M5 Junction 10 Improvements Scheme

Environmental Statement

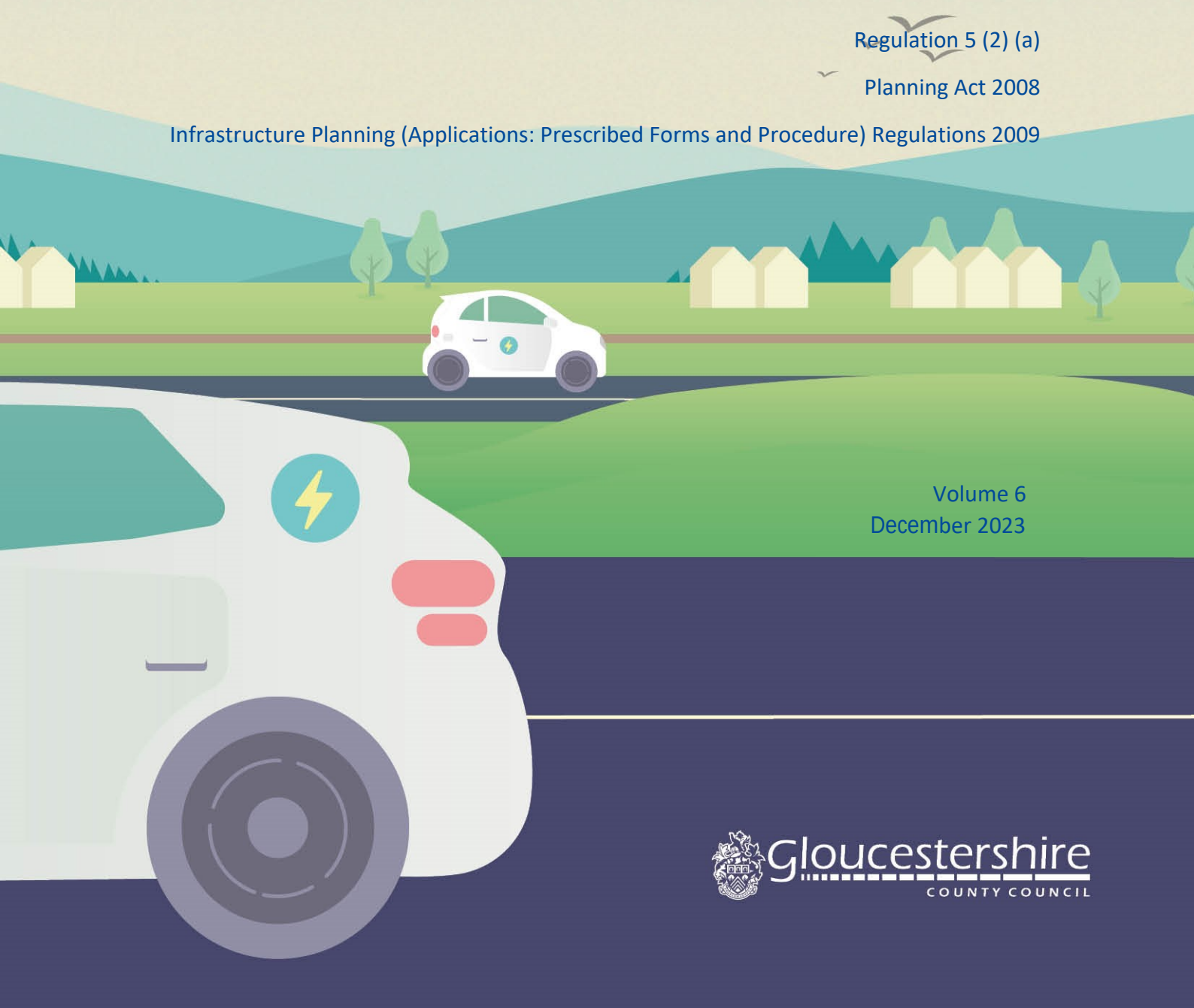
Appendix 8.3 – Surface Water Quality Assessment

TR010063 - APP 6.15

Regulation 5 (2) (a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Volume 6

December 2023

Gloucestershire COUNTY COUNCIL

THIS PAGE IS LEFT INTENTIONALLY BLANK

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

6.15 Environmental Statement:

Appendix 8.3 – Surface Water Quality Assessment

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010063
Application Document Reference	TR010063/APP/6.15
Author:	M5 Junction 10 Improvements Scheme Project Team

Version	Date	Status of Version
Rev 0	December 2023	DCO Application

Contents

Chapter Page

Tables

Figures

1. Introduction

1.1.1. This report supports the Road Drainage and Water Environment Chapter of the Environmental Statement (application document TR010063 – APP 6.6) for the M5 Junction 10 Improvements Scheme (hereafter referred to as the Scheme). It provides a greater explanation of the assessments used to determine the likely operational significant effects of the Scheme on surface water quality.

1.1.2. The assessments documented in this technical note follow The Design Manual for Roads and Bridges (DRMB) LA 113 (Road Drainage and the Water Environment). The assessments consider the impact of routine road runoff on receiving watercourses and the risk of a spillage causing a pollution incident. To fully understand the potential impacts of the Scheme on surface water quality, assessments have been undertaken based on the current road layout and drainage system within the Scheme's footprint (hereafter referred to as the current scenario) and on the Scheme road layout and drainage system (hereafter referred to as the Scheme scenario).

1.1.3. This report describes the drainage design of the current scenario and the Scheme scenario, the assessment methodology, the input data used and the results of the assessments. The technical note then concludes by stating the likely operational significant effects of the Scheme on surface water quality based on the significant criteria provided in LA 104 (Environmental assessment and monitoring).

2. Drainage design

2.1. Current drainage design

2.1.1. The current drainage design consists of eight drainage catchments. All drainage catchments discharge to surface watercourses (either the Leigh Brook or River Chelt). Table 2-1 provides details of each drainage catchment.

2.1.2. Appendix 8.3A includes a figure which shows the location of the drainage catchments.

Table 2-1 - Current drainage design

Drainage catchment name	Receiving watercourse	Impermeable area (ha)	Permeable area (ha)	Current mitigation
J1	Leigh Brook	1.106	0.18	Vegetated ditch
A4019 Main Line at Elms Park	River Chelt	2.456	0.286	Vegetated ditch
Combined Basin	Leigh Brook	3.571	0.743	Vegetated ditch
S1	River Chelt	1.618	0.550	Vegetated ditch
M5 South of the River Chelt*	River Chelt	0.480*	0.000	None
S2	Leigh Brook	5.885	1.955	Vegetated ditch
B Road	River Chelt	0.496	0.192	None
Piffs Elm Culvert	Leigh Brook	2.027	0.666	Vegetated ditch

*Area has been estimated using National Highways Drainage Data Management System (HADDMS) and professional judgement.

2.2. The Scheme drainage design

2.2.1. The Scheme drainage design consists of nine drainage catchments. All drainage catchments discharge to surface water (either the Leigh Brook or River Chelt).

2.2.2. Appendix 8.3B provides details of each drainage catchment including the change in impermeable and permeable area compared to the current drainage design. Overall, the Scheme is resulting in a 7.867 ha increase in impermeable area and a 1.349 ha increase in permeable area. Table 2-2 also shows the additional mitigation which is being applied as part of the Scheme. All drainage catchments apart from S1 south, M5 south of the River Chelt and B Road will have additional mitigation applied as part of the Scheme.

2.2.3. Appendix 8.3A includes figures showing the area of each drainage catchment.

Table 2-2 - The Scheme drainage design

Drainage catchment name	Receiving watercourse	Impermeable area (ha)	Permeable area (ha)	Change in impermeable area (ha)	Change in permeable area (ha)	Current mitigation	The Scheme mitigation
J1	Leigh Brook	1.020	0.186	-0.086	+0.006	Vegetated ditch	Basin*
Link Road	River Chelt	1.028	0.240	+1.028	+0.240		Swale, basin, vegetated ditch
A4019 Main Line at Elms Park	River Chelt	3.336	0.389	+0.880	+0.103	Vegetated ditch	Basin
Combined Basin	Leigh Brook	6.465	1.316	+2.948	+0.573	Vegetated ditch	Swale**, basin, wetland
S1	River Chelt	3.604	0.382	+2.607	-0.096	Vegetated ditch	Basin
S1 South	River Chelt	0.621	0.072			Vegetated ditch	None
M5 South of the River Chelt***	River Chelt	0.480	0.00	0.000	0.000	None	None
S2	Leigh Brook	8.274	3.235	+0.362	+0.614	Vegetated ditch	Swale, basin
B Road	River Chelt	0.624	0.101	+0.128	-0.091	None	None

*Only 0.492 ha (48%) of this catchment drains through the basin.

**Only 1.028 ha (16%) of this catchment drains through the swale.

*** This catchment is outside of the Scheme drainage works and hence no data has been collected or modelled as part of the Scheme on the drainage areas. This drainage catchment has been included as it will form part of the cumulative assessment for outfalls into the River Chelt. The area has been estimated using HADDMS and professional judgement.

3. Assessment methodology

3.1. Introduction

3.1.1. The surface water quality assessment has been undertaken in accordance with the DRMB LA 113 and LA 104 (Environmental assessment and monitoring).

3.1.2. As outlined in DMRB LA 113 the significance of potential effects on the water environment starts with the identification of the importance of the water receptors. The importance of water receptors has been established using Table 3.70 from DMRB LA 113.

3.1.3. A magnitude of impact is then assigned to each receptor using Table 3.71 from DMRB LA 113. The magnitude of impact is determined through the routine runoff and surface water quality assessment (the Highways England Water Risk Assessment Tool (HEWRAT)) and the spillage assessment. If required a Bioavailability assessment is undertaken using UKTAG Rivers and Lakes Metal Bioavailability Assessment Tool (M-BAT). When determining the magnitude of impact mitigation measures are taken into consideration. Further details of the routine runoff and surface water quality assessment (HEWRAT), spillage assessment and bioavailability assessment are presented in sections 3.2 and 3.3.

3.1.4. Once the importance of each receptor and the magnitude of the potential impact upon it are established, the significance of the potential effects is determined in accordance with Table 3.8.1 in DMRB LA 104.

3.2. Routine runoff assessment

Simple assessment

3.2.1. The HEWRAT has been used to assess whether the impact of routine runoff on surface water quality is acceptable by assessing the acute impacts from soluble pollutants, chronic impacts from sediment related pollutants and compliance with Environmental Quality Standards (EQS) using annual average concentrations of soluble pollutants. The EQSs used for the assessment are pre-defined in the HEWRAT:

- Bioavailable copper 1 µg/l.
- Bioavailable dissolved zinc 10.9 µg/l.

3.2.2. The assessment for chronic impacts from sediment contains two tiers of assessment:

- Tier 1 is a simple assessment requiring only an estimate of the river width.
- Tier 2 is a more detailed assessment which requires the physical dimensions of the river.

3.2.3. Tier 1 is initially used for the assessment with Tier 2 only being used if the assessment fails using Tier 1.

3.2.4. The following results are obtained from the HEWRAT:

- A pass or fail result for acute impacts from soluble pollutants.
- A pass or fail result for chronic impacts due to sediment related pollutants.
- Compliance with EQSs annual average concentrations of soluble pollutants.

3.2.5. For the assessment of impacts associated with soluble pollutants, outfalls within 1km (measured along the watercourse) shall be aggregated for purposes of cumulative assessment.

3.2.6. For the assessment of impacts associated with sediment related pollutants, outfalls within 100m (measured along the watercourse) shall be aggregated for purposes of cumulative assessment.

