CONTENTS

TABLES

1 AIR QUALITY

1.1 LEGISLATIVE AND POLICY FRAMEWORK

Details of the relevant legislation and policy notes considered in the air quality assessment are provided in Appendix B-2.

GUIDANCE

- DMRB, LA 105, Air Quality[1]

LA 105[1] "*provides a framework for assessing, mitigating and reporting the effects of motorway and all-purpose trunk road projects on air quality*." As stated within the document, "*there are no specific requirements for Department for Infrastructure, Northern Ireland supplementary or alternative to those given in LA 105*."

- DEFRA, Local Air Quality Management Technical Guidance, LAQM.TG16[2]

DEFRA has published technical guidance for use by the Local Authority for review and assessment work. This guidance, referred to in this document as LAQM.TG16[2] has been used where appropriate in the assessment presented herein. Although this technical document is focussed around LAQM activities, the guidance provides relevant methods concerning treatment and interpretation of modelling and monitoring data that are not fully enclosed by LA 105[1].

1.2 METHODOLOGY

The document provides a framework for assessing, mitigating and reporting the effects of motorway and all-purpose trunk road projects on air quality through:

- Determination as to whether the impacts of the proposed scheme on human health or designated habitats can trigger a significant air quality effect
- Determination as to whether the impacts of the proposed scheme affects the UK's reported ability to comply with the EU directive on ambient air quality[3] in the shortest timeframe possible
- Determination as to whether construction activities associated with the delivery of the proposed scheme triggers a significant air quality effect on nearby sensitive receptors

[1] Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland, (2020). DMRB, LA 105 revision 0. Air Quality [online] Available at: https://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf [Accessed 04/05/2020].
[2] DEFRA, (2018). Local Air Quality Management Technical Guidance (LAQM.TG16) version 1, February 2018. [online] Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf [Accessed 04/05/2020].
[3] European Parliament, Council of the European Union, (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. [online] Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050 [Accessed 04/05/2020].

- The assessment and application of appropriate mitigation measures and air quality monitoring where the proposed scheme:
  - triggers a significant air quality effect
  - affects the UK's reported ability to comply with the EU directive on ambient air quality[3] in the shortest timeframe possible, or
  - results in adverse dust impacts

The following assessment components are outlined in consideration of LA 105[1]:

Level of Assessment

As stated previously, the proposed scheme is currently at options selection stage. Therefore, a simple level of air quality assessment has been considered.

Baseline Conditions

The following baseline information has been gathered to inform the air quality assessment:

- Air quality monitoring data obtained from the Local Authority and from a project specific monitoring survey
- LAQM progress reports, including the locations of any AQMAs within, or close to the border of the study area
- Pollution Climatic Mapping (PCM) modelled concentrations that coincide with roads included in the study area
- Background concentrations for the road traffic pollutants NO_x, NO_2, PM_{10} and $PM_{2.5}$ for the quoted assessment years and nitrogen (N) deposition, where designated habitats are included in the assessment

As mentioned above, to support the proposed scheme, a specific NO_2 passive diffusion tube monitoring programme was conducted to establish baseline concentrations for the study area. The twelve-month programme began in May 2019 and had been scheduled to be completed by May 2020. However, due to the COVID-19 pandemic, the monitoring study concluded in March 2020. Reduction of the monitoring programme by two months is not deemed detrimental to the overall baseline data set. Further information in regard to the baseline monitoring survey is presented in Appendix B-4. The locations of the monitoring sites selected are shown in Figure 6.2.10 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0208).

The data was used to facilitate verification of atmospheric dispersion modelling completed for the operational stage air quality assessment, as outlined in Appendix B-5.

Construction Stage

Construction Dust Risk

LA 105[1] provides updated guidance in regard to the potential for fugitive dust emissions to cause significant effect on human health and designated habitats. The premise is to identify, describe and assess the risk of dust arising from construction activities that have the potential to result in statutory nuisance.

Table 1-1 and Table 1-2 shall be followed to determine whether each route option has a high or low construction dust risk.

Table 1-1 – Construction Dust Risk Potential

Risk	Applicable Types of Projects
Large	Large smart motorway projects, bypass and major motorway junction improvements.
Small	Junction congestion relief project i.e. small junction improvements, signalling changes. Short smart motorway projects

Table 1-2 – Receiving Environment Sensitivity to Construction Dust

Construction Dust Risk Potential	Distance from construction activities		
	0-50m	50-100m	100-200m
Large	High	High	Low
Small	High	Low	Low

The construction dust assessment derives a level of risk potential that is then used to inform the mitigation measures required to support the proposed scheme. LA 105[1] notes that, "*With best practice construction mitigation measures the impact of construction dust are unlikely to trigger a significant air quality effect*". The proposed Route Options in line with to Table 1-1, are classed as a 'Large' risk, and the construction dust risk potential from Table 1-2 can be read for the same.

Construction Traffic

Paragraph 2.60 of LA 105[1] states that, "*The impact of construction activities on vehicle movements shall be assessed where construction activities are programmed to last for more than two years*."

Early indications of the construction programme is that construction-related activities are programmed to last for a timeframe of 18 months. As such, this element of assessment has not been considered further.

It is noted in LA 105[1] that, "*If the construction activities are less than two years it is unlikely that the construction activities would constitute a significant air quality effect or impinge on the UK's reported ability to comply with the EU directive on ambient air quality given the short term duration of the construction activities as opposed to the long term operation of the project*."

Operational Stage

The operational stage air quality assessment focussed on the predicted changes in concentrations of specific air pollutants at identified sensitive receptors, which are associated with changes in vehicle emissions attributed to the operation of each route option. The assessed vehicle pollutants comprise nitrogen dioxide (NO_2) and particulates (PM_{10}, $PM_{2.5}$).

Although this stage of the proposed scheme is currently at the options selection, atmospheric dispersion modelling has been carried out in order to present a more robust approach to the assessment of local air quality conditions. The assessment methodology outlined below is reflective of this approach.

Assessment Scenarios

The operational stage air quality assessment focussed on the following scenarios, for which traffic data has been provided to facilitate atmospheric dispersion modelling of vehicle emissions using Cambridge Environmental Research Consultants Ltd (CERC)'s Atmospheric Dispersion Modelling System (ADMS)-Roads v5.0.0.1 model:

- Base year of 2019 to facilitate model verification using local authority monitoring data
- Opening year of 2025, DM (without the proposals)
- Opening year of 2025, DS (with the proposals)

The base year of 2019 was assessed to enable verification of the model results with the results of the air quality monitoring programme. This base year also aligns with the representative meteorological data and traffic data year (2019) provided for the assessment.

The respective traffic data for each of the above scenarios includes details of the AADT flows, vehicle speeds (km/h) and the percentage of Heavy-Duty Vehicles (HDVs) applicable to the local road network in all assessment years.

Paragraph 2.34 of LA 105[1] states that, "*Where AADT or AAWT traffic information is used to undertake the assessment, the AADT or AAWT speed shall be used to identify the relevant speed band*." Identification of the relevant speed band for each link has been completed for the respective traffic datasets for each route option and screened accordingly.

Meteorological Data

Meteorological data, such as wind speed and direction, are used by the model to determine pollutant dispersion and levels of dilution in the lower atmosphere.

Meteorological data used in the model was obtained from the Met Office observing station at Lough Fea for 2019. This station is located approximately 9.5 km to the north west of Cookstown and is considered to provide representative data for the assessment. Where required, missing cloud cover data has been extrapolated from the Aldergrove meteorological site to supplement the Lough Fea dataset. A wind rose plot of the Lough Fea meteorological site is provided in Appendix B-5.

Conversion of NOx to NO2

Road contributions of NOx (road-NO_x) were predicted using the ADMS-Roads model. The proportion of road-NO_x predicted to be converted to NO_2 at the identified receptor locations was derived using the NO_x to NO_2 calculator version 7.1[4], as provided by DEFRA.

Background Pollutant Concentrations

Background pollutant concentration data for NO_x, NO_2, PM_{10} and $PM_{2.5}$ were obtained from the DEFRA UK-Air website[5] for a base year of 2019 and opening year of 2025 (see Appendix B-6).

Estimated background concentrations are available for all years between 2017 and 2030. The maps assume that background concentrations will improve (reduce) over time, in line with the predicted reduction in vehicle emissions and emissions from other sources.

[4] DEFRA, (2019). NO_x to NO_2 Calculator, version 7.1. [online] Available at: https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v7.1.xlsm [Accessed 06/07/2020].
[5] DEFRA, (2019). 2017-based background maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$. [online] Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017 [Accessed 06/07/2020].

It should be noted that for NO_x, PM_{10} and $PM_{2.5}$, the background maps present both the 'total' estimated concentrations and the individual contributions from a range of emission sources such as motorways, industry, and rail, in addition to particulates from vehicle braking, tyre and road abrasion.

When detailed dispersion modelling of an individual sector is required as part of an air quality assessment, the respective contribution can be subtracted from the overall background estimate to avoid the potential for 'double-counting'. However, for this assessment the total background concentrations have been applied to provide a conservative approach.

With regard to model verification, contributions relating to the Motorway, Trunk-A and Primary-A road transport sectors were removed from the mapped national background NO_x concentrations encompassing each of the monitoring locations used in the model adjustment process.

The NO_2 adjustment for NO_X Sector Removal Tool[6] has been used to derive the revised NO_2 background concentrations for use in the model verification exercise (see Appendix B-5).

Derivation of Vehicle Emission Factors

Vehicle emission factors used in the assessment have been obtained using the Emission Factor Toolkit (EFT) version 9.0[7] (published in May 2019), published by DEFRA. The EFT[7] allows for the calculation of emission factors arising from road traffic for all years between 2017 and 2030 for the pollutants NO_X, PM_{10} and $PM_{2.5}$.

For future year emissions prediction, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time.

The EFT[7] can be set by geographical region in order to take into account the respective fleet composition. As such, the EFT[7] has been set for Northern Ireland to derive vehicle emissions factors for the operational stage air quality assessment.

Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is deemed fit for purpose. However it is unlikely that model validation undertaken by the software developer will have included validation near the proposals. To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area has been completed. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the results and was carried out in accordance with the methodology specified in LAQM.TG16[2].

Details of the verification factor calculations and application are presented in Appendix B-5.

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[6] DEFRA, (2019). NO_2 adjustment for NO_X Sector Removal Tool version 7.0. [online] Available at: https://laqm.defra.gov.uk/documents/NO2-Adjustment-for-NOx-Sector-Removal-Tool-v7.0.xlsb [Accessed 01/06/2020].

[7] DEFRA, (2019). Emissions Factors Toolkit, version 9.0. [online] Available at: https://laqm.defra.gov.uk/documents/EFT2019_v9.0.xlsb [Accessed 01/06/2020].

Addressing uncertainty in predicted future roadside NO2 concentrations

Observed trends in roadside NO_2 concentrations throughout the UK has indicated that NO_x vehicle emissions are not reducing at the expected rate. As such, there is a gap between these observed trends and DEFRA's projected vehicle emission rates for future years.

To account for this, a 'Gap Analysis' has been completed for annual mean NO_2 concentrations in accordance with LA 105[1]. The annual mean NO_2 results presented as part of the gap analysis are considered representative of conditions likely to be experienced at considered sensitive receptors in the opening year.

Designated Habitats

The assessment of the impacts on designated habitats, has been completed in reference to LA 105[1]. The rate of N deposition is affected by contributions of ambient NO_2 resulting from NO_x road traffic emissions.

A designated habitat is included for assessment where it is a:

- SAC or Candidate Special Area of Conservation (cSAC)
- Special Protection Area (SPA) or proposed Special Protection Area (pSPA)
- Site listed under the Convention on Wetlands and Wildfowl (Ramsar) or
- ASSI and
- Other designations of principle importance, such as local nature reserves, local wildlife sites, nature improvement areas, ancient woodland and veteran trees.

Paragraph 2.26.1 of LA 105[1] states that, "*Only sites that are sensitive to N deposition should be included in the assessment, it is not necessary to include sites for example that have been designated as a geological feature or watercourse*."

Compliance with EU Directive on Ambient Air Quality (2008/50/EC)[3]

Annual mean NO_2 concentrations and impacts were evaluated with respect to the risk of compliance with the EU directive on ambient air quality, in consideration of LA 105[1]. The assessment uses Pollutant Climate Mapping (PCM)[8] model baseline projections and the impacts predicted at representative roadside receptors.

The PCM model link data were overlaid with the applicable ARN derived for each route option to determine any qualifying features, to which a compliance risk assessment is to then be carried out.

The PCM links applicable to this assessment are presented in Figure 6.2.12 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0210).

[8] DEFRA, (2020). 2020 NO_2 projections data (2018 reference year). [online] Available at: https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data [Accessed 03/08/2020].

Overall Evaluation of Significance

Advice on evaluating the significance of local air quality effects for road infrastructure schemes is provided in LA 105[1]. Determination is made whether a project triggers a significant air quality effect by assessment of the following:

- The effects on human health
- The effects on designated habitats and
- The outcomes of the compliance risk assessment

The outputs of the air quality modelling shall inform the compliance risk assessment and the local air quality assessment (impact of the proposed scheme on human and designated sites) to determine whether the proposed scheme leads to a significant air quality effect.

LA 105[1] gives descriptors for magnitude of change of NO_2 and PM_{10}. These have been used in assessing the potential for local air quality significant effects.

The descriptors for the magnitude of change are defined by a percentage range based on the respective annual mean Air Quality Objectives which align with LA 105[1]. These criteria were applied to the local air quality assessment results at each modelled sensitive receptor, based on the change (increase or decrease) in annual mean concentration between the DM and DS scenarios for the opening year of 2025 for each of the route options.

The magnitude of change criteria set out in LA 105[1] for the assessment of change to annual mean concentrations of NO_2 and PM_{10} has been adapted to include $PM_{2.5}$ predictions. However, this does not constitute formal significance criteria, thus has only been used to provide context to the air quality assessment outputs for $PM_{2.5}$. The magnitude of change criteria is presented in Table 1-3.

Table 1-3 – Local Air Quality – Magnitude of Change Criteria

Pollutant	Air Quality Objective (AQO)	Magnitude of Change (Annual Mean) (µg/m^3)			
		Imperceptible	Small	Medium	Large
		(< 1% +/- of AQO)	(1-5% +/- of AQO)	(5-10% +/- of AQO)	(> 10% +/- of AQO)
NO_2	40 µg/m^3	< 0.4	0.4 – 2.0	2.0 – 4.0	> 4.0
PM_{10}	40 µg/m^3	< 0.4	0.4 – 2.0	2.0 – 4.0	> 4.0
$PM_{2.5}$	25 µg/m^3	< 0.25	0.25 – 1.25	1.25 – 2.5	> 2.5

Table 1-4 provides the basis for informing professional judgement in determining the potential for a significant effect.

Table 1-4 – Local Air Quality – Potential for Significant Effect – Human Health

Magnitude of Change in Concentration (+/-) (µg/m^3)	Number of Receptors with	
	Worsening of AQO already above objective, or creation of a new exceedance	Improvement of AQO already above objective, or removal of an existing exceedance
Large	1 – 10	1 – 10
Medium	10 – 30	10 – 30
Small	30 – 60	30 – 60

The magnitude of change criteria, as presented in Table 1-3 and as per LA 105[1] focus only on those receptors exceeding the respective Air Quality Objective for NO_2 and/or PM_{10} in either the DM and/or DS scenario.

Where the outcome of the local air quality assessment indicates that all DM and DS modelled concentrations are less than the relevant Air Quality Objective or the magnitude of change is 'imperceptible', then the proposed scheme's effect on local air quality is not likely to be significant.

The local air quality assessment has been based on the consideration of changes in pollutant concentrations at a range of sensitive receptor locations that are confined within the operational stage study area (see Figure 6.2.9 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0207)), including those that reflect the potential for the greatest changes with each of the proposals in operation.

The compliance risk assessment contributes to the evaluation of significance by summarising the evidence behind the conclusion as to whether the proposed scheme has:

- affected the reported ability of the zone to comply with the latest reported timescales;
- caused a zone to be non-compliant; and/or
- materially affected the national / local air quality plan in relation to achievement of compliance in the quickest time possible.

In regard to designated habitats, LA 105[1] contains a flow chart process which is intended to aid the competent expert in biodiversity in concluding whether the changes in N deposition are likely to trigger a significant air quality effect.

Identification of Sensitive Receptors

Sensitive locations are places where residential properties, schools, hospitals, care homes, public areas or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the proposed scheme. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure because of on-site construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the exhausts of construction and operational traffic associated with each route option.

Construction Stage Assessment

All sensitive receptors as defined in LA 105[1] and LAQM.TG16[2], to within 200 m of dust producing construction activities have been identified in Figure 6.2.1 to 6.2.4 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0199 to 0202). A count of sensitive receptors within the construction study area for each route option is presented in Table 1-5 using the Land and Property Services (LPS) POINTER Address dataset provided under licence from Ordnance Survey NI (OSNI) within a Geographical Information System (GIS) platform.

Table 1-5 – Count of Sensitive Receptors – Construction Stage Dust Assessment

Distance to Route Option Road Centreline	Number of Receptors*
Red Route Option	
0-50 m	48
50-100 m	62 (110)
100-200 m	198 (308)

Purple A Route Option	
0-50 m	49
50-100 m	96 (145)
100-200 m	214 (359)
Purple B Route Option	
0-50 m	49
50-100 m	97 (146)
100-200 m	207 (353)
Green Route Option	
0-50 m	42
50-100 m	66 (108)
100-200 m	222 (330)

* Bracketed number indicates a cumulative / running total count of sensitive receptor locations within 200 m of each route option road centreline.

Operational Stage Assessment

Human Health

Sensitive receptors have been included within the operational stage study area and dispersion modelling assessment, in regard of human health. Receptors with the highest annual mean pollutant concentrations (closest to the road, junctions etc.) and/or anticipated to experience the highest magnitude of change (next to roads contained within the operational stage study area) have been included in the local air quality assessment. Box 1.1 of LAQM.TG16 provides examples of the locations where the Air Quality Objectives should and should not apply. All identified sensitive receptors are treated with the same level of sensitivity.

The receptor locations considered within the human health component of the operational stage air quality assessment are illustrated in Figure 6.2.9 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0207). Receptors were identified using LPS POINTER Address dataset and OSNI licenced mapping within a GIS platform and modelled at a height of 1.5m to be representative of human exposure.

Table 1-6 presents a breakdown of the quantities and types of receptors contained within the local air quality assessment.

Table 1-6 – Count of Sensitive Receptors – Operational / Local Qir Quality Assessment

Type of Receptor	Number of Receptors*
Residential	5397
Education	16
Health	12
Unclassified*	1098

Total	6523

* Unclassified in POINTER dataset as '0' – Included in Local Air Quality Assessment for completeness.

Designated Sites

DAERA provided a consultation response[9] which states, "*With regards to air quality impacts, an assessment of NO_x concentrations from the proposal would be required for Upper Ballinderry River ASSI/SAC which is located within 200m of the Sandholes Link Road*". Further details of the designated habitat are contained in and presented in Figure 6.2.11. (Appendix A Drawing Reference 718314-WSP-B-D-3000-0209).

Table 1-7 – Identification of Sensitive Receptors – Designated Habitat Sites

Site Name	Designation	General Site Character[10]
Upper Ballinderry River	ASSI / SAC	Inland water bodies (Standing water, Running water) (30%); Bogs, Marshes, Water fringed vegetation, Fens (18%); Heath, Scrub, Maquis and Garrigue, Phygrana (0.2%); Dry grassland, Steppes (0.3%); Humid grassland, Mesophile grassland (9%); Broad-leaved deciduous woodland (20%); Mixed woodland (3%); Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas) (19.5%)

Compliance Risk Assessment

An assessment of the proposed scheme effects in relation to the risk of compliance with the EU directive on ambient air quality[3] has been carried out with reference to LA 105[1]. Each compliance risk receptor is situated 4m from the kerb and at a height of 2m above ground level. The receptor locations contained within Table 1-8 have been used to inform the compliance risk assessment and are illustrated in Figure 6.2.12 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0210).

Table 1-8 – Identification of Sensitive Receptors – Compliance Risk Assessment

Receptor	X	Y	Receptor	X	Y
C 185691780	281033.8	378641	C 185691903	280993.4	378848.7
C 185691851	281014.6	378639.2	C 185771876	281049.3	378908.2
C 185694226	281110.1	377944.2	C 185692048	281111.5	378973.2
C 185694460	281091.9	377927.5	C 185691935	281283.5	379071.2
C 185694479	281114	377707.1	C 185691949	281377.7	379124.3
C 185694510	281135.6	377708.8	C 185691947	281378.3	379109.2
C 185694524	281148.7	377580.9	C 185692342	281588.6	379140
C 187124993	281126.1	377580.8	C 185693203	281115.3	377152
C 185692951	281154.3	377504.8	C 185693199	280928.6	377129.3

[9] DAERA, (2019). A29 Cookstown Bypass and Sandholes Link Road Scheme (AE1-19-7708).
[10] Joint Nature Conservation Committee (JNCC), (2020). Upper Ballinderry River SAC. [online] Available at: https://sac.jncc.gov.uk/site/UK0030296 [Accessed 03/08/2020].

Receptor	X	Y	Receptor	X	Y
C 185692823	281132.7	377501.1	C 185693194	280938.2	377114.3
C 185692965	281161.4	377436.9	C 185693301	280817.9	377096.4
C 185692832	281140.6	377435.2	C 185693306	280826.9	377116
C 185692935	28117[8].7	377270.1	C 185693312	280775.7	377104.3
C 185692846	281157.5	377270.4	C 185693305	280779.1	377087.2
C 185693408	281176.5	377076.8	C 185694719	280576.6	376958
C 185693396	281197.1	377077.1	C 185694696	280525.3	376923.7
C 185693429	281206.2	376977	C 185696283	280227.7	376847.8
C 185693432	281183.4	376970.8	C 185696288	280188.3	376858.6
C 187295412	281233.9	376708.5	C 185696269	280287.2	376848
C 185691792	281023	378746.5	C 185696276	280241.1	376860.1
C 185691898	281018.9	378800	C 185696306	280192.9	376873.3
C 185691911	281015.1	378851.4	C 185696294	280147.4	376885.8

1.3 ASSUMPTION AND LIMITATIONS

CONSTRUCTION STAGE ASSESSMENT

Detailed information regarding the level of construction activities and associated material to compile the construction stage dust assessment for each route option was limited at the time of writing. As such, it has been assumed that all construction related activities are completed to the same degree.

To inform the construction stage dust assessment, a count of sensitive receptors within the defined construction stage study area for each route option has been completed. The construction stage dust assessment has then been completed using professional judgement and experience of compiling dust risk assessments for road infrastructure schemes of a similar nature. It has been assumed that the construction period will be less than two years. As such, a construction stage traffic assessment has not been completed.

OPERATIONAL STAGE ASSESSMENT

There are uncertainties associated with both measured and predicted concentrations of air pollutants.

The proposed scheme specific NO_2 baseline monitoring programme began in May 2019 and had been scheduled to be completed by May 2020. However, due to the COVID-19 pandemic, the monitoring study concluded in March 2020.

The mean of the results gained in 2019 has been annualised in accordance with the methodology contained in LAQM.TG16[2], to provide an estimate of the annual mean concentration at each monitoring location. The ratio between the annual mean and the period mean NO_2 concentration has been determined for 2019 for each monitoring location.

The annualised diffusion tube measurements have been adjusted for bias using the national bias adjustment factor spreadsheet[11], which contains a database of bias adjustment factors determined from Local Authority co-location studies throughout the UK, determined for each laboratory, year and preparation method combination for which data are available. A local co-location study has not been carried out as there is no continuous monitoring equipment situated in the wider Cookstown area.

The model (ADMS-Roads) used in this assessment relies on input data (including predicted traffic flows), which also have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS-Roads model will not consider.

To reduce the uncertainty associated with predicted concentrations and provide an evaluation of model performance, a verification exercise has been carried out following guidance set out in LAQM.TG16[2] to provide confidence in the results and subsequent outcomes of the assessment. As the model has been verified against local monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations within the measure of uncertainty derived, as reported in Appendix B-5.

The average uncertainty (derived as the root mean square error, RMSE) of the air quality dispersion model equates to 2.0µg/m^3 for annual mean NO_2. As such, the modelled receptors that are predicted to experience NO_2 concentrations between 38.0µg/m^3 and 42.0µg/m^3 are considered to be at potential risk of exceeding the Annual Mean Objective and EU Limit Value of 40µg/m^3. Of those receptor locations included in the human health component of the operational stage air quality assessment, none are predicted to be within this range with any of the four route options implemented in the opening year of 2025.

Dispersion modelling has been carried out with the use of AADT and associated speed and composition traffic data. The speed data contained within the traffic model has not been adjusted for the approaches of junctions although average modelled link speed were provided.

Sensitive receptor locations were determined using the OSNI POINTER dataset. There may in some cases be properties which are not yet present within the existing data source or not appropriately identified. Every attempt has been made to identify and consider any such properties for this assessment.

- A critical load range has not been designated within the Air Pollution Information System (APIS)[12] for the Upper Ballinderry River ASSI / SAC however the feature is identified as being sensitive to N deposition. For this assessment, an indicative critical load range of between

[11] Bureau Veritas, on behalf of DEFRA, (2019). National Diffusion Tube Bias Adjustment Factor Spreadsheet Version 06/20. [online] Available at: https://laqm.defra.gov.uk/assets/Database_Diffusion_Tube_Bias_Factors_v06_20_FINAL.XLSX [Accessed 04/05/2020].

[12] Centre for Ecology and Hydrology et al, (2020). Air Pollution Information System (APIS) Upper Ballinderry River ASSI / SAC. [online] Available at: http://www.apis.ac.uk/srcl/select-a-f.eature?site=UK0030296&SiteType=SAC&submit=Next [Accessed 03/08/2020].

5kgN/ha/yr to 10kgN/ha/yr has been specified.tigation of the potential for marked walking routes within towns

2 CULTURAL HERITAGE

2.1 LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

- Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995

This Order is the principal basis for the protection of archaeological sites in Northern Ireland and provides for historic monuments and archaeological sites to be protected in a variety of ways, including the taking into state care and scheduling. When sites and monuments are scheduled, they remain in private ownership but are protected from damage and unauthorised development. Sites are scheduled in accordance with quality and rarity criteria.

The most relevant aspect of this legislation to the proposed scheme is the requirement to gain a licence to search for archaeological objects, or to carry out an excavation, and any archaeological object found must be reported. All archaeological excavations must be carried out under the direction of a qualified archaeologist, licensed by the Historic Environment Division (HED) of the Department for Communities (DfC).

- Planning Act (Northern Ireland) 2011

This Act repeals the previous legislation set out within Article 42 to 52 of the Planning (Northern Ireland) Order 1997 and sets out the protection for listed buildings and structures. There are more than 8,500 listed buildings/structures in Northern Ireland (currently under review), with those selected assessed and evaluated against established criteria. Key elements include the age of a building, its condition, style, aesthetic quality, structure and any innovatory qualities.

The Act also provides legislation in relation to demolition, alteration or extension of listed buildings, and the requirements for gaining listed building consent when the demolition, alteration or extension would affect the buildings character as a building of special architectural or historic interest.

NATIONAL POLICY

- The Regional Development Strategy 2035

This is an overarching strategic planning framework to facilitate and guide the public and private sectors. In relation to the cultural heritage resource it aims to identify, protect, conserve, and where possible enhance the built heritage, including archaeological sites and monuments and historic buildings.

- Strategic Planning Policy Statement for Northern Ireland (SPPS) 2015

The aim of the SPPS in relation to Archaeology and Built Heritage is to manage change in positive ways so as to safeguard that which society regards as significant whilst facilitating development that will contribute to the ongoing preservation, conservation and enhancement of these assets. In relation to the proposed scheme, the following aspects of the SPPS are relevant:

- Development which would adversely affect archaeological remains of regional importance (monuments in State Care, scheduled monuments, and Areas of Significant Archaeological Interest (ASAI)) or the integrity of their settings must only be permitted in exceptional circumstances. As the scheduling programme is an ongoing process, there are archaeological remains of regional importance yet to be scheduled. This policy approach should also apply to

such sites which, whilst not scheduled presently, would otherwise merit such statutory protection;

- Development proposals which would adversely affect archaeological remains of local importance or their settings should only be permitted where the planning authority considers that the need for the proposed development or other material considerations outweigh the value of the remains and/or their settings;
- Where a planning authority is minded to grant planning permission for development which will affect sites known or likely to contain archaeological remains, it should ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development. Where appropriate, this may involve the preservation of remains in situ, or a licensed excavation, recording examination and archiving of the archaeology;
- Development involving an alteration of a Listed Building may be permitted, particularly where this will secure the ongoing viability and upkeep of the building. It is important that such development respects the essential character and architectural or historic interest of the building and its setting, and that features of special interest remain intact and unimpaired. Proposals for the total demolition of a listed building or any significant part of it must not be permitted unless there are exceptional reasons why it cannot be retained in its original or a reasonably modified form; and
- Planning permission should not be granted for development that would lead to the loss of, or cause harm to, the overall character, principal components or setting of Historic Parks, Gardens and Demesnes. Particular account should be taken of the impact of the proposal on the archaeological, historical or botanical interest of the site. The integrity and overall quality and setting of the site including its original design concept and other associated features, including contribution to local landscape character, should where possible be maintained.

¡ Planning Policy Statement (PPS) 6: Planning, Archaeology and the Built Heritage 1999 (References to Department within the policy statement relate to the DfC – formerly the Department for the Environment)

The tenets of PPS 6 are to be retained until such time that the Mid Ulster Plan Strategy is adopted. As this is still at Draft stage, the following policies are still relevant within the Mid Ulster Council region. Where the policies of PPS 6 conflict with the SPPS, then the SPPS policies shall take precedence. The following policies within PPS 6 are relevant to the proposed scheme:

- PPS 6 states that archaeological remains are a limited, finite and non-renewable resource, in many cases highly fragile and vulnerable to damage and destruction. Appropriate management is therefore essential to ensure that they survive in good condition and care must be taken to ensure that archaeological remains are not needlessly or thoughtlessly damaged or destroyed;
- There is a presumption in favour of the physical preservation in situ of archaeological remains of regional (national) importance and their settings. These comprise monuments in State Care, Scheduled Monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings would not be permitted unless there are exceptional circumstances;
- Development proposals which would adversely affect archaeological sites which are of local importance or their settings will only be permitted where the Department considers the

importance of the proposed development or other material considerations outweigh the value of the remains in question;

- Where the impact of the development proposal on important archaeological remains is unclear, or the relative importance of such remains is uncertain, the Department will normally require developers to provide further information in the form of an archaeological assessment or archaeological evaluation; and
- The Department will impose conditions to ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development, including where appropriate the completion of a licensed excavation and recording of remains before development commences.

REGIONAL AND LOCAL POLICY

¡ Mid Ulster District Council, Local Development Plan 2030 – Draft Plan Strategy, 2019

The draft plan strategy published in February 2019 reiterates the local council commitments to follow the policy of SPPS and its predecessor PPS 6. The plan currently sits at a draft stage and is due to be adopted in 2020. The plan is being considered as part of the assessment process, and as such, the policies that are directly attributable to this assessment are:

- Policy HE 4 – Archaeological remains of regional importance and their setting. – "*Development proposals which would adversely impact upon archaeological remains of regional importance or the integrity of their settings will conflict with the Plan. Archaeological remains and their settings will be preserved in situ. Development will only be permitted in exceptional circumstances where it is demonstrated that the proposal is of overriding importance to Northern Ireland*";
- Policy HE 5 – Archaeological remains of local importance and their setting. – "*Development proposals which will adversely impact upon archaeological remains of local importance or their settings will conflict with the Plan unless it has been clearly demonstrated that the importance of the proposed development outweighs the value of the archaeological remains and/or their settings*";
- Policy HE 6 – Areas of Archaeological Potential. – "*Within Areas of Archaeological Potential (AAPs) applicants will normally be required to submit an archaeological assessment or an archaeological evaluation with their planning application*";
- Policy HE 7 – Archaeological assessment, evaluation and mitigation. – "*Where the impact of a development proposal on known archaeological remains is unclear, or the relative significance of such remains is uncertain, applicants will be required to provide an appropriate and proportionate archaeological assessment and, if required, an archaeological evaluation. If an applicant fails to submit the required archaeological assessment or evaluation, where requested, planning permission will be refused. Only in exceptional circumstances, where we are minded to approve planning permission for development, which may affect known sites or monuments of lesser archaeological importance, or areas likely to contain archaeological remains we will consider appropriate and proportionate mitigation measures. Such mitigation measures will be bespoke to each individual case*";
- Policy HE 8 – Registered Historic Parks, Gardens and Demesnes. – "*Development which will lead to the loss of or cause harm to, the overall character, or principal components or setting of historic parks, gardens and demesnes will conflict with the Plan*"; and

- Policy HE 15 – Industrial Heritage Assets. – "*Development proposals which visually respect, are sensitive to and secure the retention, repair and sustainable maintenance of identified industrial heritage assets and their historic settings will conform with the Plan*."

2.2 METHODOLOGY

The assessment was undertaken with respect to the guidance provided by Volume 11, Section 3, Part 2, LA 106 Cultural heritage assessment, which refers to the Chartered Institute for Archaeologists (CIfA) Standards and Guidance for Historic Environment Desk Based Assessments[13].

VALUE/SENSITIVITY

The assessment of the value of cultural heritage assets has involved consideration of how far the asset(s) contribute to an understanding of the past, through their individual or group qualities, either directly or potentially. These are professional judgements, but they are also guided by legislation, national policies, acknowledged standards, designation, criteria and priorities.

The assessment has followed the guidance tables for assessing value/sensitivity from the DMRB Volume 11, Section 2, Part 4, LA 104 Environmental assessment and monitoring, which recommends the adoption of five ratings for value in relation to the cultural heritage resource: very high, high, medium, low, and negligible (see Table 2-1).

Table 2-1 – Factors for Assessing the Value of Archaeological Assets

Value (sensitivity) of receptor / resource	Typical Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution
High	High importance and rarity, national scale, and limited potential for substitution
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution
Low	Low or medium importance and rarity, local scale
Negligible	Very low importance and rarity, local scale

EFFECTS ON SETTING

In accordance with guidance notes provided by the HED publication on setting[14], a three-stage process was undertaken to assess the effect of the route options on the setting of historic assets:

[13] Chartered Institute for Archaeologists, (2017). Standard and Guidance for Historic Environment Desk Based Assessments. [online] Available at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_3.pdf [Accessed 03/08/2020].
[14] Department for Communities Historic Environment Division, (2018). Guidance on Setting and the Historic Environment. [online] Available at: https://www.communities-ni.gov.uk/publications/guidance-setting-and-historic-environment [Accessed 03/08/2020].

- Stage 1: Heritage assets that might be affected by the route options were identified. The potential for impacts on assets in the wider landscape due to the potential intervisibility with the route options was also determined through the desk based review and site walkover survey;
- Stage 2: The setting of all baseline heritage assets was defined by establishing how the surroundings contribute to the significance of the heritage assets in the ways they are understood, appreciated and experienced; and
- Stage 3: The way in which the route options would impact upon setting was then assessed for all baseline assets.

MAGNITUDE OF IMPACT

The Magnitude of Impact is assessed using the guidance contained in DMRB Volume 11, Section 2, Part 4, LA 104 Environmental assessment and monitoring, and is presented in Table 2-2 below:

Table 2-2 – Factors for Assessing the Magnitude of Impacts

Magnitude of impact (change)		Typical Description
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

IMPACT SIGNIFICANCE

The overall impact has been assessed using the following matrix (see Table 2-3) from the DMRB Volume 11, Section 2, Part 4, LA 104 Environmental assessment and monitoring:

Table 2-3 – Significance of Effect Matrix

	Magnitude of Impact (degree of change)					
Value/Sensitivity		No Change	Negligible	Minor	Moderate	Major
	Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Sight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

2.3 MITIGATION METHODOLOGY AND GUIDANCE

The development of mitigation strategies for impacts on cultural heritage assets follows the guidance provided within Volume 11, Section 3, Part 2, LA 106 Cultural heritage assessment of the DMRB. This guidance is supplemented in Northern Ireland by the DEM 156/15 Management of Archaeological Investigation on Major Road Improvement Schemes, and strategies are developed in line with the Prosperity Agreement.

The implementation of DEM 156/15 involves division of the archaeological investigations into 4 work packages. A summary of each work package is presented below:

1. Targeting – The aim of this work package is to efficiently identify archaeological sites and/or areas of archaeological potential using desk-based investigative methods and/or appropriate non-intrusive investigations. A joint site walkover should be conducted with HED and DfI to establish the areas of potential across the scheme and discuss the mitigation and investigation proposals.
2. Trenching – The aim of this work package is to identify archaeological sites and/or areas of archaeological potential through intrusive archaeological investigations, normally in the form of trial trenching. The trial trenching layout should be agreed with HED prior to any licence applications through the production of a Written Scheme of Investigation.
3. Extending – The aim of this work package is to fully investigate all archaeological features identified during the Trenching work package. This would involve the extension of trial trenches into larger strip, map and sample excavations and the full excavation and recording of any features discovered.
4. Reporting – The aim of this work package is to ensure the appropriate reporting, specialist analysis and dissemination of the results of the archaeological investigations through technical reports and more publicly accessible publications.

2.4 ASSUMPTION AND LIMITATIONS

This assessment has been prepared based on the results of desk-based research and walkover surveys only. No intrusive archaeological investigations have been undertaken.

3 LANDSCAPE AND VISUAL

3.1 LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

Key legislation exists to ensure direct and indirect protection of our most valued and important landscapes, their intrinsic visual qualities and their individual elements and features. Key legislation with direct relevance to the proposed scheme is tabulated below:

Table 3-1 – Key Legislation

Legislation	Description in relation to Stage 2 assessment
Wildlife and Natural Environment Act (Northern Ireland) 2011[15]	Places a duty on every public body to further the conservation of biodiversity through restoration or enhancement of flora and habitats and furthermore in relation to conservation that any type of habitat includes restoring or enhancing the habitat. Of particular relevance is the following: "*Duty to conserve biodiversity* *1.— (1) It is the duty of every public body, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions.* *(3) Conserving biodiversity includes —* *(b) in relation to any type of habitat, restoring or enhancing the habitat*."
The European Landscape Convention (Florence: Council of Europe, 2000, ETS 1X6) [16]	Recognises that all landscapes are potentially important, irrespective of location or condition and should be considered in any assessment of effects.
European Union's Habitats Directive (92/43/EEC)[17]	Aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. Of relevance is the Upper Ballinderry River SAC, see Table 3-2 below.
Nature Conservation and Amenity Lands Order (NI) 1985[18]	Implements policies for the enjoyment of the countryside: "*The Department may… take such steps as it considers expedient to encourage the provision and improvement, for persons resorting to the countryside, of facilities for the enjoyment of the countryside and open-air recreation in the countryside*"

[15] Wildlife and Natural Environment Act (Northern Ireland), (2011). Available at: http://www.legislation.gov.uk/nia/2011/15/contents/enacted [Accessed: 01/06/2020].
[16] The European Landscape Convention, (2000). Available at: http://conventions.coe.int/Treaty/EN/Treaties/Html/176.htm [Accessed: 01/06/2020].
[17] European Union's Habitats Directive (92/43/EEC). Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm [Accessed: 01/06/2020].
[18] Nature Conservation and Amenity Lands Order (NI) 1985. Available at: https://www.legislation.gov.uk/nisi/1985/170/contents [Accessed: 01/06/2020].

