipated (including due to a increase in riparian and aquatic vegetation), but **no change in quality element.**	Localised but permanent improvement to hydromorphological regime (including removal of approx. 300m existing culvert). However negligible effect anticipated on river processes and fish habitat upstream and downstream. **No measureable change in quality element.**	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised but permanent increase in open river habitat. Localised improvement in fish habitat, but **no change in quality element.**
Dissolved oxygen	Creation of 210m of new realigned channel, with incorporated hydromorphological and riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised improvement in dissolved oxygen concentrations, but **no change in quality element.**	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Potential to lead to localised improvement in dissolved oxygen concentrations (due to increased photosynthetic activity by aquatic flora), but **no change in quality element.**	Localised but permanent improvement to hydromorphological regime (including removal of approx. 300m existing culvert). However negligible effect anticipated on river processes and dissolved oxygen concentrations upstream and downstream. **No measureable change in quality element.**	[illegible]
pH	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact
Phosphate	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	[illegible]
Ammonia	Element is insensitive to impact	Element is insensitive to impact	Element is insensitive to impact	[illegible]
Temperature	Element is insensitive to impact	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Potential to lead to localised improvement in water temperature, but **no change in quality element.**	Element is insensitive to impact	[illegible]
Specific Pollutants	N/A - Specific pollutants effects screened out for scheme design component			
Quantity and dynamics of water flow	Creation of 210m of new realigned channel, with incorporated hydromorphological improvements (involving removal of approx. 300m existing culvert). Localised but permanent improvement to hydromorphology regime. Localised improvement in quantity and dynamics of flow, but **no change in quality element.**	Element is insensitive to impact	[illegible]	[illegible]
Connection to groundwater bodies	Creation of 210m of new realigned channel (involving removal of approx. 300m existing culvert). Localised but permanent re-connection to surrounding shallow groundwater within superficial deposits. However no likely effect anticipated on connection to groundwater bodies. **No measureable change in quality element**	Element is insensitive to impact	[illegible]	[illegible]
River continuity	Creation of 210m of new realigned channel (involving removal of approx. 300m existing culvert). Localised but permanent changes to hydromorphology regime. Localised improvement in river continuity, but **no change in quality element.**	Element is insensitive to impact	[illegible]	[illegible]
River depth and width variation	Creation of 210m of new realigned channel, with incorporated hydromorphological improvements (involving removal of approx. 300m existing culvert). Localised but permanent changes to hydromorphology regime. Localised improvement in river width and depth, but **no change in quality element.**	Element is insensitive to impact	[illegible]	[illegible]
Structure and substrate of the river bed	Creation of 210m of new realigned channel, with incorporated hydromorphological improvements (involving removal of approx. 300m existing culvert). Localised improvement in structure and substrate of river bed, but **no change in quality element.**	Element is insensitive to impact	[illegible]	[illegible]
Structure of the riparian zone	Creation of 210m of new realigned channel, with incorporated riparian/marginal habitat improvements (involving removal of approx. 300m existing culvert). Localised improvement in structure of riparian zone, but **no change in quality element.**	Removal of existing 300m culvert and creation of 210m of new open channel. Localised but permanent reduction in shading of section of river channel. Localised improvement in structure of riparian zone, but **no change in quality element.**	[illegible]	[illegible]

Detailed Impact Assessment - Water Body Scale Results

Quality element group	Cumulative effects - effects on element from scheme component(s) located in other WFD water bodies	Additional mitigation requirements: Construction	Additional mitigation requirements: Operation	WFD compliance outcome - potential for deterioration of current status
Biological Quality Elements	None - water body downstream (Trent from Moreton Brook to River Trent) affected by Proposed Scheme but no widespread adverse impacts identified with the potential to propagate upstream and affect water body (e.g. restricted structures significantly affecting biological continuity).	None required	None required	Compliant - no change in biological status of water body.
Physicochemical Quality Elements	None - water body downstream (Trent from Moreton Brook to River Trent) affected by Proposed Scheme but no widespread adverse impacts identified with the potential to propagate upstream and affect water body.	None required	None required	Compliant - no change in physicochemical status of water body.
Specific Pollutants	None			
Hydromorphological Quality Elements	None - water body downstream (Trent from Moreton Brook to River Trent) affected by Proposed Scheme but no widespread adverse impacts identified with the potential to propagate upstream and affect water body.	None required	None required	Compliant - no change in hydromorphological status of water body.

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