Detailed assessment

3.2.7. When the annual average concentrations of soluble pollutants predicted by the HEWRAT exceed the EQS a detailed bioavailability assessment is carried out using the M-BAT.

3.2.8. The M-BAT is used to provide a more detailed assessment for annual average concentrations of soluble pollutants following dilution. The M-BAT is a simplified version of the 'full' biotic ligand models[1] (BLMs) for copper and zinc and the key output is an estimate of the bioavailable concentration of a metal under the conditions found at a site (WFD – UKTAG[2], 2014).

3.2.9. Additional water quality data (dissolved organic carbon (DOC), dissolved calcium (Ca) and pH) are required for this assessment. This water quality data is used to calculate a Predicted No Effect Concentration (PNEC) for dissolved copper and dissolved zinc. The PNEC can be considered a site-specific EQS and is compared to the annual average concentrations of dissolved copper and dissolved zinc predicted in the HEWRAT. The annual average concentrations of dissolved copper and dissolved zinc predicted in the HEWRAT need to be below the dissolved copper and dissolved zinc PNEC values for compliance.

3.3. Spillage assessment

3.3.1. The HEWRAT provides an automated facility to perform the spillage assessment. The assessment determines the risk of a pollution incident occurring as the result of a spillage.

3.3.2. The assessment initially estimates the risk that there will be an incident causing the spillage of a potentially polluting substance somewhere on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse or groundwater. The pollution impacts considered are those that fall into wither Category 1 or 2 incidents, as defined by the Environment Agency in their Common Incident Classification System (CICS), hereafter described as 'serious pollution incidents'. The risks are expressed as annual probabilities of such an event occurring, allowing objective decisions to be made as to their acceptability, or whether measures are needed to reduce the risk.

3.3.3. Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability of such an incident shall not be greater than 1%. Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability shall not be greater than 0.5% where spillage has the potential to affect a:

- Site of Special Scientific Interest (SSSI).
- Source Protection Zone (SPZ).
- Protected area.
- Drinking water supply.
- Commercial activity abstracting from the watercourse.

3.3.4. Where more than one outfall discharges to the same reach of a watercourse, the combined risk from the outfalls is assessed.

[1] A BLM is a predictive tool that can take account of water quality parameters (such as calcium and pH) to determine the amount of bioavailable metal present (WFD-UKTAG, 2014).
[2] Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG)

4. Input data

4.1. Simple routine runoff assessment

4.1.1. Table 4-1 presents the input data and its sources for the simple routine runoff assessment.

4.1.2. One of the inputs for the assessment is Annual Average Daily Traffic (AADT). AADT has been modelled for the Scheme with the Scheme dependent developments and without the Scheme dependent developments. The Scheme dependent developments refer to the housing developments described in the Joint Core Strategy (a partnership between Gloucester City Council, Cheltenham Borough Council and Tewkesbury Borough Council which produced a coordinated strategic development plan to show how the region will develop during the period up to 2031). The assessment will consider both these modelling scenarios. However, the HEWRAT requires AADT to be input in bands (>10,000 and <50,000, >=50,000 and <100,000 and >=100,000) and having analysed the two scenarios the AADT value calculated for each drainage catchment fall within the same AADT band.

Table 4-1 - Simple routine runoff assessment input data

Parameter	Drainage design	J1	Link Road	A4019 Main Line at Elms Park	Combined Basin	S1	S1 south	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert	Source or assumption
AADT band	Current	>10,000 and <50,000	N/A	>10,000 and <50,000	>10,000 and <50,000	>=50,000 and <100,000	>=50,000 and <100,000	>=50,000 and <100,000	>=100,000	>10,000 and <50,000	>=50,000 and <100,000	Traffic modelling – Base Year 2019
	The Scheme	>10,000 and <50,000	>10,000 and <50,000	>10,000 and <50,000	>10,000 and <50,000	>=100,000	>=100,000	>=100,000	>=100,000	>10,000 and <50,000	>=100,000	Traffic modelling – Do Something: Design Year 2042 (with the Scheme dependent developments and without Scheme dependent developments)
Climatic region	Current	Warm/dry										HEWRAT v2.0 Help Guide
	The Scheme	Warm/dry										
Rainfall site	Current	Birmingham										
	The Scheme	Birmingham										
Annual Q95 River Flow	Current	0.003 m^3/s	0.052 m^3/s	0.052 m^3/s	0.003 m^3/s	0.052 m^3/s	0.052 m^3/s	0.052 m^3/s	0.003 m^3/s	0.052 m^3/s	0.003 m^3/s	Estimated using the LowFlows 2 software (Wallingford HydroSolutions[3])*
	The Scheme											
Base Flow Index (BFI)	Current	0.5**	0.7***	0.7***	0.5**	0.7***	0.7***	0.7***	0.5**	0.7***	0.5**	**Default value ***National River Flow Archive[4]: 54026 – Chelt at Slate Mill
	The Scheme											
Impermeable road area drained (ha)	Current	1.106	N/A	2.456	3.517	1.618	N/A	0.480	5.885	0.496	2.027	Drainage design drawings(DF3.4 Drainage Layout)
	The Scheme	1.020	1.028	3.336	6.465	3.604	0.621	0.480	8.274	0.624	N/A	
Permeable area draining to outfall (ha)	Current	0.180	N/A	0.286	0.743	0.550	N/A	0.000	1.955	0.192	0.666	
	The Scheme	0.186	0.240	0.389	1.316	0.382	0.072	0.000	3.235	0.101	N/A	

[3] Home - WHS (hydrosolutions.co.uk) (accessed October 2021)

[4] Search Data | National River Flow Archive (ceh.ac.uk) (accessed February 2022)

Parameter	Drainage design	J1	Link Road	A4019 Main Line at Elms Park	Combined Basin	S1	S1 south	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert	Source or assumption
Discharge within 1km of protected site for conservation	Current	No	No	No	No	No	No	No	No	No	No	Defra's Magic Website[5]
	The Scheme											
Downstream structure, lake, pond or canal that reduced velocity within 100m of the point of discharge	Current	No	No	No	No	No	No	No	No	No	No	Defra's Magic Website
	The Scheme											
Tier 1												
Estimated river width (m)	Current	2.0	2.2	3.1	2.3	3.8	3.8	3.8	2.5	3.8	2.0	Topographic data collected for modelling flood risk.
	The Scheme											
Tier 2												
Bed width (m)	Current	N/A	N/A	N/A	2.3	N/A	N/A	N/A	2.5	N/A	2.0	Topographic data collected for modelling flood risk.
	The Scheme				N/A				N/A		N/A	
Side slope (m/m)	Current	N/A	N/A	N/A	0.8771	N/A	N/A	N/A	0.5027	N/A	0.834	
	The Scheme				N/A				N/A		N/A	
Long slope (m/m)	Current	N/A	N/A	N/A	0.0058	N/A	N/A	N/A	0.0062	N/A	0.0062	
	The Scheme				N/A				N/A		N/A	
Manning's n	Current	N/A	N/A	N/A	0.08	N/A	N/A	N/A	0.08	N/A	0.08	
	The Scheme				N/A				N/A		N/A	
Ambient background concentration for dissolved copper (µg/l)	Current	0.8	3.5	3.5	0.8	4	4	4	0.8	4	0.8	Water quality monitoring undertaken for the Ground Investigation (Analytical Report Number: 21-11872)
	The Scheme											

[5] MAGIC (defra.gov.uk) (accessed February 2022)

Parameter	Drainage design	J1	Link Road	A4019 Main Line at Elms Park	Combined Basin	S1	S1 south	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert	Source or assumption
Water Hardness (for dissolved zinc only)	Current	Medium										Map showing the rate of hardness in mg/l as Calcium Carbonate in England and Wales, Defra, 2009.
	The Scheme	Medium										
Mitigation for treatment for soluble	Current	15%	N/A	15%	15%	15%	N/A	0%	15%	0%	15%	Details of mitigation provided by the drainage design team and percentage removal calculated using values provided in CG 501.
	The Scheme	27%	70%	41%	67%	41%	15%	0%	70%	0%	N/A	
Mitigation for treatment for sediments	Current	25%	N/A	25%	25%	25%	N/A	0%	25%	0%	25%	
	The Scheme	47%	94%	70%	89%	70%	25%	0%	94%	0%	N/A	

* The Scheme scenario will result in the Leigh Brook catchment reducing in size (by approximately 0.07km^2) due to the removal of the A4019 twin culverts. The annual Q95 flow for the Leigh Brook has been estimated for the current scenario (i.e. including the twin culverts) and for the Scheme (removing the twin culvert). The estimated Q95 flow is the same for both scenarios (0.003m3/s).

Calculating indicative treatment efficiencies

4.1.3. Indicative treatment efficiencies for mitigation measures have been taken from Table 8.6 4N3 (Pollution and flow measures options) from DMRB CG 501 (Design of highway drainage systems). Table 8.6.4N3 provides an indicative treatment efficiency (shown as percentage removal) for suspended solids, dissolved copper and dissolved zinc. If a mitigation measure does not treat the entire drainage catchment, then a treatment efficiency has been calculated based on the impermeable road area draining through the mitigation measure. Where more than one mitigation measure is included for a catchment the cumulative removal rate has been calculated. Table 4-2 and Table 4-3 present the calculated percentage removals for suspended sediments and solubles. As the HEWRAT only accepts one value for the percentage removal for solubles, the dissolved metal with the lowest percentage removal has been used for the assessment.

Table 4-2 - Calculated indicative treatment efficiencies for the current drainage design

Drainage Catchment name	Treatment train	Suspended solids % removal	Dissolved copper % removal	Dissolved zinc % removal
J1	Vegetated ditch	25	15	15
A4019 main line at Elms Park	Vegetated ditch	25	15	15
Combined basin	Vegetated ditch	25	15	15
S1	Vegetated ditch	25	15	15
S2	Vegetated ditch	25	15	15
B-road	None	0	0	0
M5 south of the River Chelt	None	0	0	0
Piffs Elm Culvert	Vegetated ditch	25	15	15

Table 4-3 - Calculated treatment efficiencies for the Scheme drainage design

Drainage Catchment name	Treatment train	Suspended solids % removal	Dissolved copper % removal	Dissolved zinc % removal
J1	Basin, vegetated ditch	47	31	27
Link Road	Swale, basin, vegetated ditch	94	75	70
A4019 main line at Elms Park	Basin, vegetated ditch	70	49	41
Combined basin	Swale, basin, wetland, vegetated ditch	89	67	72
S1	Basin, vegetated ditch	70	49	41
S1 south	Vegetated ditch	25	15	15

M5 south of the River Chelt	None	0	0	0
S2	Swale, basin, vegetated ditch	94	75	70
B-road	None	0	0	0

4.2. Detailed routine runoff assessment

The input data for the M-BAT has been obtained from water samples collected in September 2021 as part of the Ground Investigation[6].

4.2.1. *Figure 4.1* shows the sample locations on the Leigh Brook and River Chelt. Table 4-4 provides the values obtained for the parameters required for the assessment.