NATIONAL POLICY

The following National Planning Policies are of relevance to the proposed scheme in terms of landscape and visual amenity:

Table 3-2 – Key National Planning Policies

Policy	Description in relation to Stage 2 assessment
Planning Strategy Rural NI[19]	
POLICY GB/CPA 2 Non-Residential Uses (Green Belt)	Development, which does not interfere with the open character of the land, may be acceptable in terms of siting and design. However, in all but the most special cases, the decision will depend on the need for the proposal, or whether it is an appropriate rural use, as well as whether it will do harm to the rural character of the landscape.
SPPS for Northern Ireland 2015[20]	
SPPS Furthering Sustainable Development	Paragraph 3.3 promotes high quality development and good design and working towards the restoration of and halting the loss of biodiversity is highlighted.
SPPS Supporting Good Design and Positive Place-Making	Paragraphs 4.24 and 4.26 state that landscape design and planting considerations are also an integral part of design and can contribute to biodiversity' and that "*Particular weight should be given to the impact of development on the character of areas recognised for their landscape or townscape value*".
SPPS Preserving and Improving the Built and Natural Environment	Paragraphs 4.37 and 4.38 refer to the commitment to preserve and improve the built and natural environment and halt the loss of biodiversity.
SPPS Historic Parks, Gardens and Demesnes	Paragraphs 6.17 states that "*particular account should be taken of the impact of the proposal on the historical or botanical interest of the site*" and that "*contribution to local landscape character, should where possible be maintained*".
SPPS Conservation Areas	Of relevance to the Upper Ballinderry River SAC is paragraph 6.19, which states that "*In the interests of preserving or enhancing the character or appearance of a Conservation Area, development proposals should:* ¡ *protect important views within, into and out of the area;* ¡ *protect trees and other landscape features contributing to the character or appearance of the area; and* ¡ *conform with the guidance set out in any published Conservation Area design guides*".
SPPS	Paragraph 6.29 highlights that "*the Local Development Plan (LDP) should take into account the implications of its other local policies and proposals on*

[19] Planning Strategy Rural NI, (1993). Available at: https://www.planningni.gov.uk/index/policy/rural_strategy.htm [Accessed: 01/06/2020].
[20] Department of the Environment, (2015). Strategic Planning Policy Statement for Northern Ireland. [online] Available at: https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf [Accessed 05/04/2020].

Policy	Description in relation to Stage 2 assessment
Implementation of Regional Policy (Archaeology and Built Heritage)	*all features of the archaeological and built heritage and their settings. Including:* ¡ *Historic Parks, Gardens & Demesnes;* ¡ *Conservation Areas; and* ¡ *Local Landscape Policy Areas (LLPAs).”*
SPPS Development in the Countryside (Regional Strategic Objectives)	Within paragraph 6.66, policy objectives for development in the countryside include: ¡ “*promote high standards in the design, siting and landscaping of development*.”
SPPS Local Designations	Paragraph 6.190 states that “*a development proposal which could have a significant adverse impact on a site of local importance should only be permitted where the benefits of the proposed development outweigh the value of the site. In such cases, appropriate mitigation and/or compensatory measures shall be required*.”
SPPS Other Habitats, Species or Features of Natural Heritage importance	Paragraph 6.191 states that “*planning permission should only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known:* ¡ *ancient and long-established woodland;* ¡ *features of the landscape which are of major importance for wild flora and fauna; or* ¡ *other natural heritage features worthy of protection, including trees and woodland.”*
SPPS Implementation of Natural Heritage	Paragraph 6.198 states that “*the potential effects on landscape and natural heritage, including the cumulative effect of development are considered. With careful planning and design the potential for conflict can be minimised and enhancement of features brought about*.”

REGIONAL AND LOCAL POLICY

The following regional and local planning policies are of relevance to the proposed scheme in terms of landscape and visual amenity:

Table 3-3 – Key Regional and Local Planning Policies

Regional / Local Policies	Description in relation to Stage 2 assessment
Regional	
Mid Ulster District Council, Local Development Plan 2030 – Draft Plan Strategy, 2019[21]	
An objective in relation to development and the use of land in Mid Ulster is to	To protect and enhance the natural and built environment as wise custodians of our landscape and to achieve biodiversity, quality design,

[21] Mid Ulster District Council, (2019). Local Development Plan 2030 – Draft Plan Strategy. [online] Available at: https://www.midulstercouncil.org/getmedia/dd8d49d7-79a6-4419-948f-2569cb0d0fa5/Local-Development-Plan-2030-Strategy-for-reconsultation.pdf.aspx [Accessed 04/05/2020].

Regional / Local Policies	Description in relation to Stage 2 assessment
enhance the environment and improve infrastructure	enhanced leisure and economic opportunity and promote health and wellbeing.
Policy GP1 - General Principles Planning Policy	(c) Siting, Design and External Appearance: "*Development should:* ¡ *in the countryside, have regard to the character of the area, the local landscape and not rely primarily on new landscaping for integration*."
Regional Development Strategy 2035[22]	
RG11: Conserve, protect and, where possible, enhance our built heritage and our natural environment	Paragraph 3.31 highlights to: ¡ "*Sustain and enhance biodiversity;* ¡ *Recognise and promote the conservation of local identity and distinctive landscape character; and* ¡ *Conserve, protect and where possible enhance areas recognised for their landscape quality*"
Local	
Cookstown Area Plan 2010[23]	
Policy CON 2	The protection of LLPA's. LLPA's are identified in the Cookstown Area Plan within and around urban areas and are designated for their landscape and/or wildlife value. There are seven LLPA's designated within the Cookstown Area Plan 2010, two of which are potentially impacted by the route options and shown on Map 36a: Cookstown: ¡ LLPA 1 Ballinderry River, which broadly follows the corridor of the River Ballinderry. Proposals may be acceptable provided that they do not detract from the intrinsic value of the designated area; and ¡ LLPA 4 Coolnafranky, on the eastern margin of the town, which comprises school sites and playing fields.
Policy CON 6	Relates to Killymoon Castle Historic Park, Garden and Demesne which lies within the south-eastern extent of the study area. Refer to Map 30 within the Cookstown Area Plan 2010.
Policy CTY 1	Relates to designated Green Belt. Green Belt has been designated around Cookstown with the Cookstown Area Plan 2010.
Policy AGRI 1	Relates to recreation and open space. A 16.57 ha site (R3 Killymoon) on the southern extents of the Ballinderry River LLPA1 will be developed as a community woodland containing a riverside walk.

[22] Department for Regional Development, (2012). Regional Development Strategy (RDS) 2035 – Building a Better Future. [online] Available at: https://www.planningni.gov.uk/index/policy/rds2035.pdf [Accessed 04/05/2020].
[23] Department of the Environment, (2004). Cookstown Area Plan, 2010. [online] Available at: https://wayback.archive-it.org/11112/20190702180401/https://www.planningni.gov.uk/index/policy/development_plans/devplans_az/cookstown_2010.htm [Accessed 07/09/2020].

3.2 METHODOLOGY

TECHNICAL SCOPE

A simple level, qualitative assessment has been undertaken to assess the potential significance of effect, arising from change on landscape character areas, locally designated landscapes and sensitive visual receptors using professional judgement, with reference to DMRB LA 107[24], which sets out the assessment of landscape and visual effects, and LA 104, which describes the appropriate level of assessment. A simple level assessment is described within LA 104 as "*The collection and assessment of data and information that is readily available to reach an understanding of the likely environmental effects of a project. This informs the final design or need for further detailed assessment*". The below iterative steps have been followed:

- Undertake a desk-based study to identify those receptors potentially susceptible to significant effects;
- Undertake a field study to support the desk-based study and subsequent assessment;
- Classification/description of landscape character areas, the visual amenity and sensitive visual receptors; and
- Undertake a simple assessment to determine the likely significance of effects on landscape and visual receptors for each of the four route options.

DESK BASED STUDY

Open source data was used to identify national and regional landscape character assessments, local designations and representative viewpoints.

Baseline data has been collated within the study area, informed by aerial photographs and OS data, collating information on topography, landform, land use, vegetation and landscape pattern.

FIELD STUDY

Site survey work was undertaken in September 2019 when trees were in leaf and restricted to roads and footpaths which were publicly accessible. In order to be able to establish the effects on some visual receptors, a number of residential visual receptors were surveyed under pre-arranged access agreements due to limited publicly accessible land.

CLASSIFICATION OF LANDSCAPE CHARACTER AREAS AND VIEWS

Existing landscape character assessments have been identified at a regional level and, together with the site survey, used to inform the identification of Local Landscape Character Areas (LLCA's) at a more appropriate scale for the purposes of this assessment, the characteristics of which are described within Stage 2 SAR Section 6.4.2.2 Landscape Context.

[24] DMRB, (2020). LA 107 – Landscape and Visual Effects. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search?discipline=SUSTAINABILITY_AND_ENVIRONMENT [Accessed: 01/06/2020].

Representative viewpoints, as defined in LA 107 (page 24, Note 1), have been identified throughout the study area to represent and inform the potential effects of the route options. These are shown on Figure 6.4.2 (Appendix A Drawing Reference 718314-WSP-B-D-3000-0129).

The comparison of route options relative to assets and resources associated with landscape character and visual impacts has been focused on:

- Impacts on local designations as identified within Section 3.1 Legislative and Policy Framework;
- Evaluation of potential significant effects on the composition and quality of the existing landscape associated with the study area based on an analysis of distinctive LLCA's while taking into consideration night-time effects and the value the public place on the local landscape; and
- Evaluation of potentially significant effects on the visual amenity of the study area as a result of the introduction of the route options into the existing landscape based on analysis of representative viewpoints and taking into account night-time effects.

Temporal scope

The temporal scope of the assessment with regard to the construction phase will be 2023 to 2025. For the operational phase, the temporal scope relates to the proposed scheme opening in 2025. For the landscape and visual assessment, it is important to consider longer term effects. Therefore, the temporal scope is extended beyond the proposed scheme opening to take account of the design year of 2040 when mitigation planting would have sufficiently matured to provide a landscape integration or visual screening function.

ASSESSMENT METHOD

The sensitivity of the identified landscape and visual receptors has been applied to specific landscape receptors, combining judgements of the susceptibility of the receptor to the specific type of change proposed and the value related to the receptor. The potential magnitude of effect (change) that the proposed scheme would have on each landscape and visual receptor has then been considered, taking into account the scale, geographical extent and duration (short term 0 to 5 years, medium term 5 to 15 years and long term over 15 years) of the proposed scheme.

Assessment of sensitivity and magnitude of effect have been informed by professional judgement and have been guided by criteria in LA 107. The sensitivity and magnitude of effect ratings have then been considered together to determine the significance of effect on each landscape and visual receptor. The assessment of significance of effect has taken into account typical mitigation measures described in Stage 2 SAR Section 6.4.4.

Table 3-4 and Table 3-5 set out the effect rating criteria used within this assessment for landscape and visual effects. The ratings have been used to identify where potentially significant effects may occur to help inform the selection of a preferred route from the four route options.

Likely embedded landscape mitigation that would reasonably and realistically be integrated into the proposed scheme design will be taken into account when assessing the magnitude of effect.

For the purposes of this assessment significant effects are considered to comprise residual effects that are within the moderate, large or very large categories during the construction phase, operation opening year or at the operation design year, see Table 3-6 below.

The approach to deriving effects significance from receptor value and magnitude of effects shall be based on Table 3-4, Table 3-5 and Table 3-6 below.

Table 3-4 below identifies the landscape effect ratings, based on LA 107 and the descriptor for each rating.

Table 3-4 – Landscape Effect Ratings

Magnitude of effect (degree of change)		Typical descriptions
Major	Adverse	Total loss or large-scale damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, conspicuous features or elements (i.e. road infrastructure).
	Beneficial	Large scale improvement of landscape character to features and elements; and/or addition of new distinctive features or elements, or removal of conspicuous road infrastructure elements.
Moderate	Adverse	Partial loss or noticeable damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, noticeable features or elements (i.e. road infrastructure).
	Beneficial	Partial or noticeable improvement of landscape character by restoration of existing features or elements; or addition of new characteristic features or elements or removal of noticeable features or elements.
Minor	Adverse	Slight loss or damage to existing landscape character of one (maybe more) key features and elements; and/or addition of new uncharacteristic features and elements.
	Beneficial	Slight improvement of landscape character by the restoration of one (maybe more) key existing features and elements; and/or the addition of new characteristic features.
Negligible	Adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements.
	Beneficial	Very minor noticeable improvement of character by the restoration of one or more existing features and elements.
No change		No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.

Table 3-5 below identifies the visual effect ratings, based on LA 107 and the descriptor for each rating.

Table 3-5 – Visual Effect Ratings

Magnitude of effect (change)	Typical descriptions
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project work or activity would be discernible or being at such a distance it would form a barely noticeable feature or element of the view.

No change	No part of the project work or activity would be discernible.

Table 3-6 – Significance Matrix

	Magnitude of effect (degree of change)					
Value (sensitivity)		No change	Negligible	Minor	Moderate	Major
	Very high	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

3.3 ASSUMPTION AND LIMITATIONS

The following assumptions and limitations are applicable for the assessment of the baseline conditions in relation to landscape and visual amenity:

PROPOSED SCHEME DESIGN

- It has been assumed that typical earthworks would have a gradient of no more than 1:2.5. Earthworks steeper than 1:2.5 would compromise the ability to incorporate both mitigation planting and its future management; and
- For the purposes of a simple night-time assessment it has been assumed that the following junctions have been lit:
  - Loughry Roundabout;
  - Castle Road;
  - Cloghog Road roundabout;
  - A29 Moneymore Road roundabout; and
  - Killymoon Road.

SURVEY

- Site survey work was undertaken in September 2019 when trees were in leaf. In order to predict a worst-case scenario professional judgement has been used to assess potential landscape and visual effects during winter months, when deciduous vegetation is not in leaf.

VISUAL RECEPTORS

- The presence of sensitive visual receptors has been considered from key locations during the site visit in September 2019. Due to the nature of the predominantly urban fringe and rural landscape, the assessment is limited to those locations that represent groups of properties on the eastern edge of Cookstown or groups of properties and farmsteads with a similar visual outlook and sensitivity;

- WSP has not assessed any viewpoints within the Sperrins AONB due to the distance of view and there being no risk of a significant effect; and
- Static views from isolated rural receptors have been considered to be of High sensitivity.

PUBLIC ACCESS

- Visual receptors have been identified from publicly accessible vantage points where possible. In some cases, notably individual private properties and farmsteads, close access to the viewpoint was only possible through pre-arranged access agreements into adjacent land. The use of aerial photography and professional judgement supplement the understanding of visual amenity within the study area.

TREE SURVEY

- Trees were observed from both publicly accessible and private land (under access agreements) during the landscape assessment with no ancient or veteran specimens identified in proximity of points where any of the four route options deviated. There are also no database records of ancient or veteran trees which could be impacted by the proposed scheme. At this stage, it has not been determined if there are any trees on site of sufficient value to influence route selection and a detailed tree survey is not required until such time as the design is sufficiently advanced to identify trees to be removed, trees to be retained or suitable tree protection measures; and
- An arboriculturist, or other appropriately qualified professional, can then determine whether trees outside of the works footprint can be retained or require felling due to direct impacts, the threat of wind throw or due to tree root severance. Minor variation in route alignment may be possible in order to retain trees of sufficient value to warrant consideration for retention.

MITIGATION

- Likely embedded landscape mitigation, comprising woodland, linear belts of shrubs and trees, hedgerows and individual trees, that would reasonably and realistically be integrated into the proposed scheme design will be taken into account when assessing the magnitude of effect (change). It has also been assumed that mitigation planting would establish sufficiently by the design year (2040) in order to provide the required function (e.g. visual screening, landscape integration).

4 BIODIVERSITY

4.1 LEGISLATIVE AND POLICY FRAMEWORK

Listed below are the relevant environmental and wildlife legislation and policies in Northern Ireland, further details of which are provided in Appendix B-10.

4.2 METHODOLOGY

DESK STUDY

The PEA desk study involved internet-searches for information on statutory designated sites using datasets on the DAERA website[25]. Species records were also obtained from Ulster Museum's Centre for Environmental Data and Recording (CEDaR). The CEDaR database search was enhanced with a data search from the National Biodiversity Data Centre (NBDC)[26] for otter (*Lutra lutra*) and freshwater pearl mussel (*Margaritifera margaritifera*). Information was also obtained from previous ecological surveys undertaken for the proposed scheme by Mouchel (2009[27]) and WSP (2019[28]).

PRELIMINARY FIELD SURVEYS

Prior to the more focussed PEA, an initial site walkover was conducted by WSP in February 2019 to identify broad ecological baseline conditions and potential constraints, and to support the desk based data gathering effort.

The PEA involved a programme of baseline ecological surveys undertaken between late August and late September 2019 by subconsultants Woodrow Sustainable Solutions Ltd. (Woodrow). The following surveys were undertaken along the full length of the proposed scheme (i.e. all four route options and Sandholes Link Road), plus a surrounding buffer of 100 m.

- Extended Phase 1 habitat survey following standard methods prescribed by Joint Nature Conservation Committee[29] and advocated by NIEA[30], involving the identification of broad habitat types, their suitability for legally protected and notable/priority species of conservation concern, and the presence of invasive non-native species;

[25] DAERA (no date). Protected Areas webpage. [online] Available at: https://www.daera-ni.gov.uk/landing-pages/protected-areas [Accessed 03/02/2020].
[26] National Biodiversity Data Centre (no date). Biodiversity Maps. [online] Available at: https://maps.biodiversityireland.ie/Map [Accessed 03/08/2020].
[27] Mouchel, (2009). Figures illustrating the results of the Phase 1 habitat, badger and bat surveys carried out in 2009.
[28] WSP, (2019). Ecology Technical Note. A29 Ecology Walk Over Survey Summary. Dated: 25 February 2019.
[29] JNCC, (2010). Handbook for Phase 1 habitat survey - a technique for environmental audit, ISBN 0 86139 636 7. Peterborough: JNCC.
[30] NIEA, (2017). Habitat Surveys NIEA Specific Requirements. [online] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/habitat-survey-specifications.pdf [Accessed 03/02/2020].

- Badger survey with reference to methods prescribed by NIEA[31]; and,
- Habitat Suitability Assessment (HSA) and Preliminary Roost Appraisal (PRA) for bats, with reference to Bat Conservation Trust (BCT) Good Practice Guidelines[32].

In addition, the following aquatic surveys were undertaken along the Ballinderry River up to 200 m either side of the proposed crossing points of the Sandholes Link Road and the common crossing point of the four route options in the southern section of the proposed scheme.

- Otter survey, with reference to NIEA[33]; and,
- River habitat surveys following the methods of NIEA[34] and Environment Agency[35], incorporating HSA for fish, white-clawed crayfish (*Austropotamobius pallipes*)[36] [37] and freshwater pearl mussel[38].

ROUTE OPTION APPRAISAL

The assessment of potential impacts on features of biodiversity interest (biodiversity receptors) associated with the route options under consideration is based on the relevant DMRB guidance[39]. This involves determining the significance of potential effects anticipated to be associated with the proposed scheme on biodiversity receptors (i.e. designated sites, habitats and species). This is done by weighing up the importance of the biodiversity receptors against the level of impact predicted to be posed upon them.

The importance of biodiversity receptors is determined using the criteria outlined in Table 4-1.

[31] NIEA, (2007). Badger Surveys NIEA Specific Requirements. [online] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/badger-survey-specifications--.pdf [Accessed 03/02/2020].
[32] Collins, J. (ed,) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition). London: The Bat Conservation Trust.
[33] NIEA, (2017). Otter Surveys NIEA Specific Requirements. [online] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf [Accessed 03/02/2020].
[34] NIEA, (2009). River Hydromorphology Assessment Technique (RHAT) Training guide. [online]http://www.epa.ie/wfdstatus/rivers/RW_RHAT_training_guide_final_20_04_09.pdf [Accessed 03/02/2020].
[35] Environment Agency, (2003). River Habitat Survey in Britain and Ireland. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/311579/LIT_1758.pdf [Accessed 03/02/2020].
[36] Peay S, (2003). Monitoring the White-clawed Crayfish *Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series No. 1. Peterborough: English Nature.
[37] Reynolds, J.D., O'Connor, W., O'Keeffe, C. & Lynn, D., (2010). A technical manual for monitoring white-clawed crayfish *Austropotamobius pallipes* in Irish lakes. Irish Wildlife Manuals, No 45, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
[38] Skinner A, Young M & Hastie L, (2003). Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2. Peterborough: English Nature.
[39] Highways England et al., (2019). DMRB Volume 11 Section 3, Part 5, LA 108 Biodiversity. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465 [Accessed 03/02/2020].

Table 4-1 – Biodiversity Resource Importance

International/European Importance	
Sites	Sites including: 1) European sites: a) Sites of Community Importance (SCIs); b) Special Protection Areas (SPAs); c) Potential SPAs (pSPAs); d) Special Areas of Conservation (SACs); e) Candidate or possible SACs (cSACs or pSAC); f) Wetlands of International Importance (Ramsar Sites). 2) Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves. 3) Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.
Habitats	N/A
Species	Resident, or regularly occurring, populations of species which can be considered at an international or European level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at an international or European scale.
UK/National Importance	
Sites	Sites including: 1) Areas of Special Scientific Interest (ASSI); 2) National Nature Reserves (NNR); 3) National Parks; 4) Marine Protected Areas (MPA) including Marine Conservation Zones (MCZ); or 5) Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.
Habitats	Habitats including: 1) areas of Northern Ireland Priority Habitats; 2) habitats included in the relevant statutory list of priority species and habitats; and 3) areas of irreplaceable habitats including: a) ancient woodland; b) ancient or veteran trees; c) blanket bog; d) limestone pavement; e) sand dunes; f) salt marsh; or g) lowland fen. 4) areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such.
Species	Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at a UK or national scale.
Regional Importance	
Sites	Designated sites (non-statutory) including heritage coasts.
Habitats	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).

International/European Importance	
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or b) the population forms a critical part of a wider regional population; or c) the species is at a critical phase of its life cycle; 2) species identified in regional plans or strategies (e.g. Northern Ireland Priority Species).
County Importance	
Sites	Wildlife / nature conservation sites designated at a county (or equivalent) level including: 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNR); 4) Sites of Importance for Nature Conservation (SINC); 5) Sites of Nature Conservation Importance (SNCI); or 6) County Wildlife Sites (CWS).
Habitats	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable).
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or b) the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or c) the species is at a critical phase of its life cycle. 2) species identified in a county or equivalent authority area plans or strategies.
Local Importance	
Sites	Wildlife / nature conservation sites designated at a local level including: 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNR); 4) Sites of Importance for Nature Conservation (SINC); 5) Sites of Nature Conservation Importance (SNCI); or 6) Sites of Local Nature Conservation Importance (SLNCI).
Habitats	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.
Species	Populations/communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

LEVEL OF IMPACT

The levels of impact upon each biodiversity receptor are defined as major, moderate, minor, negligible and no change; and are determined using the criteria outlined in Table 4-2 and in consideration of the following characteristics:

- positive or negative (e.g. adverse/beneficial);
- duration (e.g. permanent/temporary);
- reversibility (e.g. irreversible/reversible);
- extent/magnitude; and

- frequency and timing.

Table 4-2 – Level of impact and Typical Descriptions

Level of Impact (change)		Typical Description
Major	Adverse	1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate	Adverse	1) Temporary/reversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	1) Temporary addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor	Adverse	1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
Negligible	Adverse	1) Temporary/reversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	1) Temporary addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
No change		No observable impact, either positive or negative.

SIGNIFICANCE OF EFFECTS

As stated above, the significance of effects is defined by comparing the level of impacts arising from the proposed scheme with the importance of each biodiversity receptor under consideration, using the matrix shown in Table 4-3. Significant effects typically comprise those which are predicted to be moderate or above following the application of mitigation, where relevant.

Table 4-3 – Significance Matrix

	Level of Impact					
Resource Importance		No change	Negligible	Minor	Moderate	Major
	International/ European	Neutral	Slight	Moderate or large	Large or very large	Very large

	UK/National	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Regional	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	County	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Local	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

4.3 ASSUMPTION AND LIMITATION

As identified above, small areas of intensively managed agricultural land in the northern section of the Green route alignment were not within the areas surveyed during the PEA. However, the omission of these small areas is not considered to represent a significant limitation of the assessment of baseline ecological conditions associated with the Green route.

Access was restricted to enter a small number of locations during the PEA field surveys due to either private property, security fencing, potentially hazardous terrain, dense scrub/brash or livestock. Most access restrictions prevented the survey of small areas of land, however, fencing prevented access to an approximately 150 m section of the Ballinderry River, upstream of the Sandholes Link Road crossing.

The desk study, consultation and field survey information collected to inform the baseline conditions upon which this DMRB Stage 2 Assessment is based conforms to the DMRB scheme assessment guidance[40] and provides a broad understanding of the important biodiversity receptors associated with the proposed scheme. It is noted that responses are still pending from a number of consultees and that further, more detailed and species-specific surveys will be carried out in Stage 3 to inform the assessment and mitigation for the preferred route option. For the purposes of this DMRB Stage 2 Assessment however, it is considered that sufficient information has been obtained to allow adequate appraisal of the route options to be undertaken, despite the above-noted restrictions.

[40] The Highways Agency et al., (1993). Volume 5, Section 1, Part 2. Scheme Assessment Reporting TD 37/93. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search/80bdc2d9-be88-403d-a531-b3f7f6e90cff [Accessed 03/08/2020].

5 GEOLOGY AND SOILS

5.1 LEGISLATIVE AND POLICY FRAMEWORK

This section provides a brief list and summary of legislation and national, regional and local planning policies and guidance that have been considered and used to conduct this assessment.

LEGISLATION

- Waste and Contaminated Land Order 1997 SI 1997/2778
  - This Order sets out the regime for identifying and remedying contaminated land within Northern Ireland;
  - The Contaminated Land Regime, which is set out in Part 3, has been enacted but is not yet in force; and
  - A timetable for implementation of the regime in Northern Ireland has not been agreed; and
  - This regime supports the 'polluter pays' principle and is intended to manage issues arising from historic contamination. It is fully retrospective in action and the Local Councils will be the primary regulators for the regime.
- Waste and Contaminated Land (Amendment) Act (Northern Ireland) 2011
  - Gives the Department of Environment (now DAERA) and district councils investigative, enforcement and clean up powers to deal with illegally dumped waste. Changes the legislative framework for management of land that has been contaminated by pollution.
- Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) SR 2009/252
  - Brings into force rules requiring polluters to prevent and repair damage to water systems, land quality, species and their habitats and protected sites.
- Environmental Protection Act 1990
  - Establishes the legislative framework for identifying and dealing with contaminated land, although in Northern Ireland, the main provisions of the Act are contained in the Waste and Contaminated Land (Northern Ireland) Order 1997; and
  - The following provisions in the Environment Protection Act 1990 are those that apply to Northern Ireland, sections 3, 62, 140, 141, 142, 146, 147, 148, 153, 156 and 158.
- Planning Act (Northern Ireland) 2011
  - The planning process has an important role to play in managing land affected by contamination to ensure that the development is suitable for use. At the application stage the Consultees and other regulators (DAERA and Local Councils) provide advice to the relevant Council to ensure that the redevelopment of all potentially contaminated sites should be supported by adequate site investigation and risk assessment to identify all potential unacceptable risks; and a remediation strategy (if required) to ensure that the new development is suitable for use, be it residential, commercial or recreational space.

NATIONAL POLICY

- Strategic Planning Policy Statement for Northern Ireland (SPPS) 2015

- The SPPS Section 3.6 provides guidance on furthering sustainable development including utilising sites with environmental constraints such as land contamination;
- Section 6.93 provides guidance on the implementation of regional strategic policy including consideration of previously developed sites that may be subject to land contamination;
- Section 6.163 provides guidance on the consideration of minerals including soils; and
- Section 6.168 provides guidance on the natural heritage including soils.

¡ Regional Development Strategy 2035

- This document was published in 2010 by the Department for Regional Development and provides an overarching strategic planning framework for Northern Ireland up to 2035; and
- Section 3.27 discusses protecting soils during development.

REGIONAL AND LOCAL POLICY

¡ Mid Ulster District Council, Local Development Plan 2030 – Draft Plan Strategy, 2019.

- The Draft Plan Strategy sets out Mid Ulster District Council's vision for planning land use up to 2030 and details the objectives, spatial planning framework and planning policies which are proposed to be used to deliver that vision; and
- The draft document details minerals and mineral sites (discussed in Stage 2 SAR Section 6.7 – Materials and Wastes).

5.2 METHODOLOGY

DESK STUDY

A Preliminary Site Sources Report (PSSR)[41] details the following:

¡ Field studies including GI;
¡ Site description including land use, geology, hydrogeology, hydrology, site history, potential contamination and mining / quarrying;
¡ Ground conditions;
¡ Preliminary engineering assessment; and
¡ Route options and risks.

Other sources of baseline information included:

¡ Geological Survey of Northern Ireland (GSNI) Digimap NI107[42];

- Sheets 27 and 35 1:50,000 maps published by the GSNI (2010 and 1995 respectively);
- Soil map for Northern Ireland developed using the World Reference Base for Soil Resources (WRB) (2006)108; and
- OSNI Spatial NI Geoportal109 (including NIEA Historical Land Use Layer).

[41] WSP, (2020). Preliminary Site Sources Report 2020.
[42] Geological Survey of Northern Ireland. Digimap NI107.

Key information relevant to the geology and soils baseline from these sources are used to inform and support the baseline below.

SITE VISIT

A site walkover was undertaken by the WSP geotechnical team on 12 February 2019 and the findings from that walkover have been used to inform this geology and soils section.

The PSSR dated August 2020 prepared by WSP Ltd details the findings of the walkover and includes photographs.

GROUND INVESTIGATIONS

The following phases of GI have been carried out for the previous design phase:

- Preliminary GI (2008) reported by Mouchel Ltd[43]; and
- Main GI (2011) reported by Mouchel Ltd[44].

ASSESSMENT OF MAGNITUDE AND SIGNIFICANCE

This geology and soils assessment has been undertaken in accordance with:

- DMRB LA 109 Geology and Soils[45] which wholly supersedes DMRB Volume 11 Section 3 Part 11 Geology and Soils; and
- DMRB LA 104;

and has been supplemented by the assessment procedures contained within:

- BS10175:2011 +A2:2017[46]; and
- CLR11[47]. Its should be noted that CLR11 has been archived by the publisher and revised guidance is under consultation and due to be formally published in 2020.

The value (sensitivity) of receptors has been reported in accordance with the criteria provided in Table 3.11 of DMRB LA 109.

The magnitude of change has been reported in accordance with the criteria provided in Table 3.12 and NI/1.1 of DMRB LA 109.

The significance of effects has been reported in accordance with the criteria provided in Tables 3.7 and 3.8.1 of DMRB LA 104.

[43] Mouchel Ltd, (2009). Preliminary Ground Investigation Report reference 718314/B/R5006.
[44] Mouchel Ltd, (2011). Main Ground Investigation Report reference 718314/C/R/5011.
[45] Highways England, (2019). DMRB LA 109 Geology and Soils. [online] Available at: https://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20109%20Geology%20and%20soils-web.pdf [Accessed 27/02/2020].
[46] BSI, (2011). BS10175:2011 +A2:2017 Investigation of Potentially Contaminated Sites, Code of Practice. BSI.
[47] Environment Agency, (2004). CLR11 2004. Model Procedures for the Management of Land Contamination. Environment Agency.

5.3 ASSUMPTION AND LIMITATIONS

This baseline assessment has been informed by the reports and site observations prepared and undertaken to date including the WSP PSSR. There is currently no Preliminary Risk Assessment (PRA) (as required by DAERA in their consultation response) to further identify land contamination issues within the study area and this will be prepared at Stage 3, although potential sources of contamination have been identified in the PSSR and in this section.

Very limited chemical testing was undertaken across both phases of GI. Once the preferred route is confirmed and additional GI planned, additional sampling and chemical testing is likely to be required.

Once the final route is confirmed, an Agricultural Land Survey may be required to assess the exact classification of the soils along the preferred route.

6 MATERIAL ASSETS AND WASTE

6.1 LEGISLATIVE AND POLICY FRAMEWORK

This assessment has taken into account, and is in alignment with, the following current legislation and policy identified as relevant to the assessment of material assets and waste.

LEGISLATION

- The Waste Regulations (Northern Ireland) 2011 (as amended).[48]
  - The 2011 Regulations implements the revised Waste Framework Directive (2008/98/EC) and provide a definition of waste:
    - ""waste" means any substance or object which the holder discards or intends or is required to discard; and for the purposes of this definition;
    - "holder" means the producer of the waste or the person who is in possession of it; and
    - "producer" means any person whose activities produce waste or any person who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste".
  - The Regulations sets out the priority order which applies to the prevention and management of waste – the Waste Hierarchy, as shown in Figure 6-1[49]. The Waste Hierarchy applies to any persons who imports, produces, collects, carries, keeps, treats or disposes of waste.

Figure 6-1 – The Waste Hierarchy

[48] HM Government, (2011). The Waste Regulations (Northern Ireland) 2011. [online] Available at: http://www.legislation.gov.uk/nisr/2011/127/contents/made [Accessed 21/01/2020].
[49] European Commission, (2019). Directive 2008/98/EC on waste (Waste Framework Directive). [online] Available at https://ec.europa.eu/environment/waste/framework/ [Accessed 28/01/2020].

- The Regulations also set recycling targets to be included in the national waste strategy, whereby at least 70% (by weight) of construction and demolition waste (excluding hazardous waste and naturally occurring materials) are subject to material recovery by 2020.
- Of particular note from the Regulations is the duty on those who produce, transport and dispose of waste to ensure that their activities do not have an adverse impact on the environment. The Regulations also sets out the Duty of Care tracking system to ensure the producer, carrier and disposal operator take responsibility for proper disposal of their waste. Waste carriers must be registered and licenced, and producers of waste must ensure that their waste is removed by a registered carrier. Facilities which dispose of waste, or hold waste pending disposal must be licenced to operate as a waste facility.

¡ The Controlled Waste and Duty of Care Regulations (Northern Ireland) 2013 (as amended).[50]

- These Regulations clarify the classification of 'household', 'commercial' and 'industrial' wastes. The regulations introduce more stringent controls under the waste duty of care system to provide for better information contained in waste transfer notes, aid tracking waste and strengthen controls around the movement of waste.

¡ Hazardous Waste Regulations (Northern Ireland) 2005 (as amended).[51]

- These Regulations set out the regime for the control and tracking the movement of hazardous waste in Northern Ireland and transpose the Hazardous Waste Directive (91/689/EC). The regulations describe the meaning and determination of waste that should be classed as hazardous. The use of consignment notes to track hazardous waste movements are described.

¡ Waste and Contaminated Land (Northern Ireland) Order 1997 (as amended).[52]

- Although amended by multiple legislation documents, the Order is still extant and sets out the waste management regime covering waste carrier registration and identifying and remedying contaminated land.

¡ The Waste Management Strategy Regulations (Northern Ireland) 2009.[53]

- These Regulations (amending the Waste and Contaminated Land (Northern Ireland) Order 1997) require the Department of Environment (superseded by the DAERA) to have a waste management strategy containing policies in relation to the recovery and disposal of waste in Northern Ireland.

[50] HM Government, (2013). The Controlled Waste and Duty of Care Regulations (Northern Ireland) 2013. [online] Available at http://www.legislation.gov.uk/nisr/2013/255/contents/made [Accessed 21/01/2020].
[51] HM Government, (2005). The Hazardous Waste Regulations (Northern Ireland) 2005. [online] Available at http://www.legislation.gov.uk/nisr/2005/300/contents/made [Accessed 21/01/2020].
[52] HM Government, (1997). The Waste and Contaminated Land (Northern Ireland) Order 1997. [online] Available at http://www.legislation.gov.uk/nisi/1997/2778/contents [Accessed 21/01/2020].
[53] HM Government, (2009). The Waste Management Strategy Regulations (Northern Ireland) 2009. [online] Available at http://www.legislation.gov.uk/nisr/2009/178/contents/made [Accessed 21/01/2020].

NATIONAL POLICY

- Regional Development Strategy 2035.[54]
  - This Strategy provides overarching strategic planning framework to influence development in Northern Ireland. Key measures relevant to material assets and waste include encouraging the use of building rubble to reduce depletion of natural resources (under policy RG9); Managing waste sustainably under RG 10 through applying the Waste Hierarchy and Proximity Principle.
- Delivering Resource Efficiency; Northern Ireland Waste Management Strategy 2013.[55]
  - This Strategy sets the policy framework for the management of waste in Northern Ireland. It contains actions and targets to meet EU Directive requirements and the DAERA Programme for Government commitments. The Strategy follows the priority order for waste treatment set out in the Waste Hierarchy and has a strong focus on waste prevention (including re-use), preparing for re-use and recycling. The Strategy moves the emphasis of waste management in Northern Ireland from resource management, to resource efficiency and lifecycle thinking, whilst minimising the impact of use on the environment; and
  - Key targets for Government projects (such as the proposed scheme) include a minimum of 10% by value of recycled content on construction projects. Furthermore, each Centre of Procurement Expertise (of which Department for Infrastructure is one) must, by 2020, adhere to an annual waste to landfill reduction target of 75% (or more) recycling or re-use of construction, demolition and excavation (CDE) wastes.
- Waste Management Plan for Northern Ireland 2019.[56]
  - This Plan is being prepared to fulfil the requirements of the revised Waste Framework Directive 2008 (Directive 2008/98/EC). A final version of the Plan underwent consultation during December 2019, to determine if it fulfilled the requirements of the Directive;
  - The Plan provides an overview of waste management in Northern Ireland and is not intended to introduce new waste policies. The core aim of the Plan is to bring current waste management policies under the umbrella of one national plan. The Plan makes reference to the Northern Ireland Waste Management Strategy, and other regional waste management plans; and
  - The Plan states that the CDE sector is Northern Irelands largest waste generator. In 2009/10, the Plan indicates that approximately 70% of construction waste was recycled; this met the Waste Framework Directive target (also 70%). According to the Plan, the percentage of CDE

[54] Department for Regional Development, (2012). Regional Development Strategy (RDS) 2035 – Building a Better Future. [online] Available at: https://www.planningni.gov.uk/index/policy/rds2035.pdf [Accessed 04/05/2020].
[55] Department of the Environment, (2013). Delivering Resource Efficiency; Northern Ireland Waste Management Strategy. [online] Available at https://www.daera-ni.gov.uk/publications/delivering-resource-efficiency-northern-ireland-waste-management-strategy [Accessed 21/01/2020].
[56] Department of Agriculture, Environment and Rural Affairs, (2019). Waste Management Plan for Northern Ireland 2019. [online] Available at https://www.daera-ni.gov.uk/consultations/Waste-Management-Plan-for-Northern-Ireland [Accessed 21/01/2020].

arisings recycled was expected to rise to 79.4% in 2016; however, no data for Northern Ireland after 2009/10 is provided.

- Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development, 2015.[57]
  - The SPPS identifies the importance of natural resource and supports their responsible exploitation. The strategic objectives and policies to be implemented through Local Development Plans focus on balancing the need for mineral development proposals against safeguarding the environment and minimising the impacts of such developments. Application of sustainable and safe restoration is also a primary objective; and
  - Waste management aspects of the SPPS makes reference to the Northern Ireland Waste Management Strategy. A key strategic objective for waste is to promote the development of waste management and recycling facilities in appropriate locations, whilst ensuring that detrimental effects are minimised. Appropriate restoration of waste management sites after use must also be secured.

REGIONAL AND LOCAL POLICY

- Cookstown Area Plan 2010[23]
  - The purpose of the Plan is to inform the general public, statutory authorities, developers and other interested bodies of the policy framework and land use proposals that will be used to guide development decisions within Cookstown District;
  - In relation to waste, the Plan makes reference to the Waste Management Strategy for Northern Ireland published in 2000, which has been superseded by the 2013 Delivering Resource Efficiency; Northern Ireland Waste Management Strategy, summarised above;
  - Under minerals, the Plan makes reference to Cookstown District being one of the main sources of sand and gravel, building and roadstone aggregates in Northern Ireland; and
  - Policies are in place to identify areas on constraints on mineral developments (Policy MN1) and protect mineral resources from surface developments (Policy MN2).
- Mid Ulster District Council, Local Development Plan 2030 – Draft Plan Strategy, 2019.[58]
  - The Council intends to close their own operated landfill sites to meet the objective to maximise recycling. The waste management development strategy requires sustainable management with the necessary infrastructure whilst minimised impacts associated with the waste facilities;
  - The strategy for mineral development requires facilitating such sites whilst protecting the environment and minimising the impact on communities, landscapes, the water environment, and built and natural heritage. The Plan also sets out the requirement to identify mineral

[57] Department of the Environment, (2015). Strategic Planning Policy Statement for Northern Ireland. [online] Available at: https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf [Accessed 05/04/2020].
[58] DEFRA and Department for Transport (DfT), (2017). UK Plan for tackling roadside nitrogen dioxide concentrations. [online] Available at: https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017 [Accessed 04/05/2020].

deposits and safeguard the resources in areas known as Mineral Reserve Policy Areas (MPRAs); and

- The Local Development Plan is supported by the Mid Ulster District Council Local Development Plan Mineral Development, Identification of Areas of Constraints on Mineral Development & Impact of Surface Development on Aggregate Resources in Mid Ulster, 2019.[59] This paper sets out further detail on constraints related to mineral development and the impact of surface development on aggregate resources in Mid Ulster.

¡ Armagh City, Banbridge and Craigavon Borough Council; Fermanagh and Omagh District Council; and Mid Ulster District Council, Joint Waste Management Plan, 2016.[60]

- This Plan sets out the arrangement for the management of control waste generated within the jurisdictions of the joint councils and includes a description of the services and infrastructure needed. The Plan makes reference to the 70% recycling target for all non-hazardous construction and demolition waste set out in the Waste Framework Directive.

The Plan sets out a range of measures and actions to manage construction wastes. Government actions focus on facilitating resource efficient management of CDE wastes through the identification and prosecution of unlawful disposal; raising awareness and proving guidance; and developing markets for resource efficient waste management. Where clients have control of project budgets, they are noted as having the greatest influence to promote CDE waste reuse and recycling, as well as fulfilling Duty of Care responsibilities. Incentives such as promotion of sustainable design, appointing contractors with quality and environmental credentials, and reflecting costs of waste disposal accurately in project budgets, are noted as requirements in the Plan. The construction sector is encouraged to managed CDE arisings effectively by preventing waste, balancing cut and fill as far as possible, specifying recyclable and recycled materials, and implementing Site Waste Management Plans (SWMP).

6.2 METHODOLOGY

The primary standard used to inform the assessment process is LA 110.

BASELINE DATA COLLECTION

Through desktop research, the baseline scenario describes the current and likely future state (in the absence of the proposed scheme) of:

¡ The types and quantity of material required associated with operation of the existing land use within the first study area;

[59] Mid Ulster District Council, (2019). Local Development Plan Mineral Development, Identification of Areas of Constraints on Mineral Development & Impact of Surface Development on Aggregate Resources in Mid Ulster. [online] Available at https://www.midulstercouncil.org/MidUlsterCouncil/media/Mid-Ulster-Council/Publications/Planning/Local%20Development%20Plan/Background-Evidence-Paper-Identification-of-AOC-on-Min-Dev-Impact-of-Surface-Development.pdf [Accessed 22/01/2020].

[60] Armagh City, Banbridge and Craigavon Borough Council; Fermanagh and Omagh District Council; and Mid Ulster District Council, (2016). Joint Waste Management Plan. [online] Available at https://www.midulstercouncil.org/your-council/policies-documents [Accessed 22/01/2020].

- The types and quantities of waste produced associated with operation of the existing land use within the first study area;
- Information on availability of key construction materials required for the proposed scheme within the secondary study area; and
- Information on waste infrastructure and remaining landfill capacity within the secondary study area.

Baseline data has been sourced from publicly available data sources comprising:

- Mineral products Association, (2018). Profile of the UK Mineral Products Industry[61];
- Department for the Economy, (2018). Annual Minerals Statements[62];
- British Geological Society, (2012). Mineral resource maps in Northern Ireland[63];
- Northern Ireland Assembly, (2016). Background paper on Waste Management in Northern Ireland [64];
- Waste and Resources Action Programme (WRAP), (2011). Construction, demolition and excavation waste arisings, use and disposal in Northern Ireland 2009/10[65];
- Armagh City, Banbridge and Craigavon Borough Council; Fermanagh and Omagh District Council; and Mid Ulster District Council, (2016). Joint Waste Management Plan[60]; and
- Mid Ulster District Council, (2019). Local Development Plan Mineral Development[59].

Baseline data has also been sourced through consultation responses received from the DAERA and Mid Ulster District Council.

ASSESSMENT DATA COLLECTION

In accordance with LA 110, the assessment is a quantitative exercise that aims to identify the following:

For material assets:

- Types and quantities of materials required to construct the proposed scheme;
- Information on materials that contain secondary / recycled content;
- Information on any known sustainability credentials of materials to be consumed;

[61] Mineral products Association, (2018). Profile of the UK Mineral Products Industry. [online] Available at https://mineralproducts.org/documents/Facts-at-a-Glance-2018.pdf [Accessed 19/09/2019].
[62] Department for the Economy, (2018). Annual Minerals Statements. [online] Available at https://www.economy-ni.gov.uk/publications/annual-minerals-statements [Accessed 19/09/2019].
[63] British Geological Society, (2012). Mineral resource maps in Northern Ireland. [online] Available at https://www.bgs.ac.uk/mineralsuk/planning/resource.html#NI [Accessed 19/09/2019].
[64] Northern Ireland Assembly, (2016). Background paper on Waste Management in Northern Ireland. [online] Available at http://www.niassembly.gov.uk/assembly-business/committees/2016-2017/agriculture-environment-and-rural-affairs/new-page/background-paper-on-waste-management-in-northern-ireland/ [Accessed 19/09/2019].
[65] Waste and Resources Action Programme (WRAP), (2011). Construction, demolition and excavation waste arisings, use and disposal in Northern Ireland 2009/10. [online] Available at https://www.daera-ni.gov.uk/publications/construction-demolition-and-excavation-waste-arisings-use-and-disposal-northern-ireland [Accessed 19/09/2019].

- The type and volume of materials that will be recovered from off-site sources for use on the proposed scheme;
- The cut and fill balance; and
- Details of on-site storage and stockpiling arrangements, and any supporting logistical details.

An assessment of the effects of consuming materials required during the construction phase and first year of operational has been undertaken by considering the origins and sources of materials, including their general availability (production, stock, sales) and the proportion of recovered (reused or recycled) materials they contain (as well as other sustainability features).

The reuse of excavated and other arisings (that meet waste exemption criteria) is evaluated as part of the assessment of materials, to determine whether the adverse impacts associated with the consumption of primary resources can be reduced.

For waste:

- The amount of waste (by weight) that will be recovered and diverted from landfill either on site or off site (i.e. for use on other projects);
- Types and quantities of waste arising from the proposed scheme (demolition, excavation arisings and remediation) requiring disposal to landfill;
- Details of on site storage and segregation arrangement for waste and any supporting logistical arrangements; and
- Potential for generation of hazardous waste (type and quantity).

An assessment of the remaining landfill capacity in Northern Ireland is used to determine the impacts and effects of waste generated during the construction phase and first year of operation of the proposed scheme.

The assessment shall consider the type and volume of waste to be generated by the proposed scheme and determine the potential impact on remaining landfill capacity in the region; this is completed for inert and non-inert (non-hazardous and hazardous) waste types, where data are available. Wherever waste is recovered (diverted from landfill) the influence of this action is taken into account in the assessment of significance of effect.

The quantitative exercise for the assessment uses material and waste type and quantity data provided by the WSP Design Team for the proposed scheme.

As noted under Stage 2 SAR Section 6.7.1, the temporal scope of the assessment comprises the construction phase and first year of operation.

SIGNIFICANCE CRITERIA

The assessment shall adopt the significance criteria set out in LA 110 as presented in Table 6-1. The criteria does not require a separate assessment of sensitivity and magnitude of change. The assessment criteria is applied individually to material assets (using column 2 of Table 6-1) and waste (using column 3 of Table 6-1).

Table 6-1 – Material Assets and Waste Significance Criteria

Significance category	Description	
	Materials	Waste
Very Large	(No criteria for 'Very Large'; use details provided in 'Large').	>1% reduction or alteration in national capacity of landfill, as a result of accommodating waste from a project; or Construction of new (permanent) waste infrastructure is required to accommodate waste from a project.
Large	Project achieves <70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials; and Aggregates required to be imported to site comprise <1% re-used / recycled content; and Project sterilises ≥1 mineral safeguarding site and/or peat resource.	>1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and 50% of project waste for disposal outside of the region.
Moderate	Project achieves <70% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and Aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target*.	>1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and 1-50% of project waste for disposal outside of the region.
Slight	Project achieves 70-99% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and Aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target*.	≤1% reduction or alteration in the regional capacity of landfill; and Waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Neutral	Project achieves >99% overall material recovery / recycling (by weight) of non-hazardous Construction Demolition Waste (CDW) to substitute use of primary materials; and Aggregates required to be imported to site comprise >99% re-used / recycled content.	No reduction or alteration in the capacity of waste infrastructure within the region.
Notes	*Recycled aggregate target. The Recycled Aggregate Targets[66] included in LA 110 are applicable to England and its regions.	

[66] Ministry of Housing, Communities & Local Government, (2009). National and regional guidelines for aggregates provision in England 2005-2020. [online] Available at

Significance category	Description	
	Materials	Waste
	For Northern Ireland (as detailed in Delivering Resource Efficiency; Northern Ireland Waste Management Strategy 2013[55]), Government projects have a target to include a minimum of 10% by value of recycled content on construction projects. This 10% value is used as the Recycled Aggregate Target for the proposed scheme.	

The descriptions provided in Table 6-2 have been used to define whether effects identified are significant or not.

Table 6-2 – Descriptions for Significance of Effect

Significance Criteria	Materials Significance of Effect	Waste Significance of Effect
Very large	Significant	Significant
Large	Significant	Significant
Moderate	Significant	Significant
Slight	Not significant	Not significant
Neutral	Not significant	Not significant

6.3 ASSUMPTION AND LIMITATIONS

MATERIAL ASSETS

The assessment of material resources is dependent on the validity of the collated information, regarding the materials that are expected to be consumed during the 'in scope' lifecycle phases of the proposed scheme. The data has been provided from the WSP Design Team in a comparable manner between the route options based on the current design stage and will be refined (if necessary) at Stage 3 (EIAR).

Baseline data and information for the assessment uses the most recent available published data; typically, this varies between 2016 and 2018. As the same data has been used for the route options appraisal, the timeframe is not considered to impact the route options selection.

A lifecycle assessment (including embodied carbon and water) of materials has not be included in the scope of this Stage 2 SAR as the effort and resources required are deemed disproportionate to the benefit they would offer the assessment of significance of effect.

https://www.gov.uk/government/publications/national-and-regional-guidelines-for-aggregates-provision-in-england-2005-to-2020 [Accessed 29/01/2020].

Materials data has been provided by the WSP Design Team based on the preliminary design of the route options. Specific assumptions are:

- Conversion factors have been used where data from the WSP Design Team was not provided in tonnes. This includes a 1.25 t/m^3 factor for aggregate and earthworks cut and fill; a 1.24 t/m^3 conversion factor for concrete; and a 0.42 t/m^3 conversion factor for metal as set out in WRAP guidance.[67] The conversion factors have been applied equally to the route options and is not considered to materially affect the route options assessment.
- A 60% re-use / recovery rate on excavated materials (cut) has been advised by the WSP Design Team for the Red route, Purple A route, Purple B route and Green route. A re-use/recovery rate of 70% has been advised for the Sandholes Link Road cut volumes. These recovery rates have been used in the assessment of environmental effects. Should these recovery rates alter during the options assessment as the design progresses, re-assessment of the effects would be required.
- The WSP Design Team have advised that all aggregates used on the proposed scheme will meet the 10% recycled content target as set out in the Northern Ireland Waste Management Strategy[55] The recycled content target is used to assess the significance of environmental effects. Should the design alter during the options assessment to an extent where meeting the target is not considered likely, re-assessment of the effects would be required.

WASTE

There are no mandatory reporting requirements in Northern Ireland for commercial and industrial waste (including CDE waste) generation and remaining landfill capacity. Data has been requested and provided through consultation with DAERA to inform the baseline. As the same data has been used for the route options appraisal, no impact the route options selection is anticipated.

Published data in relation to transfer, recovery and recycling infrastructure is limited and generally only available until 2010. As the same data has been used for the route options appraisal, the timeframe is not considered to impact the route options selection.

The assessment of impacts and effects on landfill void capacity is based upon the validity of the collated information, regarding the waste generated and disposed by the proposed scheme. The data has been provided from the WSP Design Team in a comparable manner between the route options based on the current design stage and will be refined (if necessary) at Stage 3 (EIAR).

UK landfill operators can claim commercial confidentiality for their data at time of submission; data for sites with a commercial confidentiality in place are therefore unavailable for the analyses presented in this section. It is not anticipated that any lack of data in this context would significantly affect the results of the assessment.

Waste data has been provided by the WSP Design Team based on the preliminary design of the route options. Specific assumptions are:

[67] WRAP, (undated). Waste recording and reporting. [online] Available at http://www.wrap.org.uk/sites/files/wrap/Reporting%20Guidance.pdf [Accessed 02/03/2020].

- A conversion factor of 1.25 t/m^3 for earthworks cut and fill, as set out in WRAP guidance[67], has been used where data from the WSP Design Team was not provided in tonnes. The conversion factors have been applied equally to the route options and is not considered to materially affect the option assessment;
- Earthworks cut that cannot be re-used on-site from will be sent to a waste recycling facility. The recovery of earthworks has been used to assess the significance of environmental effects. Should the design alter during the options assessment to an extent where using a recycling facility is not considered likely, re-assessment of the effects would be required; and
- Demolition activities on the proposed scheme are limited to the removal of a culvert (Fairy Burn Culvert). As such, negligible quantities of demolition waste are anticipated and have not been quantified. Should the design alter during the options assessment to an extent where additional demolition is considered likely, re-assessment of the effects would be required.

Hazardous wastes may be generated during the construction phase, however at the current design stage, types and volumes cannot be quantified. However, the assessment assumed that quantities of hazardous waste generated by the proposed scheme would to be negligible. Should the WSP Design Team become aware of potential hazardous waste generation during the options assessment to an extent where volumes can be quantified, re-assessment of the effects would be required.

7 NOISE AND VIBRATION

7.1 LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

- Noise Insulation Regulations (Northern Ireland) 1995[68] (NIR)
  - The NIR (the 'Regulations') impose a duty upon the overseeing Highways Authority to make offers of noise insulation for dwellings and other places used for residential purposes near a new road or an additional carriageway. In order to qualify for such an offer, four criteria must all be fulfilled at 1m in front of the most exposed door or window of an eligible room in the façade of a property:
    - Level - The highest total traffic noise level expected within the first fifteen months use of the road (the 'Relevant Noise Level') must be not less than the Specified Level of 68 dB(A) $L_{A10,18hr}$. Predicted noise levels of 67.5 dB $L_{A10,18hr}$ and above are rounded up to 68 dB $L_{A10,18hr}$.
    - Increase - The Relevant Noise Level must be at least 1 dB(A) greater than that immediately before construction commenced (the 'Prevailing Noise Level').
    - Contribution - Noise from traffic on the road for which the Regulations apply must contribute at least 1 dB $L_{A10,18hr}$ to the Relevant Noise Level.
    - Locality - The property under consideration must be within 300 m of the Proposed Scheme.
  - The Regulations apply only to qualifying eligible rooms, which include living rooms and bedrooms affected by road traffic noise.

NATIONAL POLICY

- Strategic Planning Policy Statement (SPPS) for Northern Ireland[57]
  - The SSPS for Northern Ireland was formally updated in September 2015. The SPPS sets out how planning policies should be applied. Annex A of the SPPS relates to the management of noise.
  - Annex A states the following key points:
    - Noise should be treated as a material consideration in the determination of planning applications likely to give rise to significant levels of noise.
    - Consultation with the relevant authorities, including environmental health, may be necessary.
    - Planning authorities should seek to reach balanced decisions that consider noise issues alongside other relevant material considerations.
    - It may be appropriate to apply conditions to planning approvals in order to mitigate against excessive noise impacts.

[68] Department of the Environment, (1995). The Noise Insulation Regulations (Northern Ireland) 1995.

- Noise Policy Statement for Northern Ireland (NPSNI)[69]
  - The NPSNI has the following objectives:
    Through the effective management and control of environmental, neighbour and neighbourhood noise the Noise Policy aims to:
    - 1. Avoid or mitigate significant adverse impacts on health and quality of life;
    - 2. Mitigate and minimise adverse impacts on heath and quality of life; and
    - 3. Where possible, contribute to the improvement of health and quality of life.
  - Developments should avoid noise levels that would indicate Significant Observed Adverse Effect Level (SOAEL);
  - For developments that lie between Lowest Observed Adverse Effect Level (LOAEL) and SOAEL, measures should be taken to reduce adverse effects to a minimum; and
  - Noise management may be designed proactively to potentially benefit the overall noise environment, without the detriment of other environmental impacts.

REGIONAL AND LOCAL POLICY

- Mid Ulster District Council, Local Development Plan 2030 – Draft Plan Strategy, 2019[59]
  - This document aims to give guidance to statutory authorities, developers and the general public of the development strategy and guide development decisions. The plan is currently in draft and will remain open for public consultation until September 2020.
  - Policy GP1 - General Principles Planning Policy which states that:
    - '*Planning permission will be granted for sustainable development where the proposal accords with the Plan and there is no demonstrable harm*';
    - in relation to a number of considerations, of which the following relates to noise:
    - *'Amenity - Development should be compatible with surrounding land uses, the amenities of nearby residents and have regard to the character of the area in which it is located. In considering the impact on amenity regard should be given to several environmental factors including "Levels and effects of noise and vibration*"';

GUIDANCE

- British Standard 5228-1[70] (BS 5228-1)
  - BS 5228-1 provides guidance on the measurement, prediction and assessment of construction noise and recommends basic methods of noise control where there is a need to protect persons working or living near, and those working on, construction and open sites.

[69] DAERA, (2013). Noise Policy Statement for Northern Ireland. [online] Available at: https://www.daera-ni.gov.uk/consultations/noise-policy-statement-northern-ireland-npsni [Accessed 03/08/2020].
[70] The British Standards Institution, (2014). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. London: BSI

- Calculation of Road Traffic Noise[71]
  - The former Department of Transport/Welsh Office technical memorandum CRTN sets out a standardised method for the calculation of road traffic noise; and
  - The factors which may influence road traffic noise levels can be divided into three groups:
    - Road related factors - gradient and surface type;
    - Traffic related factors - flow, speed and the proportion of heavy-duty vehicles; and
    - Propagation factors - the distance between the road and the receptor location and either the type of ground cover between the road and receptor location or the presence of screening (i.e. barriers or buildings).
- DMRB, LA 111, Noise and Vibration[72]
  - LA 111 "*sets out the requirements for noise and vibration assessments from road projects, applying a proportionate and consistent approach using best practice and ensuring compliance with relevant legislation*." As stated within the document, "*there are no specific requirements for Department for Infrastructure, Northern Ireland supplementary or alternative to those given in LA 111*."
- Director of Engineering Memorandum 164/17, Noise Insulation Regulations (NI) Guidance[73] (DEM 164/17)
  - DEM 164/17 Guidance Note gives further instruction to the application of CRTN[74] to calculate future year noise levels, as required under the Noise Insulation Regulations, Northern Ireland, 1995 (NIR).

Determination of significance is based on the magnitude of change in conjunction with other contextual factors, including the absolute noise level. An initial assessment of significance has been undertaken at this optioneering stage.

7.2 METHODOLOGY

Sensitive receptors have been grouped into one set combining both dwellings and other sensitive receptors. This is done to simplify the comparison between the four route options.

[71] Department of Transport and Welsh Office, (1988). Calculation of Road Traffic Noise. London: H.M.S.O.
[72] Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland, (2020). DMRB, LA 111 revision 2. Noise and Vibration. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search/cc8cfcf7-c235-4052-8d32-d5398796b364 [Accessed 03/08/2020].
[73] DfI, (2017). DEM 164/17, Noise Insulation Regulations (NI) – Guidance on TransportNI approach to the Calculation of Road Traffic Noise (CRTN). [online] Available at: https://www.infrastructure-ni.gov.uk/publications/noise-insulation-regulations-ni-dfi-roads-calculation-road-traffic-noise-crtn-dem-16417 [Accessed 03/08/2020].
[74] Department of Transport and Welsh Office, (1988). Calculation of Road Traffic Noise. London: H.M.S.O.

Within the study area there are 3977 dwelling buildings and 52 other sensitive receptor buildings, including Cookstown Primary School, Holy Trinity Primary College, Weaver House Nursing Home, Northern Ireland Ambulance Service and several Places of Worship.

BASELINE

The operational noise baseline has been determined through prediction, using traffic data for the do-minimum (scenario without the proposed scheme) in the opening year (2025).

Noise monitoring of the existing noise climate has also been completed at a sample of locations in the vicinity of the route options.

CONSTRUCTION

A count of sensitive receptors within the defined construction noise study area for each route option has been completed. The location of sensitive receptors is based on the Ordnance Survey Northern Ireland (OSNI) Pointer address database for Northern Ireland.

OPERATION

Operational noise levels arising from each of the route options, each including the Sandholes Link Road have been determined through prediction, using computer software CadnaA and traffic data for the do-something (scenario with the proposed scheme) noise levels in the opening year.

Noise level changes due to each route option have been determined at noise sensitive receptors in the short-term daytime. This is a comparison of the do-something (scenario with the proposed scheme) against the do-minimum in the opening year.

The noise impacts, in terms of noise level and noise level change, for each route option have been determined at sensitive receptors within the study area. Based on these results, an initial assessment of significance has been completed for all route options and the outputs have been compared.

In terms of absolute noise level, the LOAEL and SOAEL are established as set out in Table 7-1.

Table 7-1 – Operational Noise LOAELs and SOAELs for All Receptors

Time Period	LOAEL	SOAEL
Day (06:00-24:00)	55 dB $L_{A10,18hr}$ facade	68 dB $L_{A10,18hr}$ facade

The operational magnitude of noise change, for increase or decrease, is defined in Table 7-2.

Table 7-2 – Operational Magnitude of Change – Short-Term

Short term magnitude	Short term noise change (dB LA10,18hr)
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9

Negligible	Less than 1.0

The initial assessment of likely significant effect on noise sensitive receptors has been determined using the criteria in Table 7-3.

Table 7-3 – Initial Assessment of Operation Noise Significance

Short term magnitude	Significance
Major	Significant
Moderate	
Minor	Not significant
Negligible	

7.3 ASSUMPTION AND LIMITATIONS

OPERATIONAL NOISE ASSESSMENT

- Ground absorption is set to a nominal value of coefficient of 0.5 to represent a mixture of hard and soft ground. Roads and buildings are set to be acoustically reflecting;
- Ground height data for the do-minimum scenario and unchanged terrain is from OSNI Open Data Digital Terrain Model datasets at 1 m vertical contour resolution;
- Ground height data for the proposed options is taken from 3D engineering drawings, as supplied by WSP Design Team;
- Dwellings and other sensitive building types are identified using OSNI Pointer address data;
- Each sensitive building is reported as one receptor, a building with multiple address points reported appears once in the results;
- Dwellings, larger non-dwelling receptors and other smaller, non-receptor buildings included for screening, are assigned heights of 2, 3, 4 or 8.0 m above local ground increasing relative to the building footprint area;
- Building outlines have been incorporated into the noise model based on OSNI detailed mapping tiles;
- Open space sensitive receptors (e.g. designated areas, public rights of way) are not included;
- Building receivers are set at 4.0 m above local ground representing a first floor window;
- Roads unaltered by the options are spatially aligned using the OSNI Open Data 50k Transport Line dataset which was aligned to the modelled road links by WSP transport planners;
- New or altered roads are spatially aligned using the engineering drawings;
- Road links with flows less than 1000 vehicles in any scenario, Annual Average Weekday Traffic (AAWT) 18 hour, are excluded; based on CRTN guidance;
- Minimum road speed of 20 km/h is applied, the CRTN method is valid between 20-130 km/h;
- Speed pivoting has not been applied to the traffic data;
- Road surfaces are modelled as standard Hot Rolled Asphalt (HRA);

- Road widths modelled as 7.0 m wide; and
- Road heights and gradients are determined from the ground height data.

8 POPULATION AND HEALTH

8.1 LEGISLATIVE AND POLICY FRAMEWORK

The following list summarises the legislation, policy and guidance applicable to the Population and Health assessment.

NATIONAL POLICY

- Strategic Planning Policy Statement for Northern Ireland (SPPS) 2015[121]
  - The SPPS consolidates twenty separate policy publications into one document and sets out strategic planning policy for Northern Ireland. It sets the strategic direction for the new councils to bring forward detailed operational policies within future local development plans. Of particular importance to the proposed scheme is the recognition that transportation networks are important in achieving the goal of rebuilding and rebalancing the economy and promoting greater interconnectedness.
- Access to the Countryside (Northern Ireland) Order 1983
  - Under the Access to the Countryside (NI) Order 1983, district councils have a duty "*to assert, protect and keep open and free from obstruction or encroachment, any public rights of way…*". Councils are given discretionary powers to repair and maintain rights of way, to create, divert or close public paths and to make access agreements or orders to open land.
- The Regional Development Strategy for Northern Ireland 2035 (2010)
  - The Regional Development Strategy for Northern Ireland is the spatial strategy of the Executive. Its purpose is to deliver the spatial aspects of the Programme for Government. It complements the Sustainable Development Strategy and informs the spatial aspects of the strategies of all Government Departments.
  - The Strategy is a long-term plan which recognises the important role Belfast plays in generating regional prosperity and that Londonderry is the focus for economic growth in the North West region. To ensure that all places benefit from economic growth, the Strategy reflects the Programme for Government approach of balanced sub-regional growth and recognises the importance of key settlements as centres for growth and investment. The strategy recognises that successful regions have vibrant cities at their core, but that rural areas, towns and villages have a key role in supporting economic growth throughout the region, with improved connectivity between communities to enhance the movement of people, goods, energy and information.
  - It recognises there is a need to understand the role and function of settlements and their role in serving rural communities and the importance of promoting co-operation between places. It encourages clustering of towns and cities so that services can be shared and do not need to be duplicated. It identifies those settlements within close proximity to each other which have the potential to cluster. Cookstown is recognised as a Hub providing key local services in conjunction with other Hubs to form a Cluster outside of the main cities of Belfast and Londonderry.
- The Regional Transportation Strategy (RTS)

- The RTS is a 'daughter document' of the Regional Development Strategy for Northern Ireland 2035 which sets out the spatial development framework for Northern Ireland up to 2025.

¡ Ensuring a Sustainable Transport Future: A New Approach to Regional Transportation (2011)[75]

- This document sets out the Department for Infrastructure's (formally the Department for Regional Development) new approach to regional transportation and particularly future decisions on investment. It complements the Regional Development Strategy and aims to achieve the transportation vision: *"to have a modern, sustainable, safe transportation system which benefits society, the economy and the environment and which actively contributes to social inclusion and everyone's quality of life".* The new approach starts with the assumption that the decision to travel has been made. It seeks to provide the infrastructure and services that will ensure that travel and transport are as sustainable as possible.

¡ A Whole System Strategic Framework for Public Health 2013-2023 (2014)[76]

- An approach to public health which focuses on working collaboratively with individuals, communities and partner organisations to address the factors that impact on health and wellbeing in Northern Ireland. It also states the commitment of national government to ensuring that there are effective mechanisms in place to ensure protection of the community from current and future threats to public health.

¡ Exercise Explore Enjoy - A Strategic plan for Greenways (2016)[77]

- This plan sets out the vision and framework for a more strategic and ambitious programme to develop greenway routes right across the whole of the north. Greenways and similar community paths are identified as crucial for creating public spaces that will enhance quality of life and leave an enduring legacy to be enjoyed by future generations.

¡ A Bicycle Strategy for Northern Ireland (2015)[78]

- This sets out progressively how the government aims to transform Northern Ireland into a place where travelling by bicycle is a healthy, everyday activity. It identifies the necessary

[75] Department for Regional Development, (2011). Ensuring a Sustainable Transport Future: A New Approach to Regional Transportation. [online] Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/drd/Ensuring%20a%20Sustainable%20Transport%20Future%20-%20A%20New%20Approach%20to%20Regional%20Transportation%20%28final%20version%2C%20April%202012%29.pdf [Accessed 24/01/2020].
[76] Department of Health, Social Services and Public Safety, (2014). Making Life Better: A Whole System Strategic Framework for Public Health (2013-2023). [online] Available at:https://www.health-ni.gov.uk/sites/default/files/publications/dhssps/making-life-better-strategic-framework-2013-2023_0.pdf [Accessed 24/01/2020].
[77] Department for Infrastructure, (2016). Exercise, Explore, Enjoy: A Strategic Plan for Greenways. [online] Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/exercise-explore-enjoy-a-strategic-plan-for-greenways-november-2016-final.pdf [Accessed 23/01/2020].
[78] Department for Regional Development, (2015). Changing Gear: A Bicycle Strategy for Northern Ireland [online] Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/drd/a-bicycle-strategy-for-northern-ireland.pdf [Accessed 23/01/2020].

investment for infrastructure and initiatives required to continue promoting increased active travel.

REGIONAL AND LOCAL POLICY

- Mid Ulster Local Development Plan 2030 - Draft Plan Strategy[79]
  - The Draft Plan Strategy sets the vision of Mid Ulster Council for planning land use up to 2030 and details the objectives, spatial planning framework and planning policies which will be used to deliver that vision.
  - It supports the vision of the Mid Ulster Community Plan to create a region which is 'a welcoming place where our people are content, healthy and safe; educated and skilled; where our economy is thriving; our environment and heritage are sustained; and where our public services excel'.
- Our Community Plan: 10-year plan for Mid Ulster (2017)[80]
  - This community planning document sets out the shared vision for Mid Ulster and then identifies what needs to be done to deliver that vision. It focuses on people, communities and organisations coming together to improve local well-being and quality of life, and making sure that plans, strategies, priorities and programmes at all levels integrate with each other. The plan has been created to clearly link with the Mid Ulster Development Plan and takes account of equality, good relations, sustainable development, social inclusion and rural proofing. It has been screened to ensure that it does not impact negatively upon these core principles.
- Mid Ulster Preparatory Study – Transportation (2015)[81]
  - Provides the Council with an overview of the regional planning and roads policy context in relation to transportation and to provide information on the strategic road network, various transportation schemes, future transportation initiatives, existing car parking provision and public transport services within the Mid Ulster plan area.
- 2019/2020 Annual Report on the work of DfI Roads across the Mid Ulster District Council Area[82]

[79] Mid Ulster District Council, (2019). Local Development Plan 2030 – Draft Plan Strategy. [online] Available at: https://www.midulstercouncil.org/getmedia/dd8d49d7-79a6-4419-948f-2569cb0d0fa5/Local-Development-Plan-2030-Strategy-for-reconsultation.pdf.aspx [Accessed 04/05/2020].
[80] Mid Ulster District Council, (2017). Our Community Plan: 10 Year Plan for Mid Ulster. [online] Available at: https://www.midulstercouncil.org/MidUlsterCouncil/media/Mid-Ulster-Council/Community%20Planning/COMMUNITYPLAN-2017-10-Year-Plan-for-Mid-Ulster(10).pdf [Accessed 23/01/2020].
[81] Mid Ulster District Council, (2015). Preparatory Study: Transportation. [online] Available at:https://www.midulstercouncil.org/MidUlsterCouncil/media/Mid-Ulster-Council/Publications/Planning/Local%20Development%20Plan/Prepatory%20Position%20Papers/Transportation-paper-May-2015.pdf [Accessed 20/01/2020].
[82] DfI, (2019). 2019/2020 Annual Report on the work of DfI Roads across the Mid Ulster District Council Area. [online] Available at: https://mid-ulster.cmis-ni.org/MidUlster/Document.ashx?czJKcaeAi5tUFL1DTL2UE4zNRBcoShgo=nyQmsDksAeZmoZwbUap0YcHzPM4%2BfXdTp6kXY3xdZzuox7X1rpIclQ%3D%3D&rUzwRPf%2BZ3zd4E7Ikn8Lyw%3D%3D=pwRE6AGJFLD

- This report deals with works completed across the Council area during the year 2018/2019 and sets out initial proposals for DfI schemes to be undertaken in the year 2019/2020. The opportunity is also taken to provide an update on the strategic roads schemes that are being taken forward which will benefit the Mid Ulster District Council area.

¡ Cookstown Area Plan (2010)[23]

- Provides a broad land use and policy framework for the development of Cookstown District Council Area to the year 2010. Once adopted, the Mid Ulster Local Development Plan 2030 will supersede the Cookstown Area Plan.

8.2 METHODOLOGY

LAND USE AND ACCESSIBILITY

Effects of the proposed scheme on land use and accessibility are considered in a qualitative assessment with evidence provided to support the conclusions made. Effects of the proposed scheme on land use and accessibility are considered in terms of both the receptor value (sensitivity) and the magnitude of impact (change). Desk study and professional judgement has been used to determine the receptor sensitivity and magnitude of impacts in accordance with guidance in the DMRB, Volume 11, LA 112 (Tables 3.11 and 3.12 respectively). The sensitivity of the receptor is largely based on location and local availability of alternatives, and frequency or level of use, with some variation depending on receptor type. The magnitude of impact is largely based on the remaining functionality of the receptor or the level of severance or accessibility for the user.

The significance of the predicted effects has been derived by combining the sensitivity of receptors with the magnitude of change arising from the proposed scheme, in accordance with guidance in DMRB, Volume 11, LA 104. The significance of effect has been determined for each element within the Land use and accessibility sub-topic.

To inform the assessment, land parcels within the proposed scheme boundary have been categorised as one of the following land use types: residential development (existing residential property and allocated housing), garden ground, industrial and commercial, amenity (parks, designated open spaces and community land) or agricultural land. This assignment of land use defaults to the highest value option where land is within a planning allocation (for example where agricultural land lies within a housing or employment allocation under the Mid Ulster Community Plan).

No information on the temporary land take that may be required for construction activities is available at this stage of the assessment. This will be assessed in Stage 3 and is not expected to be a differentiator in route option selection.

Nlh225F5QMaQWCtPHwdhUfCZ%2FLUQzgA2uL5jNRG4jdQ%3D%3D&mCTIbCubSFfXsDGW9IXnlg%3D%3D=hFflUdN3100%3D&kCx1AnS9%2FpWZQ40DXFvdEw%3D%3D=hFflUdN3100%3D&uJovDxwdjMPoYv%2BAJvYtyA%3D%3D=ctNJFf55vVA%3D&FgPlIEJYlotS%2BYGoBi5olA%3D%3D=NHdURQburHA%3D&d9Qjj0ag1Pd993jsyOJqFvmyB7X0CSQK=ctNJFf55vVA%3D&WGewmoAfeNR9xqBux0r1Q8Za60lavYmz=ctNJFf55vVA%3D&WGewmoAfeNQ16B2MHuCpMRKZMwaG1PaO=ctNJFf55vVA%3D [Accessed 25/02/2021].

No site visit or topic-specific surveys were undertaken. This assessment was informed by the 2019 Interim Summary Report, the Initial Site Walkover conducted on 19 to 20 February 2019 by WSP and the associated reporting.

A WCHAR assessment has also been carried out and is referred to in this section, and is reported in the Walking, Cycling and Horse-Riding Assessment report. The Walking, Cycling and Horse-Riding Assessment report has informed the level of use of walking, cycling and horse-riding facilities[83].

HUMAN HEALTH

Effects of the proposed scheme on human health are considered in a qualitative assessment with evidence provided to support the conclusions made. Changes to health determinants as a result of the proposed scheme have been identified using available information about the proposed scheme and from other environmental assessments undertaken as part of this Stage 2 assessment.

- The sensitivity of the population has been determined using professional judgement applied to the health profile presented in the baseline, and reported as low, medium, or high. A health receptors' sensitivity is based on their ability to experience a potential impact without incurring a substantial change to their health status. Information used to determine receptor value includes the following:
- Level of deprivation and/or isolation;
- Accessibility;
- Availability of local services and/or assets, and availability of alternatives;
- Use of routes by WCH, particularly vulnerable travellers, for journeys (either utility or recreational); and
- Importance of land for business or employment uses.

Likely health outcomes resulting from the proposed scheme have been reported on using guidance in the DMRB, Volume 11, LA 112 (Table 3.32).