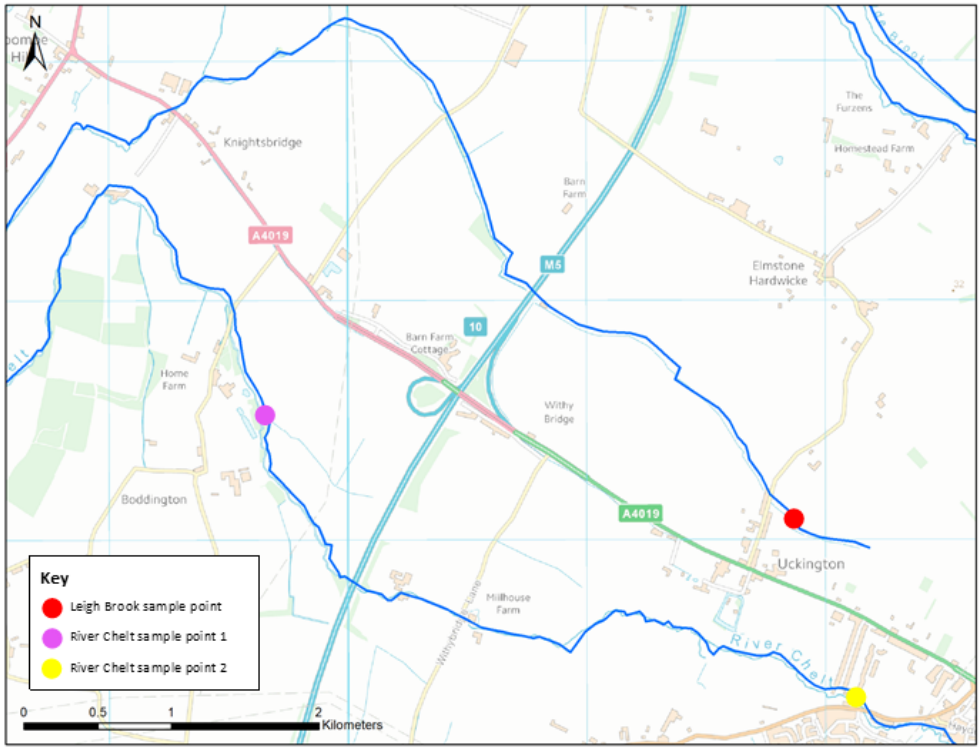


Figure 4.1 - Sample points

Table 4-4 - M-BAT input data

Parameter	Unit	Leigh Brook	River Chelt 1	River Chelt 2
Dissolved Copper	µg/l	0.8	4	3.5
Dissolved Zinc	µg/l	2.9	14	9
Dissolved Calcium	mg/l	170	91	120
DOC	mg/l	3.32	5.77	3.26

[6] Analytical Report Number: 21-11872

pH	pH units	7.7	7.6	7.5

4.3. Spillage assessment

4.3.1. Table 4-5 presents the input data and its sources for the spillage assessment.

4.3.2. One of the inputs for the assessment is AADT and percentage Heavy Goods Vehicles (HGVs). AADT and percentage HGVs has been modelled for the Scheme with the Scheme dependent developments and without the Scheme dependent developments. The assessment will consider both these modelling scenarios.

Table 4-5 - Spillage assessment inputs

Parameter	Drainage design	J1	Link Road	A4019 main line at Elms Park	Combined Basin	S1	S1 South	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert
Waterbody type	Current	Surface water									
	The Scheme										
Location (response time for emergency services)	Current	< 20 minutes									
	The Scheme										
Road Type (A-road or motorway)	Current	A	N/A	A	A	M	N/A	M	M	A	M
	The Scheme	A	A	A	A	M	M	M	M	A	N/A
If A road, is site urban or rural?	Current	Rural	N/A	Rural	Rural	N/A	N/A	N/A	N/A	Rural	N/A
	The Scheme	Rural	Rural	Rural	Rural	N/A	N/A	N/A	N/A	Rural	N/A
Traffic flow (AADT 2-way) (Base year 2019)	Current	20,897	N/A	20,578	19,263	89,215	N/A	89,215	103,147	9,596	89,215
Traffic flow (AADT 2-way) (Do Something: Design Year 2042 (with dependent developments))	The Scheme	16,057	5,372	31,530	37,097	148,838	148,838	148,838	138,573	13,691	N/A
% HGV (Base year 2019)	Current	6	N/A	8	7	32	N/A	32	32	10	32
% HGV (Do Something: Design Year 2042 (with dependent developments))	The Scheme	5	9	8	9	20	20	20	23	8	N/A
Traffic flow (AADT 2-way) (Do Something: Design Year 2042 (without dependent developments))	The Scheme	15,822	1,535	21,354	24,570	140,991	140,991	140,991	137,754	10,932	N/A
% HGV (Do Something:	The Scheme	5	8	9	9	27	21	21	23	10	N/A

Parameter	Drainage design	J1	Link Road	A4019 main line at Elms Park	Combined Basin	S1	S1 South	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert
Design Year 2042 (without dependent developments))											
Mitigation factor	Current	0.7	N/A	0.7	0.7	0.7	0.7	1	0.7	1	0.7
	The Scheme	0.53	0.21	0.35	0.13	0.35	0.7	1	0.5	1	N/A
Junction type	No Junction										
Length of road draining to outfall (m)	Current	150	N/A	130	750	380	155	120	580	380	580
	The Scheme	280	725	120	1,880	525	155	120	1,200	200	N/A
Spillage factor	Current	0.29	N/A	0.29	0.29	0.36	0.36	0.36	0.36	0.29	0.36
	The Scheme	0.29	0.29	0.29	0.29	0.36	0.36	0.36	0.36	0.29	N/A
Junction type	Cross road										
Length of road draining to outfall (m)	Current	N/A	N/A	340	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	The Scheme	N/A	100	170	300	N/A	N/A	N/A	N/A	200	N/A
Spillage factor	Current	N/A	N/A	0.88	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	The Scheme	N/A	0.88	0.88	0.88	N/A	N/A	N/A	N/A	0.88	N/A
Junction type	Side road										
Length of road draining to outfall (m)	Current	385	N/A	660	725	N/A	N/A	N/A	N/A	100	N/A
	The Scheme	200	N/A	440	200	N/A	N/A	N/A	N/A	100	N/A
Spillage factor	Current	0.93	N/A	0.93	0.93	N/A	N/A	N/A	N/A	0.93	N/A
	The Scheme	0.93	N/A	0.93	0.93	N/A	N/A	N/A	N/A	0.93	N/A
Junction type	Slip road										
Length of road draining to outfall (m)	Current	195	N/A	N/A	200	N/A	N/A	N/A	1,350	N/A	90
	The Scheme	N/A	N/A	N/A	N/A	650	N/A	N/A	640	N/A	N/A
Spillage factor	Current	0.83	N/A	N/A	0.83	N/A	N/A	N/A	0.43	N/A	0.43
	The Scheme	N/A	N/A	N/A	N/A	0.43	N/A	N/A	0.43	N/A	N/A
Junction type	Roundabout										

Parameter	Drainage design	J1	Link Road	A4019 main line at Elms Park	Combined Basin	S1	S1 South	M5 south of the River Chelt	S2	B Road	Piffs Elm Culvert
Length of road draining to outfall (m)	Current	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	The Scheme	100	N/A	N/A	226	465	N/A	N/A	430	N/A	N/A
Spillage factor	Current	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	The Scheme	3.09	N/A	N/A	3.09	3.09	N/A	N/A	3.09	N/A	N/A

Calculating spillage risk reduction factors

4.3.3. Optimum spillage risk reduction factors for mitigation measures (presented as a decimal) have been taken from Table 8.6 4N3 (Pollution and flow measures options) from DMRB CG 501 (Design of highway drainage systems). If a mitigation measure does not treat the entire drainage catchment, then a spillage risk reduction factor has been calculated based on the impermeable road area draining through the mitigation measure. Where more than one mitigation measure is included for a catchment the cumulative spillage risk reduction factor has been calculated. Table 4-6 and Table 4-7 present the calculated spillage risk reduction factors for each drainage catchment.

Table 4-6 - Calculated spillage risk reduction factors for the current drainage design

Drainage Catchment name	Current treatment train	Spillage risk reduction factor
J1	Vegetated ditch	0.7
A4019 main line at Elms Park	Vegetated ditch	0.7
Combined basin	Vegetated ditch	0.7
S1	Vegetated ditch	0.7
S2	Vegetated ditch	0.7
B-road	None	1
M5 south of the River Chelt	None	1
Piffs Elm culvert	Vegetated ditch	0.7

Table 4-7 - Calculated spillage risk reduction factors for the Scheme drainage design

Drainage Catchment name	The Scheme treatment train	Spillage risk reduction factor
J1	Basin, vegetated ditch	0.53
Link Road	Swale, basin, vegetated ditch	0.21
A4019 main line at Elms Park	Basin, vegetated ditch	0.35
Combined basin	Swale, basin, wetland, vegetated ditch	0.13
S1	Basin, vegetated ditch	0.35
S1 south	Vegetated ditch	0.70
M5 south of the River Chelt	None	1
S2	Swale, basin, vegetated ditch	0.5
B-road	None	1

5. Results

5.1. Routine runoff assessment

5.1.1. The results of the routine runoff assessment are presented in Table 5-1 and Table 5-3 for the current scenario and Table 5-4 and Table 5-5 for the Scheme scenario. The results presented include the treatment efficiencies presented in Table 4-2 and Table 4-3.

Current scenario

5.1.2. As shown in Table 5-1 all drainage catchments except S2 pass the acute impacts from soluble pollutants assessment. S2 fails both the dissolved copper and dissolved zinc acute impacts assessment. All drainage catchments exceed the freshwater EQS for dissolved copper but are all compliant with the freshwater EQS for dissolved zinc. Two drainage catchments (Combined Basin and S2) fail the chronic impacts from sediment bound pollutants assessment. The remaining drainage catchments all pass this assessment.

5.1.3. As the annual average concentration of dissolved copper exceeds the freshwater EQS, the M-BAT was used to predict a PNEC (site-specific EQS) for the watercourses which receive road runoff. The PNECs generated by the M-BAT are presented in Table 5-2. When the relevant PNEC value is compared to the annual average concentration of dissolved copper predicted by the HEWRAT (Table 5-3) all drainage catchments are compliant with the site-specific dissolved copper EQS.

Table 5-1 - Simple routine runoff assessment results – current scenario

Drainage Catchment	Acute impacts from soluble copper – pass or fail	Acute impacts from soluble zinc – pass or fail	Compliance with EQS for copper (compliant or non-compliant)	Compliance with EQS for zinc (compliant or non-compliant)	Chronic impacts from sediment-bound pollutants – pass or fail
J1	Pass	Pass	Non-compliant	Compliant	Pass
A4019 main line at Elms Park	Pass	Pass	Non-compliant	Compliant	Pass
Combined basin	Pass	Pass	Non-compliant	Compliant	Fail
S1	Pass	Pass	Non-compliant	Compliant	Pass
M5 south of the River Chelt	Pass	Pass	Non-compliant	Compliant	Pass
S2	Fail	Fail	Non-compliant	Compliant	Fail
B-road	Pass	Pass	Non-compliant	Compliant	Pass

Piffs Elm Culvert	Pass	Pass	Non-compliant	Compliant	Pass

Table 5-2 - PNEC for dissolved copper

Watercourse	PNEC for dissolved copper (µg/l)
Leigh Brook	12.50
River Chelt 1	25.10
River Chelt 2	12.23

Table 5-3 - Detailed routine runoff assessment results – current scenario

Drainage catchment	PNEC	Annual average concentration of dissolved copper (predicted by HEWRAT) (µg/l)	Compliant with site specific dissolved copper EQS
J1	12.5	1.03	Yes
A4019 main line at Elms Park	12.23	3.53	Yes
Combined basin	12.5	1.38	Yes
S1	25.1	4.02	Yes
M5 south of the River Chelt	25.1	4.07	Yes
S2	12.5	2.58	Yes
B-road	25.1	4.07	Yes
Piffs Elm Culvert	12.5	1.26	Yes

The Scheme scenario

5.1.4. As mentioned in section 4.1 the assessment considered two traffic modelling scenarios (the Scheme with dependent developments and the Scheme without dependent developments). As the HEWRAT requires AADT to be input in bands (>10,000 and <50,000, >=50,000 and <100,000 and >=100,000) the results of the routine runoff assessment are the same for both scenarios.