8.3 ASSUMPTION AND LIMITATIONS

The assessment relies on data provided by third parties (e.g. OSNI Mapping, local authorities, Northern Ireland Statistics & Research Agency (NISRA), etc) which are the most up-to-date, available at the time of the assessment. Land registry data was first obtained in January 2019, and has been periodically updated. No significant changes or limitations in these datasets have been identified that would affect the robustness of the baseline presented.

No information on the temporary land take that may be required for construction activities is available at this stage of the assessment. This will be assessed in Stage 3 and is not expected to be a differentiator in route option selection.

Land parcels where less than 1sqm will be taken for the proposed scheme, and road parcels (where ownership by DfI has been assumed) are not included in the figures for land take, and have not had

[83] WSP, (2020). A29 Cookstown Bypass Walking, Cycling and Horse-Riding Assessment.

a category (residential development, garden ground, industrial and commercial, amenity or agricultural) assigned to them.

No information on the frequency of use of community assets and facilities, businesses and agricultural land holdings, located within the study area the has been made available at this stage. The Walking, Cycling and Horse-Riding Assessment report has informed the level of use of walking, cycling and horse-riding facilities[83], however user data is limited to weekday usage in March 2019 at only four junctions.

For the purpose of Human Health, vulnerable population groups (i.e. children, young people or older individuals) have been assumed to be present throughout the study area. Where a vulnerable population group may be more susceptible to an effect, this has been identified in the assessment.

9 CLIMATE

9.1 LEGISLATIVE AND POLICY FRAMEWORK

The key legislation and policies of relevance to both the GHG and climate resilience assessment are identified below.

LEGISLATION

- The Climate Change Act (2008)[84]
  - The Climate Change Act (2008)[85] established a legal requirement for an 80% reduction in the GHG emissions of the UK economy by 2050 in comparison to the 1990 baseline. In addition, in June 2019 the UK Government updated this commitment to net zero emissions by 2050[86].
  - The Climate Change Act also created the Committee on Climate Change, with responsibility for setting five yearly carbon budgets covering successive periods of emissions reduction to 2050.
  - The Act also requires the UK Government to produce a UK Climate Change Risk Assessment every five years, assessing current and future risks to and opportunities from climate change.
- United Nations Framework Convention on Climate Change
  - The UK is a member of the United Nations Framework Convention on Climate Change ('UNFCCC') which drives international action on climate change. The UK has pledged to reduce emissions under the 'Paris Agreement' in 2015, as a part of a joint pledge by members of the EU. This provides an overarching commitment by the UK[87].

NATIONAL POLICY

- Regional Development Strategy 2035[88]
  - RG9: Reduce our Carbon Footprint and facilitate mitigation and adaptation to climate change whilst improving air quality. Mitigation and Adaptation initiatives identified in the strategy of relevance to the proposed scheme include:
    - Reduce GHG emissions from transport;
    - Identify key assets and areas that are at risk through climate change; and

[84] Note that there is no devolved government Climate Change Act for Northern Ireland
[85] HM Government, (2008). UK Climate Change Act. [online] Available at: http://www.legislation.gov.uk/ukpga/2008/27/contents [Accessed 24/01/2020].
[86] HM Government, (2019). UK becomes first major economy to pass net zero emissions law. [online] Available at: https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law [Accessed 11/09/2020].
[87] Committee on Climate Change Legal duties, (2016). [online] Available at: https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/ [Accessed 24/01/20].
[88] Department for Regional Development, (2010). Regional Development Strategy. [online] Available at: https://www.planningni.gov.uk/index/policy/rds2035.pdf [Accessed 24/01/2020].

- Minimise development in areas at risk of flooding from rivers, the sea and surface water run-off.

¡ Strategic Planning Policy Statement for Northern Ireland (2015)[57]

· The Strategic Planning Policy Statement (SPPS) for Northern Ireland identifies mitigating and adapting to climate change as a central challenge in furthering sustainable development. A key pledge of the Executive is "to continue to work towards a reduction in greenhouse gas emissions by at least 35% on 1990 levels by 2025".
· The SPPS identifies the planning system as therefore helping to mitigate and adapt to climate change by:

- shaping new and existing developments in ways that reduce GHG emissions and positively build community resilience to problems such as extreme heat or flood risk;
- requiring the siting, design and layout of all new development to limit likely GHG emissions and minimise resource and energy requirements;
- avoiding development in areas with increased vulnerability to the effects of climate change, particularly areas at significant risk from flooding and landslip; and
- working with natural environmental processes, for example through promoting the development of green infrastructure and the use of sustainable drainage systems (SUDS) to reduce flood risk and improve water quality.

¡ Northern Ireland Regional Development Strategy 2035

· Climate change is identified as a key environmental and economic driver in Northern Ireland. Policy RG9 'Reduce our carbon footprint and facilitate mitigation and adaptation to climate change whilst improving air quality' identifies reducing GHG emissions from transport as key climate change mitigation. Key climate change adaptation is identified as minimising development in areas at risk from flooding, protecting soils and identifying key assets at risk through climate change.

¡ Northern Ireland Climate Change Adaptation Programme 2019-2024[89]

· Key priorities of relevance to the proposed scheme include:
· Natural Capital 2 (NC2): To have infrastructure that are resilient to impacts of climate change; and
· Infrastructure Services 1 (IF1): To have Transport and Network Services that are resilient to the impacts of Flooding and extreme weather. Adaptation to climate change under this key priority area requires two forms of response: dealing with the long-term effects on infrastructure such as rising sea levels, and also developing resilience to acute and extreme weather events such as flash flooding.

[89] Department of Agriculture, Environment and Rural Affairs, (2019). Northern Ireland Climate Change Adaptation Programme 2019-2024. [online] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Northern%20Ireland%20Climate%20Change%20Adaptation%20Programme%202019-2024%20Final-Laid.PDF [Accessed 24/01/2020].

REGIONAL AND LOCAL POLICY

- Mid Ulster District Council Local Development Plan 2030 – Draft Plan Strategy February 2019[59]
  - Enhancing the environment and improving infrastructure is a key objective of the development plan and includes reducing contributions and vulnerability to climate change and to reduce their carbon footprint (Section 3.15 'Plan Objectives').
- Our Community Plan 10 year plan for Mid Ulster[80]
  - The Community Plan promotes creating a sustainable environment and public services. All of the strategic actions within the Community Plan incorporate these principles. The sustainable environment highlights the growing imperative of making a significant contribution to tackling global warming and climate change. It states that the delivery of the Plan must produce sustainable action that protect our environment and leave a legacy for future generations.

9.2 METHODOLOGY

GREENHOUSE GAS

Emissions calculations have been completed using Highways England's Carbon Tool[90]. Although the use of this tool to quantify construction emissions is not required within Northern Ireland, it is an industry recognised carbon calculation tool focusing on emissions throughout the project lifecycle. Values have been reported as tonnes of carbon dioxide equivalents (tCO_2e). Professional judgement has been applied when completing the carbon calculation tool. As transport distances were not supplied at this stage, distances have been estimated using assumptions published in Royal Institution of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment[91].

In the absence of information about the construction plant, such as the types of machinery and fuels to be used, the construction plant emissions have been estimated using best practice methods from the RICS guidance.

In order to calculate emissions for road lighting, the annual operating hours was multiplied by the power rating of lighting and the number of units to estimate the electricity consumption. The electricity consumption was then multiplied by annual emission factors Sourced from the Green Book, BEIS[92]

[90] Highways England (2019) Highways England: carbon emissions calculation tool. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/836958/Highways_England_Carbon_Tool_v2.2.xlsm [Accessed 23/04/2020].
[91] RICS, (2017). Whole life carbon assessment for the built environment. [online] Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf [Accessed 23/04/2020].
[92] BEIS, (2020). Greenhouse gas reporting: conversion factors 2020. [online] Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal [Accessed 23/04/2020].

End-user vehicle emissions were calculated in accordance with the DMRB Volume 11, Section 3, Part 14 Climate; LA 114[93] and Department for Transport (DfT) WebTAG A3[94], DfT Road Statistics[95]. This took into account the proportions of the vehicle types, fuel type and forecast fuel consumption parameters.

Conversion factors for GHGs published by Department for Business, Energy and Industrial Strategy (BEIS)[96] were used to convert the traffic data to GHG emissions data. The calculation includes the 'do-minimum' and 'do-something' total GHG emissions for all vehicles covered by the full extent of the traffic model.

There are currently no agreed thresholds for what level of GHG emissions is considered significant in an EIA. The significance of GHG emissions is assigned with reference to the magnitude of emissions, their context, guidance from IEMA[97] and the use of professional judgement.

As climate change impacts are global in nature, it is not possible to link a specific project, with a specific environmental impact. The significance of GHG impacts is assessed by comparing estimated GHG emissions arising from the proposed scheme with the respective UK carbon budget, which have been set by the UK Government covering 2018 to 2032 (expressed in millions of tonnes of carbon dioxide equivalents ($MtCO_2e$). The UK carbon budgets are shown in Table 9-1.

In terms of context, the carbon budgets presented are useful. However, the NPSNN sets out that "it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets." To provide additional context, the transport emissions from 2017 within Mid Ulster, Northern Ireland and nationally are presented in Table 9-2 – expressed in thousands of tonnes of carbon dioxide equivalents ($ktCO_2e$).

Table 9-1 – National Carbon Budgets Set by The Government

Carbon Budget Period	UK Carbon Budget ($MtCO_2e$)
Third: 2018-2022	2,544
Fourth: 2023-2027	1,950

[93] DMRB, (2019). Volume 11, Section 3, Part 14 Climate; LA 114. [online] Available at: http://origin.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20114%20Climate-web.pdf [Accessed 23/04/2020].
[94] Department for Transport, (2019). WebTAG data book. [online] Available at: https://www.gov.uk/government/publications/tag-data-book [Accessed 23/04/2020].
[95] Department for Transport, (2019) Road Statistics. [online] Available at: https://www.gov.uk/government/collections/road-traffic-statistics [Accessed 23/04/2020].
[96] Department for Business, Energy & Industrial Strategy, (2019), UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2017. [online] Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2017 [Accessed 23/04/2020].
[97] Institute of Environmental Management and Assessment, (2017). EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance. [online] Available at: https://www.iema.net/assets/newbuild/documents/IEMA%20GHG%20in%20EIA%20Guidance%20Document%20V4.pdf [Accessed 30/09/2019].

Fifth: 2028-2032	1,725

Table 9-2 – Emissions Sources (2017) for Mid Ulster, Northern Ireland and Nationally

Emissions Sources	Mid Ulster ($ktCO_2$)	Northern Ireland ($ktCO_2$)	National (UK) ($ktCO_2$)
I. Road Transport (A roads)	200.6	1,937.1	56,186
J. Road Transport (Motorways)	15.3	338.8	30,234
K. Road Transport (Minor roads)	203.5	1,578.6	37,978
L. Diesel Railways	-	40.8	2,133
M. Transport Other	2.1	43.9	2,136
Transport Total	421.5	3,939.2	128,666

CLIMATE RESILIENCE

The methodology assesses the impacts of changes in climate variables (identified from the climate projections as detailed in Stage 2 SAR Section 6.10.2) on the proposed scheme receptors.

The assessment considers:

- Construction stage – the impacts of weather on the site compound, materials, plant and equipment and workforce; and
- Operation – the impacts of changes in climate on pavement, embankment, ancillary equipment, drainage, vegetation and end users.

Measures embedded within the design to account for climate resilience have not been detailed at this stage however they will be identified at Stage 3 through consultation with the proposed scheme designers and other environmental disciplines.

The assessment of significance of effects is undertaken by considering the consequence and the likelihood of the potential impacts of climate change occurring. The assessment is qualitative and based on the guidance identified in Stage 2 SAR Section 6.10.1, expert judgment, engagement with the wider Project Team and a review of relevant literature. Likelihood and consequence are qualitatively assessed using the descriptions in Table 9-3 and Table 9-4. These descriptions are based on the DMRB[98].

[98] Highways England, (2019). LA 114 Climate. [online] Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20114%20Climate-web.pdf [Accessed 24/01/2020].

Table 9-3 – Consequence Definitions

Measure of consequence	Description
Very large adverse	Construction - disruption to the construction site lasting more than 1 week. Operation - national level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	Construction - disruption to the construction site lasting more than 3 days but less than 1 week. Operation - national level disruption to strategic route(s) lasting more than 1 day but less than 1 week or regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Construction - disruption to the construction site lasting more than 1 day but less than 1 week. Operation - regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Construction - disruption to the construction site lasting less than 1 day. Operation - regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Construction - disruption to an isolated section of the construction site lasting less than 1 day. Operation - disruption to an isolated section of a strategic route lasting less than 1 day.

Table 9-4 – Likelihood Definitions

Measure of likelihood	Description
Very high	Construction - The event occurs multiple times during the construction of the project. Operation - The event occurs multiple times during the lifetime of the project (60 years) e.g. approximately annually, typically 60 events.
High	Construction - The event occurs several times during the construction of the project. Operation - The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every 5 years, typically 12 events.
Medium	Construction - The event occurs limited times during the construction of the project. Operation - The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically 4 events.
Low	Construction - The event occurs during the construction of the project. Operation - The event occurs during the lifetime of the project (60 years) e.g. once in 60 years.

Very low	Construction - The event can occur once during the construction of the project. Operation - The event can occur once during the lifetime of the project (60 years).

The likelihood and consequence are combined to assess the significance of effects on receptors, as shown in Table 9-5. This is taken from the DMRB[98].

Table 9-5 – Significance Rating Matrix

		Measure of Likelihood				
		Very low	Low	Medium	High	Very high
Measure of consequence	Very Large adverse	Not significant	Significant	Significant	Significant	Significant
	Large adverse	Not significant	Not significant	Significant	Significant	Significant
	Moderate adverse	Not significant	Not significant	Significant	Significant	Significant
	Minor adverse	Not significant	Not significant	Not significant	Not significant	Not significant
	Negligible	Not significant	Not significant	Not significant	Not significant	Not significant

9.3 ASSUMPTION AND LIMITATIONS

Greenhouse Gas

- Type and quantities of material and transport information provided at this stage are indicative and will be refined as the design of the proposed scheme is finalised. Data have been provided by the WSP Design Team, based on the current design for the route options;
- As transport distances for construction and waste materials were not provided at this stage, RICS[91] assumptions have been applied;
- A worst-case scenario bitumen content of 7% has been applied to quantities of asphalt
- The embodied carbon of the quantities of asphalt have been assessed as 'Aggregate' in the Highways England tool;
- In the absence of total energy and fuel consumption figures to calculate construction plant emissions, the total construction cost for each route option was multiplied by an industry average emission factor from RICS (2017)[91];
- There is currently no specific guidance or carbon emissions thresholds, which, if exceeded, are considered significant;
- The average daily operating hours for street lighting were assumed to be 12 hours;
- Some small emissions sources have been excluded as emissions from these sources are not considered likely to be large and therefore not material to the assessment;
- There will be some uncertainty regarding traffic data as the model is based on traffic assumptions; and

- The change in traffic emissions were assumed to remain constant from the forecast year (2040) until the remainder of the lifespan of the proposed scheme.

Climate Resilience

To ensure transparency within the assessment process, the following limitations and assumptions have been identified:

- The UK Climate Projections 2018 (UKCP18) projections have been used to infer future changes in a range of climate variables that may affect the vulnerability of the proposed scheme to climate change. These represent the most up-to-date representation of future climate in the UK;
- There are inherent uncertainties associated with climate projections and they are not predictions of the future. It is possible that future climate will differ from the future baseline climate against which the resilience of the proposed scheme has been assessed, depending on global emissions over the next century. A 'high' emissions scenario (RCP 8.5) using the 2080s timeslice (2070 – 2099 - the longest temporal scale available through UKCP18) has been used to develop the baseline against which resilience has been assessed. This is consistent with the precautionary principle (i.e. 'worst case' scenario);
- Any further research, analysis or decision-making should take account of the accuracies and uncertainties associated with climate projections. It is also important to note that the analysis is based on selected observational data, the results of climate model ensembles and a selected range of existing climate change research and literature available at the time of assessment. Any future decision-making based on this analysis should consider the range of literature, evidence and research available at that time and any changes to this;
- The assessment undertaken provides a broad indication of the potential impacts of climate change on the route options based on a qualitative assessment and professional judgement. A detailed assessment of in-combination climate impacts has not been undertaken at this stage, this will be undertaken where necessary at Stage 3 (EIAR). A high-level indication of potential in-combination climate impacts has been presented in Stage 2 SAR Section 6.12; and
- Measures embedded within the design to account for climate resilience have not been detailed at this stage however they will be identified at Stage 3 through consultation with the proposed scheme designers and other environmental disciplines.

10 ROAD DRAINAGE AND THE WATER ENVIRONMENT

10.1 LEGISLATIVE AND POLICY FRAMEWORK

Reference has been made to the following key legislation and policy.

LEGISLATION

- The Water Framework Directive (2000/60/EC)
  - Directive 2000/60/EC establishes a framework for community action in the field of water policy. The WFD, implemented in Northern Ireland by The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017, seeks to enhance the status of aquatic ecosystems, promotes sustainable water use and contributes to mitigating the effects of flood and drought. It is a requirement of the Directive that member states classify major rivers and their tributaries in terms of their ecological status with reference to biological, chemical and hydromorphological quality indicators. In January 2014 the Freshwater Fish Directive (2006/44/EC) was revoked and was subsumed under the WFD.
- The Groundwater Daughter Directive (2006/118/EEC)
  - The Groundwater Daughter Directive (GDD) has replaced the original Groundwater Directive (80/68/EEC) which was repealed in 2013. The GDD introduces procedures for assessing the 'chemical status' of groundwater as per the WFD and protects groundwater by preventing direct discharge of 'hazardous pollutants' and limiting the direct discharge of non-hazardous substances.
- The Groundwater Regulations (Northern Ireland) 2009 (as amended) and Groundwater (Amendment) Regulations (Northern Ireland) 2014
  - The Groundwater Regulations (Northern Ireland) 2009 (as amended), and Groundwater (Amendment) Regulations (Northern Ireland) 2014 transpose the GDD.
- The Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006 Permitted Controlled Activities
  - The Regulations aim to protect the water environment and to secure efficient and sustainable water use. Water abstractions used for private water supplies (intended for human consumption) are also regulated under the Private Water Supplies Regulations (Northern Ireland) 2017.

NATIONAL POLICY

- Strategic Planning Policy Statement for Northern Ireland - Planning for Sustainable Development (SPPS)
  - The SPPS, published in September 2015, sets out the Department's regional planning policies for securing the orderly and consistent development of land in Northern Ireland under the reformed two-tier planning system. The provisions of the SPPS must be taken into account in the preparation of Local Development Plans and are also material to all decisions on individual planning applications and appeals.
- Planning Policy Statement (PPS) 15 (Revised): Planning and Flood Risk (2006)

- The aim of the PPS is to prevent future development within Northern Ireland that may be at risk from flooding or that may increase the risk of flooding elsewhere. PPS 15 Revised (Draft) 'Planning and Flood Risk' was published in September 2014.

¡ Sustainable Water - A Long-Term Water Strategy for Northern Ireland (2015-2040)

- The purpose of this document is to set out the Northern Ireland Executive's proposed Long-Term Water Strategy for 2015-40. The Strategy presents a clear framework for action which will facilitate implementation of a range of initiatives aimed at delivering the long-term vision to have a sustainable water sector in Northern Ireland. To achieve this vision, the Strategy encourages a sustainable and integrated approach to managing all our different water needs in a way which promotes regional development, without compromising the environment or increasing flood risk.

REGIONAL AND LOCAL POLICY

¡ The Regional Development Strategy 2035

- This document was published in 2010 by then Department for Regional Development (now Department for Infrastructure) and provides an overarching strategic planning framework for Northern Ireland up to 2035. The Strategy reinforces the commitment to minimise development in areas at risk from flooding from rivers, the sea and surface water run-off.

¡ Mid Ulster District Council Local Development Plan 2030 – Draft Plan Strategy (February 2019)

- The purpose of the Mid Ulster District Council Local Development Plan, which is still at draft stage, is to inform the general public, statutory authorities, developers and other interested bodies of the policy framework and land use proposals that will implement the strategic objectives of the Regional Development Strategy 2035 and guide development decisions within Mid Ulster District Council up to 2030.

¡ Cookstown Area Plan 2010

- The Cookstown Area Plan 2010 is still the local development plan prepared under the provisions of Part III of the Planning (Northern Ireland) Order 1991 by the Planning Service, an Agency within then Department of the Environment (now Department of Environment, Agriculture and Rural Affairs). It provides a broad land use and policy framework for the development of Cookstown District Council Area to the year 2010.

GUIDANCE

The assessment takes a conservative approach, taking into account the following guidance:

¡ Highways England, (2019). DMRB, Section 2, Part 10, LA 113 Road drainage and the water environment (formerly HD 45/09)[99];

[99] Highways England, (2019). DMRB LA 113 Road drainage and the water environment (formerly HD 45/09). [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search/d6388f5f-2694-4986-ac46-b17b62c21727 [Accessed 06/08/2020].

- CIRIA, (2001). Report C532, Control of water pollution from construction sites: Guidance for consultants and contractors[100];
- CIRIA, (2015). Report C753, The SUDS Manual[101];
- Scottish Executive, (2012). River crossings & migratory fish: Design guidance[102];
- Scottish Environment Protection Agency (SEPA), (2009). Policy No. 19, Groundwater protection policy for Scotland v3[103];
- SEPA, (2015). Position Statement WAT-PS-06-02, Culverting of watercourses[104];
- SEPA, (2010). WAT-SG-25, Engineering in the water environment: good practice guide[105];
- SEPA, (2006). WAT-SG-31, Prevention of Pollution from Civil Engineering Contracts: Special Requirements[106];
- SEPA, (2017). Land Use Planning System SEPA Guidance Note 31, Guidance on assessing the impacts of development proposals on groundwater abstractions and groundwater dependent terrestrial ecosystems, Version 3[107]; and
- NIEA, SEPA and Natural Resources Wales Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs)[108]:
  - PPG1: Understanding your environmental responsibilities - good environmental practices;
  - GPP2: Above ground oil storage tanks;
  - PPG3: Use and design of oil separators in surface water drainage systems;
  - GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;

[100] CIRIA, (2001). Report C532, Control of water pollution from construction sites: Guidance for consultants and contractors. [online] Available at: https://www.ciria.org/ProductExcerpts/C532.aspx [Accessed 18/03/2020].
[101] CIRIA, (2015). Report C753, The SUDS Manual. [online] Available at: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx [Accessed 18/03/2020].
[102] Scottish Executive, (2012). River crossings & migratory fish: Design guidance. [online] Available at: https://www2.gov.scot/Topics/marine/science/Publications/publicationslatest/rivercrossings [Accessed 18/03/2020].
[103] Scottish Environment Protection Agency (SEPA), (2009). Policy No. 19, Groundwater protection policy for Scotland v3. [online] Available at: https://www.sepa.org.uk/media/34371/groundwater-protection-policy-for-scotland-v3-november-2009.pdf [Accessed 18/03/2020].
[104] SEPA, (2015). Position Statement WAT-PS-06-02, Culverting of watercourses. [online] Available at: https://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf [Accessed 18/03/2020].
[105] SEPA, (2010). WAT-SG-25, Engineering in the water environment: good practice guide. [online] Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf [Accessed 18/03/2020].
[106] SEPA, (2006). WAT-SG-31, Prevention of Pollution from Civil Engineering Contracts: Special Requirements. [online] Available at: https://www.sepa.org.uk/media/152220/wat_sg_31.pdf [Accessed 18/03/2020].
[107] SEPA, (2017). Land Use Planning System SEPA Guidance Note 31, Guidance on assessing the impacts of development proposals on groundwater abstractions and groundwater dependent terrestrial ecosystems, Version 3. [online] Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf [Accessed 18/03/2020].
[108] NIEA, SEPA and Natural Resources Wales (various dates). GPP and PPG. [online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ [Accessed 18/03/2020].

- GPP5: Works and maintenance in or near water;
- PPG6: Working at construction and demolition sites;
- PPG7: Safe storage - The safe operation of refuelling facilities;
- GPP8: Safe storage and disposal of used oils;
- PPG18: Managing fire water and major spillages;
- GPP21: Pollution incident response planning; and
- GPP26: Safe storage - drums and intermediate bulk containers.

Whilst some of the guidance listed above has been produced by SEPA, it is deemed to be good practice across the UK.

10.2 METHODOLOGY

The assessment has been carried out in accordance with the guidance within the DMRB Section 2, Part 10, LA 113 RDWE[99], LA 104 and Volume 5, Section 1, Part 2 TA 37/93 Scheme Assessment Reporting[109]. Further detail of the methods used are provided below.

Baseline studies focused on the following tasks for the study area:

- Identification of internationally/nationally designated conservation sites with citations related to the water environment;
- Identification of surface water bodies; rivers, lakes, streams, ditches and ponds;
- Collation of surface water body characteristics and WFD classification;
- Identification of groundwater water bodies and groundwater vulnerability;
- Identification of GWDTE;
- Identification of water abstractions for local public and private water supplies; and
- Identification of existing water-related infrastructure i.e. culverts, bridges, outfalls and watercourse diversions.

The existing conditions for the water environment within the study area have been determined through desk studies, consultation with the NIEA, DAERA and site survey. The desk studies included review of the following information:

- Mouchel (2010). A29 Cookstown Bypass Stage 2 Scheme Assessment Report Preferred Options Report March 2010;
- DAERA, UK Climate Change Projections[110];
- Ordnance Survey of Northern Ireland (OSNI), OSNI Spatial NI – Map Viewer[111];

[109] Highways Agency, (1993). Volume 5, Section 1, Part 2 TA 37/93 Scheme Assessment Reporting. [online] Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol5/section1/td3793.pdf. [Accessed 18/03/2020].
[110] DAERA, (2018). UK Climate Change Projections (UKCP18). [online] Available at: https://www.daera-ni.gov.uk/articles/uk-climate-change-projections [Accessed 20/01/2020].
[111] OSNI (2019) OSNI Spatial NI – Map Viewer. [online] Available at: https://maps.spatialni.gov.uk/ [Accessed 21/01/2020].

- OSNI, PRONI Historical Maps[112];
- NIEA, Water Information Request Viewer[113];
- DAERA, Drinking Water Inspectorate – Private Water Supplies[114];
- Department for Infrastructure (DfI), Flood Hazard & Flood Risk Maps for Northern Ireland[115]; and,
- Geological Survey of Northern Ireland (GSNI), GeoIndex[116].

SITE VISIT

A hydrological walkover and fluvial geomorphological survey to establish local characteristics of watercourses was conducted between 1 and 4 July 2019. This included review of existing watercourse crossings, characterising local water features and identifying potential proposed scheme interactions, in order to establish the sensitivity of receptors.

ASSESSMENT OF IMPACTS

At this stage, four different route options (Red route, Purple A route, Purple B route, and Green route) have been assessed for the proposed scheme. Sandholes Link Road is common to all route options.

The assessment methodology includes:

- Assessment of Surface Water Impacts;
  - Construction Phase Impacts;
    - Pollution from Construction;
  - Operational Phase Impacts;
    - Routine Runoff and Surface Water Quality;
    - Spillage and Water Quality;
    - Fluvial Geomorphology Assessment;
    - Loss of Standing Water; and
    - Loss or Change to Water Supplies.
- Assessment of Groundwater Impacts;

[112] OSNI, (2019). PRONI Historical Maps. [online] Available at: https://apps.spatialni.gov.uk/PRONIApplication/ [Accessed 21/01/2020].
[113] NIEA, (2018). Water Information Request Viewer. [online] Available at: https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=7e234827aa7a405d990359aa92c7c287 [Accessed 27/01/2020].
[114] DAERA, (2020). Drinking Water Inspectorate – Private Water Supplies. [online] Available at: https://apps.spatialni.gov.uk/DrinkingWaterInspectorateApplication/ [Accessed 11/08/2020].
[115] Department of the Environment, (2020). Flood Maps (NI). Flood Hazard & Flood Risk Maps for Northern Ireland. [online] Available at: https://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=fd6c0a01b07840269a50a2f596b3daf6 [Accessed 28/01/2020].
[116] GSNI, (2019). GSNI GeoIndex. [online] Available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html [Accessed 21/01/2020].

- Construction Phase Impacts;
  - Groundwater Level and Flow;
  - Loss or change to groundwater water supply;
  - Groundwater Quality and Routine Runoff; and
  - GWDTEs;
- Operation Phase Impacts;
  - Groundwater Level and Flow;
  - Loss or change to groundwater water supply;
  - Groundwater Quality and Routine Runoff; and
  - GWDTEs.

ASSESSMENT OF SURFACE WATER IMPACTS DURING CONSTRUCTION

Pollution from Construction

Evaluation of the potential for pollution of surface waters as a result of spillage, and of the release of sediments and potential associated contaminants into watercourses or water bodies has involved a review of areas where construction would be required within, or in close proximity to, watercourses and water bodies. The approximate length of road which lies within 50 m of surface water features, the number of proposed permanent road drainage discharge structures and the number of watercourse crossings has been quantified for comparison of each route option.

The sensitivity or importance of the surface waters has been evaluated qualitatively, as has the magnitude of impact of the options on each water body (as set out further below).

ASSESSMENT OF SURFACE WATER IMPACTS DURING OPERATION

Routine Runoff and Surface Water Quality

DMRB LA 113 specifies procedures for the assessment of pollution impacts from routine runoff on surface waters.

This assessment comprises two separate elements:

- Highways England Water Risk Assessment Tool (HEWRAT) Assessment: the HEWRAT is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively; and
- Environmental Quality Standards (EQS) Assessment: EQS are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

To carry out these assessments a variety of baseline and drainage design information is required, including; traffic volumes, areas of impermeable and permeable road surfaces to be drained, proposed treatment train, receiving watercourse dimensions and flow data, water hardness, presence of sensitive sites (considered as internationally/nationally designated conservation sites) and in-stream structures or features which may influence the flow.

At this stage, as is commonly the case at DMRB Stage 2, a detailed road drainage design is not yet available and therefore a preliminary assessment has been carried out, based on the preliminary drainage design.

Sustainable Drainage Systems (SuDS) have been considered as embedded design, rather than as specific mitigation measures, and have been assessed accordingly. Reference values for effectiveness of the various systems at removing various pollutants are based on Table 8.6.4N3, published in DMRB Volume 4, Section 2, Part 3, CG 501 Design of highway drainage systems[117].

The HEWRAT and EQS assessments have been carried out for each road drainage outfall within each route option. For each of the route options, the number of outfalls passing/failing the HEWRAT and EQS assessments has been presented.

Spillage and Water Quality

The DMRB document LA 113 specifies procedures for the assessment of pollution impacts from spillage. A summary of the methodology is provided below, with full details provided in LA 113.

The assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

- The probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway; and
- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

The probability of a serious spillage occurring is dependent on a variety of factors; traffic volumes, percentage of heavy goods vehicles in the traffic volumes, whether the road is motorway, rural or urban trunk road, the road type categories within the road drainage catchment under assessment i.e. 'no junction', 'slip road', 'roundabout', 'cross road' or 'side road' and the length of each road type within the catchment.

The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the receiving surface water body and the response time of the emergency services, i.e. less than 20 minutes, less than one hour, or greater than one hour.

Typically, an annual probability of 1% (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered by DMRB as an acceptable risk. However, where a road drainage outfall discharges within 1 km of a sensitive receptor, (such as a nationally designated conservation site), a higher level of protection is required, such that the risk has no greater annual probability than 0.5% (i.e. a 1 in 200 chance of occurring in any one year).

There are no sensitive receptors within 1 km of any of the proposed four routes outfall discharges. The Upper Ballinderry SAC and ASSI are located immediately downstream of the Sandholes Link

[117] Highways England, (2020). DMRB Volume 4, Section 2, Part 3, CG 501 Design of highway drainage systems. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/search/ada3a978-b687-4115-9fcf-3648623aaff2 [Accessed 11/08/2020].

Road. This road will be assessed during Stage 3 as it is not a differentiator for the proposed route options.

Evaluation of the predicted effects has been undertaken in accordance with the guidance provided in Appendix D of LA 113 and outlined in the Impact Assessment Criteria section below.

Fluvial Geomorphology Assessment

The fluvial geomorphology assessment has involved a desk study and walkover survey carried out between 1 and 4 July 2019 to determine the specific character of the geomorphological forms and processes in each of the potentially impacted watercourses.

The above information, in conjunction with data on the WFD status of the relevant water bodies, has been used in the evaluation of the sensitivity of the watercourses. The term 'Hydromorphology' was coined during the inception of the WFD legislation and refers to the interactions of geomorphology and hydrology. Thus, any reference to hydromorphology hereafter is directly related to the WFD.

For each proposed route option the indicative location of bridges, culverts, watercourse diversions and outfalls has been reviewed. The magnitude of potential impacts on fluvial geomorphology (sediment dynamics, channel morphology and natural fluvial processes) and hydromorphology were evaluated qualitatively.

As part of the proposed scheme, it has been anticipated that the design of structures and any diverted channels will incorporate standard good practice measures, considered as embedded design for this assessment.

It should be noted that the DMRB does not outline a specific methodology or guidance on the evaluation of hydromorphological impacts. Therefore, hydromorphological sensitivity and impact magnitude criteria have been developed based on guidance provided in the DEFRA/EA R&D Report FD1914 Guide Book of Fluvial Geomorphology and Sear et al. (2010)[118].

Flood Risk

Assessment of flood plains across the proposed routes has been based on available data; flood maps (Department for Infrastructure strategic and detailed flood maps, as well as surface water maps), historical flooding records and alluvium mapping from drift geology. Flood risk and impacts on flood plains will be considered once the preferred route is selected as part of the Stage 3 assessment within the Engineering Assessment.

At Stage 3 Scheme Assessment further flood risk modelling will be undertaken to ensure that the preferred route road levels are above the required flood risk level. Potential impacts to habitat and/or wildlife will be determined at Stage 3 as well.

[118] Sear, D. A., Newson, M. D. and Thorne, C. R. Soar, P. J. and Skinner, K. S. (2010). Guidebook of Applied Fluvial Geomorphology. London: Thomas Telford.

Loss of Standing Water

Where standing water bodies will be partially or totally lost under the footprint, the area of loss has been calculated. The number of ponds lost and the aggregate area loss has been calculated, for all ponds within 250 m of the proposed scheme.

Activities occurring close to standing water bodies can also cause indirect effects, interrupting flows feeding the local water body and potentially resulting in total or partial drying up of the water body. The distance to each standing water body from the nearest point of the route options has been measured using OS 1:10,000 mapping. Using this data, the magnitude of impact on water bodies within 250 m of the proposed scheme has been evaluated qualitatively.

Loss or Change to Water Supplies

Private water abstraction information was provided by DAERA for a minimum area of 5 km buffer around the proposed routes combined footprint study area.

A distribution network for public supply to local properties are present in the study area. This is addressed in more detail within the Public Utilities section of the Engineering Assessment. Public water data has not been provided and will be investigated further at Stage 3 through consultation with Northern Ireland Water.

Potential impacts on water supplies have been evaluated qualitatively based on the potential hydrological linkage and distance between the construction areas of each of the route options and the water supply sources.

ASSESSMENT OF GROUNDWATER IMPACTS DURING CONSTRUCTION

Groundwater Level and Flow

Road cuttings and below ground structures (piles/foundations) have the potential to affect groundwater flow and groundwater levels and increase vulnerability to localised aquifers as overlying material is removed, displaced or new pathways for groundwater flow may be created. The increased hard surface area and required drainage system also affect the local groundwater recharge and hence groundwater levels and flow.

Potential impacts on groundwater level and flow have been evaluated qualitatively in the absence of site-specific groundwater level data and average depth to base of cut areas along each of the route options. Additional GI works are proposed at these locations in advance of the DMRB Stage 3 Assessment and further assessment will be completed at this stage.

Loss or change to groundwater water supply

Data on public groundwater water supply (i.e. groundwater abstractions) information was provided by DAERA for a minimum area of 5 km buffer around the proposed routes combined footprint study area. No information has been provided on the status of the abstractions provided i.e. abstraction licence is active or historical. For the purpose of this assessment, it is assumed that all abstraction licences are active (unless until stated otherwise) and are targeting aquifers for local or regional supply (superficial and bedrock aquifers respectively).

Potential impacts on public groundwater abstractions have been evaluated qualitatively based on the potential hydrogeological linkages and distances between the construction area of each of the route options and the groundwater abstraction sources.

To date, no information on private groundwater abstractions have been provided by DfI or NIEA. Further consultation will be completed in advance of the Stage 3 Assessment.

Groundwater Quality and Routine Runoff

The potential for pollution of groundwaters/aquifers is greatest where cuttings are proposed which would be close to, or partially penetrate the groundwater table. Disturbance, specifically through excavation, could result in adverse impacts to groundwater resources/aquifers establishing pathways for pollutants to migrate within and between receptors. Road cuttings are proposed along all route options and potential impacts on groundwater quality have been evaluated qualitatively in the absence of site-specific groundwater water quality and depth to base of cut areas. This will be assessed further at Stage 3.

A summary of the preliminary drainage design for the route options is provided in the Drainage Assessment of this report, and is founded on SuDS principles. DMRB LA 113 specifies procedures for the assessment of pollution impacts from routine runoff on groundwaters

The groundwater quality and run off assessments take the form of a risk assessment using the 'source-pathway-receptor' pollutant linkage principle which is widely used and explained in Model Procedures for the Management of Contaminated Land[119]. In the context of road drainage, the source is the road runoff with any pollutants it contains. The pathways are the processes which may modify the pollutants during transmission through the discharge system and unsaturated zone. The receptor is the groundwater.

To carry out these assessments a variety of baseline and drainage design information is required, including; traffic volumes, areas of impermeable and permeable road surfaces to be drained, proposed treatment train, receiving groundwater receptor(s) and flow data.

An outline drainage design review will be undertaken to identify potential outfalls, catchment areas, feasible locations for ponds/basins and their required volume, in order to inform the engineering and environmental assessments of each route option. The design of drainage systems will be developed further during the Stage 3 Assessments.

At source SuDS will include filter drains and swales, providing the first level of treatment where possible. SuDS have been considered as embedded design, rather than specific mitigation measures and have been assessed accordingly. Initial pond/basin locations have been identified but are indicative at this stage and will be developed further during Stage 3.

GWDTE

DMRB LA 113 specifies procedures for the assessment of impacts to GWDTE. These follow a stepped, risk-based approach which depends on establishing linkages between potential impacts from the route options on the hydrological and hydrogeological regime and GWDTE. Impacts to

[119] EA/DEFRA, (2004). Model Procedures for the Management of Contaminated Land. Contaminated Land Report 11.

GWDTE are most likely to occur during the construction phase of the proposed scheme due to in-land cuttings and related dewatering associated with cuttings.

The sensitivity of the GWDTE have been evaluated qualitatively based on the groundwater dependency of each National Vegetation Communities (NVC) identified following a Phase 1 Habitat Survey (Stage 2 SAR Section 6.5 Biodiversity).