5.1.5. As shown in Table 5-4 all drainage catchments pass the acute impacts from soluble pollutants assessment, chronic impacts from sediment bound pollutants assessment and are compliant with the freshwater EQS for dissolved zinc. Only one drainage catchment (J1) is compliant with the freshwater EQS for dissolved copper, the remaining drainage catchments all exceed the EQS for dissolved copper.

5.1.6. As the annual average concentration of dissolved copper exceeds the freshwater EQS for the majority of drainage catchments, the M-BAT was used to predict a PNEC (site-specific EQS) for the watercourses which receive road runoff. The PNECs generated by the M-BAT are presented in Table 5-2. When the relevant PNEC value is compared to the annual average concentration of dissolved copper predicted by the HEWRAT (Table 5-5) all drainage catchments are compliant with the site-specific dissolved copper EQS.

Table 5-4 - Simple routine runoff assessment results - the Scheme scenario

Drainage Catchment	Acute impacts from soluble copper – pass or fail	Acute impacts from soluble zinc – pass or fail	Compliance with EQS for copper (compliant or non-compliant)	Compliance with EQS for zinc (compliant or non-compliant)	Chronic impacts from sediment-bound pollutants – pass or fail
J1	Pass	Pass	Compliant	Compliant	Pass
Link Road	Pass	Pass	Non-compliant	Compliant	Pass
A4019 main line at Elms Park	Pass	Pass	Non-compliant	Compliant	Pass
Combined basin	Pass	Pass	Non-compliant	Compliant	Pass
S1	Pass	Pass	Non-compliant	Compliant	Pass
S1 south	Pass	Pass	Non-compliant	Compliant	Pass
M5 south of the River Chelt	Pass	Pass	Non-compliant	Compliant	Pass
S2	Pass	Pass	Non-compliant	Compliant	Pass
B-road	Pass	Pass	Non-compliant	Compliant	Pass

Table 5-5 - Detailed routine runoff assessment results - the Scheme scenario

Drainage catchment	PNEC	Annual average concentration of dissolved copper (predicted by HEWRAT) (µg/l)	Compliant with site specific dissolved copper EQS
Link Road	12.23	3.50	Yes
A4019 main line at Elms Park	12.23	3.52	Yes
Combined basin	12.5	1.12	Yes
S1	25.1	4.07	Yes
S1 south	25.1	4.02	Yes
M5 south of the River Chelt	25.1	4.08	Yes
S2	12.5	1.54	Yes
B-road	25.1	4.07	Yes

Cumulative routine runoff assessment

Current scenario

5.1.7. Table 5-6 presents the drainage catchments which have been combined for a cumulative assessment. The results are present in Table 5-8 and include the treatment efficiencies as shown in Table 5-7. Treatment efficiencies have been calculated based on the proportion of impermeable area road draining through each mitigation measure.

5.1.8. The cumulative assessment for outfalls to the Leigh Brook fails the acute impacts from soluble pollutants assessment and chronic impacts from sediment bound pollutants assessment. The cumulative assessment for outfalls to the River Chelt passes the acute impacts from soluble pollutants assessment. The chronic impacts from sediment bound pollutants assessment was not required because the outfalls from the two drainage catchments are not within 100m of each other.

5.1.9. Both cumulative assessments are compliant with the freshwater EQS for dissolved zinc but exceed the freshwater EQS for dissolved copper. Therefore, the PNEC values (site-specific EQS) which were predicted using the M-BAT (presented inTable 5-2) and were compared to the annual average concentration of dissolved copper predicted by the HEWRAT. As shown in Table 5-9 both assessments are complaint with the site-specific dissolved copper EQS.

Table 5-6 - Details of cumulative assessments – current scenario

Assessment point	Receiving watercourse	Catchments included in assessment	Soluble pollutants cumulative assessment	Chronic sediment related pollutants cumulative assessment
S2	Leigh Brook	S2 and Combined Basin	Yes	Yes
S1	River Chelt	S1 and M5 south of the River Chelt	Yes	No

Table 5-7 - Calculated indicative treatment efficiencies for the cumulative assessment – current scenario

Drainage Catchment name	Suspended solids % removal	Dissolved copper % removal	Dissolved zinc % removal
S2	25%	15%	15%
S1	19%	12%	12%

Table 5-8 - Cumulative simple routine runoff assessment results – current scenario

Drainage Catchment	Acute impacts from soluble copper – pass or fail	Acute impacts from soluble zinc – pass or fail	Compliance with EQS for copper (compliant or non-compliant)	Compliance with EQS for zinc (compliant or non-compliant)	Chronic impacts from sediment-bound pollutants – pass or fail
S2	Fail	Fail	Non-compliant	Compliant	Fail
S1	Pass	Pass	Non-compliant	Compliant	N/A

Table 5-9 - Cumulative detailed routine runoff assessment results – current scenario

Drainage catchment	PNEC	Annual average concentration of dissolved copper (predicted by HEWRAT) (µg/l)	Compliant with site specific dissolved copper EQS
S2	12.5	3.19	Yes
S1	25.1	4.03	Yes

The Scheme scenario

5.1.10. Table 5-10 presents the drainage catchments which have been combined for a cumulative assessment. The results are present in Table 5-12 and include the treatment efficiencies shown in Table 5-11. Treatment efficiencies have been calculated based on the proportion of impermeable area road draining through each mitigation measure.

5.1.11. Both cumulative assessments pass the acute impacts from soluble pollutants assessment. The cumulative assessment which outfalls to the Leigh Brook also passes the chronic impacts from sediment bound pollutants assessment. The chronic impacts from sediment bound pollutants assessment was not required for the cumulative assessment which outfalls to the River Chelt because the outfalls from the two drainage catchments are not within 100m of each other.

5.1.12. Both cumulative assessments are compliant with the freshwater EQS for dissolved zinc but exceed the freshwater EQS for dissolved copper, therefore the PNEC values (site-specific EQS) which were predicted using the M-BAT (presented inTable 5-2) were compared to the annual average concentration of dissolved copper predicted by the HEWRAT. As shown in Table 5-13 both assessments are complaint with the site-specific dissolved copper EQS.

Table 5-10 - Details of cumulative assessments – the Scheme scenario

Assessment point	Receiving watercourse	Catchments included in assessment	Soluble pollutants cumulative assessment	Chronic sediment related pollutants cumulative assessment
J1	Leigh Brook	J1 and Combined Basin	Yes	Yes
S1	River Chelt	S1, S1 south and M5 south of the River Chelt	Yes	No

Table 5-11 - Calculated indicative treatment efficiencies for the cumulative assessment – the Scheme scenario

Drainage Catchment name	Suspended solids % removal	Dissolved copper % removal	Dissolved zinc % removal
J1	84	62	66
S1	57	40	33

Table 5-12 - Cumulative simple routine runoff assessment results – the Scheme scenario

Drainage Catchment	Acute impacts from soluble copper – pass or fail	Acute impacts from soluble zinc – pass or fail	Compliance with EQS for copper (compliant or non-compliant)	Compliance with EQS for zinc (compliant or non-compliant)	Chronic impacts from sediment-bound pollutants – pass or fail
J1	Pass	Pass	Non-compliant	Compliant	Pass
S1	Pass	Pass	Non-compliant	Compliant	N/A

Table 5-13 - Cumulative detailed routine runoff assessment results – the Scheme scenario

Drainage catchment	PNEC	Annual average concentration of dissolved copper (predicted by HEWRAT) (µg/l)	Compliant with site specific dissolved copper EQS
J1	12.5	1.21	Yes
S1	25.1	4.10	Yes

5.2. Spillage assessment

5.2.1. The results of the spillage assessment are presented in Table 5-14 for the current scenario and Table 5-15 for the Scheme scenario. The results presented include the spillage risk reduction factors shown in Table 4-6 and Table 4-7.

5.2.2. The risk of a serious pollution incident is deemed acceptable if the annual probability is less than 0.01 (1%).

Current scenario

5.2.3. Table 5-14 shows that the risk is acceptable for all drainage catchments (i.e. the annual probability of a pollution incident occurring as a result of a spillage is less than 0.01 (1%)).

Table 5-14 - Spillage assessment results – current scenario

	Annual probability of a pollution incident occurring as the result of a spillage	**Risk acceptable**
J1	0.00010	Yes
A4019 main line at Elms Park	0.00020	Yes
Combined basin	0.00020	Yes
S1	0.00060	Yes
M5 south of the River Chelt	0.00020	Yes
S2	0.00500	Yes
B-road	0.00003	Yes
Piffs Elm Culvert	0.00090	Yes

The Scheme scenario

5.2.4. As mentioned in section 4.1 the assessment considered two traffic modelling scenarios (the Scheme with dependent developments and the Scheme without dependent developments). The results for both these scenarios are presented in Table 5-15. Table 5-15 shows that the risk is acceptable for all drainage catchments for both traffic modelling scenarios (i.e. the annual probability of a pollution incident occurring as a result of a spillage is less than 0.01 (1%)).

Table 5-15 - Spillage assessment result - the Scheme scenario

	Scheme with dependent developments		Scheme without dependent development	
	Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable	Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable
J1	0.00005	Yes	0.00005	Yes
Link Road	0.000007	Yes	0.000002	Yes
A4019 main line at Elms Park	0.00011	Yes	0.00009	Yes
Combined basin	0.00016	Yes	0.00011	Yes
S1	0.00435	Yes	0.00556	Yes
S1 south	0.00025	Yes	0.00025	Yes
M5 south of the River Chelt	0.00028	Yes	0.00028	Yes
S2	0.00292	Yes	0.00706	Yes
B-road	0.00008	Yes	0.00008	Yes

Cumulative spillage assessment

Current scenario

5.2.5. Table 5-16 shows the drainage catchments which have been combined for the cumulative assessment. The results of the cumulative spillage assessment are present in Table 5-17. The results presented include the spillage risk reduction factors shown in

5.2.6. Table 4-6. The risk of a serious pollution incident is deemed acceptable if the annual probability is less than 1% (0.01). The risk is acceptable for both the Leigh Brook and River Chelt.

Table 5-16 - Details of cumulative assessments – current scenario

Receiving watercourse	Drainage catchments
Leigh Brook	J1, Combined Basin, S2, Piffs Elm Culvert
River Chelt	A4019 Main Line at Elms Park, S1, B Road and M5 south of the River Chelt

Table 5-17 - Cumulative spillage assessment results – current scenario

	Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable
Leigh Brook	0.00620	Yes

River Chelt	0.00103	Yes

The Scheme scenario

5.2.7. Table 5-18 shows the drainage catchments which have been combined for the cumulative assessment. The results of the cumulative spillage assessment are presented in

5.2.8. Table 5-19. The results presented include the spillage risk reduction factors shown in Table 4-7. The risk of a serious pollution incident is deemed acceptable if the annual probability is less than 1% (0.01). The risk is acceptable for both the Leigh Brook and River Chelt.

Table 5-18 - Details of cumulative assessments – the Scheme scenario

Receiving watercourse	Drainage catchments
Leigh Brook	J1, Combined Basin and S2
River Chelt	Link Road, A4019 Main Line at Elms Park, S1, S1 south, B Road and M5 south of the River Chelt

Table 5-19 - Cumulative spillage assessment results – the Scheme scenario

	Scheme with dependent developments		Scheme without dependent development	
	Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable	Annual probability of a pollution incident occurring as the result of a spillage	Risk acceptable
Leigh Brook	0.0031	Yes	0.0072	Yes
River Chelt	0.0051	Yes	0.0063	Yes

6. Assessment of effects

6.1. Routine runoff assessment

6.1.1. Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for each drainage catchment of the proposed road layout using the results of routine runoff assessment for the current scenario and the Scheme scenario.