ASSESSMENT OF GROUNDWATER IMPACTS DURING OPERATION

The impacts associated with operation are essentially the same as those describe in the construction phase.

Impact Assessment Criteria

The predicted significance of impacts on surface waters have been based on an evaluation of the feature and the potential impact from the route options, as recommended in LA 113 RDWE.

SENSITIVITY

The sensitivity of the water bodies have been evaluated taking into account quality indicators and measures. The criteria used in determining the sensitivity of each water body are detailed in Table 10-1, these are in accordance with the guidance and examples provided in LA 113 RDWE.

Table 10-1 – Criteria Used to Estimate the Sensitivity of Receptors

Sensitivity	Attribute	Criteria
Very High	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ Watercourse having WFD classification shown in a River Basin Management Plan (RBMP) and Q_{95} ≥ 1.0 m^3/s; and ¡ Site protected/designated site under European Community (EC) or UK habitat legislation (e.g. SAC, SPA, Ramsar site). Fluvial Geomorphology ¡ Sediment Regime: Water feature sediment regime provides a diverse mosaic of habitat types suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears in complete equilibrium with natural erosion and deposition occurring. The water feature has sediment processes reflecting the nature of the catchment and fluvial system; ¡ Channel Morphology: Water feature includes varied morphological features (e.g. pools, riffles, bars, natural bank profiles) with no sign of channel modification; ¡ Natural Fluvial Processes: Water feature displays natural fluvial processes and natural flow regime, which would be highly vulnerable to change as a result of modification; and ¡ WFD Water Bodies: Watercourse having WFD classification shown in a RBMP and a Q_{95} >1.0 m^3/s. Water Supplies ¡ Watercourse supporting major/critical public water supplies; and ¡ Public water supply or large private water supply serving >10 properties.

Sensitivity	Attribute	Criteria
	Groundwater	¡ Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation Ecology and Nature Conservation; ¡ Groundwater vulnerability Class 5[120]; ¡ Groundwater locally supports classified GWDTEs and GWDTEs located within designated areas; ¡ Source Protection Zone (SPZ) Inner Protection Zone 1; and ¡ Public water supply or large private water supply serving >10 properties.
High	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ Watercourse having WFD classification shown in a RBMP and a Q_{95} of <1.0 m^3/s; and ¡ Site protected/designated site under EC or UK legislation (SAC, SPA, Ramsar, SPA, SSSI) and few existing pressures to biodiversity. Fluvial Geomorphology ¡ Sediment Regime: Water feature sediment regime provides habitats suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears largely in natural equilibrium with some localised accelerated erosion and/or deposition caused by land use and/or modifications. Primarily the sediment regime reflects the nature of the natural catchment and fluvial system; ¡ Channel Morphology: Water feature exhibiting a natural range of morphological features (e.g. pools, riffles, bars, varied natural river bank profiles), with limited signs of artificial modifications or morphological pressures; and ¡ Natural Fluvial Processes: Predominantly natural water feature with a diverse range of fluvial processes that is highly vulnerable to change as a result of modification. ¡ WFD Water Bodies: Watercourse having WFD classification shown in a RBMP and a Q_{95} <1.0 m^3/s Water Supplies ¡ Watercourses supporting minor/non-critical public drinking water supplies; and ¡ Private water supply serving 2-10 properties.
	Groundwater	¡ Principal aquifer providing locally important resource or supporting a river ecosystem; ¡ Groundwater vulnerability class 4a to class 4e[120];

[120] Geological Survey of Northern Ireland (GSNI), (no date). GeoIndex. [online] Available at: http://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html [Accessed 06/07/2020].

Sensitivity	Attribute	Criteria
		¡ Groundwater supports non-classified GWDTEs with highly groundwater dependent NVC; ¡ SPZ Outer Protection Zone 2; and ¡ Private water supply serving 2-10 properties.
Medium	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ Watercourses not having WFD classification shown in a RBMP and a Q_{95} of >0.001 m^3/s. Fluvial Geomorphology ¡ Sediment Regime: Water feature sediment regime provides some habitat suitable for species sensitive to change in suspended sediment concentrations or turbidity. A water feature with natural processes occurring but modified, which causes notable alteration to the natural sediment transport pathways, sediment sources and areas of deposition; ¡ Channel Morphology: Water feature exhibiting some morphological features (e.g. pools, riffles and depositional bars). The channel cross-section is partially modified in places, with obvious signs of modification to the channel morphology; ¡ Natural recovery of channel form may be present (e.g. eroding cliffs, depositional bars); ¡ Natural Fluvial Processes: Water feature with some natural fluvial processes, including varied flow types. Modifications and anthropogenic influences having an obvious impact on natural flow regime, flow pathways and fluvial processes; and ¡ WFD Water Bodies: Watercourses not having WFD classification in a RBMP and a Q_{95} of >0.001 m^3/s. Water Supplies ¡ Watercourses supporting private drinking water supplies or for agricultural/industrial use; and ¡ Private water supply serving a single property.
	Groundwater	¡ Aquifers with limited or local potential, providing water for agricultural or industrial use with limited connection to surface water; ¡ Groundwater vulnerability class 2 and class 3[120]; ¡ Non-classified GWDTEs with moderately groundwater dependent NVC communities; ¡ SPZ Total Catchment Zone 3; and ¡ Private water supply serving a single property.
Low	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ Watercourses not having WFD status shown in a RBMP and a Q_{95} of ≤0.001 m^3/s. ¡ No habitats/species of conservation and/or any existing pressures which are considered to be adversely affecting biodiversity. Areas considered to be of 'Less than Local' importance. Fluvial Geomorphology ¡ Sediment Regime: Water feature sediment regime which provides very limited physical habitat for species sensitive to

Sensitivity	Attribute	Criteria
		changes in suspended solids concentration or turbidity. Highly modified sediment regime with limited/no capacity for natural recovery; ¡ Channel Morphology: Water feature that has been extensively modified (e.g. by culverting, addition of bank protection or impoundments) and exhibits limited-to-no morphological diversity. The water feature is likely to have uniform flow, uniform banks and absence of bars. Insufficient energy for morphological change; ¡ Natural Fluvial Processes: Water feature which shows no or limited evidence of active fluvial processes with unnatural flow regime or/and uniform flow types and minimal secondary currents; and ¡ WFD Water Bodies: Watercourses not having WFD classification in a RBMP and a Q_{95} of <0.001 m^3/s Water Supplies ¡ Watercourses not supporting water abstractions.
	Groundwater	¡ Unproductive strata generally without groundwater except at shallow depth; and ¡ Groundwater vulnerability class 0 and class 1[120]

MAGNITUDE OF IMPACT

The magnitude of the various impacts is evaluated taking into account the extent of loss and effects on integrity of the relevant water body attributes. The criteria used in determining the magnitude of impact are detailed in Table 10-2, below, and are in keeping with the guidance and examples provided in LA 113 RDWE.

Table 10-2 – Criteria used to estimate the Magnitude of Impact

Sensitivity	Attribute	Typical Criteria
Major Adverse	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ Major shift away from baseline conditions such that change is likely to result in a downgrade in overall WFD status, water supply or nature conservation site; and/or ¡ Failure of both soluble and chronic-sediment related pollutants in HEWRAT and compliance failure with EQS values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Fluvial Geomorphology ¡ Significant impacts on the water feature bed, banks and vegetated riparian corridor resulting in changes to sediment characteristics, transport processes, sediment load and turbidity. This includes extensive input of sediment from the wider catchment due to modifications. Impacts would be at the water body scale; ¡ Significant/extensive alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. This could include: significant channel realignment (negative); extensive loss of lateral connectivity due to new/extended embankments;

Sensitivity	Attribute	Typical Criteria
		and/or, significant modifications to channel morphology due to installation of culverts or outfalls. Impacts would be at the water body scale; ¡ Significant shift away from baseline conditions with potential to alter processes at the catchment scale; and ¡ Substantial adverse impacts at the water body scale, which causes loss or damage to habitats. Impacts have the potential to cause deterioration in hydromorphology quality elements. Prevents the water body from achieving Good status.
	Groundwater	¡ High risk of pollution to groundwater during construction, significant temporary or long-term change in water quality, resulting in a permanent change in WFD status or permanent loss of surface water supply; ¡ High risk (risk score >250) of pollution of groundwater from routine runoff; ¡ Risk of pollution from spillage during operation >2% annually; ¡ Major loss of an aquifer in terms of water level or yield, with total loss of or major changes to dependent abstractions/habitats; ¡ Major change or total loss of groundwater baseflow contribution to protected surface water bodies; and ¡ Major change or total loss of a GWDTE (above 50%) or where the value of the site would be severely affected.
Moderate Adverse	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ A moderate shift away from baseline conditions, likely to result in a decline in water quality, but not a downgrade in WFD overall status. Partial loss in productivity of a fishery or water supply. Reduction in the water feature's capacity to dilute pollutants and waste products, and/or ¡ Failure of both soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2% annually. Fluvial Geomorphology ¡ Some changes and impacts on the water feature bed, banks and vegetated riparian corridor resulting in some changes to sediment characteristics, transport processes, sediment load and turbidity. Impacts would be at the multiple reach scale; ¡ Some alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. Activities could include: channel realignment, new/extended embankments, modified bed and/bank profiles, replacement of bed and/or banks with artificial material and/or installation of culverts. Impacts would be at the multiple reach scale; ¡ A shift away from baseline conditions with potential to alter processes at the reach or multiple reach scale; and ¡ Moderate adverse impacts at the reach or multiple reach scale, which causes some loss or damage to habitats. Impacts have the potential to cause failure or deterioration in one or more of the hydromorphological quality elements. May prevent the water body from achieving Good status.
	Groundwater	¡ Moderate risk of pollution to groundwater during construction, moderate temporary change in water quality, resulting in a temporary change of

Sensitivity	Attribute	Typical Criteria
		WFD status or preventing attainment of overall status of 'Good', or temporary loss of water supply; ¡ Medium risk (risk score 150-250) of pollution of groundwater from routine runoff; ¡ Risk of pollution from accidental spillage during operation >1.0% annually and <2.0% annually; ¡ Partial loss or changes to an aquifer in terms of water level or yield, with small changes to nearby dependent abstractions/habitats; and ¡ Partial change or loss of a GWDTE (15-50%) or where the value of the site would be affected.
Minor Adverse	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ A minor shift away from baseline conditions. Slight reduction in the water feature's capacity to dilute pollutants and waste products. Likely to result in a slight decline in water quality, but with no associated impacts on designated species/habitats or water supply; and/or ¡ Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Fluvial Geomorphology ¡ Limited impacts on the water feature bed, banks and vegetated riparian corridor resulting in limited (but notable) changes to sediment characteristics, transport processes, sediment load and turbidity at the reach scale; ¡ A small change or modification in the channel planform and/or cross section. Includes upgrade to and/or extension of existing watercourse crossing and/or structure with associated minor channel realignment with localised impacts; ¡ Minimal shift away from baseline conditions with typically localised impacts up to the reach scale; and ¡ Minor adverse impacts at the reach scale, which may cause partial loss or damage to habitats. Impacts have the potential to cause failure or deterioration in one of the hydromorphological quality elements.
	Groundwater	¡ Minor risk of pollution during construction to groundwater, relatively minor temporary changes in water quality such that ecology is temporarily affected. Equivalent to a temporary minor, but measurable, change within WFD status class or temporarily reduced quality of water supply; ¡ Low risk (risk score <150) of pollution of groundwater from routine runoff; ¡ Risk of pollution from accidental spillage during operation >0.5% annually and <1.0% annually; ¡ Minor change to an aquifer in terms of water level or yield, with little discernible change to dependent abstractions/habitats; and ¡ Minor change to or loss of a GWDTE (<15%) or where the value of the site would not be affected.
Negligible	Surface Water and Biodiversity	Surface Water Quality and Biodiversity ¡ No perceptible changes to baseline conditions. No measurable change in water quality. No change in the water feature's capacity to dilute pollutants and waste products; and/or

Sensitivity	Attribute	Typical Criteria
		¡ No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%. Fluvial Geomorphology ¡ Minimal or no measurable change from baseline conditions in terms of sediment transport, channel morphology and natural fluvial processes. Any impacts are likely to be highly localised and not have an effect at the reach scale.
	Groundwater	¡ Negligible risk of pollution to groundwater during construction, very slight temporary change in water quality with no discernible effect on watercourse ecology or water supply; ¡ Risk of pollution from accidental spillage during operation < 0.5% annually; ¡ Minimal or no change to an aquifer in terms of water level or yield, with no discernible change to dependent abstractions/habitats; and ¡ Minimal or no change to GWDTE.
No Change	Surface Water and Biodiversity, and Groundwater	¡ No loss or alteration of characteristics, features or elements; no observable impact in either direction.

IMPACT SIGNIFICANCE

The estimation of the impact significance has been arrived at by combining the estimated sensitivity of the affected water bodies and the magnitude of the impacts as indicated in Table 10-3, following the guidance provided in LA 113 RDWE.

Table 10-3 – Criteria Used to Estimate the Significance of Potential Effects

Sensitivity	Magnitude of Impact				
	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

10.3 ASSUMPTION AND LIMITATIONS

This assessment has relied upon the accuracy and level of detail of the documented data sources. For instance, the identification of water bodies and current characteristics has involved reference to NIEA websites for RBMPs and associated WFD water body information sheets. The datasets are

updated annually and the latest available information (2018) has been included, to be revised with updated information that becomes available during Stage 3. It is possible that in the intervening period conditions within the water bodies may have changed.

Detailed topographic survey data is not currently available for the watercourses where outfalls are proposed, and therefore the routine runoff and spillage assessments have been undertaken using some reasonable assumptions for a number of the input parameters. Additional data to update the assessments will be obtained during Stage 3.

Public water data has not been provided and will be investigated further at Stage 3 through consultation with Northern Ireland Water.

DMRB does not outline a specific methodology or guidance on the evaluation of hydromorphological impacts. Therefore, hydromorphological sensitivity and impact magnitude criteria have been developed based on guidance provided in the DEFRA/EA R&D Report FD1914 Guide Book of Fluvial Geomorphology and Sear et al. (2010)[118].

The results of the fluvial geomorphology walkover are based on a fluvial geomorphological walkover rather than a full fluvial audit approach, supplemented by desk study information and aerial imagery. The findings of the walkover are focused around the immediate vicinity of the proposed scheme crossings. Where possible a minimum of 250 m upstream and downstream was surveyed; however, where this was not possible due to access restrictions, spot checks were taken at accessible locations upstream and downstream in order to establish a sufficient understanding of the watercourse processes and sensitivity.

The watercourse features and processes observed may vary over time/seasons and high flow events. Site surveys were undertaken under relatively dry conditions, and the overall watercourse function and stability was inferred through professional judgement and the interpretation of features on site. In all cases the worst-case scenario has been considered and assessed as a precautionary approach at Stage 2.

As part of the proposed scheme, it has been anticipated that the design of structures and any diverted channels will incorporate standard good practice measures, considered as embedded design for this assessment.

To date, a historical GI has been completed (2008 and 2011), with a preliminary additional GI anticipated to start in November 2020 running in parallel with the Stage 3 assessment. All GI data has been used where available however, parts of the assessment has relied upon historical GI data.

No data are available on the potential risk of groundwater flooding within the Study Area however, based on the recorded depth to groundwater from the historical GI (within 1 m below ground level) and underlying geological conditions, risks from groundwater flooding cannot be excluded for all potential route options. No detailed assessment on the risks from groundwater flooding has been undertaken to date. The additional GI will inform the risks from groundwater flooding through continuous groundwater level monitoring (to be completed for the duration of the GI). Assessment of this risk will be undertaken as part of the Stage 3 Assessment,

As a result, there is limited site-specific data available on the groundwater water table and aquifer properties in the vicinity of the proposed road cuttings and below ground structures. Conservative assumptions have therefore been made, based on the available mapping data for the Study Area.

Information on private water supplies was provided by NIEA, via the Drinking Water Inspectorate Application. It is recognised that private water supply data may not have been accurately registered for all local properties, with limited information provided relating to current use, source type and source locations. A comprehensive survey/consultation of all potential private water supplies within 1 km of the proposed scheme is planned as part of the Stage 3 assessment.

The scale of various mapping datasets, such as groundwater vulnerability and soil mapping is such that only a broad characterisation of these attributes and high level assessment of potential impacts has been possible where there is no GI data available, both the aquifer productivity and groundwater vulnerability data only provide a guide to aquifer conditions at a 1:100,000 scale.

At Stage 2, there is no information available regarding discharge quantities from the existing outfalls for the Sandholes Link Road, nor information available on the permeable area discharging to the outfalls. This information will be confirmed at Stage 3 once a route is confirmed, and assessment then carried out.

The limitations discussed above (relating to surface water and groundwater receptors) are typical of a Stage 2 Assessment and the assessment detailed herein is considered to be robust and of an appropriate level of detail to inform assessment of the preferred route. As noted above further detailed investigations and assessments will be undertaken at Stage 3 to inform the design of the preferred route.

11 ASSESSMENT OF IN-COMBINATION AND CUMULATIVE EFFECTS

11.1 LEGISLATIVE AND POLICY FRAMEWORK

Legislation and policy followed in assessing the intra and inter project cumulative effects have been outlined above of this report. The following legislation sets the additional policy framework for the assessment of intra and inter project cumulative effects:

- The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2017:
  - The EIA Regulations requires consideration of cumulative effects to be included in an Environmental Impact Assessment Report. Article 67 of the EIA Regulations states:

"*Where, in relation to a proposed project, an environmental impact assessment is to be carried out under this Part, the assessment must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the project on the following factors—*

[…]

(e) the interaction between the factors referred to in sub-paragraphs (a) to (d)."

- DMRB
  - The assessment has been informed by DMRB LA 104 Environmental Assessment and Monitoring, which provides guidance for determining the significance of environmental effects, including for cumulative effects, and for the management of those effects.
- Strategic Planning Policy Statement for Northern Ireland[121]
  - The policy statement states that cumulative effects are one of the factors to be considered in a proposal. Paragraphs 6.188, 6.198 and Appendix A state:

"*In assessing proposals, including cumulative impacts in such areas, account will also be taken of the Landscape Character Assessments and any other relevant guidance including AONB Management Plans and local design guides.*"

"*Planning authorities should ensure that the potential effects on landscape and natural heritage, including the cumulative effect of development are considered. With careful planning and design the potential for conflict can be minimised and enhancement of features brought about*."

"*Where a proposed development is likely to have a significant air quality impact or add to a cumulative impact in an area, applications should be supported by sufficient information to allow full consideration of the impact on local air quality*."

[121] Department of the Environment, (2015). *Strategic Planning Policy Statement for Northern Ireland* [online] Available at: https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf [Accessed 18/09/2020].

11.2 METHODOLOGY

The methodology for assessing cumulative effects is outlined in Stage 2 SAR Section 6.12.1.

A detailed assessment of the cumulative effects will be undertaken at Stage 3 for the Preferred Alignment in accordance with the requirements of The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2017.

INTRA-PROJECT EFFECTS

Intra-project effects are those which arise from a combination of impacts identified by different environmental disciplines on a single receptor. In order for two residual effects to potentially result in a significant effect, the individual residual effects must have a temporal relationship (i.e. occur broadly at the same time) and a spatial relationship (i.e. occur in broadly the same geographic area). The assessment of intra-project effects is based upon the identification of common receptors and impacts with overlap in occurrence.

INTER-PROJECT EFFECTS

Inter-project effects are those which arise when committed developments occur together with the proposed scheme resulting in an impact on the same receptor.

An initial review was conducted of the Mid Ulster District Council Planning Register[122] for applications submitted in the 33-month period between January 2017 and September 2019 in line with the traffic model. A review has been conducted on allocated and proposed sites contained within the Cookstown Area Plan 2010[123]. Consultation with DfI was undertaken and agreed on what applications should be included in the traffic model which has informed the inter-project cumulative effects assessment. For the purposes of this assessment, consideration has been given to the following:

- Road projects within the study area which have been confirmed for delivery over a similar timeframe;
- Other development projects within the study area with valid planning permissions or consent orders, and for which EIA is a requirement; and
- Proposals in adopted development plans with a clear identified programme for delivery.

The following assumptions have been made as part of the traffic model assumptions and applied to the list of developments identified following the initial search:

- Phase 2 housing development of the Cookstown Local Plan 2010 has been excluded based on Phase 1 housing development being determined to be sufficient to meet housing targets during the forecast period following consultation with Mid Ulster as part of the traffic model

[122] Mid Ulster District Council (2020). Applications decided. [online] Available at: https://www.midulstercouncil.org/planning/applications-decided [Accessed: 11/09/2020].
[123] Department for Infrastructure (2020). Cookstown Area Plan 2010 Settlements (Cookstown). [online] Available at at: https://wayback.archive-it.org/11112/20190702180401/https://www.planningni.gov.uk/index/policy/development_plans/devplans_az/cookstown_2010.htm [Accessed 11/09/2020].

- All development listed in the Local Plan which have yet to be completed or are currently in operation have been included in the assessment;
- Planning applications within an approximate 2 km radius of Cookstown; and
- Only residential developments with five or more dwellings were considered.

The traffic model used to assess the proposed scheme takes into account proposed developments and infrastructure projects in the surrounding region so as to allow assumptions about traffic growth over time to be made. This means that inter-project cumulative effects are already built into the operational assessment for air quality and noise assessments. The inter-project cumulative effects for these topics during operation have not been specifically addressed at this stage but included within the predicted annual mean concentrations and predicted calculated road traffic noise levels reported in the air quality and noise and vibration assessment in this report respectively (see Sections 6.2 and 6.8).

Any development currently under construction that is expected to be completed before Autumn 2023 when the construction phase of the proposed scheme begins, has been excluded from the cumulative effect assessment.

11.3 ASSUMPTIONS AND LIMITATIONS

GENERAL

- In the assessment of effect interactions there is an assumption that the mitigation measures identified in the respective topic sections will be fully incorporated to mitigate the corresponding predicted adverse effects resulting from the proposed scheme;
- In the absence of sufficient information, it is assumed that the applicant for a committed development will implement standard best practice mitigation measures to reduce any residual environmental effects;
- The assessment is entirely desk based, no site visits have been specifically undertaken to inform the assessment; and
- Traffic data assumptions and limitation as detailed in Section 7 have been adopted to inform this assessment.

INTRA-PROJECT EFFECTS

No additional limitations or assumptions has been identified or applied for intra-project effects.

INTER-PROJECT EFFECTS

- The assessment is limited to projects which are reasonably foreseeable based on information current at the time of writing this report. Further developments may be proposed in subsequent years which may have inter-project cumulative effects with the proposed scheme. It is beyond the scope of this report to consider such effects;
- The assessment is limited to publicly available information obtained from the relevant planning applications and information which has been provided by Mid Ulster District Council on request. In some cases, little or no environmental information was available for some developments as either the applications did not require environmental information to be submitted or because planning applications had not been submitted for all developments;
- For the purposes of the assessment, professional judgement and a ‘worst case scenario’ has been used where there is a lack of certainty about a committed development in consultation with the relevant technical specialist.

APPENDICES

B-1 GLOSSARY OF TERMS AND ACRONYMS

GLOSSARY

Term	Definition
AADT	Annual Average Daily Traffic - A daily total traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
AQO	Air quality objective - Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive subgroups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy
ASSI	Area of Specific Scientific Interest
ASR	Annual Status Report
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of DEFRA
CEMP	Construction Environment Management Plan
Conservative	Tending to over-predict the impact rather than under-predict.
DC	Data Capture - The percentage of all the possible measurements for a given period that were validly measured.
DEFRA	Department for Environment, Food and Rural Affairs.
DMP	Dust Management Plan
EFT	Emissions Factor Toolkit
Emission rate	The quantity of a pollutant released from a source over a given period.
Exceedance	A period where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
LDV / LGV	Light Duty Vehicle / Light Goods Vehicle.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.

Term	Definition
NPPF	National Planning Policy Framework
OEMP	Outline Environment Management Plan
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
SAC	Special Area of Conservation
SPA	Special Protection Area
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
µg/m^3	A measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

APPENDIX B-2:
AIR QUALITY: LEGISLATION, POLICY AND GUIDANCE

B-2 LEGISLATION, POLICY AND GUIDANCE

LEGISLATION

European Union Directive on Ambient Air Quality (2008/50/EC)[1]

The EU Directive on ambient air quality (2008/50/EC)[1] is the primary driver for managing and improving air quality for each member state of the European Union (EU). The EU Directive[1] sets legally binding limit values for concentrations in ambient (outdoor) air of pollutants that can impact public health, including NO_2 and particulates (PM_{10}, $PM_{2.5}$).

EU Limit Values are set for individual pollutants and comprise a concentration value, an averaging time over which it is to be measured, the number of allowed exceedances per year (if any), and a date by which it must be achieved. Some pollutants (e.g. PM_{10}) have more than one limit value covering different averaging times.

Member states are required to report on the status of air quality and to assess compliance with the EU Directive[1] on an annual basis. DEFRA carries out this task on behalf of the UK government and published the latest submission to the EU Commission in September 2019. Compliance assessment modelling is carried out using a series of national models known collectively as the Pollution Climate Mapping (PCM) model.

Part III of the Environment (Northern Ireland) Order, 2002[2]

Under the Order[2], local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA).

For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

Clean Neighbourhoods and Environment Act (Northern Ireland) 2011[3]

The objective of the Act[3] is to improve the quality of the local environment by giving the local authority additional powers to deal with litter, nuisance alleys, graffiti and fly posting, abandoned and nuisance vehicles, dogs, noise and statutory nuisance.

Part 7 makes provision to constitute *"statutory nuisances"* for the purposes of the Act[3]. Specifically, Section 63 gives the following definitions of statutory nuisance relevant to dust and particles:

"Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises to be prejudicial to health or a nuisance";

"Any accumulation or deposit which is prejudicial to health or a nuisance"

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[1] European Parliament, Council of the European Union (2008). *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe* [online] Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050 [Accessed May 2020]

[2] Northern Ireland Orders in Council (2002). *The Environment (Northern Ireland) Order 2002, Part III Air Quality 2002:3153 (N.I 7)* [online] Available at: http://www.legislation.gov.uk/nisi/2002/3153/part/III [Accessed May 2020]

[3] Acts of the Northern Ireland Assembly (2011). *Clean Neighbourhoods and Environment Act (Northern Ireland) 2011, Part 7 Statutory Nuisances 2011 c.23* [online] Available at: http://www.legislation.gov.uk/nia/2011/23/part/7 [Accessed May 2020]

Following this, Section 65 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. The abatement notice would impose either all or any of the following requirements:

- requiring the abatement of the nuisance or prohibiting or restricting its occurrence or recurrence,
- requiring the execution of such works, and the taking of such other steps, as may be necessary for any of those purposes,

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

UK Air Quality Strategy, 2007[4]

The Government's policy on air quality within the UK is set out in the Air Quality Strategy[4] for England, Scotland, Wales, and Northern Ireland (AQS). The AQS[4] provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation[1].

The AQS[4] also sets standards and objectives for nine key air pollutants to protect health, vegetation, and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Appendix B-3**.

The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.

The Air Quality Objectives are medium-term policy-based targets set by the Government, which consider economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

For the pollutants considered in this assessment, there are both long-term (annual mean) and short-term standards. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

The AQS[4] contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}. Local Authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area.

[4] Department for Environment, Food and Rural Affairs (DEFRA) (2007). *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland Volumes 1 and 2* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf [Accessed May 2020]

Air Quality Regulations (Northern Ireland)[5,6]

Many of the objectives in the AQS[4] have been made statutory in Northern Ireland with the Air Quality Regulations (Northern Ireland) 2003[5] and Air Quality Standards Regulations (Northern Ireland) 2010[6] for Local Air Quality Management (LAQM).

These regulations require that likely exceedances of the AQS[4] objectives are assessed in relation to:

"…the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"

The Limit Values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS[4] objectives and the Limit value for $PM_{2.5}$ is a concentration of 25 µg/m^3.

Appendix B-3 presents the applicable Air Quality Objectives and EU Limit Values applicable to this assessment.

PLANNING POLICY

A summary of the national, regional and local planning policy relevant to the proposals and air quality is provided below.

Clean Air Strategy, 2019[7]

In January 2019, the UK government published its Clean Air Strategy[7] which shows what measures will be implemented to tackle all sources of air pollution, to make air healthier to breathe, protecting nature and to improve the economy. The Clean Air Strategy[7] sets out the comprehensive actions required across all parts of government and society to improve air quality.

Chapter five of the Clean Air Strategy[7] focuses on actions to reduce emissions from transport, stating that, *"Our most immediate air quality challenge is to bring roadside concentrations of nitrogen oxides within legal limits in the shortest possible time."*

Section 9.5 provides the pertinent information in regard to the actions being taken to tackle air pollution in Northern Ireland.

Air pollution in Northern Ireland is dominated by three main sources: nitrogen oxides from road traffic emissions, in particular those from diesel vehicles; particulate matter from residential burning of solid fuels, in particular coal; and ammonia emissions from agricultural activities such as manure storage, handling and spreading.

Northern Ireland has seen a reduction in emissions in recent years similar to those for the UK as a whole for NO_X, SO_2 and volatile organic compounds. Emissions of particulate matter have reduced at a slower rate in Northern Ireland than for the UK as a whole.

Northern Ireland receives a steady supply of good air due to its topography and setting; however, NO_2 pollution from road traffic is seen as a significant problem, with the proportion of journeys made by public transport and active travel being fairly stable over time.

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[5] Northern Ireland Statutory Rules (2003). *The Air Quality Regulations (NI) 2003 NISR 2003* [online] Available at: http://www.legislation.gov.uk/nisr/2003/342/contents/made [Accessed May 2020]

[6] Northern Ireland Statutory Rules (2010). *The Air Quality Standards Regulations (Northern Ireland) 2010 NISR 2010:118* [online] Available at: http://www.legislation.gov.uk/nisr/2010/188/contents/made [Accessed May 2020]

[7] DEFRA (2019). *Clean Air Strategy* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf [Accessed May 2020]

However, generally concentrations of NO_2 have been falling in recent years and except for Belfast, Northern Ireland is compliant with the Limit Values for NO_2 concentrations set out by the EU directive on ambient air quality[1].

Further action to reduce these concentrations was announced in the UK plan for tackling NO_2 concentrations[8]. It is identified that between 1994 and 2017 there has been a 37% decrease in the annual mean concentration.

Strategic Planning Policy Statement for Northern Ireland[9]

The Strategic Planning Policy Statement for Northern Ireland (SPPS)[10] was formally updated in September 2015. The SPPS sets out the Department of Environment's regional planning policies for securing the orderly and consistent development of land in Northern Ireland. The provisions of the SPPS must be taken into account in the preparation of Local Development Plans and are also material to all decisions on individual planning applications and appeals.

Air quality is referenced in the following sections of the SPPS:

Paragraph 3.10 - A central challenge in furthering sustainable development is mitigating and adapting to climate change, whilst improving air quality. This includes the need to reduce emissions of greenhouse gases that contribute to climate change and to respond to the impacts brought about by climate change.

Paragraph 4.11 - There are a wide range of environment and amenity considerations, including noise and air quality, which should be taken into account by planning authorities when proposing policies or managing development. For example, the planning system has a role to play in minimising potential adverse impacts, such as noise or light pollution on sensitive receptors by means of its influence on the location, layout and design of new development. The planning system can also positively contribute to improving air quality and minimising its harmful impacts

Paragraph 6.294 - Whilst smarter use of technologies can reduce the need to travel, the provision of improved infrastructure for more sustainable transport modes gives people greater choices about how they travel. Sustainable patterns of development with local design that encourage walk, cycle and public transport travel to local amenities can reduce the need for private car use. Where a modal shift occurs, this can contribute to improvements in air quality arising from reduced vehicular emissions and associated health benefits for society.

Annex A (Improving Air Quality) provides the following key points:

- The planning system can also positively contribute to the improvement of air quality and in minimising its harmful impacts on health and well-being;
- In managing development, planning authorities should recognise that air quality can be a material consideration in the determination of planning applications;
- Where a proposed development is likely to have a significant air quality impact or add to a cumulative impact in an area, applications should be supported by sufficient information to allow full consideration of the impact on local air quality;
- Adequate consultation between the planning authority and those with responsibility for air quality and pollution control will be essential.

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[8] DEFRA and Department for Transport (DfT) (2017). *UK Plan for tackling roadside nitrogen dioxide concentrations* [online] Available at: https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017 [Accessed May 2020]

[9] Department of the Environment (2015). *Strategic Planning Policy Statement for Northern Ireland* [online] Available at: https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf [Accessed May 2020]

- The impact on ambient air quality is likely to be particularly important for development proposals located within or close to a designated AQMA.

UK Plan for Tackling Roadside Nitrogen Dioxide (NO_2) Concentrations[8]

The UK Plan for tackling roadside nitrogen dioxide concentrations[8], published in 2017 and supplemented in 2018, identifies those local authorities in the UK which have been directed to develop plans to bring roadside concentrations of NO_2 within legal limits in the shortest possible time.

Additional actions for Northern Ireland are specified within the UK Plan, which states that *"The Northern Ireland Executive will improve air quality and increase sustainable transport through the following actions:*

- *Revise Northern Ireland's air quality policy and legislation and devise an Air Quality Action Plan;*
- *Develop air quality planning guidance;*
- *Promote the use of electric vehicles;*
- *Ensure Local Development Plans and planning decisions take account of existing regional strategic planning and transport policies and guidelines to encourage the use of walking, cycling and public transport;*
- *Invest in public transport, cycling and pedestrian infrastructure to encourage greater use of these modes;*
- *Build a safe and accessible cycling infrastructure by delivering bicycle networks and a Strategic Plan for Greenways;*
- *Establish Quality Bus Corridors and work with major employers to promote salary sacrifice and tax smart schemes for bike and public transport; and,*
- *Engage employers, schools and hospitals to develop travel plans and enhance active travel and public transport linkages, including by integrating rural and accessible transport services with health and education passenger transport."*

Regional Development Strategy (RDS) 2035[10]

The Department for Regional Development (DRD) published the Regional Development Strategy 2035 (RDS)[10] in 2012. The RDS[10] sets out the regional policies and strategies for Northern Ireland.

Policy RG9 of the RDS[10] (Reduce our carbon footprint and facilitate mitigation and adaptation to climate change whilst improving air quality) focuses on reducing air pollution and greenhouse gas emissions and preparing for the impacts of climate change.

The policy states the following pertinent information in regard to the proposals.

Reduce noise and air pollution from transport.

This will include the need to adapt the existing transport network to facilitate the modal shift away from the car. The car may be essential for some journeys, but its social and economic value needs to be weighed against its impact on the environment. The way existing transport is used needs to be looked at to favour modes of transport that allow reduction of Northern Ireland's carbon footprint.

[10] Department for Regional Development (2012). *Regional Development Strategy (RDS) 2035 – Building a Better Future* [online] Available at: https://www.planningni.gov.uk/index/policy/rds2035.pdf [Accessed May 2020]

Protect Air Quality Management Areas.

In order to improve air quality for all citizens in Northern Ireland local authorities are responsible for reviewing the state of air quality in their district. To assist them with this process an Air Quality Strategy has been devised for the UK. This sets down standards and objectives for the air quality pollutants causing the problems and allows local authorities to review air quality in their area against these. Where local air quality fails to meet the required standard, the local authorities must declare an air quality management area (AQMA), covering the geographical area where a problem has been identified for the pollutant that exceeds its permitted standard. Development should be consistent with the AQMA action plans. NI departments also have a responsibility to ensure limit values, target values and alert thresholds for specified pollutants are not exceeded."

Mid Ulster District Council – Local Development Plan 2030 – Draft Plan Strategy[11]

The Draft Plan Strategy[11] sets out Mid Ulster District Council's vision for planning land use up to 2030 and details the objectives, spatial planning framework and planning policies which the council propose to use to deliver that vision.

Mid Ulster District Council published its Local Development Plan 2030 – Draft Plan Strategy[11] on 22nd February 2019. Within the draft plan strategy, it states the following narrative on air quality:

"In terms of our environment we see Mid Ulster as having the facilities to maximise waste recycling and the controls in place to improve air quality…"

Our strategy is based on Regional Guidance which is geared to:

- *reduce our carbon footprint and facilitate mitigation and adaptation to climate change whilst improving air quality."*

Mid Ulster District Council – Air Quality Action Plan[12]

As part of Mid Ulster District Council's commitment to its LAQM duties, an AQAP[11] has been produced. The AQAP[11] outlines the actions that the local authority will deliver up to 2023 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to the Mid Ulster District Council area.

The latest measures set out within the AQAP[11] are as follows:

- *Investigate potential for traffic control systems leading to and within AQMAs*
- *Ensure potential air quality issues are assessed with new developments before problems arise through consultation with the Planning Department;*
- *Investigate the potential of requiring a number of electric charging points to be included in certain developments, through consultation with the Planning Department;*
- *Prepare information leaflets on how to help improve air quality and reduce exposure;*
- *Control of emissions from Part C processes;*
- *Investigation of air quality nuisance complaints, inclusion appropriate action to resolve the problem;*

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[11] Mid Ulster District Council (2019). *Local Development Plan 2030 – Draft Plan Strategy* [online] Available at: https://www.midulstercouncil.org/getmedia/dd8d49d7-79a6-4419-948f-2569cb0d0fa5/Local-Development-Plan-2030-Strategy-for-reconsultation.pdf.aspx [Accessed May 2020]

[12] Mid Ulster District Council (2019). *Air Quality in the Mid Ulster District Council Area 2019 – Air Quality Action Plan* [online] Available at: https://mid-ulster.cmis-ni.org/midulster/Decisions/tabid/67/ctl/ViewCMIS_DecisionDetails/mid/391/Id/adc0469e-64fb-4e2c-a174-8cd719651abb/Default.aspx [Accessed May 2020]

- *Identify, map and promote use of electric vehicle recharging points within Council area;*
- *Enforcement the Clean Air Act with regards to industrial smoke;*
- *Encourage the installation of new bicycle stands at large supermarkets located in the District and will promote the use of existing bicycle stands;*
- *Ensure that bicycle stands are available at all council buildings;*
- *Investigate fleet improvements of Council owned vehicles;*
- *Annual engagement event to educate and raise awareness regarding air quality. Also, to*
- *find joint working opportunities; and*
- *Investigation potential for marked walking and routes within towns.*

APPENDIX B-3:

AIR QUALITY: RELEVANT AIR QUALITY OBJECTIVES AND LIMIT VALUES

B-3 RELEVANT UK AIR QUALITY OBJECTIVES AND EU LIMIT VALUES

RELEVANT UK AIR QUALITY OBJECTIVES AND EU LIMIT VALUES

National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health

Pollutant	Applies to	Objective	Measured as	Date to be achieved by and maintained thereafter	European Obligations	Date to be achieved by and maintained thereafter
Nitrogen dioxide (NO_2)	UK	40 µg/m^3	annual mean	31.12.2005	40 µg/m^3	01.01.2010
		200 µg/m^3 not to be exceeded more than 18 times a year	1 hour mean	31.12.2005	200 µg/m^3 not to be exceeded more than 18 times a year	01.01.2010
Particulate Matter (PM_{10}) (gravimetric) A	UK (except Scotland)	40 µg/m^3	annual mean	31.12.2004	40 µg/m	01.01.2005
		50 µg/m^3 not to be exceeded more than 35 times a year	24 hours mean	31.12.2004	50 µg/m^3 not to be exceeded more than 35 times a year	01.01.2005
Particulate Matter ($PM_{2.5}$)	UK (except Scotland)	25 µg/m^3	annual mean	2020	Target value 25 µg/m^3	2010

National Air Quality Objectives and European Directive Limit and Target Values for the Protection of Vegetation and Ecosystems

Pollutant	Applies to	Objective	Measured as	Date to be achieved by and maintained thereafter	European Obligations	Date to be achieved by and maintained thereafter
Nitrogen Oxides (NO_X)	UK	30 µg/m^3	annual mean	31.12.2000	30 µg/m^3	19.07.2001

APPENDIX B-4:

AIR QUALITY: PROPOSED SCHEME SPECIFIC MONITORING PROGRAMME

B-4 PROPOSED SCHEME SPECIFIC MONITORING PROGRAMME

The Design Manual for Roads and Bridges Air Quality guidance[13] (LA 105) requires the consideration of whether there is enough existing monitoring data to assess the impact of the scheme against a baseline. LA 105[13] recommends that if there is insufficient monitoring data within the study area, passive diffusion tubes for measurement of NO_2 should be deployed to establish the local air quality conditions.