6.1.2. Table 6-1 shows that two drainage catchments (Combined Basin and S2) have a beneficial impact. This is a result of the additional mitigation applied to these drainage catchments. As shown in Table 2-2 the Scheme scenario is applying additional mitigation of a swale, basin and wetland for the Combined Basin drainage catchment and a swale and basin for the S2 drainage catchment. To achieve a minor beneficial impact the assessment of either acute soluble or chronic sediment related pollutants becomes a pass from an existing site where the current scenario was a failure. To achieve a moderate beneficial impact the assessment of both acute soluble and chronic sediment related pollutants becomes a pass from an existing site where the current scenario was a failure. Drainage catchment S2 for the Scheme scenario cannot directly be compared to drainage catchment S2 from the current scenario. This is because the drainage has been redesigned in this area and the current drainage catchments S2 and Piffs Elm Culvert combine to form the S2 drainage catchment for the Scheme. Therefore, the results of the routine runoff assessment of the S2 and Piffs Elm Culvert drainage catchments from the current scenario need to both be considered when assigning the S2 Scheme drainage catchment a magnitude of impact. The S2 current drainage catchment failed the acute impact from soluble assessment and the chronic sediment related pollutants assessment. The Piffs Elm Culvert current drainage catchment passed all elements of the routine runoff assessment. Using professional judgement, a conservative approach has been adopted and a minor beneficial magnitude of impact assigned to the S2 Scheme drainage catchment.

6.1.3. Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor magnitude of impact the significance can be slight or moderate. A conservative approach has been taken when assigning the level of significance and therefore the significance of effect has been determined as slight beneficial.

6.1.4. The remaining drainage catchments all have a negligible magnitude of impact. As the importance of the receiving watercourses is high the significance of effect is slight adverse.

Table 6-1 - Assigning significance –routine runoff

Drainage catchment	Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
J1	Leigh Brook	High	Negligible	Slight adverse
Link Road	River Chelt	High	Negligible	Slight adverse
A4019 main line at Elms Park	River Chelt	High	Negligible	Slight adverse
Combined basin	Leigh Brook	High	Minor beneficial	Slight beneficial
S1	River Chelt	High	Negligible	Slight adverse
S1 south	River Chelt	High	Negligible	Slight adverse
M5 south of the River Chelt	River Chelt	High	Negligible	Slight adverse

S2	Leigh Brook	High	Minor beneficial	Slight beneficial
B-road	River Chelt	High	Negligible	Slight adverse

Cumulative routine runoff assessment

6.1.5. Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for the Scheme drainage catchments which were combined for the cumulative assessment.

6.1.6. Table 6-2 shows that both cumulative assessments have a negligible magnitude of impact. Based on the significance matrix in DMRB LA 104 the significance of effect is therefore slight adverse. Even though minor beneficial impacts were identified for the individual assessment of the Combined Basin drainage catchment, this benefit could not be proved for the cumulative assessment. This is because according to the DMRB LA 113 standard to achieve a minor beneficial magnitude of impact a comparison needs to be made between the results of the assessment for the current scenario and the Scheme scenario. A cumulative assessment was not undertaken for these two drainage catchments for the current scenario because the outfalls were not within 1km. However, the outfall location for the Combined Basin drainage catchment moved in the Scheme drainage design which meant a cumulative assessment was required.

Table 6-2 - Assigning significance – cumulative runoff routine assessment

Drainage catchment	Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
J1	Leigh Brook	High	Negligible	Slight adverse
S1	Leigh Brook	High	Negligible	Slight adverse

6.2. Spillage assessment

6.2.1. Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for the Scheme for each drainage catchment based on the results of the current scenario and the Scheme scenario spillage assessments.

Scheme with dependent developments

6.2.2. Table 6-3 shows that the majority of drainage catchments have a negligible magnitude of impact because the annual probability of a pollution incident occurring as a result of a spillage is less than 0.005 (0.5%). Based on the significance matrix in DMRB LA 104 the significance of effect for these drainage catchments is slight adverse due to the importance of the receiving watercourses being high.

6.2.3. The S2 drainage catchment has an annual probability of a pollution incident occurring as a result of a spillage of less than 0.005 (0.5%) as well as a reduction in annual probability of 50% or more when compared to the current assessment and therefore has a minor beneficial magnitude of impact. This reduction in annual probability of 50% or more is a result of additional mitigation being applied to the drainage catchment. As shown in Table 2-2 the Scheme is including the additional mitigation of a swale and basin for the drainage catchment. Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor magnitude of impact the significance can be slight or moderate. A slight beneficial significance of effect has been assigned to drainage catchment S2 as the annual probability is less than 0.75%. The level of significance assigned has been determined based on the following assumptions:

- Slight beneficial significance: reduction in annual probability of 50% to 75%.

- Moderate beneficial significance: reduction in annual probability greater than 75%.

6.2.4. These assumptions are based on professional judgement.

Table 6-3 - Assigning significance – spillage risk (with dependent developments)

Drainage catchment	Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
J1	Leigh Brook	High	Negligible	Slight adverse
Link Road	River Chelt	High	Negligible	Slight adverse
A4019 main line at Elms Park	River Chelt	High	Negligible	Slight adverse
Combined basin	Leigh Brook	High	Negligible	Slight adverse
S1	River Chelt	High	Negligible	Slight adverse
S1 south	River Chelt	High	Negligible	Slight adverse
M5 south of the River Chelt	River Chelt	High	Negligible	Slight adverse
S2	Leigh Brook	High	Minor beneficial	Slight beneficial
B-road	River Chelt	High	Negligible	Slight adverse

Scheme without dependent developments

6.2.5. Table 6-4 shows that the majority of drainage catchments have a negligible magnitude of impact because the annual probability of a pollution incident occurring as a result of a spillage is less than 0.005 (0.5%). Based on the significance matrix in DMRB LA 104 the significance of effect for these drainage catchments is slight adverse.

6.2.6. Drainage catchment A4019 Main Line at Elms Park has an annual probability of a pollution incident occurring as a result of a spillage of less than 0.005 (0.5%) as well as a reduction in annual probability of 50% or more when compared to the current assessment and therefore has a minor beneficial magnitude of impact. This reduction in annual probability of 50% or more is a result of additional mitigation being applied to the drainage catchments. As shown in Table 2-2 the Scheme is including the additional mitigation of a basin for the drainage catchment. Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor magnitude of impact the significance can be slight or moderate. A slight beneficial significance of effect has been assigned to this drainage catchment as the annual probability is less than 0.75%. The level of significance assigned has been determined based on the following assumptions:

- Slight beneficial significance: reduction in annual probability of 50% to 75%.
- Moderate beneficial significance: reduction in annual probability greater than 75%.

6.2.7. These assumptions are based on professional judgement.

6.2.8. Drainage catchments S1 and S2 have a minor adverse magnitude of impact. This is because the annual probability of a pollution incident occurring as a result of a spillage is not below 0.005 (0.5%). A minor adverse impact is determined by the annual probability of pollution incident occurring as a result of a spillage being equal to or more than 0.005 (0.5%) and less than 0.01 (1%). The risk is still acceptable because the annual probability is less than 0.01 (1%). Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor adverse magnitude of impact the significance can be slight or moderate. The level of significance assigned has been determined based on the following assumptions:

- Slight adverse significance: annual probability is less than 0.75%.
- Moderate adverse significance: annual probability is equal to or greater than 0.75%.

6.2.9. These assumptions are based on professional judgement.

Table 6-4 - Assigning significance – spillage risk (without dependent developments)

Drainage catchment	Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
J1	Leigh Brook	High	Negligible	Slight adverse
Link Road	River Chelt	High	Negligible	Slight adverse
A4019 main line at Elms Park	River Chelt	High	Minor beneficial	Slight beneficial
Combined basin	Leigh Brook	High	Negligible	Slight adverse
S1	River Chelt	High	Minor adverse	Slight adverse
S1 south	River Chelt	High	Negligible	Slight adverse
M5 south of the River Chelt	River Chelt	High	Negligible	Slight adverse
S2	Leigh Brook	High	Minor adverse	Slight adverse
B-road	River Chelt	High	Negligible	Slight adverse

Cumulative spillage assessment

6.2.10. Using the criteria in DMRB LA 113 and DMRB LA 104 the magnitude of impact and significance of effect has been determined for the Scheme drainage catchments which were combined for the cumulative assessment.

Scheme with dependent developments

Table 6-5 - Assigning significance – cumulative spillage risk (with dependent developments)

Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
Leigh Brook	High	Negligible	Slight adverse
River Chelt	High	Minor adverse	Slight adverse

6.2.11. Table 6-5 shows that the Leigh Brook has a negligible magnitude of impact because the annual probability of a pollution incident occurring as a result of a spillage is less than 0.005 (0.5%). Based on the significance matrix in DMRB LA 104 the significance of effect for these drainage catchments is slight adverse.

6.2.12. The River Chelt has a minor adverse magnitude of impact. This is because the annual probability of a pollution incident occurring as a result of a spillage is not below 0.005 (0.5%). A minor adverse impact is determined by the annual probability of pollution incident occurring as a result of a spillage being equal to or more than 0.005 (0.5%) and less than 0.01 (1%). The risk is still acceptable because the annual probability is less than 0.01 (1%). Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor adverse magnitude of impact the significance can be slight or moderate. The level of significance assigned has been determined based on the following assumptions:

- Slight adverse significance: annual probability is less than 0.75%.

- Moderate adverse significance: annual probability is equal to or greater than 0.75%.

6.2.13. These assumptions are based on professional judgement.

Scheme without dependent developments

Table 6-6 - Assigning significance – cumulative spillage risk (without dependent developments)

Receiving watercourse	Importance of receptor	Magnitude of impact	Significance of effect
Leigh Brook	High	Minor adverse	Slight adverse
River Chelt	High	Minor adverse	Slight adverse

6.2.14. Table 6-6 shows that both the River Chelt and the Leigh Brook have a minor adverse magnitude of impact. This is because the annual probability of a pollution incident occurring as a result of a spillage is not below 0.005 (0.5%). A minor adverse impact is determined by the annual probability of pollution incident occurring as a result of a spillage being equal to or more than 0.005 (0.5%) and less than 0.01 (1%). The risk is still acceptable because the annual probability is less than 0.01 (1%). Based on the significance matrix in DMRB LA 104 when a receptor has a high importance and a minor adverse magnitude of impact the significance can be slight or moderate. The level of significance assigned has been determined based on the following assumptions:

- Slight adverse significance: annual probability is less than 0.75%.
- Moderate adverse significance: annual probability is equal to or greater than 0.75%.

6.2.15. These assumptions are based on professional judgement.

7. Conclusion

7.1.1. A surface water quality assessment for the Scheme has been undertaken in accordance with DMRB standard LA 113.

7.1.2. Following the significance matrix presented in the DMRB LA 104 guidance it can be concluded that the Scheme will not have any significant effects on the surface water quality of the River Chelt or Leigh Brook when operational.

7.1.3. The routine runoff assessment has shown that two drainage catchments result in minor beneficial impacts to the water quality of the Leigh Brook. This is a result of the additional mitigation that the Scheme is applying to the drainage catchments. These impacts are of slight beneficial significance. The remaining drainage catchments result in a negligible impact on the water quality of the Leigh Brook and River Chelt. As the Leigh Brook and the River Chelt are of high importance, even though the magnitude of impact is negligible it is of slight adverse significance.

7.1.4. The cumulative routine runoff assessment has shown impacts on water quality to be negligible and of slight adverse significance. Beneficial impacts were not picked up in the cumulative assessment because the drainage catchments assessed cumulatively for the Scheme were not required to be assessed cumulatively for the current scenario.

7.1.5. For the spillage assessment conclusions can be drawn for two traffic modelling scenarios: the Scheme with Scheme dependent developments and the Scheme without Scheme dependent developments. The spillage assessment with Scheme dependent developments has shown that one drainage catchment which outfalls to the Leigh Brook results in a minor beneficial impact to water quality which is of slight beneficial significance. This beneficial impact is a result of additional mitigation the Scheme is applying to the drainage catchment. The two remaining drainage catchments which outfall to the Leigh Brook and all six drainage catchments that outfall to the River Chelt result in a negligible impact on water quality. As the Leigh Brook and the River Chelt are of high importance, even though the magnitude of impact is negligible these are of slight adverse significance.

7.1.6. The cumulative spillage assessment showed a minor adverse impact to the River Chelt, which is caused by the annual probability of a pollution incident occurring as a result of a spillage not being less than 0.005 (0.5%). The significance of this impact is slight adverse. Cumulatively there would be negligible impacts to the water quality of the Leigh Brook, which would be of slight adverse significance due to the importance of the Leigh Brook being high.

7.1.7. The spillage assessment without Scheme dependent developments has shown that one drainage catchment which outfalls to the River Chelt results in minor beneficial impacts to water quality which is of slight beneficial significance. This beneficial impact is a result of additional mitigation the Scheme is applying to the drainage catchment. Four drainage catchments which outfall to the River Chelt and two drainage catchments which outfall to the Leigh Brook result in a negligible impact on the water quality. As the Leigh Brook and the River Chelt are of high importance, even though the magnitude of impact is negligible these are of slight adverse significance. One drainage catchment which outfalls to the Leigh Brook and one drainage catchment which outfalls to the River Chelt result in a minor adverse impact to water quality which is of slight adverse significance. This slight adverse impact is a result of the annual probability of a pollution incident occurring as a result of a spillage not being less than 0.005 (0.5%).

The cumulative spillage assessment showed a minor adverse impact to the Leigh Brook and the River Chelt, which again is caused by the annual probability of a pollution incident occurring as a result of a spillage not being less than 0.005 (0.5%). The significance of this impact is slight adverse.

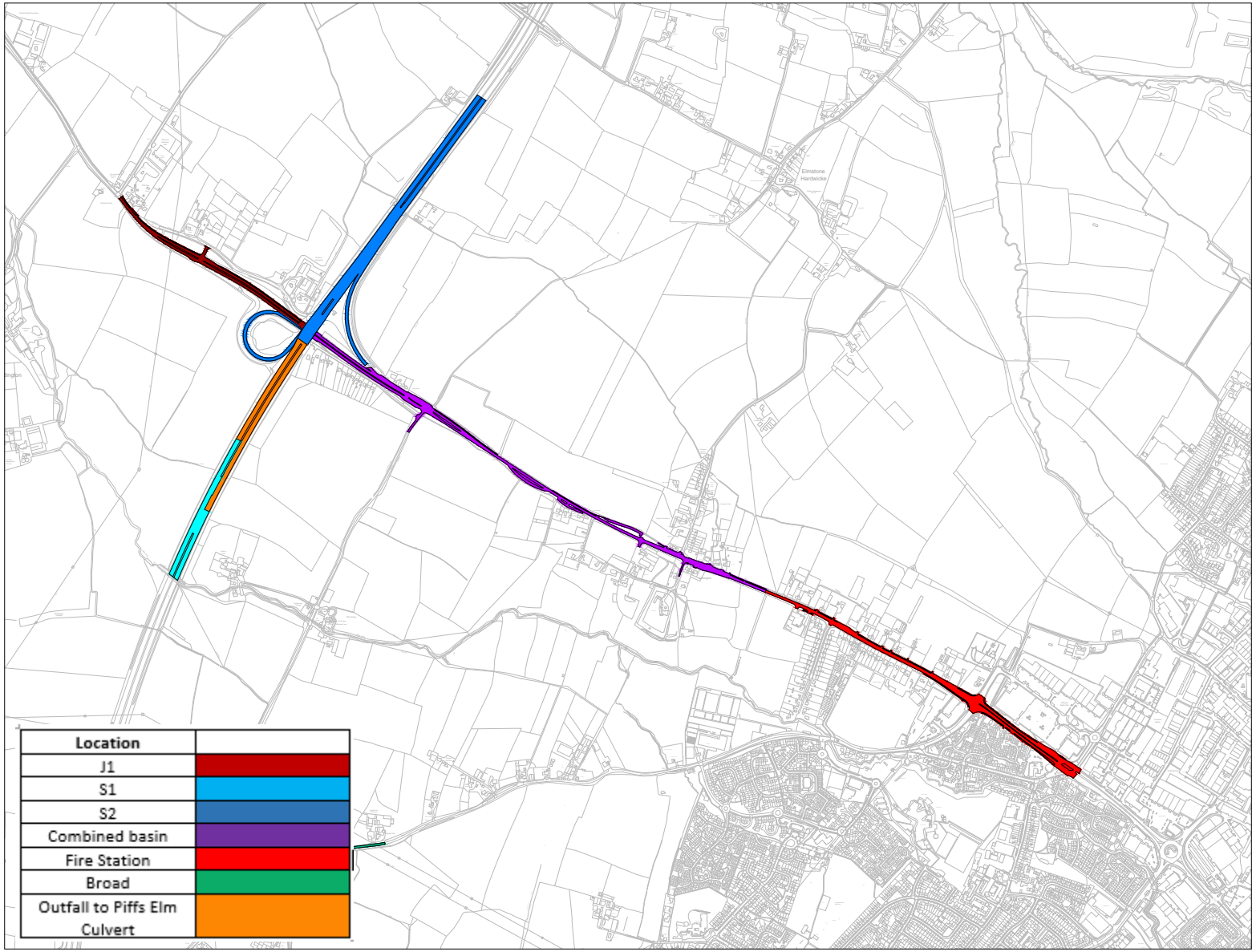
Appendices

Appendix 8.3A. Current drainage catchments

Schedule of figures included in this application document

Figure reference	Document title	Sheet	Revision
8.3A	Existing drainage catchment area	1 of 1	0

EXISTING DRAINAGE CATCHMENT AREA

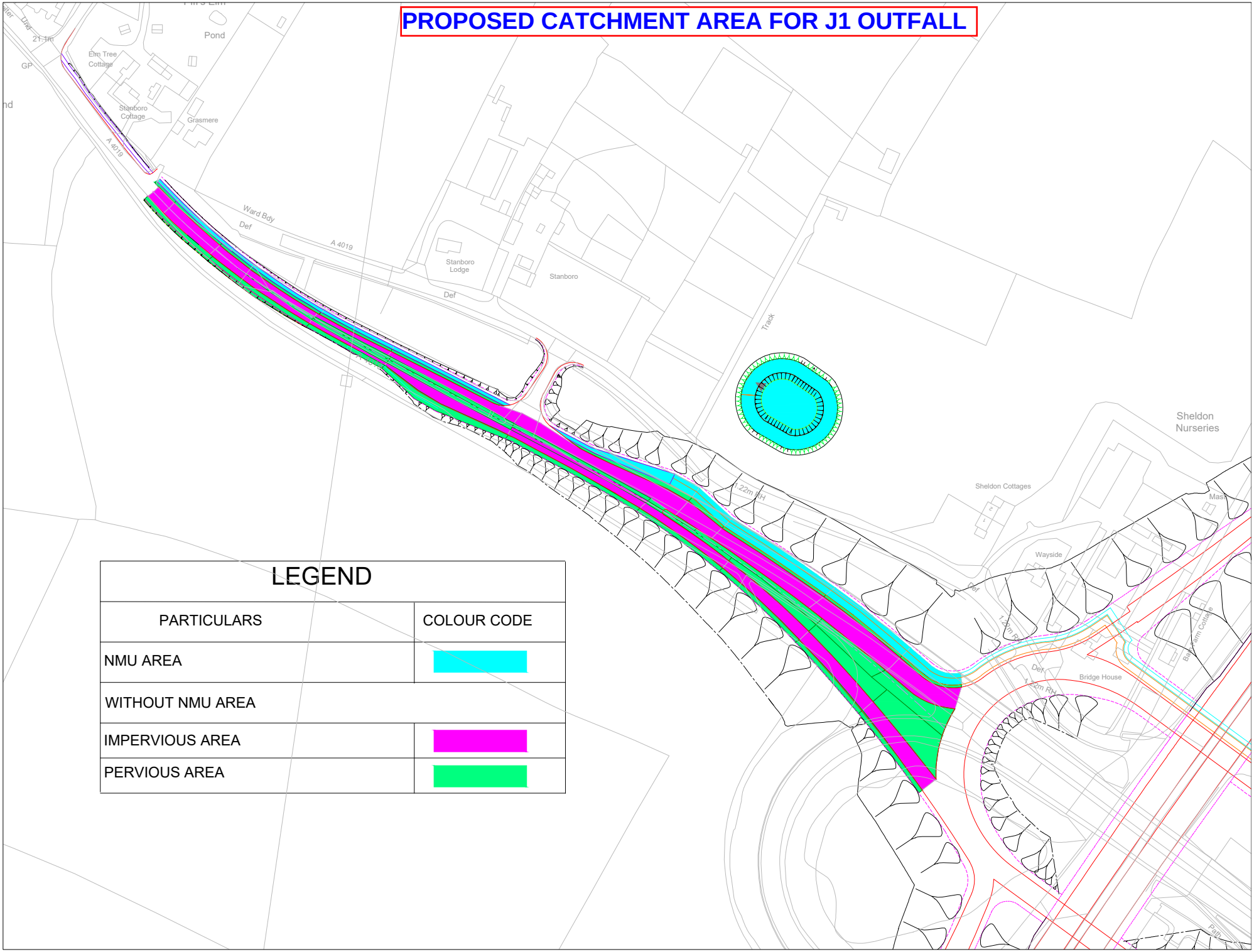


Appendix 8.3B. The Scheme drainage catchments

Schedule of figures included in this application document

Figure reference	Document title	Sheet	Revision
8.3B_1	Proposed catchment area for J1 outfall	1 of 1	0
8.3B_2	Proposed catchment for S1 outfall, S1 south outfall and south of River Chelt	1 of 1	0
8.3B_3	Proposed catchment area for S2 outfall	1 of 1	0
8.3B_4	Proposed catchment area for Link Road	1 of 1	0
8.3B_5	Proposed catchment area for combined basin	1 of 1	0
8.3B_6	Proposed catchment area for Fire Station outfall	1 of 1	0
8.3B_7	Proposed catchment area for B road outfall	1 of 1	0