DEFRA'S Local Air Quality Management Technical Guidance[14] (LAQM.TG16) recommends at least six months monitoring should be undertaken to allow for seasonal variability in NO_2 concentrations. The winter season represents a relatively conservative period for monitoring because of the increased occurrence of temperature inversions in which still, cold air can be trapped by local topography allowing pollutant concentrations to accumulate, which would normally be dispersed.

As such, a baseline air quality monitoring programme was established for the proposals.

Site specific monitoring of ambient NO_2 concentrations was undertaken using passive diffusion tubes. The diffusion tubes, which give an average concentration over the exposure period, were used to monitor NO_2 over monthly exposure periods.

Diffusion tubes provide a time weighted average concentration over the exposure period. They are used extensively by Local Authorities to provide data as part of their commitment to LAQM and are recommended in Environmental Agency Technical Guidance Note M8[15] and DEFRA guidance[14,16].

NO_2 diffusive samplers consist of an acrylic tube fitted with coloured and white thermoplastic rubber caps. The coloured cap contains an absorbent material. The concentrations of nitrite ions and hence NO_2 chemically adsorbed is quantitatively determined by ultraviolet (UV) or Visible Spectrophotometry with reference to a calibration curve derived from the analysis of standard nitrite solutions using a United Kingdom Accreditation Service (UKAS) accredited method.

DIFFUSION TUBE ANALYSIS AND SUPPLY

Diffusion tubes were analysed and supplied by Gradko International, a UKAS accredited laboratory. For this monitoring survey a preparation of 20% triethanolamine (TEA) in de-ionized water was used.

The samples have been analysed in accordance with Gradko's standard laboratory operating procedures. Concentrations of NO_2 absorbed by the tubes were determined using ultraviolet / visible spectrophotometry. The method meets the guidelines set out in DEFRA diffusion tube guidance[14,16].

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[13] Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland, (2020). *Design Manual for Roads and Bridges, LA 105 revision 0. Air Quality* [online] Available at: https://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf [Accessed May 2020]

[14] DEFRA (2018) *Local Air Quality Management Technical Guidance (LAQM.TG16) version 1, February 2018* [online] Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf [Accessed May 2020]

[15] Environment Agency (2011) *Technical Guidance Note M8: Monitoring Ambient Air* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/301188/TGN_M8_Monitoring_Ambient_Air.pdf [Accessed May 2020]

[16] AEA Energy & Environment, on behalf of DEFRA (2008) *Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users* [online] Available at: https://laqm.defra.gov.uk/documents/0802141004_NO2_WG_PracticalGuidance_Issue1a.pdf [Accessed May 2020]

MONITORING PERIOD

The monitoring survey is scheduled for a period of twelve months, commencing on Friday 3rd May 2019 and used four or five-weekly exposure periods. Due to the COVID19 pandemic, monitoring ceased on 6th March 2020, thus the monitoring period was reduced to ten months.

Each monitoring period has been scheduled with consideration to the NO_2 diffusion tube monitoring calendar of suggested exposure periods for 2019[17] and 2020[18]. A summary of the monitoring period is provided in **Table B-4-1** below:

Table B-4-1 – Proposed Scheme Specific NO_2 Monitoring Survey - Periods

Monitoring Period	Start Date	End Date	Exposure (Weeks)
1	3rd May 2019	7th June 2019	5
2	7th June 2019	5th July 2019	4
3	5th July 2019	9th August 2019	5
4	9th August 2019	6th September 2019	4
5	6th September 2019	4th October 2019	4
6	4th October 2019	8th November 2019	5
7	8th November 2019	6th December 2019	4
8	6th December 2019	10th January 2020	5
9*	10th January 2020	7th February 2020	4
10*	7th February 2020	6th March 2020	4
11**	6th March 2020	3rd April 2020	4
12**	3rd April 2020	1st May 2020	4

**Excluded from monitoring period calculations ** Not completed due to COVID19 pandemic.*

MONITORING LOCATIONS

Monitoring locations were chosen as prescribed in DEFRA guidance[14,16]. The monitoring sites were selected to ensure free circulation of air around the open end of the diffusion tube and positioned at a height above ground between 2 m and 4 m, to be representative of human exposure and avoid stagnant or more turbulent than normal air and localised sources of NO_2.

The locations selected for the proposed scheme specific monitoring programme are presented in Figure 6.2.10 (Appendix A Figure 6.2.10: Drawing Reference 718314-WSP-B-D-3000-0208).

Where site conditions allowed, the monitoring locations were not located near (within 10 m) the following localised sources or sinks of air pollutants, and areas that could cause undue disturbance to free air flow around the tubes:

- Heater flues (particularly low-level balanced flues);
- Trees and other vegetation;
- Air conditioning outlets;
- Extractor vents; and/or,
- Underground ventilation shafts.

[17] DEFRA (2019). *NO_2 Diffusion Tube Monitoring Calendar for Local Authorities - 2019* [online] Available at: https://laqm.defra.gov.uk/assets/dttimetable2019v1.pdf [Accessed May 2020]

[18] DEFRA (2020). *NO_2 Diffusion Tube Monitoring Calendar for Local Authorities - 2020* [online] Available at: https://laqm.defra.gov.uk/assets/2020laqmcalendar1.pdf [Accessed May 2020]

PROCESSING AND RESULTS

Table B-4-2 presents a summary of the raw monitoring results for 2019. The table shows each period mean NO_2 concentration for 2019 (eight periods) as well as the averaged result, prior to annualisation and bias adjustment.

Table B-4-2 – Project Specific NO_2 Monitoring Survey – Raw Results

Site ID	Location	Grid Reference		Height (m)	Dist. from road (m)	Valid DC (%)	Raw Monitoring Results (µg/m^3)								
		X	Y				P1	P2	P3	P4	P5	P6	P7	P8	Ave
M1	LC 4405 – A505 Drum Road	280470	376866	2.65	1.60	100	26.6	25.6	21.9	22.7	28.7	27.2	36.2	30.5	27.4
M2	LC 6379 – Sandholes Road	280397	376766	2.70	1.30	100	20.5	17.9	17.4	13.4	22.8	23.5	24.8	23.2	20.5
M3	LC 6175 – Sandholes Road	280718	376291	2.70	4.00	100	15.9	14.6	5.6	19.0	16.8	18.3	21.0	18.2	16.2
M4	LC 3427 – Tullywiggan Road	281400	375862	2.40	2.10	100	16.9	17.0	17.4	18.1	21.3	20.9	16.8	22.1	18.8
M5	LC 1118.1 – A29 Church Street	281236	376433	2.80	3.30	100	26.6	26.4	25.3	23.5	30.2	26.0	29.9	14.8	25.4
M6	LC 4717 – Killymoon Road	281807	377131	2.60	1.60	100	7.7	7.8	6.9	7.7	9.6	13.1	16.5	14.0	10.4
M7	LC 6036.6 – Westlands Road South	280566	377358	2.70	1.00	100	27.9	20.4	23.4	23.6	21.1	27.4	40.3	34.4	27.3
M8	LC 4568 – Orritor Road	280129	378499	2.65	2.25	100	13.6	12.6	9.4	7.8	14.4	15.2	24.8	14.6	14.1
M9	LC 4154 – Morgan's Hill Road	280559	378920	2.65	1.30	100	14.3	11.4	14.9	14.4	18.0	19.2	21.5	22.3	17.0
M10	LC 4526 – Tullagh Road	279934	377977	2.60	1.60	100	7.6	7.7	6.7	5.8	8.4	12.1	14.4	10.7	9.2
M11	LC 41474 – Lissan Close	280762	379206	2.70	1.80	88	9.4	8.4	9.4	9.4	12.4	13.3	21.3		11.9
M12	LC 4863 – Lissan Road	280967	379059	2.70	2.20	100	14.0	12.2	13.0	13.6	15.7	19.3	25.4	22.0	16.9
M13	LC 4992 – Coolreaghs Road	280607	379811	2.70	1.75	100	5.5	5.2	5.3	5.4	7.1	9.1	12.0	11.5	7.6
M14	LC 1214.1 – A29 Moneymore Road	281373	379121	2.75	1.70	100	29.5	29.4	21.9	24.8	33.2	28.9	34.7	39.0	30.2
M15	LC 108 – A29 Riverside	282627	380268	2.60	1.70	100	16.7	15.5	14.1	13.8	16.9	19.5	25.2	21.5	17.9
M16	LC 5134 – Old Coagh Road	281626	378569	2.75	0.60	88		9.9	9.1	10.6	13.0	15.5	20.9	18.9	14.0
M17	LC 6432 – Molesworth Street	281651	378156	2.65	1.80	100	18.5	20.3	18.8	21.6	24.9	22.3	29.0	23.1	22.3
M18	LC 4825 – Fountain Road	282008	377636	2.60	2.50	100	15.1	17.9	11.0	9.3	15.8	18.3	26.1	16.4	16.2
M19	LC 1157 – A29 Chapel Street	281106	377816	2.65	3.85	100	21.3	22.0	16.7	13.8	21.2	20.5	29.1	22.5	20.9
M20	LC 4384 – Convent Road	280830	377844	2.75	2.05	63	7.9		5.8	7.2	9.7		18.6		9.9

Blank – No data available

ANNUALISATION

As the monitoring programme has been running for less than nine months, all results were annualised in accordance with Box 7.10 of LAQM.TG16[14], prior to bias adjustment for 2019.

This process generated separate annualisation values for each monitoring site based on incorporating NO_2 monitoring data for at least two continuous analysers contained within DEFRA's Automatic Urban and Rural Network (AURN)[19] for the year to date.

Continuous data were taken from the Ballymena Ballykeel, Belfast Centre and Derry Rosemount monitoring stations to derive period mean and annual mean averages for use in the annualisation process. However, the Belfast Centre AURN station experienced issues in data collection from Tuesday 17th September 2019 to Tuesday 10th March 2020. As such, this data were discounted from the annualisation adjustment.

BIAS ADJUSTMENT

Bias adjustment was then carried out by using the National Diffusion Tube Bias Adjustment Factor Spreadsheet (v06/20)[20] to derive a bias adjustment factor instead of applying a local value.

A bias adjustment of 0.92 was applied post annualisation, which was obtained with selecting the 20% TEA in water tube preparation method and Gradko analysis function for the latest available year (2019).

Table B-4-3 presents the results from the project specific NO_2 monitoring programme for 2019.

[19] DEFRA (2020). *Automatic and Rural Network (AURN)* [online] Available at: https://uk-air.defra.gov.uk/networks/network-info?view=aurn [Accessed May 2020]

[20] Bureau Veritas, on behalf of DEFRA (2020). *National Diffusion Tube Bias Adjustment Factor Spreadsheet Version 06/20* [online] Available at: https://laqm.defra.gov.uk/assets/Database_Diffusion_Tube_Bias_Factors_v06_20_FINAL.XLSX [Accessed May 2020]

Table B-4-3 – Project Specific NO_2 Monitoring Survey – Annualised and Bias Adjusted Results (2019)

Monitoring Site		NO_2 Mean Concentration (µg/m^3) (2019)											
Site ID	Height (m)	Site Type	Valid DC (%) to date	Period Mean (D1 Pm)	B1 Pm	B2 Pm	B1 Am	B2 Am	B1 Am/Pm	B2 Am/Pm	Ave (Ra)	Annual Mean	Annual Mean & Bias Adj
M1	2.65	Roadside	100	27.4	12.6	10.1	14.4	10.6	1.1	1.1	1.1	30.2	27.7
M2	2.70	Roadside	100	20.5	12.6	10.1	14.4	10.6	1.1	1.1	1.1	22.5	20.7
M3	2.70	Roadside	100	16.2	12.6	10.1	14.4	10.6	1.1	1.1	1.1	17.8	16.4
M4	2.40	Roadside	100	18.8	12.6	10.1	14.4	10.6	1.1	1.1	1.1	20.7	19.0
M5	2.80	Roadside	100	25.4	12.6	10.1	14.4	10.6	1.1	1.1	1.1	27.9	25.6
M6	2.60	Roadside	100	10.4	12.6	10.1	14.4	10.6	1.1	1.1	1.1	11.4	10.5
M7	2.70	Kerbside	100	27.3	12.6	10.1	14.4	10.6	1.1	1.1	1.1	30.0	27.6
M8	2.65	Roadside	100	14.1	12.6	10.1	14.4	10.6	1.1	1.1	1.1	15.4	14.2
M9	2.65	Roadside	100	17.0	12.6	10.1	14.4	10.6	1.1	1.1	1.1	18.7	17.2
M10	2.60	Roadside	100	9.2	12.6	10.1	14.4	10.6	1.1	1.1	1.1	10.1	9.3
M11	2.70	Roadside	88	11.9	12.3	9.7	14.4	10.6	1.2	1.1	1.1	13.5	12.4
M12	2.70	Roadside	100	16.9	12.6	10.1	14.4	10.6	1.1	1.1	1.1	18.6	17.1
M13	2.70	Roadside	100	7.6	12.6	10.1	14.4	10.6	1.1	1.1	1.1	8.4	7.7
M14	2.75	Roadside	100	30.2	12.6	10.1	14.4	10.6	1.1	1.1	1.1	33.2	30.5
M15	2.60	Roadside	100	17.9	12.6	10.1	14.4	10.6	1.1	1.1	1.1	19.7	18.1
M16	2.75	Kerbside	88	14.0	12.7	10.3	14.4	10.6	1.1	1.0	1.1	15.1	13.9
M17	2.65	Roadside	100	22.3	12.6	10.1	14.4	10.6	1.1	1.1	1.1	24.6	22.6
M18	2.60	Roadside	100	16.2	12.6	10.1	14.4	10.6	1.1	1.1	1.1	17.9	16.4
M19	2.65	Roadside	100	20.9	12.6	10.1	14.4	10.6	1.1	1.1	1.1	23.0	21.1
M20	2.75	Urban BKG	63	9.9	11.9	9.7	14.4	10.6	1.2	1.1	1.2	11.3	

Pm – Period Mean; Am – Annual Mean; Values rounded to 1 Decimal Place; Blank – Data capture less than 75%

B1 – Ballymena Ballykeel; B2 – Derry Rosemount

APPENDIX B-5:

AIR QUALITY: OPERATIONAL STAGE – SUPPORTING INFORMATION

B-5 OPERATIONAL STAGE – SUPPORTING INFORMATION

ATMOSPHERIC DISPERSION MODEL

The predicted impacts on local air quality associated with changes to road vehicle exhaust emissions because of the operation of the proposals were assessed using the Cambridge Environmental Research Consultants (CERC) atmospheric dispersion modelling system for roads (ADMS-Roads v5.0.0.1).

ADMS-Roads applies advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of long and short-term air pollutant concentrations within the given model domain.

MODEL PROCEDURE

The following procedures were carried out to facilitate in the compilation of the dispersion model and subsequent operational phase assessment:

- Collation of input data – traffic data (flows, speeds, percentage of HDVs), road network mapping, sensitive receptor coordinates and meteorological data;
- Input of data in to the ADMS-Roads model for the scenarios to be modelled;
- Calculation of emissions for each pollutant to be assessed through ADMS-Roads and incorporating the DEFRA's EFT[21] (version 9.0);
- Running the ADMS-Roads model for each considered scenario;
- Conversion of modelled NO_x concentrations to NO_2 concentrations using DEFRA's NO_x to NO_2 calculator[22] (version 7.1) and addition of DEFRA background concentrations[23] (see **Appendix B-6**) to the modelled concentrations;
- Verification and adjustment of modelled road-NO_x contributions from the assessed road through analysing the ADMS-Roads modelled road-NO_x outputs versus scheme-specific monitored road-NO_x for the baseline scenario of 2019;
- Comparison of predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at all considered receptors to the relevant Air Quality Objectives in each scenario; and
- Analysis of changes in pollutant concentrations between the Do-Minimum (DM) and Do-Something (DS) scenarios to assess the significance of impacts associated with each route option on local air quality.

A summary of the dispersion modelling parameters included in the ADMS-Roads dispersion models is included in **Table B-5-1**.

Table B-5-1 – ADMS-Roads Model Inputs

Parameter	Study Area
Latitude	54.64
Surface Roughness	0.75
Monin-Obukhov Length (m)	10

[21] DEFRA (2019). *Emissions Factors Toolkit, version 9.0* [online] Available at: https://laqm.defra.gov.uk/documents/EFT2019_v9.0.xlsb [Accessed June 2020]
[22] DEFRA (2019). NO_x to NO_2 Calculator [online] Available at: https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v7.1.xlsm [Accessed August 2020]
[23] DEFRA (2019). *2017-based background maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$* [online] Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017 [Accessed July 2020]

MODEL VALIDATION

ADMS-Roads is commonly used in the UK for an array of air quality management and assessment studies. ADMS-Roads is continually validated against available measured data obtained from real world conditions, field studies and research experiments which improves model performance.

However, any model validation carried out by CERC is unlikely to have been carried out for the same type of study area which encompasses the Proposed Scheme.

Therefore, a comparison of the modelling results against representative monitoring data is required to minimise model uncertainties, by revising modelled results with an adjustment factor to give greater confidence in the final outputs and to confirm that the final pollutant concentrations predicted are representative of the local monitoring information from the study area.

MODEL VERIFICATION

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions.

The following are examples of potential causes of such uncertainties:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters, such as 'roughness length'; and
- Overall limitations of the dispersion model.

LAQM.TG16[14] states that,

"Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects."

Through appropriate adjustment of the modelled road NO_x contribution, uncertainties such as those identified above can be minimised where possible to progress consistency with available measured data. An adjustment factor has been derived and applied to all scenario model outputs.

MODEL PRECISION

Residual uncertainty may remain after systematic error or 'model accuracy' has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the 'precision' of the model predictions, for example how wide the scatter or residual variability of the predicted values compare with the monitored concentration of an air pollutant at a given location, once systematic error has been allowed for.

The quantification of model precision provides an estimate of how the final predictions may deviate from monitored pollutant concentrations at the same location over the same period.

Measured data from the proposed scheme specific monitoring programme has been used for the verification process, which is presented below.

MODEL PERFORMANCE

An evaluation of model performance has been undertaken to establish confidence in the model results. LAQM.TG16[14] identifies several statistical procedures that are appropriate to evaluate model performance and assess the uncertainty.

These include:

- Root mean square error (RMSE);
- Fractional bias (FB); and
- Correlation coefficient (CC).

These parameters estimate how the model results agree or diverge from the observations.

These calculations can be carried out prior to, and after adjustment, or based on different options for adjustment, and can provide useful information on model improvement.

A brief explanation of each statistic is provided in **Table B-5-2**, and further details can be found in Box 7.17 of LAQM.TG16[14].

Table B-5-2 – Statistical parameters for describing Model Performance

Statistical Parameter	Comment	Ideal Value
Root Mean Square Root (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are equivalent to the quantities compared. If the RMSE values are higher than 25%, of the objective being assessed, it is recommended that the model inputs and verification should be revisited to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40µg/m^3, if an RMSE of 10µg/m^3 is determined for a model, it is advised to revisit the model parameters and model verification. Ideally, an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual mean NO_2 objective.	0.00
Fractional Bias (FB)	FB is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model overprediction and positive values suggest a model under-prediction.	0.00
Correlation Coefficient (CC)	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a series of modelled and observed data points.	1.00

To assess the uncertainty of a model, the RMSE is the simplest parameter to calculate providing an estimate of the average error of the model in the same units as the modelled predictions.

ASSESSMENT VERIFICATION PROCESS

Approach

The model verification process contains a review of the modelled pollutant concentrations against corresponding monitoring data to determine how well the air quality model performed. Depending on the outcomes of the initial review, it may be considered that the model has performed to an adequate level and that no further adjustment is required to be carried out for the modelling results, as per LAQM.TG16[14].

Alternatively, the model may have performed outside of the ideal performance limits quoted within LAQM.TG16[14] (i.e. model agrees within +/-25% of monitored equivalent, but ideally within +/- 10%). There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered as practical, then the modelled results require adjustment to best align with the monitoring data. This may either be a single verification adjustment factor to be applied to the modelled concentrations across the entire study area, or a range of different adjustment factors to account for different zones such as motorway, urban or rural areas or for each identified local authority's jurisdiction.

Model verification is predominantly undertaken based on concentrations of nitrogen dioxide (NO_2). Most NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2), in accordance with LAQM.TG16[14]. As such, adjustment has been applied to the road NO_x source contribution, thus ensuring that any adjustment has been applied prior to being converted from NO_x to NO_2.

Monitoring Data for Assessment Verification Process

The dispersion model was set to predict the 2019 annual mean road-NO_x contribution at identified monitoring locations to carry out an appropriate model adjustment exercise.

The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentrations measured using the diffusion tube data for each considered monitoring location, utilising the NO_x from NO_2 calculator provided by DEFRA[22] and the NO_2 background concentration [23] (from the DEFRA background mapping).

For this assessment, a proposed scheme specific diffusion tube monitoring programme was established within the Cookstown area (see Appendix A, Figure 6.2.10 (Appendix A Figure 6.2.10: Drawing Reference 718314-WSP-B-D-3000-0208). These sites were positioned adjacent to the local road network where respective traffic data were available for the proposed scheme.

Considering the location of the monitoring sites, roadside and background site status, traffic data network coverage, and data capture, 19 diffusion tube monitoring locations were selected for the initial model verification process.

Background pollutant concentrations of NO_x and NO_2 were revised for the model verification exercise only, to remove the Motorway, Primary-A and Trunk-A road source contributions from

the total mapped backgrounds applicable for each 1 km x 1 km grid square encompassing the Traffic Reliability Area (TRA).

The NO_2 mapping concentrations were adjusted accordingly with use of the DEFRA NO_2 adjustment for NO_x Sector Removal Tool[24].

The respective monitoring location results used in the verification process are contained in **Table B-5-3,** which presents the initial model verification exercise of applying no adjustment to Road-NO_x contributions.

It contains a comparison of the monitored and modelled NO_2 results for the base year of 2019 to ascertain whether any further adjustment would be required, based on the guidance provided in LAQM.TG16[14].

[24] DEFRA (2019). *NO_2 adjustment for NO_x Sector Removal Tool version 7.0* [online] Available at: https://laqm.defra.gov.uk/documents/NO2-Adjustment-for-NOx-Sector-Removal-Tool-v7.0.xlsb [Accessed June 2020]

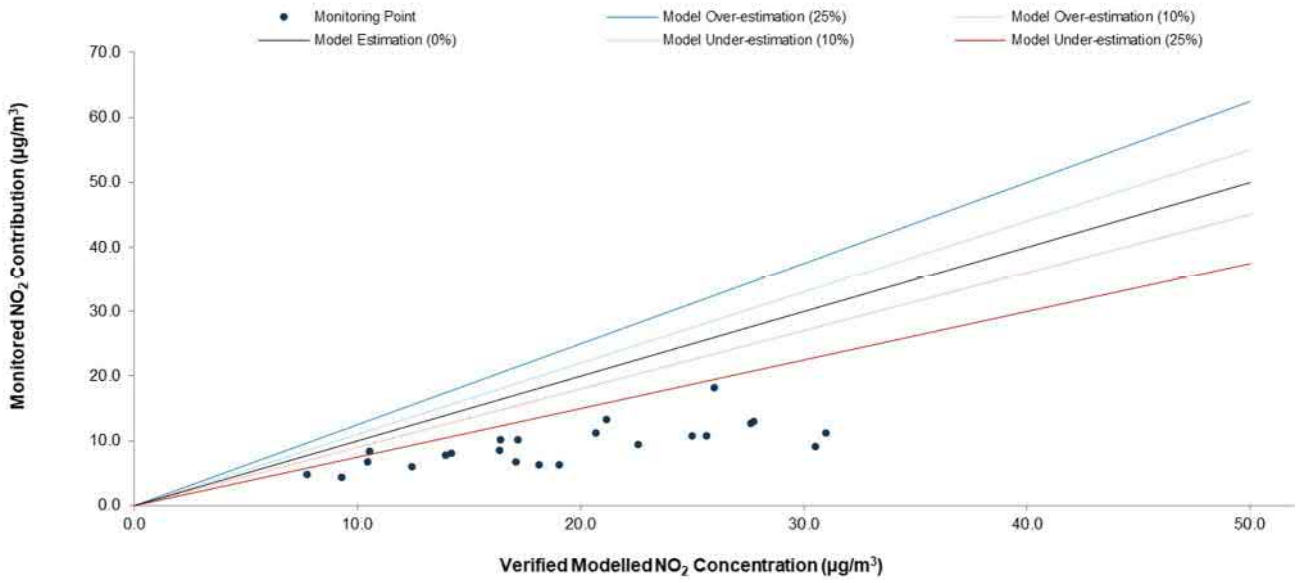
Table B-5-3 – NO_2 Model Verification Procedure – No Adjustment

Model Verification Procedure	Project Specific NO_2 Monitoring Programme																		
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19
2019 Background NO_x	10.1	10.1	10.1	5.4	6.7	10.4	7.6	7.4	7.4	4.8	5.8	5.8	5.8	5.7	5.3	8.9	8.9	10.4	10.4
2019 Background NO_2	7.6	7.6	7.6	4.2	5.2	7.9	5.9	5.7	5.7	3.8	4.6	4.6	4.6	4.5	4.1	6.8	6.8	7.9	7.9
2019 Monitored Total NO_2 **(From Diff.Tube Results)**	27.7	20.7	16.4	19.0	25.6	10.5	27.6	14.2	17.2	9.3	12.4	17.1	7.7	30.5	18.1	13.9	22.6	16.4	21.1
2019 Monitored Road NO_2	20.1	13.0	8.7	14.8	20.5	2.7	21.8	8.5	11.5	5.5	7.9	12.5	3.2	26.0	14.0	7.1	15.8	8.6	13.3
Monitored Road NO_x (from NO_x to NO_2 Calculator for Diffusion tubes)	39.6	24.9	16.3	28.1	39.9	4.9	42.8	15.8	21.6	10.0	14.5	23.5	5.7	52.0	26.4	13.2	30.3	16.0	25.4
Modelled Road Cont. NO_x (from ADMS Roads)	9.9	6.5	1.7	3.8	10.2	0.8	12.5	4.2	8.2	1.0	2.6	3.8	0.4	8.5	3.8	1.7	4.8	4.1	10.0
Ratio of Monitored to Modelled Road Cont. NO_x	4.0	3.8	9.7	7.4	3.9	6.0	3.4	3.7	2.6	10.0	5.6	6.1	16.2	6.1	6.9	7.6	6.3	3.9	2.5
Adjustment Factor	**1.00**																		
Adjusted Road Cont. NO_x	9.9	6.5	1.7	3.8	10.2	0.8	12.5	4.2	8.2	1.0	2.6	3.8	0.4	8.5	3.8	1.7	4.8	4.1	10.0
Adjusted Modelled Total NO_x	20.0	16.6	11.8	9.2	16.9	11.2	20.1	11.6	15.6	5.8	8.4	9.7	6.2	14.2	9.1	10.6	13.7	14.5	20.4
Modelled Total NO_2 based on Empirical NO_x to NO_2 Relationship (from NO_x to NO_2 calc)	13.0	11.2	8.6	6.3	10.8	8.3	12.7	8.1	10.2	4.4	6.0	6.7	4.8	9.2	6.3	7.8	9.5	10.1	13.3
Monitored Total NO_2	27.7	20.7	16.4	19.0	25.6	10.5	27.6	14.2	17.2	9.3	12.4	17.1	7.7	30.5	18.1	13.9	22.6	16.4	21.1
% Difference ((Modelled - Monitored / Monitored) x 100)	**-53.2**	**-45.8**	**-47.6**	**-66.7**	**-58.0**	**-21.0**	**-54.2**	**-43.3**	**-40.7**	**-52.9**	**-51.6**	**-60.8**	**-38.4**	**-70.0**	**-65.3**	**-44.2**	**-58.2**	**-38.6**	**-37.3**

Data reported to 1 decimal place

Figure B-5-1 shows the comparison of unadjusted modelled total NO_2 against the monitored NO_2 concentrations (see **Table B-5-3**) with all the identified monitoring locations considered for the model verification exercise.

Figure B-5-1 - NO_2 Verification Process – No Adjustment



Box 7.14 of LAQM.TG16[14]outlines the following:

"If your checks confirm that:

- There is no systematic under or over prediction;
- Predictions at sites where monitoring shows concentrations are close to the objective show good comparison; and
- The majority of results are within 25% as a minimum, but preferably within 10%, of monitored concentrations.

Then you do not necessarily need to adjust your modelling results. However, you may consider model adjustment as this can lead to further improvements in the results obtained, for example where all results move to within 10% of monitored concentrations."

The model verification exercise showed that the difference between the total modelled NO_2 and total monitored NO_2 at all identified diffusion tube monitoring locations are above ± 25% when processed and no adjustment is made to the modelled road-NO_x contributions (see **Table B-5-3**).

As such, it was deemed necessary to carry out adjustment to the modelled road-NO_x contributions to gain improvements in the dispersion modelling results, as per LAQM.TG16[14].

Preliminary Model Adjustment

Table B-5-4 presents the preliminary model adjustment exercise, which considers the comparison of modelled and monitored total annual mean NO_2 once adjustment was made to the modelled road-NO_x contributions.

Table B-5-4 – NO_2 Model Verification Procedure – Preliminary Adjustment

Model Verification Procedure	Project Specific NO_2 Monitoring Programme																		
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19
2019 Background NO_X	10.1	10.1	10.1	5.4	6.7	10.4	7.6	7.4	7.4	4.8	5.8	5.8	5.8	5.7	5.3	8.9	8.9	10.4	10.4
2019 Background NO_2	7.6	7.6	7.6	4.2	5.2	7.9	5.9	5.7	5.7	3.8	4.6	4.6	4.6	4.5	4.1	6.8	6.8	7.9	7.9
2019 Monitored Total NO_2 (From Diff.Tube Results)	27.7	20.7	16.4	19.0	25.6	10.5	27.6	14.2	17.2	9.3	12.4	17.1	7.7	30.5	18.1	13.9	22.6	16.4	21.1
2019 Monitored Road NO_2	20.1	13.0	8.7	14.8	20.5	2.7	21.8	8.5	11.5	5.5	7.9	12.5	3.2	26.0	14.0	7.1	15.8	8.6	13.3
Monitored Road NO_X (from NO_X to NO_2 Calculator for Diffusion tubes)	39.6	24.9	16.3	28.1	39.9	4.9	42.8	15.8	21.6	10.0	14.5	23.5	5.7	52.0	26.4	13.2	30.3	16.0	25.4
Modelled Road Cont. NO_X (from ADMS Roads)	9.9	6.5	1.7	3.8	10.2	0.8	12.5	4.2	8.2	1.0	2.6	3.8	0.4	8.5	3.8	1.7	4.8	4.1	10.0
Ratio of Monitored to Modelled Road Cont. NO_X	4.0	3.8	9.7	7.4	3.9	6.0	3.4	3.7	2.6	10.0	5.6	6.1	16.2	6.1	6.9	7.6	6.3	3.9	2.5
Adjustment Factor	**4.03 (4.0332)**																		
Adjusted Road Cont. NO_X	39.7	26.4	6.8	15.3	41.2	3.2	50.5	17.1	33.0	4.0	10.5	15.5	1.4	34.2	15.5	6.9	19.3	16.4	40.2
Adjusted Modelled Total NO_X	49.8	36.5	16.9	20.7	47.9	13.7	58.1	24.4	40.4	8.9	16.4	21.3	7.3	40.0	20.7	15.9	28.2	26.8	50.6
Modelled Total NO_2 based on Empirical NO_X to NO_2 Relationship (from NO_X to NO_2 calc)	27.8	21.4	11.3	12.6	26.3	9.6	31.1	14.9	22.8	6.1	10.3	13.0	5.4	22.3	12.5	10.6	17.1	16.6	28.2
Monitored Total NO_2	27.7	20.7	16.4	19.0	25.6	10.5	27.6	14.2	17.2	9.3	12.4	17.1	7.7	30.5	18.1	13.9	22.6	16.4	21.1
% Difference ((Modelled - Monitored / Monitored) x 100)	**0.3**	**3.5**	**-30.7**	**-34.1**	**2.4**	**-8.4**	**12.6**	**4.7**	**32.9**	**-34.8**	**-17.0**	**-24.2**	**-30.6**	**-26.9**	**-30.8**	**-23.8**	**-24.3**	**1.1**	**33.6**

Data reported to 1 decimal place

Figure B-5-2 below presents the calculation to derive the road-NO_x model adjustment factor for the preliminary adjustment exercise. This factor was then applied to the modelled road-NO_x concentration for the monitoring locations to provide adjusted modelled road-NO_x values to then be compared to the total NO_2 monitoring concentrations, once converted from NO_x to NO_2.

Figure B-5-2 - NO_2 Verification Process - Preliminary Adjustment - Road-NO_x Model Adjustment

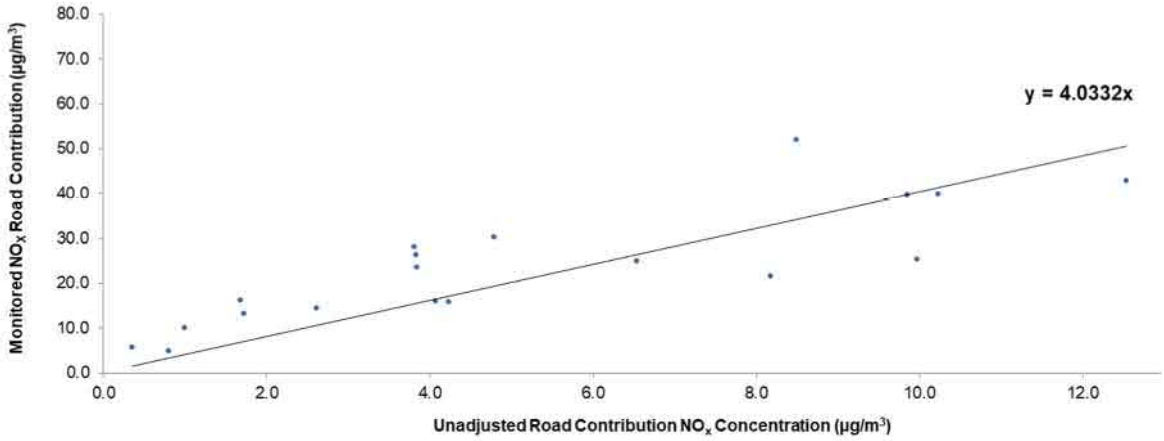
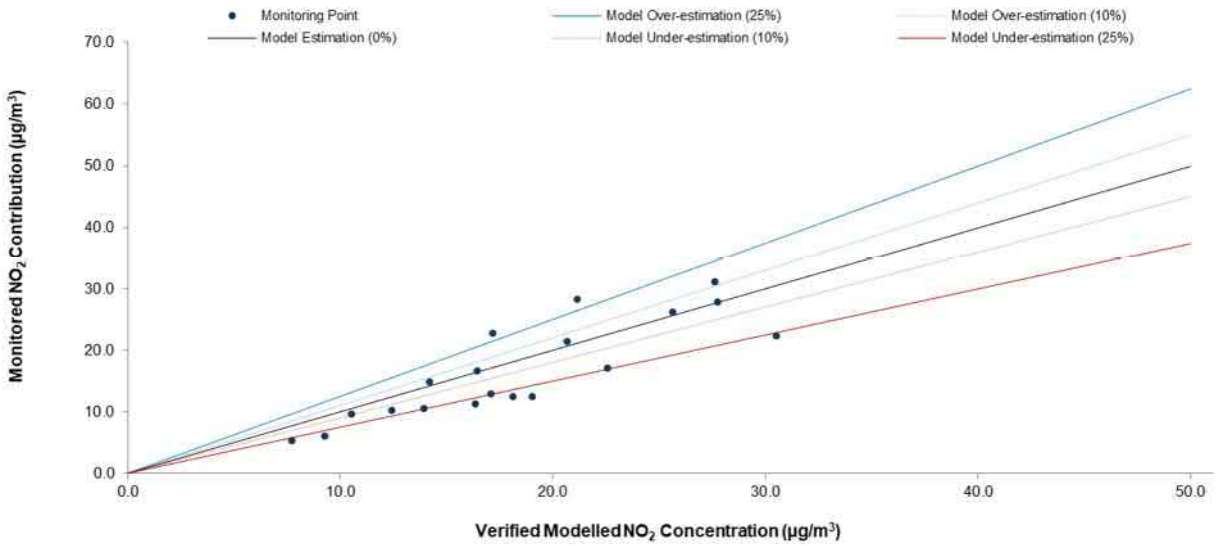


Figure B-5-3 below presents the comparison of monitored versus modelled NO_2 for each monitoring locations in the preliminary model adjustment procedure, with the adjustment factor of 4.03 applied to the modelled road-NO_x contributions.

Figure B-5-3 - NO_2 Verification Process - Preliminary Adjustment - Post Adjustment



Revised Model Adjustment

Table B-5-4 provides the relevant data required to generate the revised adjustment exercise, following removal of eight monitoring location(s) from the model verification procedure, due to their performance of remaining above ± 25% when processed.

Table B-5-4 – NO_2 Model Verification Procedure –Revised Adjustment

Model Verification Procedure	Project Specific NO_2 Monitoring Programme										
	M1	M2	M5	M6	M7	M8	M11	M12	M16	M17	M18
2019 Background NO_X	10.1	10.1	6.7	10.4	7.6	7.4	5.8	5.8	8.9	8.9	10.4
2019 Background NO_2	7.6	7.6	5.2	7.9	5.9	5.7	4.6	4.6	6.8	6.8	7.9
2019 Monitored Total NO_2 (From Diff.Tube Results)	27.7	20.7	25.6	10.5	27.6	14.2	12.4	17.1	13.9	22.6	16.4
2019 Monitored Road NO_2	20.1	13.0	20.5	2.7	21.8	8.5	7.9	12.5	7.1	15.8	8.6
Monitored Road NO_x (from NO_x to NO_2 Calculator for Diffusion tubes)	39.6	24.9	39.9	4.9	42.8	15.8	14.5	23.5	13.2	30.3	16.0
Modelled Road Cont. NO_x (from ADMS Roads)	9.9	6.5	10.2	0.8	12.5	4.2	2.6	3.8	1.7	4.8	4.1
Ratio of Monitored to Modelled Road Cont. NO_x	4.0	3.8	3.9	6.0	3.4	3.7	5.6	6.1	7.6	6.3	3.9
Adjustment Factor	**3.99 (3.9867)**										
Adjusted Road Cont. NO_x	39.3	26.1	6.7	15.2	40.8	3.2	50.0	16.9	32.6	4.0	10.4
Adjusted Modelled Total NO_x	49.4	36.2	16.8	20.5	47.4	13.6	57.6	24.2	40.0	8.8	16.2
Modelled Total NO_2 based on Empirical NO_x to NO_2 Relationship (from NO_x to NO_2 calc)	27.6	21.3	11.3	12.5	26.0	9.6	30.9	14.8	22.7	6.0	10.3
Monitored Total NO_2	27.7	20.7	25.6	10.5	27.6	14.2	12.4	17.1	13.9	22.6	16.4
% Difference ((Modelled - Monitored / Monitored) x 100)	**-0.5**	**2.8**	**-1.6**	**-8.5**	**11.7**	**4.0**	**-17.5**	**-24.7**	**-24.1**	**-24.8**	**0.6**

Data reported to 1 decimal place

Figure B-5-4 below presents the calculation to derive the road NO_x model adjustment factor for the revised model verification exercise. This factor was then reapplied to the modelled road-NO_x concentration for the remaining monitoring locations to provide adjusted modelled road-NO_x values in the revised model verification exercise.

Figure B-5-4 - NO_2 Verification Process - Revised Adjustment - Road-NO_x Model Adjustment

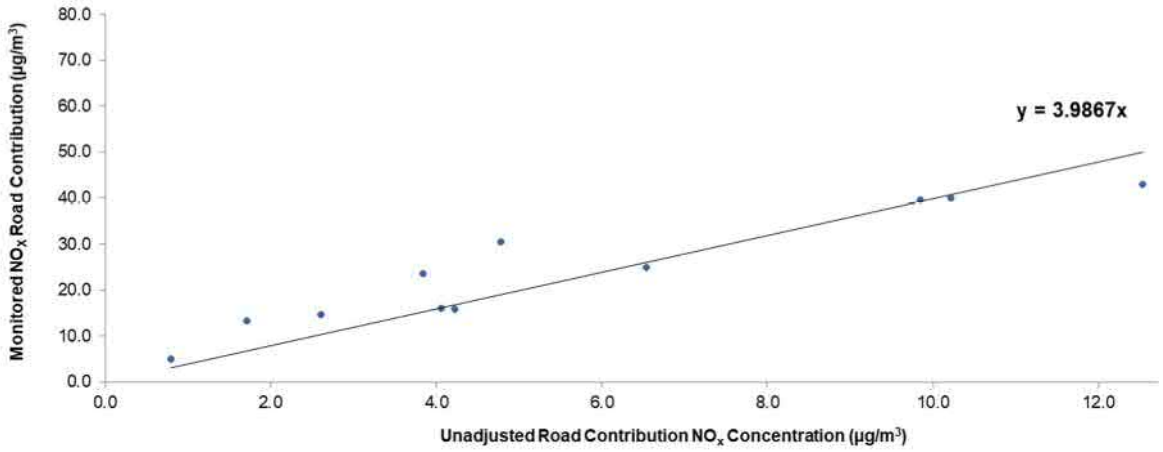
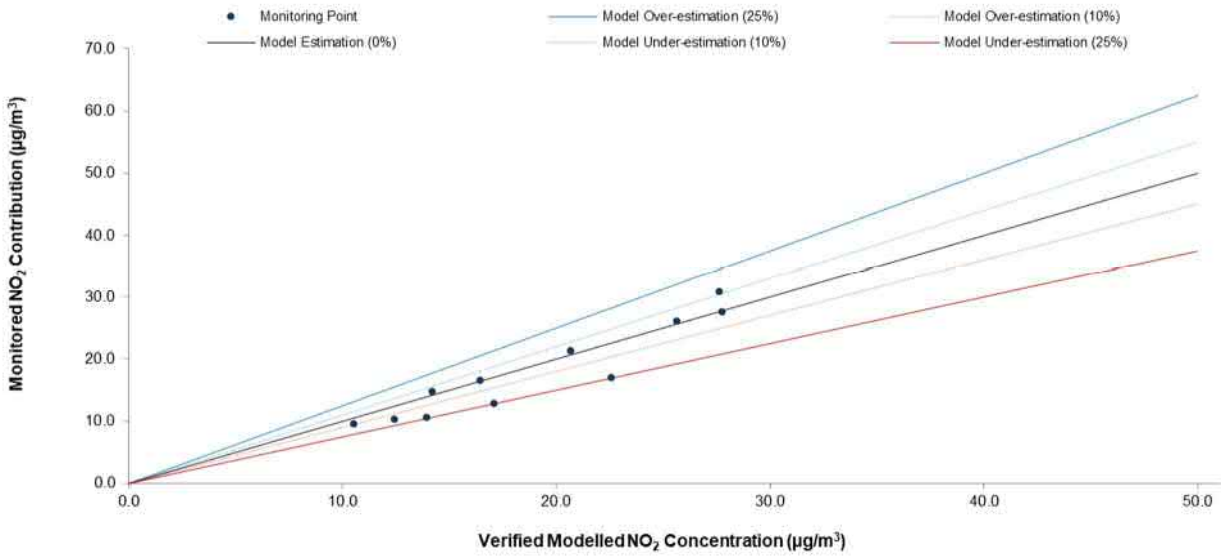


Figure B-5-5 below presents the comparison of monitored versus modelled NO_2 for each monitoring locations in the revised model verification procedure.

Figure B-5-5 - NO_2 Verification Process - Revised Adjustment - Post Adjustment



The remaining sites demonstrated broad agreement within ± 25% once the revised adjustment factor is applied with six of the monitoring locations maintaining an agreement to within ± 10%. As such, the air quality model, after appropriate verification can be considered to be ideally suitable.

Figure 6.2.10 (Appendix A Figure 6.2.10: Drawing Reference 718314-WSP-B-D-3000-0208) presents the spatial locations of the monitoring utilised in the model verification process.

Summary

The summary of model performance statistics, as outlined in LAQM.TG16[14] are provided in **Table B-5-5** below.

Table B-5-5 – Model Performance Statistics

Model Verification Step	No. of Sites	No. of Sites within +/- 25%	No. of Sites within +/- 10%	Root Mean Square Error (RMSE)		Fractional Bias (FB)	Correlation Co-efficient (CC)
				µg/m^3	% AQO		
No Adjustment	19	0	0	10.4	26.0	0.7 (0.70)	0.7 (0.73)
Preliminary Adjustment	19	11	6	4.2	10.5	0.1 (0.08)	0.9 (0.85)
Revised Adjustment	11	11	6	2.0	5.0	0.1 (0.06)	0.9 (0.95)

A comparison of the performance of the modelled total NO_2 concentrations against the monitoring data used in each model verification step has been carried out.

The RMSE value calculated when no adjustment to the modelled road-NO_x contribution was 10.4 µg/m^3, equating to 26.0% of the annual mean NO_2 objective. The FB value is calculated as 0.73 and the CC is calculated as 0.70. None of the considered monitoring locations are preforming at an adequate level (within +/- 25%) and therefore it was deemed acceptable to complete a model adjustment exercise.

When the preliminary adjustment was made to the road-NO_x contributions, the RMSE value calculated reduced to 4.2 µg/m^3, equating to 10.5% of the annual mean NO_2 objective. The FB value is calculated as 0.08 and the CC is calculated as 0.85.

On interpretation of these statistics, eight of the considered monitoring locations contained within the preliminary adjustment exercise would be judged to not be performing within a suitable range of agreement (within +/- 25%).

With inclusion of the respective monitoring sites, the RMSE equates to 0.5% of the ideal value of 4 µg/m^3. The FB indicates that, at 0.08, the model is under-predicting in its output.

Once those relevant monitoring locations were removed and the revised modelled road-NO_x adjustment factor derived, the RMSE value calculated reduces to 2.0 µg/m^3, which is 5.0% of the annual mean air quality objective. The FB value is calculated as 0.06 and the CC is calculated as 0.95.

The RMSE sits within the ideal value of 4.0 µg/m^3 or within 10% of the annual mean NO_2 objective, representing an improvement in model performance and demonstrating a near-ideal value for FB (i.e. no tendency for the model to over or under predict) and an improvement for CC (model predictions exhibiting more of an absolute relationship).

Consequently, a road-NO_x verification factor of 3.99 (3.9867) has been applied in order to adjust the modelled concentrations for each scenario included in the road vehicle exhaust emissions assessment.

PM_{10} and $PM_{2.5}$ Adjustment

There were no identified PM_{10} or $PM_{2.5}$ monitoring locations situated adjacent to the modelled road network.

As such, the verification factor determined above for adjusting the road-NO_X contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with the guidance set out in LAQM.TG16[14] which states:

"In the absence of any PM_{10} data for verification, it may be appropriate to apply the road-NO_x adjustment to the modelled road-PM_{10}. If this identifies exceedances of the objective, then it would be appropriate to monitor PM_{10} to confirm the findings."

Modelling Uncertainty

Further modelling uncertainty could be reduced with the refinement of the dispersion model, in particular in areas where traffic may experience reduced speeds on the approach to all junctions contained within the dispersion model, which may improve the overall model performance.

The overall modelling assessment has been carried out with using AADT traffic flow and associated speed and composition data. To reduce further uncertainty, time period modelling may have been carried out which may have highlight periods of congestion.

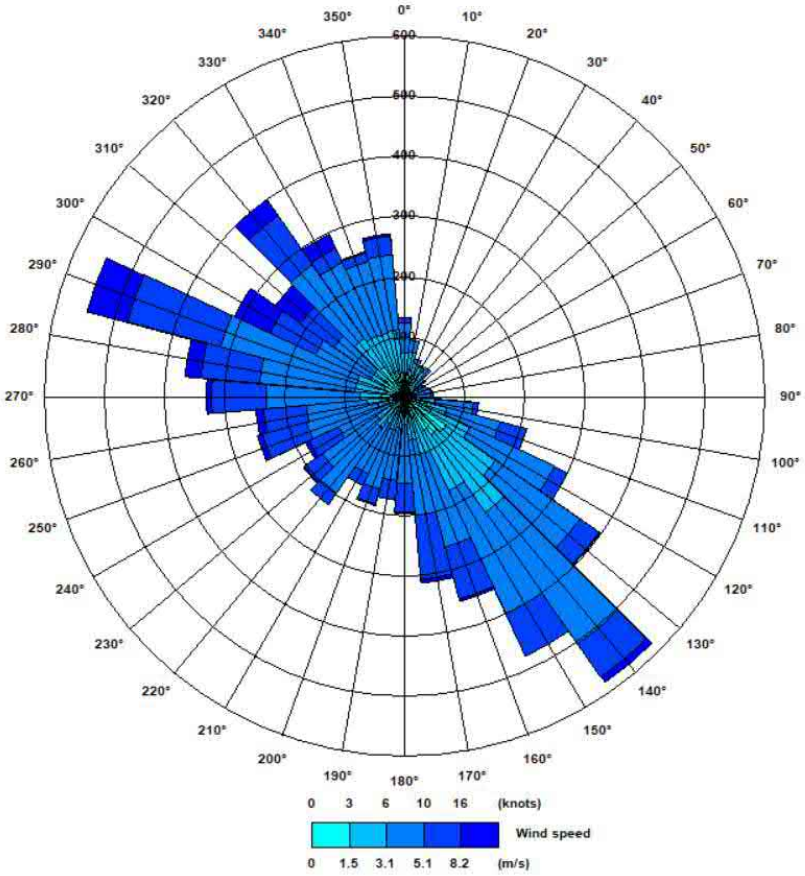
The monitoring data acquired for the model verification exercise is predominately focused within the Cookstown area.

Given the size of the study area included within the air quality model, the spread of available monitoring data applicable to the local air quality assessment study area, uncertainty associated with the traffic model, and assumptions inherent to the air quality model (e.g. meteorological data representative at all monitoring sites, surface roughness and minimum measure of atmospheric stability consistent throughout modelled domain), the adjusted model is considered to be performing adequately within the context of the input parameters.

However, the results of the local air quality assessment do need to be viewed within the limitations of the model uncertainty.

WIND ROSE

Lough Fea Meteorological Site (supplemented Cloud Cover by Aldergrove) – 2019



APPENDIX B-6:
AIR QUALITY: BACKGROUND POLLUTANT INFORMATION

B-6 BACKGROUND POLLUTANT INFORMATION

Background pollutant concentrations used in the assessment have been taken from the national maps provided on the DEFRA website[23], where background concentrations of those pollutants included within the AQS[4] have been mapped at a grid resolution of 1 km x 1 km for the whole of the UK. Estimated concentrations are available for all years between 2017 and 2030.

Table B-6-1 presents the total background pollutant concentrations of NO_X, NO_2, PM_{10} and $PM_{2.5}$ for 2019 and 2025, that encompass the local air quality assessment study area and the surrounding locality.

Table B-6-1 Background Pollutant Annual Mean Concentration (µg/m^3) – 2019 & 2025

Grid Square		2019				2025			
BNG	*OSNI*	NO_x	NO_2	PM_{10}	$PM_{2.5}$	NO_x	NO_2	PM_{10}	$PM_{2.5}$
93500 540500	280369 380486	4.5	3.6	8.1	4.8	3.7	2.9	7.7	4.4
94500 540500	281364 380571	4.8	3.8	8.7	5.0	4.0	3.2	8.3	4.6
95500 540500	282360 380657	5.9	4.6	8.3	4.9	4.9	3.8	7.8	4.5
92500 539500	279458 379405	4.5	3.6	8.3	4.8	3.7	2.9	7.8	4.4
93500 539500	280454 379490	6.0	4.7	9.1	5.3	5.0	3.9	8.6	4.9
94500 539500	281450 379576	6.4	5.0	8.8	5.3	5.2	4.1	8.3	4.9
95500 539500	282445 379661	6.8	5.3	9.1	5.3	5.5	4.4	8.6	4.9
96500 539500	283441 379746	6.0	4.7	8.1	4.9	5.0	4.0	7.6	4.5
91500 538500	278548 378324	4.4	3.5	8.2	4.8	3.6	2.9	7.8	4.4
92500 538500	279544 378409	5.0	4.0	8.5	5.0	4.1	3.2	8.0	4.6
93500 538500	280539 378495	7.7	6.0	10.1	6.1	6.2	4.9	9.6	5.6
94500 538500	281535 378580	9.6	7.3	9.5	5.9	8.0	6.2	9.0	5.4
95500 538500	282531 378665	6.8	5.3	8.7	5.2	5.7	4.4	8.2	4.8
96500 538500	283526 378750	5.8	4.5	8.0	4.9	4.8	3.8	7.6	4.5
91500 537500	278633 377328	4.8	3.8	7.9	4.7	3.9	3.1	7.5	4.4
92500 537500	279629 377414	5.4	4.2	8.0	4.9	4.4	3.5	7.6	4.5
93500 537500	280625 377499	8.1	6.2	9.4	6.0	6.7	5.2	8.9	5.5
94500 537500	281620 377584	11.2	8.4	9.7	6.1	9.6	7.3	9.2	5.6
95500 537500	282616 377669	6.6	5.2	8.4	5.1	5.6	4.4	8.0	4.7
96500 537500	283612 377755	5.3	4.2	7.8	4.8	4.5	3.5	7.3	4.4
91500 536500	278719 376333	4.9	3.9	7.6	4.7	4.0	3.2	7.2	4.3
92500 536500	279714 376418	6.2	4.9	8.6	5.1	5.2	4.1	8.1	4.8
93500 536500	280710 376503	10.6	8.0	11.1	7.1	9.4	7.1	10.7	6.7
94500 536500	281706 376588	7.4	5.7	9.7	5.6	6.2	4.8	9.2	5.2
95500 536500	282701 376674	5.7	4.5	8.1	4.9	4.8	3.8	7.6	4.5
96500 536500	283697 376759	5.1	4.0	8.1	4.8	4.3	3.4	7.6	4.5
92500 535500	279800 375422	4.9	3.9	9.0	5.1	4.1	3.2	8.6	4.7
93500 535500	280795 375508	6.0	4.7	9.0	5.2	5.0	3.9	8.6	4.8
94500 535500	281791 375593	5.7	4.5	8.8	5.1	4.7	3.7	8.3	4.7

Grid Square		2019				2025			
BNG	*OSNI*	NO_x	NO_2	PM_{10}	$PM_{2.5}$	NO_x	NO_2	PM_{10}	$PM_{2.5}$
95500 535500	282787 375678	5.2	4.1	8.5	4.9	4.3	3.4	8.0	4.5
92500 534500	279885 374427	4.6	3.7	8.2	4.8	3.8	3.0	7.8	4.4
93500 534500	280880 374512	5.4	4.3	9.3	5.2	4.4	3.5	8.9	4.8
94500 534500	281876 374597	5.3	4.2	8.3	4.9	4.3	3.4	7.8	4.5
93500 533500	280966 373516	5.0	3.9	7.7	4.7	4.1	3.2	7.3	4.3

APPENDIX B-7:
AIR QUALITY: COMPLIANCE RISK ASSESSMENT

B-7 COMPLIANCE RISK ASSESSMENT

Table B-7-1 – DEFRA PCM Model Results for Annual Mean Roadside NO_2 Concentrations (2018-2025)

Road	Census Point ID	Annual Mean Roadside NO_2 Concentration (µg/m^3)							
		2018	2019	2020	2021	2022	2023	2024	2025
A29	**902630**	18.6	17.7	16.7	15.8	15.0	14.2	13.5	12.8
A505	**902664**	9.6	9.0	8.3	7.8	7.2	6.8	6.4	6.0
EU Limit Value		**40 µg/m^3**							

Table B-7-2 – Compliance Risk Assessment – Red Route - Summary of Results (2025)

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691780	27.6	21.2	-6.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691851	23.1	17.8	-5.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694226	33.0	21.4	-11.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694460	28.4	19.2	-9.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694479	27.3	18.8	-8.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694510	29.2	19.8	-9.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694524	43.6	22.7	-20.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187124993	39.8	21.3	-18.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692951	49.7	24.1	-25.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692823	39.2	20.8	-18.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692965	37.1	23.2	-13.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692832	31.0	20.4	-10.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692935	35.7	22.6	-13.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692846	31.3	20.6	-10.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693408	27.7	18.3	-9.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693396	30.5	19.3	-11.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693429	28.2	16.1	-12.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693432	23.2	14.5	-8.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187295412	34.8	19.9	-15.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691792	27.0	20.7	-6.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691898	26.6	20.2	-6.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691911	29.3	21.4	-8.0

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691903	23.8	17.5	-6.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185771876	26.4	20.0	-6.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692048	24.1	18.6	-5.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691935	19.5	14.6	-4.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691949	23.3	16.7	-6.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691947	19.8	14.6	-5.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692342	16.6	13.0	-3.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693203	22.5	19.8	-2.7
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693199	18.8	18.1	-0.7
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693194	16.5	15.7	-0.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693301	17.1	15.7	-1.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693306	19.6	18.4	-1.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693312	20.2	18.4	-1.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693305	19.6	17.5	-2.2
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694719	31.9	25.0	-6.8
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694696	29.4	23.3	-6.1
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696283	20.2	20.7	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696288	20.1	20.6	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696269	23.2	23.7	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696276	23.6	24.0	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696306	23.0	23.6	0.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696294	20.4	21.2	0.8

Results rounded to 1 decimal place

Table B-7-3 – Compliance Risk Assessment – Purple A Route - Summary of Results (2025)

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691780	27.6	20.4	-7.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691851	23.1	17.1	-6.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694226	33.0	22.8	-10.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694460	28.4	20.2	-8.1

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694479	27.3	19.7	-7.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694510	29.2	20.8	-8.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694524	43.6	25.0	-18.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187124993	39.8	23.3	-16.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692951	49.7	25.0	-24.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692823	39.2	21.4	-17.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692965	37.1	23.8	-13.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692832	31.0	20.8	-10.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692935	35.7	23.2	-12.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692846	31.3	21.1	-10.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693408	27.7	19.3	-8.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693396	30.5	20.6	-9.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693429	28.2	17.6	-10.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693432	23.2	15.6	-7.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187295412	34.8	21.8	-13.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691792	27.0	20.4	-6.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691898	26.6	20.0	-6.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691911	29.3	21.2	-8.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691903	23.8	17.4	-6.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185771876	26.4	19.8	-6.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692048	24.1	18.4	-5.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691935	19.5	14.3	-5.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691949	23.3	16.3	-7.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691947	19.8	14.3	-5.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692342	16.6	12.7	-3.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693203	22.5	19.7	-2.8
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693199	18.8	17.9	-1.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693194	16.5	15.5	-1.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693301	17.1	15.6	-1.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693306	19.6	18.1	-1.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693312	20.2	18.0	-2.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693305	19.6	17.2	-2.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694719	31.9	25.1	-6.7

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694696	29.4	23.4	-6.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696283	20.2	20.6	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696288	20.1	20.5	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696269	23.2	23.7	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696276	23.6	24.0	0.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696306	23.0	23.5	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696294	20.4	21.1	0.7

Results rounded to 1 decimal place

Table B-7-4 – Compliance Risk Assessment – Purple B Route - Summary of Results (2025)

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691780	27.6	21.9	-5.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691851	23.1	18.3	-4.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694226	33.0	23.3	-9.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694460	28.4	20.6	-7.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694479	27.3	20.1	-7.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694510	29.2	21.3	-7.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694524	43.6	25.7	-17.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187124993	39.8	23.9	-15.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692951	49.7	25.7	-24.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692823	39.2	21.9	-17.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692965	37.1	24.4	-12.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692832	31.0	21.2	-9.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692935	35.7	23.7	-11.9
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692846	31.3	21.5	-9.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693408	27.7	19.7	-8.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693396	30.5	21.0	-9.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693429	28.2	18.1	-10.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693432	23.2	15.9	-7.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187295412	34.8	22.5	-12.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691792	27.0	21.8	-5.3

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691898	26.6	21.2	-5.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691911	29.3	22.1	-7.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691903	23.8	18.3	-5.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185771876	26.4	18.7	-7.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692048	24.1	16.9	-7.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691935	19.5	12.7	-6.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691949	23.3	14.3	-9.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691947	19.8	12.7	-7.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692342	16.6	11.4	-5.2
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693203	22.5	19.9	-2.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693199	18.8	18.0	-0.8
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693194	16.5	15.7	-0.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693301	17.1	15.7	-1.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693306	19.6	18.3	-1.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693312	20.2	18.1	-2.1
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693305	19.6	17.4	-2.2
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694719	31.9	25.3	-6.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694696	29.4	23.5	-5.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696283	20.2	20.6	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696288	20.1	20.5	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696269	23.2	23.6	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696276	23.6	24.0	0.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696306	23.0	23.6	0.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696294	20.4	21.1	0.7

Results rounded to 1 decimal place

Table B-7-5 – Compliance Risk Assessment – Green Route - Summary of Results (2025)

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691780	27.6	20.3	-7.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691851	23.1	17.0	-6.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694226	33.0	23.0	-10.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694460	28.4	20.4	-8.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694479	27.3	19.8	-7.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694510	29.2	20.9	-8.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185694524	43.6	25.1	-18.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187124993	39.8	23.4	-16.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692951	49.7	25.2	-24.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692823	39.2	21.6	-17.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692965	37.1	23.9	-13.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692832	31.0	20.9	-10.0
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692935	35.7	23.4	-12.3
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692846	31.3	21.2	-10.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693408	27.7	19.5	-8.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693396	30.5	20.8	-9.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693429	28.2	17.8	-10.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185693432	23.2	15.7	-7.5
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 187295412	34.8	22.0	-12.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691792	27.0	20.4	-6.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691898	26.6	20.0	-6.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691911	29.3	21.1	-8.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691903	23.8	17.3	-6.4
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185771876	26.4	19.7	-6.7
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692048	24.1	18.3	-5.8
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691935	19.5	14.3	-5.2
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691949	23.3	16.3	-7.1
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185691947	19.8	14.3	-5.6
A29 / 902630	UK0043 – NI / Non-Agglo	Yes	12.8	22.0	<2020	C 185692342	16.6	12.7	-3.9
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693203	22.5	19.7	-2.8
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693199	18.8	17.8	-1.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693194	16.5	15.5	-1.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693301	17.1	15.5	-1.6

Compliance Info						Local Assessment (4m Validation Point)			
DEFRA Link Census ID	Zone / Agglomeration	Compliant Zone?	2025 PCM - Total NO_2	Max Modelled Conc in Zone (2025)	Projected Compliance Year	Receptor ID	Annual Mean DM NO_2	Annual Mean DS NO_2	Change in NO_2 with Scheme
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693306	19.6	18.1	-1.6
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693312	20.2	17.9	-2.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185693305	19.6	17.2	-2.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694719	31.9	25.2	-6.7
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185694696	29.4	23.4	-6.0
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696283	20.2	20.6	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696288	20.1	20.5	0.4
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696269	23.2	23.7	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696276	23.6	24.0	0.3
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696306	23.0	23.5	0.5
A505 / 902664	UK0043 – NI / Non-Agglo	Yes	6.0	22.0	<2020	C 185696294	20.4	21.1	0.7

Results rounded to 1 decimal place

APPENDIX B-8:
AIR QUALITY: DESIGNATED SITES ASSESSMENT

B-8 DESIGNATED SITES ASSESSMENT

NO_X CONCENTRATIONS AT UPPER BALLINDERRY RIVER ASSI / SAC

Table B-8-1 – Annual NO_x Concentrations – Red Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR0m	280473	376883	0 m	**89.0**	**55.6**	**41.1**	-14.5
UBR10m	280464	376887	10 m	**51.5**	**34.6**	27.5	-7.1
UBR20m	280455	376890	20 m	**39.7**	28.0	23.3	-4.7
UBR30m	280445	376894	30 m	**33.7**	24.6	21.1	-3.5
UBR40m	280436	376897	40 m	**30.1**	22.5	19.8	-2.7
UBR50m	280427	376901	50 m	27.8	21.2	18.9	-2.3
UBR60m	280417	376905	60 m	26.1	20.2	18.3	-1.9
UBR70m	280408	376908	70 m	24.8	19.5	17.9	-1.6
UBR80m	280399	376912	80 m	23.8	18.9	17.5	-1.4
UBR90m	280389	376915	90 m	23.0	18.5	17.3	-1.2
UBR100m	280380	376919	100 m	22.4	18.1	17.0	-1.1
UBR110m	280371	376923	110 m	21.9	17.8	16.9	-0.9
UBR120m	280361	376926	120 m	21.4	17.6	16.7	-0.9
UBR130m	280352	376930	130 m	21.0	17.4	16.6	-0.8
UBR140m	280343	376933	140 m	20.7	17.2	16.5	-0.7
UBR150m	280333	376937	150 m	20.4	17.0	16.4	-0.6
UBR160m	280324	376941	160 m	20.2	16.9	16.3	-0.6
UBR170m	280315	376944	170 m	20.0	16.7	16.2	-0.5
UBR180m	280305	376948	180 m	19.8	16.6	16.1	-0.5
UBR190m	280296	376952	190 m	19.6	16.5	16.1	-0.4
UBR200m	280287	376955	200 m	19.4	16.4	16.0	-0.4

* Exceedances of the critical level of 30 µg/m^3 are in **bold.** Results rounded to 1dp

Table B-8-2 – Annual NO_x Concentrations – Purple A Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR0m	280473	376883	0 m	89.0	55.6	41.4	-14.2
UBR10m	280464	376887	10 m	51.5	34.6	27.7	-6.9
UBR20m	280455	376890	20 m	39.7	28.0	23.4	-4.6
UBR30m	280445	376894	30 m	33.7	24.6	21.2	-3.4
UBR40m	280436	376897	40 m	30.1	22.5	19.8	-2.7
UBR50m	280427	376901	50 m	27.8	21.2	19.0	-2.2
UBR60m	280417	376905	60 m	26.1	20.2	18.4	-1.8
UBR70m	280408	376908	70 m	24.8	19.5	17.9	-1.6
UBR80m	280399	376912	80 m	23.8	18.9	17.6	-1.3
UBR90m	280389	376915	90 m	23.0	18.5	17.3	-1.2
UBR100m	280380	376919	100 m	22.4	18.1	17.1	-1.0
UBR110m	280371	376923	110 m	21.9	17.8	16.9	-0.9
UBR120m	280361	376926	120 m	21.4	17.6	16.8	-0.8

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR130m	280352	376930	130 m	21.0	17.4	16.6	-0.8
UBR140m	280343	376933	140 m	20.7	17.2	16.5	-0.7
UBR150m	280333	376937	150 m	20.4	17.0	16.4	-0.6
UBR160m	280324	376941	160 m	20.2	16.9	16.3	-0.6
UBR170m	280315	376944	170 m	20.0	16.7	16.2	-0.5
UBR180m	280305	376948	180 m	19.8	16.6	16.1	-0.5
UBR190m	280296	376952	190 m	19.6	16.5	16.1	-0.4
UBR200m	280287	376955	200 m	19.4	16.4	16.0	-0.4

* Exceedances of the critical level of 30 µg/m^3 are in **bold.** Results rounded to 1dp

Table B-8-3 – Annual NO_x Concentrations – Purple B Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR0m	280473	376883	0 m	89.0	55.6	41.8	-13.8
UBR10m	280464	376887	10 m	51.5	34.6	27.9	-6.7
UBR20m	280455	376890	20 m	39.7	28.0	23.5	-4.5
UBR30m	280445	376894	30 m	33.7	24.6	21.3	-3.3
UBR40m	280436	376897	40 m	30.1	22.5	19.9	-2.6
UBR50m	280427	376901	50 m	27.8	21.2	19.0	-2.2
UBR60m	280417	376905	60 m	26.1	20.2	18.4	-1.8
UBR70m	280408	376908	70 m	24.8	19.5	18.0	-1.5
UBR80m	280399	376912	80 m	23.8	18.9	17.6	-1.3
UBR90m	280389	376915	90 m	23.0	18.5	17.3	-1.2
UBR100m	280380	376919	100 m	22.4	18.1	17.1	-1.0
UBR110m	280371	376923	110 m	21.9	17.8	16.9	-0.9
UBR120m	280361	376926	120 m	21.4	17.6	16.8	-0.8
UBR130m	280352	376930	130 m	21.0	17.4	16.7	-0.7
UBR140m	280343	376933	140 m	20.7	17.2	16.5	-0.7
UBR150m	280333	376937	150 m	20.4	17.0	16.4	-0.6
UBR160m	280324	376941	160 m	20.2	16.9	16.3	-0.6
UBR170m	280315	376944	170 m	20.0	16.7	16.2	-0.5
UBR180m	280305	376948	180 m	19.8	16.6	16.2	-0.4
UBR190m	280296	376952	190 m	19.6	16.5	16.1	-0.4
UBR200m	280287	376955	200 m	19.4	16.4	16.0	-0.4

* Exceedances of the critical level of 30 µg/m^3 are in **bold.** Results rounded to 1dp

Table B-8-4 – Annual NO_x Concentrations – Green Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR0m	280473	376883	0 m	89.0	55.6	41.6	-14.0
UBR10m	280464	376887	10 m	51.5	34.6	27.7	-6.9
UBR20m	280455	376890	20 m	39.7	28.0	23.4	-4.6
UBR30m	280445	376894	30 m	33.7	24.6	21.2	-3.4
UBR40m	280436	376897	40 m	30.1	22.5	19.9	-2.6

Receptor	OSNI Grid Reference		Distance from Edge	Total NO_x Concentrations (µg/m^3)			
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH
UBR50m	280427	376901	50 m	27.8	21.2	19.0	-2.2
UBR60m	280417	376905	60 m	26.1	20.2	18.4	-1.8
UBR70m	280408	376908	70 m	24.8	19.5	17.9	-1.6
UBR80m	280399	376912	80 m	23.8	18.9	17.6	-1.3
UBR90m	280389	376915	90 m	23.0	18.5	17.3	-1.2
UBR100m	280380	376919	100 m	22.4	18.1	17.1	-1.0
UBR110m	280371	376923	110 m	21.9	17.8	16.9	-0.9
UBR120m	280361	376926	120 m	21.4	17.6	16.8	-0.8
UBR130m	280352	376930	130 m	21.0	17.4	16.6	-0.8
UBR140m	280343	376933	140 m	20.7	17.2	16.5	-0.7
UBR150m	280333	376937	150 m	20.4	17.0	16.4	-0.6
UBR160m	280324	376941	160 m	20.2	16.9	16.3	-0.6
UBR170m	280315	376944	170 m	20.0	16.7	16.2	-0.5
UBR180m	280305	376948	180 m	19.8	16.6	16.2	-0.4
UBR190m	280296	376952	190 m	19.6	16.5	16.1	-0.4
UBR200m	280287	376955	200 m	19.4	16.4	16.0	-0.4

* Exceedances of the critical level of 30 µg/m^3 are in **bold.** Results rounded to 1dp

NITROGEN (N) DEPOSITION AT UPPER BALLINDERRY RIVER ASSI / SAC

Table B-8-5 – Annual N Deposition – Red Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total N Deposition Rate (kgN/ha/yr)				
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH	% CH of LCL*
UBR0m	280473	376883	0 m	23.4	19.1	17.1	-2.0	-40.0%
UBR10m	280464	376887	10 m	18.6	16.1	15.0	-1.1	-22.0%
UBR20m	280455	376890	20 m	16.9	15.1	14.4	-0.7	-14.0%
UBR30m	280445	376894	30 m	16.0	14.6	14.1	-0.5	-10.0%
UBR40m	280436	376897	40 m	15.5	14.3	13.8	-0.5	-10.0%
UBR50m	280427	376901	50 m	15.1	14.1	13.7	-0.4	-8.0%
UBR60m	280417	376905	60 m	14.9	13.9	13.6	-0.3	-6.0%
UBR70m	280408	376908	70 m	14.7	13.8	13.5	-0.3	-6.0%
UBR80m	280399	376912	80 m	14.5	13.7	13.5	-0.2	-4.0%
UBR90m	280389	376915	90 m	14.4	13.6	13.5	-0.1	-2.0%
UBR100m	280380	376919	100 m	14.3	13.6	13.4	-0.2	-4.0%
UBR110m	280371	376923	110 m	14.2	13.5	13.4	-0.1	-2.0%
UBR120m	280361	376926	120 m	14.1	13.5	13.4	-0.1	-2.0%
UBR130m	280352	376930	130 m	14.1	13.5	13.3	-0.2	-4.0%
UBR140m	280343	376933	140 m	14.0	13.4	13.3	-0.1	-2.0%
UBR150m	280333	376937	150 m	14.0	13.4	13.3	-0.1	-2.0%
UBR160m	280324	376941	160 m	13.9	13.4	13.3	-0.1	-2.0%
UBR170m	280315	376944	170 m	13.9	13.4	13.3	-0.1	-2.0%
UBR180m	280305	376948	180 m	13.9	13.4	13.3	-0.1	-2.0%
UBR190m	280296	376952	190 m	13.8	13.3	13.3	0.0	0.0%
UBR200m	280287	376955	200 m	13.8	13.3	13.2	-0.1	-2.0%

* Indicative critical load range of 5 to 10 kgN/ha/yr applied. Results rounded to 1dp

Table B-8-6 – Annual N Deposition – Purple A Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total N Deposition Rate (kgN/ha/yr)				
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH	% CH of LCL*
UBR0m	280473	376883	0 m	23.4	19.1	17.1	-2.0	-40.0%
UBR10m	280464	376887	10 m	18.6	16.1	15.1	-1.0	-20.0%
UBR20m	280455	376890	20 m	16.9	15.1	14.4	-0.7	-14.0%
UBR30m	280445	376894	30 m	16.0	14.6	14.1	-0.5	-10.0%
UBR40m	280436	376897	40 m	15.5	14.3	13.9	-0.4	-8.0%
UBR50m	280427	376901	50 m	15.1	14.1	13.7	-0.4	-8.0%
UBR60m	280417	376905	60 m	14.9	13.9	13.6	-0.3	-6.0%
UBR70m	280408	376908	70 m	14.7	13.8	13.6	-0.2	-4.0%
UBR80m	280399	376912	80 m	14.5	13.7	13.5	-0.2	-4.0%
UBR90m	280389	376915	90 m	14.4	13.6	13.5	-0.1	-2.0%
UBR100m	280380	376919	100 m	14.3	13.6	13.4	-0.2	-4.0%
UBR110m	280371	376923	110 m	14.2	13.5	13.4	-0.1	-2.0%
UBR120m	280361	376926	120 m	14.1	13.5	13.4	-0.1	-2.0%
UBR130m	280352	376930	130 m	14.1	13.5	13.4	-0.1	-2.0%
UBR140m	280343	376933	140 m	14.0	13.4	13.3	-0.1	-2.0%
UBR150m	280333	376937	150 m	14.0	13.4	13.3	-0.1	-2.0%
UBR160m	280324	376941	160 m	13.9	13.4	13.3	-0.1	-2.0%
UBR170m	280315	376944	170 m	13.9	13.4	13.3	-0.1	-2.0%
UBR180m	280305	376948	180 m	13.9	13.4	13.3	-0.1	-2.0%
UBR190m	280296	376952	190 m	13.8	13.3	13.3	0.0	0.0%
UBR200m	280287	376955	200 m	13.8	13.3	13.3	0.0	0.0%

* Indicative critical load range of 5 to 10 kgN/ha/yr applied. Results rounded to 1dp

Table B-8-7 – Annual N Deposition – Purple B Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total N Deposition Rate (kgN/ha/yr)				
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH	% CH of LCL*
UBR0m	280473	376883	0 m	23.4	19.1	17.2	-1.9	-38.0%
UBR10m	280464	376887	10 m	18.6	16.1	15.1	-1.0	-20.0%
UBR20m	280455	376890	20 m	16.9	15.1	14.4	-0.7	-14.0%
UBR30m	280445	376894	30 m	16.0	14.6	14.1	-0.5	-10.0%
UBR40m	280436	376897	40 m	15.5	14.3	13.9	-0.4	-8.0%
UBR50m	280427	376901	50 m	15.1	14.1	13.7	-0.4	-8.0%
UBR60m	280417	376905	60 m	14.9	13.9	13.6	-0.3	-6.0%
UBR70m	280408	376908	70 m	14.7	13.8	13.6	-0.2	-4.0%
UBR80m	280399	376912	80 m	14.5	13.7	13.5	-0.2	-4.0%
UBR90m	280389	376915	90 m	14.4	13.6	13.5	-0.1	-2.0%
UBR100m	280380	376919	100 m	14.3	13.6	13.4	-0.2	-4.0%
UBR110m	280371	376923	110 m	14.2	13.5	13.4	-0.1	-2.0%
UBR120m	280361	376926	120 m	14.1	13.5	13.4	-0.1	-2.0%
UBR130m	280352	376930	130 m	14.1	13.5	13.4	-0.1	-2.0%
UBR140m	280343	376933	140 m	14.0	13.4	13.3	-0.1	-2.0%

Receptor	OSNI Grid Reference		Distance from Edge	Total N Deposition Rate (kgN/ha/yr)				
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH	% CH of LCL*
UBR150m	280333	376937	150 m	14.0	13.4	13.3	-0.1	-2.0%
UBR160m	280324	376941	160 m	13.9	13.4	13.3	-0.1	-2.0%
UBR170m	280315	376944	170 m	13.9	13.4	13.3	-0.1	-2.0%
UBR180m	280305	376948	180 m	13.9	13.4	13.3	-0.1	-2.0%
UBR190m	280296	376952	190 m	13.8	13.3	13.3	0.0	0.0%
UBR200m	280287	376955	200 m	13.8	13.3	13.3	0.0	0.0%

* Indicative critical load range of 5 to 10 kgN/ha/yr applied. Results rounded to 1dp

Table B-8-8 – Annual N Deposition – Green Route – Upper Ballinderry River ASSI / SAC

Receptor	OSNI Grid Reference		Distance from Edge	Total N Deposition Rate (kgN/ha/yr)				
	X	Y		2019 BY	2025 DM	2025 DS	2025 CH	% CH of LCL*
UBR0m	280473	376883	0 m	23.4	19.1	17.1	-2.0	-40.0%
UBR10m	280464	376887	10 m	18.6	16.1	15.1	-1.0	-20.0%
UBR20m	280455	376890	20 m	16.9	15.1	14.4	-0.7	-14.0%
UBR30m	280445	376894	30 m	16.0	14.6	14.1	-0.5	-10.0%
UBR40m	280436	376897	40 m	15.5	14.3	13.9	-0.4	-8.0%
UBR50m	280427	376901	50 m	15.1	14.1	13.7	-0.4	-8.0%
UBR60m	280417	376905	60 m	14.9	13.9	13.6	-0.3	-6.0%
UBR70m	280408	376908	70 m	14.7	13.8	13.6	-0.2	-4.0%
UBR80m	280399	376912	80 m	14.5	13.7	13.5	-0.2	-4.0%
UBR90m	280389	376915	90 m	14.4	13.6	13.5	-0.1	-2.0%
UBR100m	280380	376919	100 m	14.3	13.6	13.4	-0.2	-4.0%
UBR110m	280371	376923	110 m	14.2	13.5	13.4	-0.1	-2.0%
UBR120m	280361	376926	120 m	14.1	13.5	13.4	-0.1	-2.0%
UBR130m	280352	376930	130 m	14.1	13.5	13.4	-0.1	-2.0%
UBR140m	280343	376933	140 m	14.0	13.4	13.3	-0.1	-2.0%
UBR150m	280333	376937	150 m	14.0	13.4	13.3	-0.1	-2.0%
UBR160m	280324	376941	160 m	13.9	13.4	13.3	-0.1	-2.0%
UBR170m	280315	376944	170 m	13.9	13.4	13.3	-0.1	-2.0%
UBR180m	280305	376948	180 m	13.9	13.4	13.3	-0.1	-2.0%
UBR190m	280296	376952	190 m	13.8	13.3	13.3	0.0	0.0%
UBR200m	280287	376955	200 m	13.8	13.3	13.3	0.0	0.0%

* Indicative critical load range of 5 to 10 kgN/ha/yr applied. Results rounded to 1dp

APPENDIX B-9:
CULTURAL HERITAGE: GAZETTEER

Department for Infrastructure

A29 COOKSTOWN BYPASS

Cultural Heritage Gazetteer

January 2020
62244120

Internal

Department for Infrastructure

A29 COOKSTOWN BYPASS

Cultural Heritage Gazetteer

Type of document (Version) Internal

PROJECT NO.62244120

January 202020

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ARCHAEOLOGY AND BUILT HERITAGE GAZETTEER

Reference numbers relate to the following sources:

- HB = Historic Building
- HGI = Heritage Gardens Inventory for Historic Parks, Gardens and Demesnes
- NISMR = Northern Ireland Sites and Monuments Record including Scheduled Monuments
- IHR = Industrial Heritage Records
- DIER = Database of Irish Excavation Reports
- AAP = Area of Archaeological Potential

Where N/A is used the site is not currently listed within any of the databases currently used for the recording of archaeological and heritage assets within Northern Ireland.