PROPOSED CATCHMENT AREA FOR J1 OUTFALL

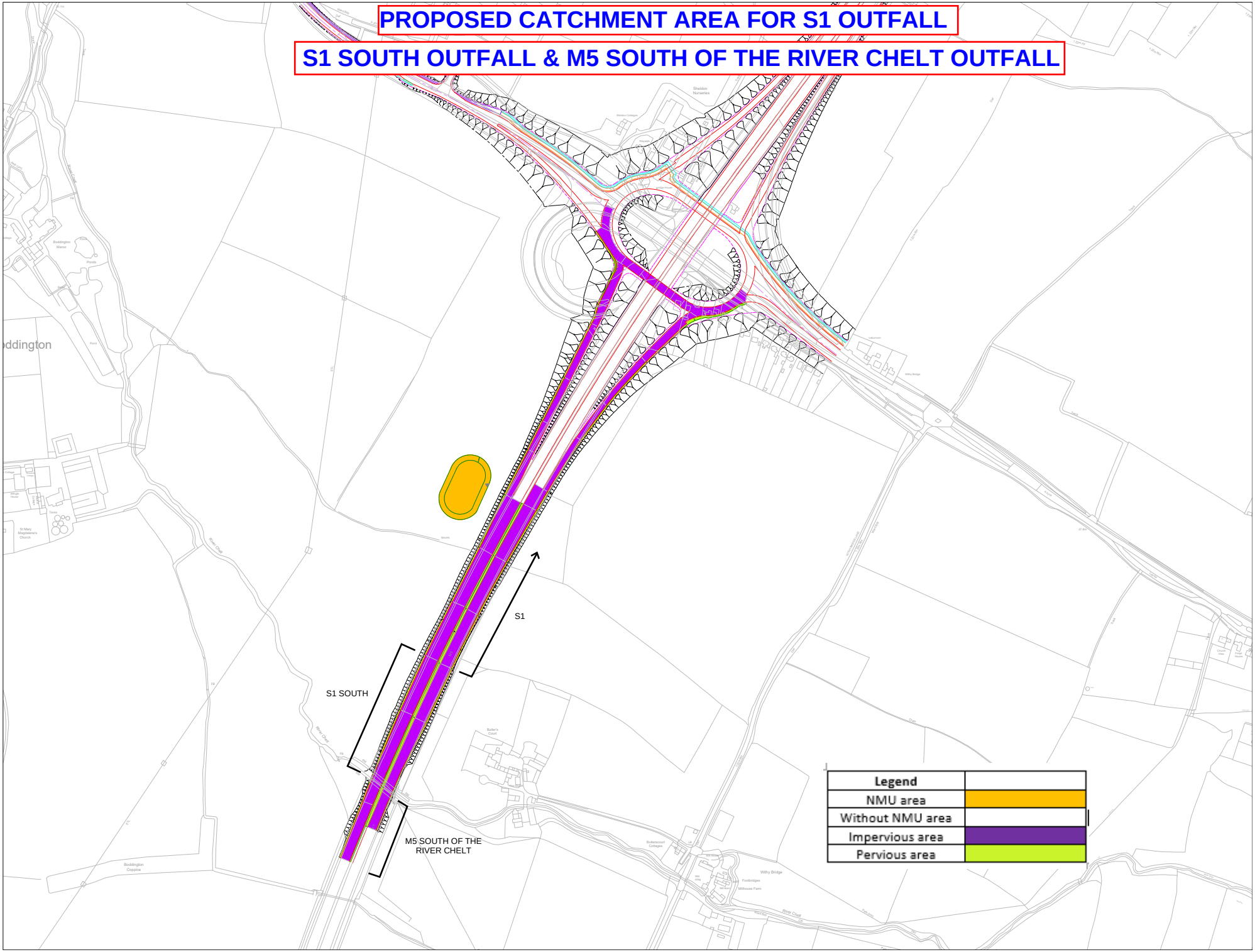


LEGEND

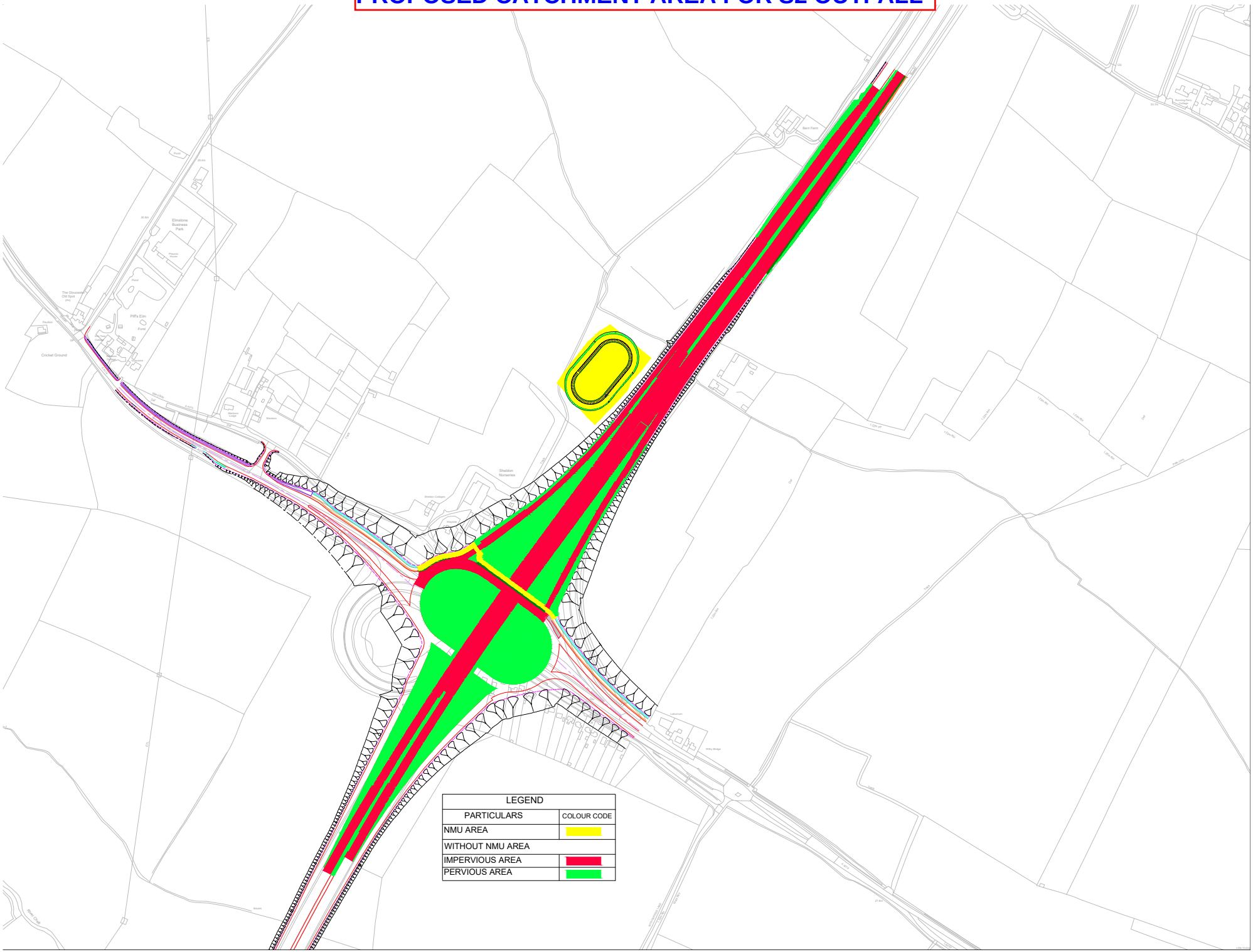
PARTICULARS	COLOUR CODE
NMU AREA	
WITHOUT NMU AREA	
IMPERVIOUS AREA	
PERVIOUS AREA	

PROPOSED CATCHMENT AREA FOR S1 OUTFALL

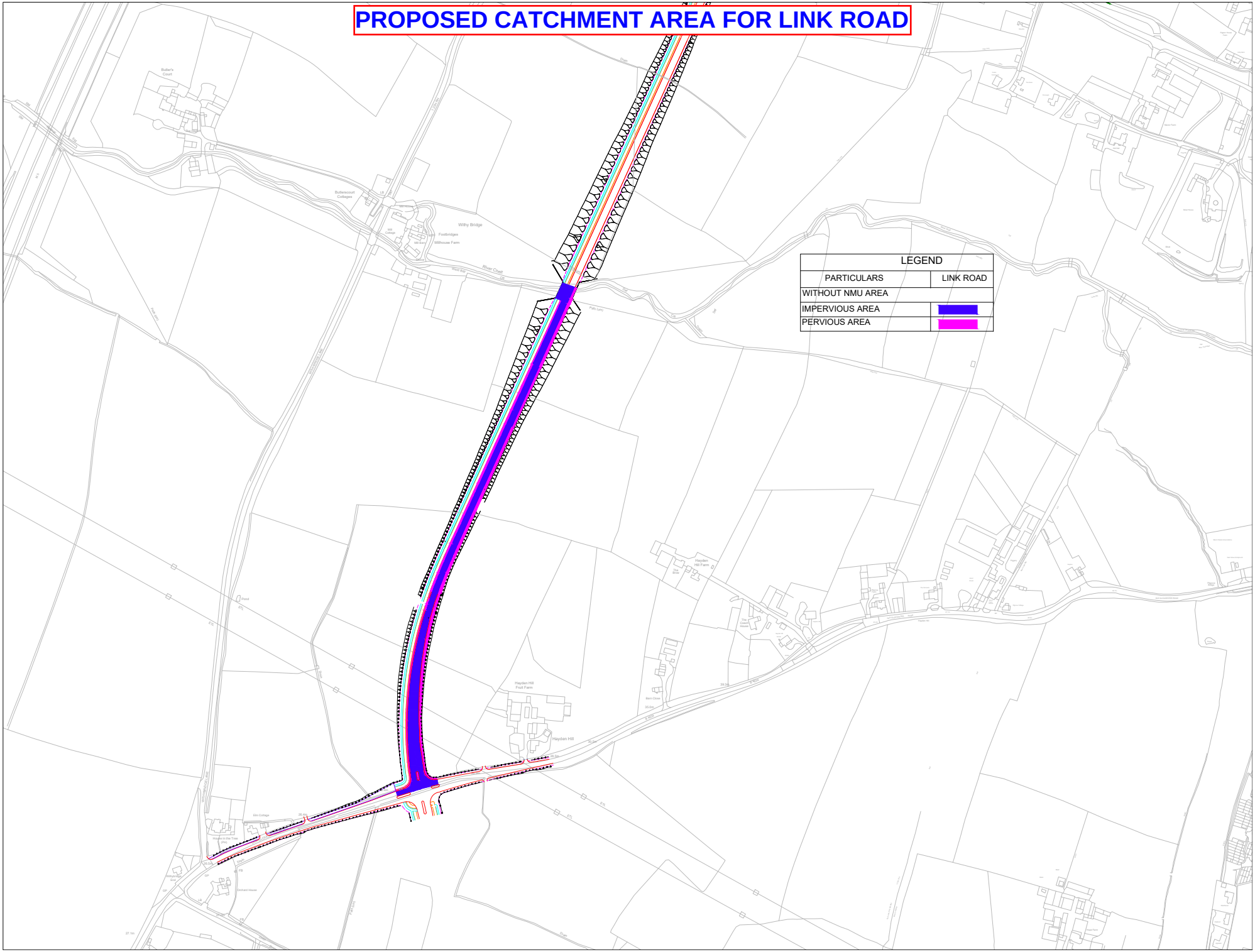
S1 SOUTH OUTFALL & M5 SOUTH OF THE RIVER CHELT OUTFALL



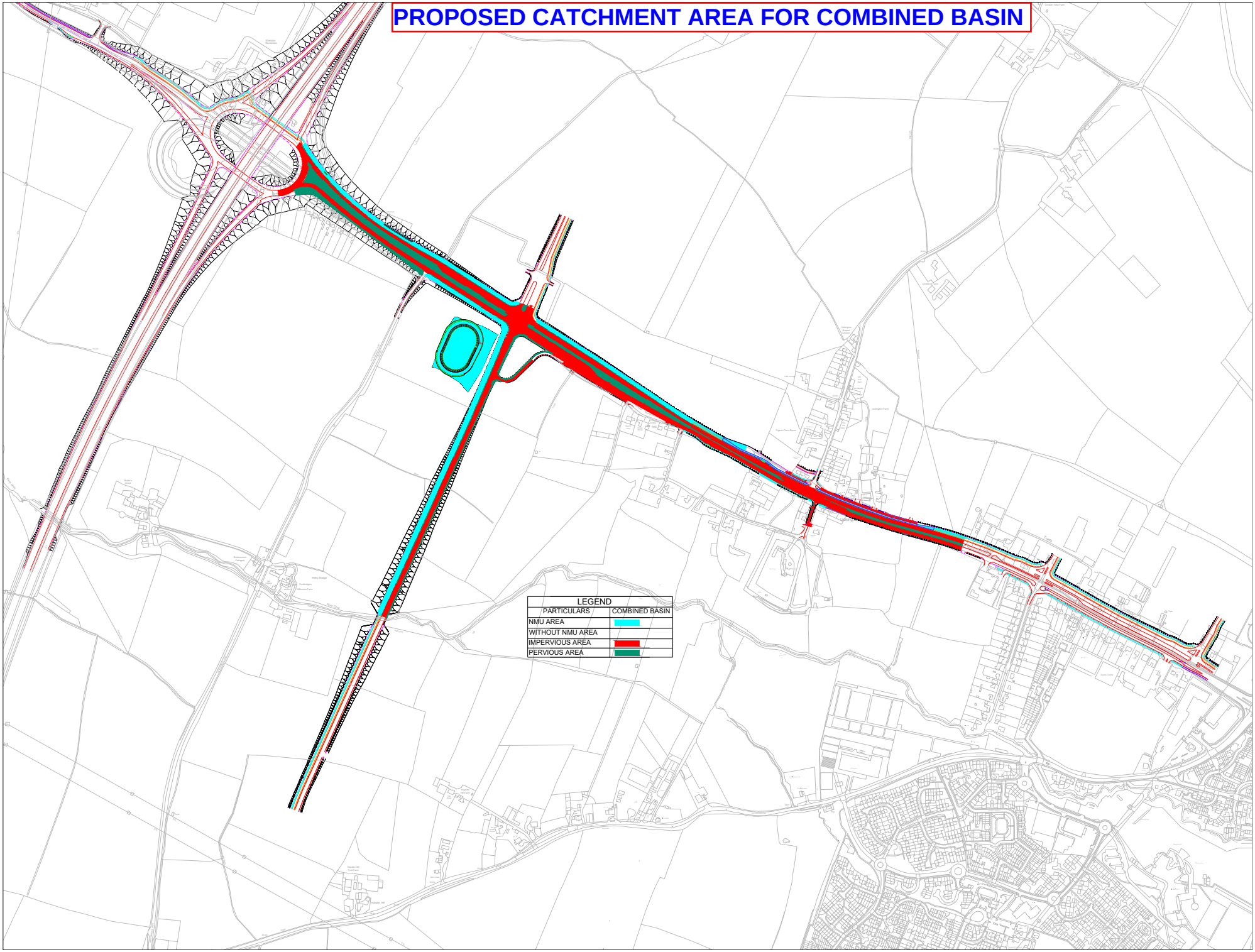
PROPOSED CATCHMENT AREA FOR S2 OUTFALL



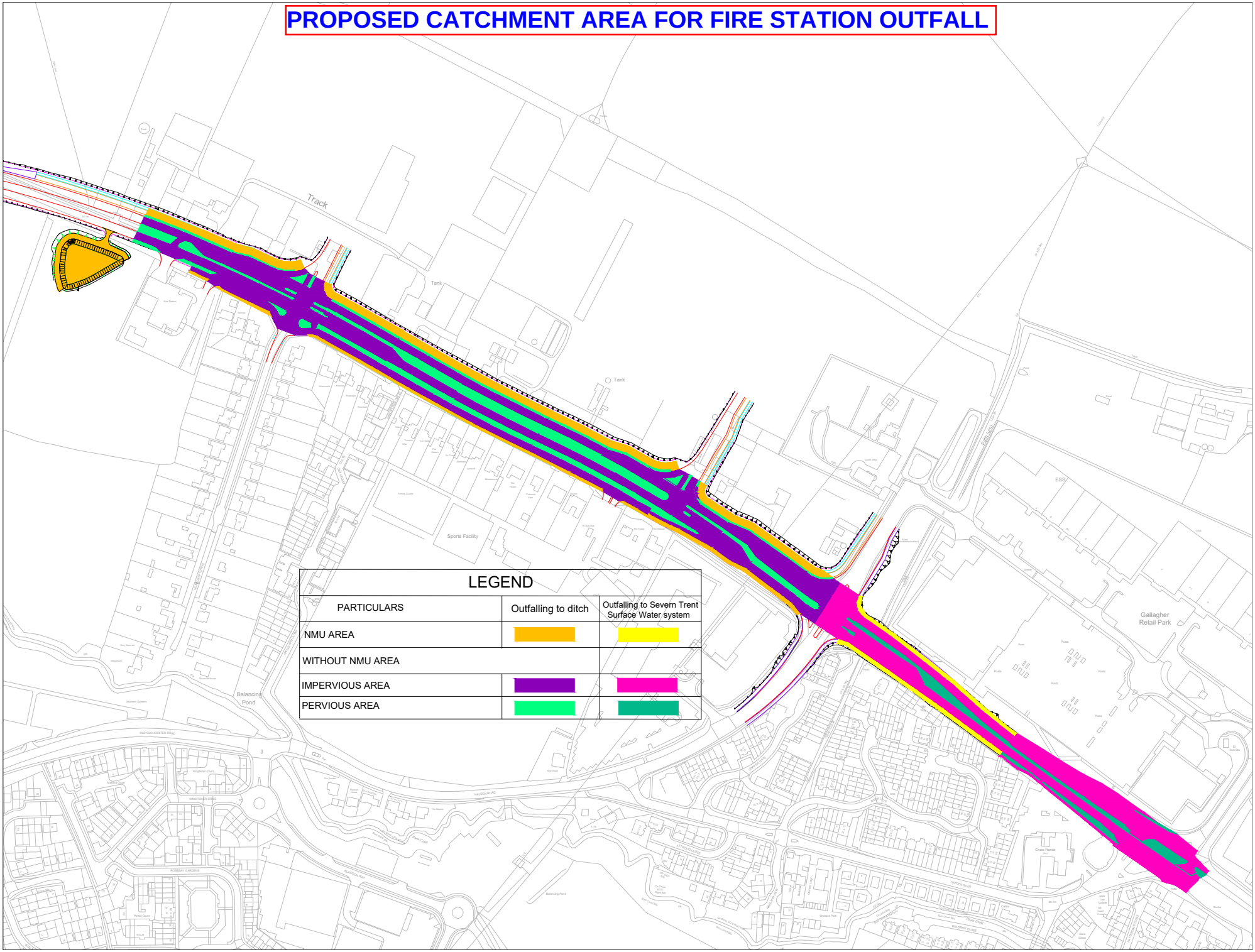
PROPOSED CATCHMENT AREA FOR LINK ROAD



PROPOSED CATCHMENT AREA FOR COMBINED BASIN



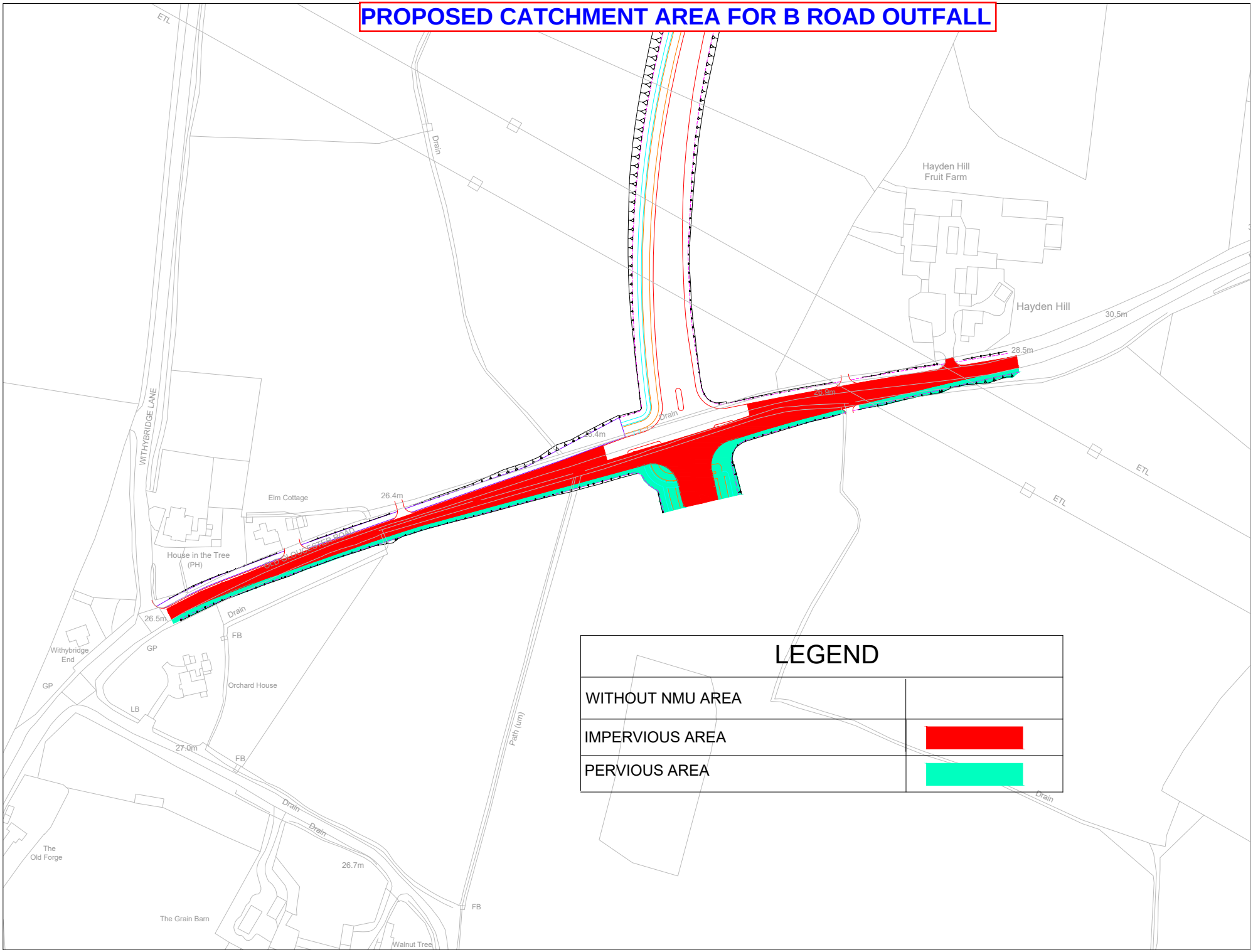
PROPOSED CATCHMENT AREA FOR FIRE STATION OUTFALL



LEGEND

PARTICULARS	Outfalling to ditch	Outfalling to Severn Trent Surface Water system
NMU AREA		
WITHOUT NMU AREA		
IMPERVIOUS AREA		
PERVIOUS AREA		

PROPOSED CATCHMENT AREA FOR B ROAD OUTFALL



LEGEND	
WITHOUT NMU AREA	
IMPERVIOUS AREA	
PERVIOUS AREA	

ATKINS
Member of the SNC-Lavalin Group

5th Floor, Block 5
Shire Hall
Bearland
Gloucester
GL1 2TH

Tel: +44 (0) 8000 514 514