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
1	HGI T-026	281220, 375463	Historic Parks, Gardens and Demesnes	Historic Parks, Gardens and Demesnes	Loughry	The asset consists of the Historic Park, Garden and Demesnes at Loughry, which forms part of the 17th century estate. The site now accommodates the present house, which was constructed around 1800 and is set within a mature parkland of trees and clumps, woodland walks located by the Killymoon River, trees rings and is the current landscaping and planting for the local college. The site also contains the remains of the estates ice house, swift's summer house, a gate lodge, a rath, a megalithic tomb, an enclosure, and a cist burial.	Post-Medieval	High
2	N/A	281932, 375574	Area of Significant Archaeological Interest	Area of Significant Archaeological Interest	Tullyhogue	The asset consists of an area highlighted within the Draft Mid Ulster Council Local Development Plan as containing a number of archaeological sites of significance. These include the Scheduled Monuments of Loughry bronze Age Settlement (TYR038:047), Giants Grave (TYR038:020), Loughry Rath (TYR038:013), Tullghoge Fort and Inauguration Site (TYR038:016), and two sets of standing stones at the Grange (TYR039:020, and TYR039:021). The area is located between the Loughry and Killymoon Historic Parks, Gardens and Demesnes to the south of Cookstown.	Prehistoric / Medieval	High
3	HB 09/05/028	281203, 375633	House	Grade B2 Historic Building	27 Ardcumber Road	The asset consists of a B2 Listed Building comprising a house constructed around 1830. The house is a two-storey, pitched house, with a flat-roofed entrance porch located along the frontal elevation. The building is accompanied with a pitched single storey addition along its southern extent which is protected by a corrugated metal roof. There is a further two-storey outbuilding located at the rear which is accompanied with two single-storey pitched roof outbuildings to the southwest. A single-storey pitched garage is located along the southern extent of the property. It is likely that this house was originally a single-storey structure, and, like many vernacular houses within this area, it is likely that the building assumed its present form in the later 1800s or early 1900s. The style of the window frames could suggest that any change took place at an earlier, rather than a later date- perhaps the 1860s.	Post-Medieval	High

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Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
4	N/A	280762, 375770	Farmstead	Map Regression	Strifehill	The asset consists of Striffehill Farmstead, first depicted on the Ordnance Survey map of 1833 comprising two small rectangular structures located on either side Striffehill Road. On the Ordnance Survey map of 1906 the farmstead comprises four small rectangular structures set within a triangular enclosure on the south-western extent of Strifehill Road, with the structure that was located on the north-eastern section no longer present. The farmstead now contains numerous modern buildings but some of the original buildings may still exist.	Post-Medieval	Low
5	N/A	280148, 375831	Village and House	Map Regression	Ballyreagh House and Village	The asset consists of Ballyreagh Village, located to the south of the Coolkeeghan Junction, first depicted on the Ordnance Survey map of 1833. The village comprises sixteen rectangular structures of various sizes, with a well located in the northern extent of the village. There is some scaling down of the village, but there is also evidence of enlargement of the larger rectangular structures on the Ordnance Survey map of 1906. This map also annotated the main structure as 'Ballyreagh Ho.'. The Ordnance Survey map of 1935 shows further additions to the village, with 20 buildings in the area. Several of the main buildings that formed Ballyreagh House still exist but much of the village has now been demolished and replaced with the construction of Kilcrongh Business Park.	Post-Medieval	Low
6	N/A	281347, 375987	Farmstead	Map Regression	Ardcumber Junction	The asset consists of a large farmstead depicted on the Ordnance Survey map of 1833 comprising one rectangular range accompanied with two smaller square buildings set within a rectangular enclosure. A third set of structures set within the centre of the junction are later depicted on the Ordnance Survey map of 1906, that are later annotated as 'Rinnvilla'. None of these buildings exist today with the area now occupied by modern housing.	Post-Medieval	Negligible
7	N/A	280598, 376056	Farmsteads	Map Regression	Coolkeeghan South-West	The asset consists of two small farmsteads depicted in close proximity to each other on the Ordnance Survey map of 1833-34 comprising small rectangular structures set along Strifehill Road. On the Ordnance Survey map of 1906, the north-eastern building is no longer depicted but the rectangular structure to the south-west remains the same. The Ordnance Survey map of 1935 depicts the structure as unroofed and is no longer extant today with the area now occupied by modern housing and an industrial estate.	Post-Medieval	Negligible
8	DIER 2006:1940; AE/05/117	279812, 376061	Postholes and pits	Event	Kilcronagh Business Park	The asset consists of a series of pits discovered during evaluations and excavations at the Kilcronagh Business Park development. The pits range in date from the Prehistoric to the Medieval periods. The Prehistoric features consisted of four pits, with one containing a large number of worked flint, and one other containing Bronze Age pottery. The Medieval activity related to an area of post holes and pits associated with a large elongated pit containing souterrain ware that dates to the 10th century. There were also spreads containing slag that may be of an Early Medieval date.	Prehistoric / Medieval	Negligible
9	N/A	280863, 376076	Farmstead	Map Regression	Coolkeeghan South B	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure set within a triangular enclosure. On the Ordnance Survey map of 1906, the farmstead comprises one rectangular range and a large L-shaped structure set within a triangular enclosure. These later structures still possibly exist as modern farm buildings.	Post-Medieval	Low
10	N/A	281161, 376078	Farmstead	Map Regression	Coolkeeghan South-East	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure set within a rectangular enclosure. The farmstead is then shown consisting of two rectangular structures set within a rectangular enclosure on the Ordnance Survey map of 1906. This additional structure is then shown as unroofed on the Ordnance Survey map of 1935. The farmstead no longer exists and has been replaced by a modern house.	Post-Medieval	Negligible
11	N/A	281021, 376078	Farmstead	Map Regression	Coolkeeghan South A	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure set within a triangular enclosure. The structure is no longer depicted on the Ordnance Survey map of 1906 with a possible replacement to the west.	Post-Medieval	Negligible
12	N/A	281280, 376081	Fort and Hall	Map Regression	Fort and Killymoon Orange hall	The asset consists of a circular area and rectangular structure depicted and annotated as a 'Fort' on the Ordnance Survey map of 1833. The fort is shown as a semi-circular embankment set to the south of a small rectangular structure. The fort is no longer depicted on the Ordnance Survey map of 1906, replaced by a large rectangular enclosure. However, the rectangular range building is still depicted but is now annotated as "Killymoon Orange Hall'. The hall no longer exists and the area is occupied by modern housing.	Post-Medieval	Negligible
13	N/A	281372, 376147	Farmstead	Map Regression	Tullywiggan	The asset consists of Tullywiggan farmstead, first depicted on the Ordnance Survey map of 1906 comprising a large square enclosure containing four rectangular ranges designed to form a square complex with a large central courtyard. No upstanding remains of the farmstead exist and the area is now part of a field system.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
14	N/A	280511, 376181	Farmstead	Map Regression	Coolkeeghan Junction South-East A	The asset consists of a small farmstead first depicted on the Ordnance Survey map of 1833, comprising a small rectangular structure that has an attached rectangular enclosure to the south-west of the building. The building is no longer depicted on the Ordnance Survey map of 1906, and the area is now occupied by a large modern Driver and Vehicle Agency Building.	Post-Medieval	Negligible
15	HGI T-024	282603, 376204	Historic Parks, Gardens and Demesnes	Historic Parks, Gardens and Demesnes	Killymoon Castle	The asset consists of the Historic Park, Garden and Demesnes at Killymoon Castle, which was created along with the castle in 1802 and was once surrounded by a vast plantation. The site creates views across parkland with few trees. Steep terracing is located at Ballinderry and Killymoon rivers. The garden is accompanied with a glasshouse and garden house, and the land now forms part of the modern golf course.	Post-Medieval	High
16	N/A	279899, 376239	Farmstead	Map Regression	Ballyreagh North	The asset consists of a rectangular building depicted on the Ordnance Survey map of 1833, aligned north-east to south-west with a small rectangular enclosure to the rear of the building (north-west). The house or farmstead has a small square outbuilding to the north-east and is accessed via a long road running north-west from the northern edge of Ballyreagh Village, before a 90 degree turn to the north-east. The road continues past the building providing access to the Fairy Burn to the north-east. The farmstead has expanded by the Ordnance Survey map of 1900 with a larger outbuilding to the north-east and another to the north. Further buildings are added in the early 20th century and a possible pump is annotated on the Ordnance Survey map of 1934-35. The farmstead and associated buildings were demolished between 2015 and 2018 and replaced with a large warehouse.	Post-Medieval	Negligible
17	N/A	280459, 376251	Farmstead	Map Regression	Coolkeeghan Junction South-East B	The asset consists of a small farmstead, depicted on the Ordnance Survey map of 1833, comprising an L-shaped range, set within a hexagonal enclosure. The building is then shown accompanied with a small square building to the south-east of the L-shaped range on the Ordnance Survey map of 1906. The farmstead no longer exists with a modern industrial unit, D E A Gate Automation, in the area.	Post-Medieval	Negligible
18	N/A	281532, 376255	Temple	Map Regression	Killymoon Temple	The asset consists of two buildings located within woodland, to the south-west of Killymoon Estate that are depicted and annotated as 'Temple' on the Ordnance Survey map of 1833. The buildings are shown as an L-shaped structure accompanied with a small square structure directly to the south-west, and a large rectangular enclosure to the south. Having the site annotated as 'Temple' suggests the site was possibly used for religious proposes or was a place of memorial. No trace of the buildings and enclosure can be found on the Ordnance Survey map of 1906 or subsequent maps and in its place, is a large agricultural field.	Post-Medieval	Negligible
19	N/A	280383, 376261	Farmstead	Map Regression	Coolkeeghan Junction South-West	The asset consists of a small farmstead depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure, set within a triangular enclosure. The building is then shown on the Ordnance Survey map of 1906-07, with a small porch area at its centre, with the farmstead annotated as 'Farrannasaggart'. The farmstead then appears like this on all subsequent mapping and may still exist at this location with modern alterations having been made.	Post-Medieval	Low
20	N/A	280763, 376310	Ruin	Map Regression	Coolkeeghan Ruin	The asset consists of a ruin, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure set within an open field. The ruin is no longer depicted on the Ordnance Survey map of 1906 and no upstanding remains of the ruins exist.	Post-Medieval	Negligible
21	N/A	280414, 376317	Farmstead	Map Regression	Coolkeeghan Junction	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising two small rectangular buildings set within a small triangular enclosure. The farmstead is then shown as a single rectangular structure on the Ordnance Survey map of 1906 and subsequent mapping. No upstanding remains exist of the farmstead and the area is now used as open wooded ground.	Post-Medieval	Negligible
22	N/A	281468, 376322	Weir	Walkover Survey	Weir	The asset consists of the remains of a weir that would have served as part of the water management system for the mills in the area during the Post-Medieval period.	Post-Medieval	Low
23	N/A	281003, 376371	Farmstead	Map Regression	Coolkeeghan North-East	The asset consists of a small farmstead first depicted on the Ordnance Survey map of 1833 comprising three rectangular structures set within a rectangular enclosure. The farmstead is no longer depicted on the Ordnance Survey map of 1906 and the area is part of a field system.	Post-Medieval	Negligible
24	N/A	280413, 376378	Bridge	Map Regression	Fairy Burn Bridge	The asset consists of a bridge, first depicted on the Ordnance Survey map of 1906. The bridge is depicted and annotated just north of Coolkeeghan Junction, crossing the Fairy Burn. The bridge is not depicted on later 20th century maps, but a bridge still exists at this location.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
25	N/A	281210, 376411	Farmstead	Map Regression	Kings Bridge Farmstead	The asset consists of a farmstead, first depicted on the Ordnance Survey map of 1833 comprising two rectangular structures. A small square structure is then depicted to the west of the buildings on the Ordnance Survey map of 1906, and the farmstead is set within a rectangular enclosure. Two more rectangular structures are added to the south-east and north-west by the time of the Ordnance Survey map of 1935. The farmstead is still in use with several modern barn buildings and the original buildings contain modern additions and alterations.	Post-Medieval	Low
26	N/A	280665, 376422	Farmstead	Map Regression	Coolkeeghan North-West	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure, set within a rectangular enclosure. A smaller rectangular structure to the west may also be associated with the farmstead. The two structures are no longer depicted on the Ordnance Survey map of 1935 and the area is now part of a field system.	Post-Medieval	Negligible
27	IHR 04851:000:00	281230, 376460	Bridge	IHR	King's Bridge	The asset consists of a bridge, located to the south of Cookstown, first depicted and annotated on the Ordnance Survey map of 1833-34. A bridge is then depicted and annotated here on all subsequent historical mapping. The bridge may have been altered or rebuilt to accommodate the modern road.	Post-Medieval	Low
28	HB 09/05/001 A	282264, 376477	Country House	Grade A Historic Building	Killymoon Castle	The asset consists of a Grade A Listed Building located within the large estate of Killymoon to the south-east of Cookstown which has views which overlook the Ballinderry River. The estate had been owned by the Stewart family since 1634, with the current castle constructed in 1802 for Colonel James Stewart to the designs of English architect John Nash. The new house was to incorporate architectural features of the previous house which had been destroyed by fire. The house was constructed to a picturesque late Georgian and Norman-inspired design, being mainly constructed from sandstone. It was the first of such a design to be constructed in Ireland and is considered a rare and significant example of this type. The building consists of an extensive two to three storey sandstone building with a basement, laid out on an asymmetrical plan, with three-storey circular and octagonal towers, with connecting lower blocks, which are designed in a Norman inspired round-arched castle style except for the earlier wing which has both rectangular and Gothic arched openings. The castle and the surrounding outbuildings that create the estate, form a significant group of buildings that are associated with a substantial family from the early 17th century until the first part of the 20th century. In 1850 the property was sold at the death of William Stewart and was bought by the Moutray family. The present owner's family bought it at the break-up of the estate in 1922.	Post-Medieval	High
29	IHR 04850:000:00	281170, 376500	Corn Mill - Weaving Factory site	IHR	Gortalowry Corn Mill	The asset consists of a corn mill first depicted and annotated on the Ordnance Survey map of 1833-34, located along the northern extent of the Ballinderry River. The site is then depicted on the Ordnance Survey map of 1906-07, as a much larger structure, and annotated as the Gortalorory Weaving Factory. The mill is a good example of the transition in this period from an agriculturally based economy to an industrially based economy. The mill no longer exists at this location.	Post-Medieval	Negligible
30	HB 09/05/001 C IHR 04852:000:00	282434, 376523	Mill	Grade B1 Historic Building	Saw Mill at Killymoon Castle	The asset consists of the Grade B1 Listed Saw Mill located within the estate grounds of Killymoon Castle, which was constructed around the mid-18th century, designed in a simple classical style. This would place the building during a period of development within the Killymoon Estate, by the Stewart family, before the construction of the present Killymoon castle. Together with the castle, the other 18th century outbuildings and various estate structures, form part of a significant group of buildings that were associated with a prominent family from an early date to the first part of the 12th century.	Post-Medieval	High
31	N/A	281774, 376531	Sawmill and Sluice	Map Regression	Killymoon Mill Race	The asset consists of the Killymoon Sawmill Mill Race, first depicted on the Ordnance Survey map of 1833, comprising a weir, mill race and sluice that connects the Balinderry River to the Killymoon Sawmill, partially running underground to avoid the castle. These elements of the mill are no longer visible, although the weir is likely to survive, and the mill race will be present as sub-surface remains.	Post-Medieval	Low
32	N/A	281272, 376563	House	Map Regression	Brookmount House	The asset consists of Brookmount House, first depicted on the Ordnance Survey map of 1833, comprising two L-shaped ranges that may be associated with the mill and weaving factory to the south. The house is depicted and annotated on all subsequent Ordnance Survey maps but has been replaced by a large open industrial development area and car park.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
33	HB 09/05/001 B	282343, 376573	Farm Buildings	Grade A Historic Building	Outbuildings at Killymoon Castle	The asset consists of Grade A Listed Buildings located within the large estate of Killymoon, and to the east of Killymoon Castle. The buildings were part of the 18th century development of the Killymoon estate by the Stewart family, and were erected prior to the construction of the present Killymoon Castle. The buildings consist of a two-storey rubble sandstone three-bay centrepiece that is accompanied with a lower single storey block which is set at right angles. The building has been constructed in a classical design with characteristic features, such as a gibbsian, which surrounds several of the windows and doorways, arched doorway entrances and moulded stone cornicing. The castle and the surrounding outbuildings that create the estate, form a significant group of buildings that are associated with a substantial family from the early 17th century until the first part of the 20th century.	Post-Medieval	High
34	N/A	281621, 376582	Boundary Wall	Walkover Survey	Estate Boundary Wall 1	The asset consists of a section of wall located next to the Killymoon water treatment centre, that relates to the former Killymoon estate boundary.	Post-Medieval	Low
35	HB 09/15/010	280429, 376604	House	Record Only Historic Building	Derryloran House	The asset consists of a former listed building that has been demolished and redeveloped.	Post-Medieval	Negligible
36	N/A	280557, 376627	Rectory	Map Regression	Old Derryloran Rectory	The asset consists of Old Derryloran rectory, depicted on the Ordnance Survey map of 1833 to the south-east of the Old Derryloran Church, within the Glebe. The rectory comprises one L-shaped range, three small rectangular outbuildings, one large central T-shaped structure and a large L-shaped structure to the south. A large rectangular walled garden is located to the south of the buildings and a further rectangular enclosure is located to the south of the walled garden. The rectory is then shown as a large enclosed rectangular structure, with an open rectangular central courtyard, on the Ordnance Survey map of 1906. The walled garden and enclosure that was located to the south of the rectory are now part of the field systems. The rectory no longer exists and has been replaced by a modern housing estate, with street names reflecting the former use of the area: Old Rectory Park, Old Rectory Court, Old Rectory Heights, Old Rectory Crescent and Old Rectory Glen.	Post-Medieval	Negligible
37	N/A	280120, 376657	Farmstead and well	Map Regression	Glebe	The asset consists of a small farmstead and well, depicted on the Ordnance Survey map of 1833 within the north-western corner of the Derryloran Glebe, comprising two small rectangular structures set within a large rectangular enclosure. The farmstead and well are no longer depicted on the Ordnance Survey map of 1906 and the area is now occupied by a modern housing estate.	Post-Medieval	Negligible
38	N/A	279889, 376724	Farmstead and well	Map Regression	Derryloran South	The asset consists of a small farmstead and well, first depicted on the Ordnance Survey map of 1833, comprising a rectangular range and a small square structure, with three rectangular enclosures and a small well to the north of the buildings. The farmstead is then depicted on the Ordnance Survey map of 1906 comprising two rectangular ranges set within a large rectangular enclosure. A small square outbuilding is added by the time of the Ordnance Survey map of 1934-35, and there is still a farmstead in this area today.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
39	DIER 2003:1843	280348, 376776	Ditches; industrial activity	Archaeological Monitoring	Derryloran, Tyrone	The asset consists of three large ditches and numerous pits and post-holes found during archaeological monitoring required as part of planning conditions for a factory expansion. The archaeology uncovered at Derryloran would appear to represent the remains of an Early Christian enclosure related to an earlier monastic enclosure that included the site of Derryloran Church. Alongside the three ditches, a number of pits contained sherds of everted-rim ware and others were potentially associated with metal production, with one a potential smelting oven with a large quantity of burnt wood lining its base, on top of which lumps of slag were recovered. Settlement activity on the site was evidenced by remains of a structure comprising an arc of post-holes. The first ditch was aligned north to south measuring 4 m long (visible) by 4 m wide and 2 m deep with initially steep V-shaped sides falling to a box-shaped base. The ditch was filled by numerous deposits, representing its silting, while the lower 0.3m was filled by a leached silt which also contained pieces of wood planking and other natural wood fragments. The upper fill of the ditch appeared to represent a recut within the upper 0.25m. The second ditch was aligned south-east to north-west before turning to a north-south orientation to respect that of the first ditch and run alongside it. It was narrower and less substantial than the outer ditch, being around 2m wide and 0.8-1m deep, again with a V-shaped profile. The fills appear to mainly represent silting, although there may have been some deliberate backfilling, represented by a very clean, compact red redeposited clay subsoil within the southern portion of the ditch. A single sherd of everted-rim ware was recovered from the basal fill of the ditch within its central portion. The third ditch was aligned north-east to south-west to south-east and did not appear to respect the line of the second ditch, cutting across it at one point. It measured 2m wide and 0.6-0.1m deep, with a V-shaped profile. Again, the fills of this feature appeared to represent natural silting, while no finds were recovered from it.	Early Medieval	Negligible
40	IHR 04849:000:00	281900, 376790	Factory	IHR	Ulster Tape & Webbing Factory	The asset consists of the Ulster Tape and Webbing factory, which was founded in 1922 by Mr S.H. Devlin. When it started there was only one weaver with two Looms but having been registered as a Limited Liability Company in 1926 it expanded under the Founders Son, Mr Samuel Devlin to have twenty-six Looms. During the Second World War the weaving shed operated for 18 hours per day for almost six years, producing 30 million yards of webbing for various government contracts. Linen, hemp, cotton, and jute were all spun with the linen being used for parachute harnesses and May West jacket straps, while the cotton was dyed khaki or navy blue. At the end of the war a Letter of Appreciation was received from the Ministry. Aerial photographs show the factory is now likely a warehouse for JD's Catering Suppliers.	Modern	Low
41	AAP1	280394, 376792	Area of Archaeological Potential	Local Development Plan	Derryloran Church AAP	The asset consists of an area highlighted as an Area of Archaeological Potential within the local development plan due to the Derryloran Church and graveyard (Site 42), as well as excavation evidence to the west suggesting the church used to be part of a larger monastic site from the medieval period (Site 39). The area highlighted indicates to developers that, on the basis of current knowledge, it is likely that archaeological remains will be encountered in the course of future development or change within the area.	Medieval	Medium
42	NISMR TYR038:019 HB 09/15/009 DIER 1980-84:0184	280420, 376800	Church	NISMR	Derryloran Church	The asset consists of a church that has existed in this location from the 12th century onwards. The church is located to the south-west of Cookstown, and is now in a ruinous state with a cemetery surrounding. The earliest mention of a possible church dates to 1195 when it was noted as being plundered. Later information from 1622 reports that a church is "almost finished" with the present ruin representing this church, constructed using some of the stone from the 12th century church. The western porch is an 18th century addition and the church was in use until 1822. An archaeological investigation, carried out between 1980-84, demonstrated that a medieval church, with a battered foundation at the eastern extent was replaced by an early 17th century church.	Early Medieval	Medium
43	N/A	281734, 376815	Boundary Wall	Walkover Survey	Estate Boundary Wall 2	The asset consists of a section of wall containing an arched doorway located to the south of Castle Road, that relates to the former Killymoon estate boundary.	Post-Medieval	Low
44	DIER 2007:1762	281290, 376820	Pit	Archaeological Monitoring	Derryloran, Tyrone	The asset consists of a small pit discovered during archaeological monitoring in advance of a warehouse development within Derryloran industrial estate. The pit was aligned north to south and measured 1.4 m by 1 m by 0.23 m; truncated to the south by an electric cable trench, with no trace found beyond. The edges of the pit sloped steeply onto a flattish base, and contained a basal deposit of mid-brown soft sand, covered by a dark-brown/black loamy clay with numerous burnt stones and lots of charcoal. No artefacts were found within the pit, which has been interpreted as the possible remains of a small trough. The pit was removed in its entirety after investigations were complete.	Early Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
45	N/A	280744, 376823	Sluices / Weir	Map Regression	Glenavon Sluices/Weir	The asset consists of a weir within the Ballinderry River, annotated and depicted on the Ordnance Survey map of 1833 located to the south-east of Derryloran Bridge. The weir may have been associated with the Bleach Mill to the north and the Mill to the south. On the Ordnance Survey map of 1906 the weir is then annotated as 'Glenavon Sluice'. It is likely that the weir still exists within the river at this location.	Post-Medieval	Low
46	N/A	281651, 376839	Lodge	Map Regression	Killymoon Estate Western Lodge	The asset consists of the Killymoon Estate Western Lodge, first depicted on the Ordnance Survey map of 1833 comprising a small L-shaped building to the north of Castle Road. The lodge is no longer depicted on the Ordnance Survey map of 1935 and the area is now a drive way to a modern house.	Post-Medieval	Negligible
47	N/A	280115, 376846	Farmstead	Map Regression	Derryloran East	The asset consists of a farmstead, depicted on the Ordnance Survey map of 1833 comprising two rectangular ranges with a triangular enclosure attached to their southern extent. The two ranges are then depicted in detail on the Ordnance Survey map of 1906 with the triangular enclosure replaced by a large rectangular enclosure. The farmstead still exists today and are in use as barns.	Post-Medieval	Low
48	N/A	280191, 376854	Village	Map Regression	Blackhill Village	The asset consists of Blackhill Village, first depicted on the Ordnance Survey map of 1906 comprising four rectangular ranges, located along the northern extent of Drum Road, with an L-shaped range located to the north of the buildings. The area is now occupied by a modern building and none of the village buildings survive.	Post-Medieval	Negligible
49	NISMR TYR038:031	282318, 376865	Tomb Cairn	Scheduled Monument	Killymoon Demesnes Court Tomb	The asset consists of a Prehistoric Court Tomb situated in an area of woodland within Killymoon Golf Course. It comprises a roughly oblong spread of stones, which measures around 45 m by 35 m. The cairn lies on relatively flat ground, on a limestone outcrop, set within an area of scattered boulders, some of which show signs of deliberate destruction from bore holes. Within this area there are twelve orthostatic stones which form a horseshoe-shaped chamber measuring 10 m long by 4 m wide. Two outlying stones along the eastern extent of the site are aligned on an east-west axis. Some suspicion has been cast on the validity of the site, as in 1989 and 2002 field observation found that the tomb may in fact be a Victorian folly, built to look like an ancient monument. Several indicators for these suspicions are noted by the site surveyor: • the site is not marked on the 1813 or subsequent maps of the 19th century • the general disturbance of the area • the estate owners were collectors of antiquities and possibly created their own archaeological find • no artefacts have been recovered from the area • the evidence of boreholes in surrounding stones • the construction design is not typical of cairns from this period and there is a lack of similar archaeological discoveries of this type within the surrounding landscape. The site has also been noted as being greatly disturbed by livestock.	Prehistoric	High
50	IHR 04848:000:00	280460, 376870	Bridge	IHR	Derryloran Bridge	The asset consists of the Derryloran bridge, located to the south-west of Cookstown, first depicted and annotated on the Ordnance Survey map of 1833-34. The current bridge may have been altered or rebuilt to accommodate the modern tarmac road.	Post-Medieval	Low
51	N/A	280021, 376874	Farmstead	Map Regression	South Drum Road	The asset consists of a small farmstead, depicted on the Ordnance Survey map of 1833 comprising a small square building with a square enclosure to the south-east. The structure and enclosure are depicted on the Ordnance Survey map of 1906 but not on the Ordnance Survey map of 1935. The area is now part of a field system.	Post-Medieval	Negligible
52	DIER 2008:1188	281682, 376887	Bronze Age Funerary	Archaeological Evaluation	Castle Road, Cookstown, Tyrone	The asset consists of a number of small pits and post-holes, some of which contained Bronze Age pottery, alongside two linear features interpreted as the remains of two separate ring-barrows. The archaeological features were uncovered during an evaluation conducted in advance of a proposed nursing home that has not been developed. The features and any unknown remains that are likely to exist nearby are preserved in situ.	Prehistoric	Medium
53	NISMR TYR038:018	281720, 376890	Standing Stone	NISMR	Remains of Standing Stone	The asset consists of a standing stone, located to the south-east of Cookstown within Derryloran. The standing stone is not depicted until the Ordnance Survey map of 1906, but is described in the Ordnance Survey field reports as "An ancient standing stone". Although described as ancient, the late date of depiction suggests that the stone may have been a Post-Medieval marker stone, rather than an ancient monument. The construction of a number of houses in the area have removed any trace of this monument.	Prehistoric; Uncertain	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
54	N/A	279850, 376908	Farmstead	Map Regression	Mid Derryloran	The asset consists of a small farmstead depicted on the Ordnance Survey map of 1833 comprising a single rectangular structure, accompanied with a rectangular enclosure to the south. The Ordnance Survey map of 1906 shows that the original range has been replaced with an east-west aligned building that still exists on site today.	Post-Medieval	Negligible
55	N/A	279977, 376908	Farmstead	Map Regression	North Drum Road	The asset consists of a small farmstead depicted on the Ordnance Survey map of 1833, comprising a single small rectangular structure set within a triangular enclosure. The farmstead is not depicted on the Ordnance Survey map of 1854 and the area is now part of a field system.	Post-Medieval	Negligible
56	HB 09/15/005	280697, 376910	Hotel	Record Only Historic Building	Glenavon House Hotel	The asset consists of a hotel located on Drum Roadthat is no longer deemed worthy of a full second survey.	Modern	Low
57	IHR 04675:000:00	280490, 376930	Gasometer	IHR	Cookstown Gasometer	The asset consists of a 20th century gasometer, located to the south-west of Cookstown, first depicted on the Ordnance Survey map of 1906. The gasometer is a large container area where natural gas is stored to near atmospheric temperatures, for industrial use. The gasometer is still in use into the middle of the 290th century but has now been demolished with the site occupied by industrial units.	Modern	Negligible
58	N/A	281226, 376979	Quarry	Map Regression	F.S. Quarry	The asset consists of a quarry depicted and annotated as 'F.S. Quarry' on the Ordnance Survey map of 1833. The quarry appears on all subsequent maps but no longer exists with a large modern housing development now occupying the area.	Post-Medieval	Negligible
59	N/A	282345, 376985	Clubhouse	Map Regression	Killymoon Golf Course Club House	The asset consists of the Killymoon Golf Course Club House, first depicted as a small square structure, set within a square enclosure on the Ordnance Survey map of 1906. The Killymoon Golf Club was established in 1889 and was one of the founding members of the Golfing Union of Ireland and Irish Ladies Golfing Union. The original clubhouse has been demolished.	Modern	Negligible
60	N/A	280241, 376988	Building	Map Regression	Greenvale Mill Building	The asset consists of a large L-shaped building, located to the north-east of the Derryloran Bleach Mill, depicted on the Ordnance Survey map of 1833. The building is located between the Mill Race and the Ballinderry River. The L-shaped range is no longer depicted on the Ordnance Survey map of 1854 and two large rectangular ranges are depicted on the Ordnance Survey map of 1906. The area is now occupied by a large MDF manufacturing factory.	Post-Medieval	Negligible
61	N/A	281438, 376989	Well and nursery	Map Regression	Cookstown Well and Nursery	The asset consists of a well and nursery depicted on the Ordnance Survey map of 1833 within the south-eastern extent of Cookstown. The site is no longer depicted on the Ordnance Survey map of 1854, and the area is now occupied by a large modern housing estate.	Post-Medieval	Negligible
62	IHR 04674:000:00	280330, 377000	Bleach works & Spinning Mill	IHR	Ballinderry River Bleach Works	The asset consists of a large complex of industrial bleach works and spinning mills, located to the south-west of Cookstown, depicted on the Ordnance Survey map of 1833. The map depicts the mill as two rectangular buildings connected to a 'Mill Race' to the north. The mill buildings expand into the later 19th century and early 20th century with the construction of several large rectangular mill buildings, located to the north of the Mill race. The function of the mill may have changed to a spinning mill during this period, and by the time of the Ordnance Survey map of 1906, the area is heavily congested with factories, mills and other buildings annotated as the 'Greenvale Spinning Mills'. The mill buildings all appear to have been demolished and the area is now occupied by a hotel, modern housing and a large MDF factory.	Post-Medieval	Negligible
63	HB 09/15/006	280624, 377003	Gates/ Screens/ Lodges	Grade B1 Historic Building	Lodge at Greenvale	The asset consists of the Grade B1 Listed lodge at Greenvale, located on Drum Road, comprising a detached, single-storey, hipped and rendered former gate lodge that was constructed around 1840, possibly to designs by William Farrell. The former gate lodge is slightly set back from the main Drum Road on the corner of the main driveway into Greenvale House. The lodge is designed in a picturesque Classical style, with the Tuscan columns, portico and frieze enhancing the appearance.	Post-Medieval	High
64	HB 09/15/007	280444, 377043	Hotel	Record Only Historic Building	Greenvale Hotel	The asset consists of a hotel located on Drum Road. The building is no longer deemed worthy of a full second survey.	Modern	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
65	N/A	279955, 377059	Farmstead	Map Regression	Blackhill Farmstead	The asset consists of a farmstead, first depicted on the Ordnance Survey map of 1833 comprising two large rectangular ranges, with a single rectangular outbuilding located to the north, and four rectangular structures located to the south. The buildings are set within a large oval enclosure that has nine rectangular enclosures spurring off from it. The farmstead is then shown in much greater detail on the Ordnance Survey map of 1854 comprising three rectangular ranges, an L-shaped range to the north, three small square outbuildings to the south, surrounded by agricultural enclosures of various sizes. The Ordnance Survey map of 1906 depicts a single rectangular range and an L-shaped range to the south-west. The L-shaped range than changes to a T-shaped building and a rectangular range is added to the southern extent on the Ordnance Survey map of 1935. A large farmstead still exists at this location and possible upstanding remains of the original farmstead may survive in a ruinous state.	Post-Medieval	Low
66	N/A	281852, 377062	Pavilion	Map Regression	Killymoon Pavilion	The asset consists of a circular enclosure is depicted and annotated as 'Pavilion' on the Ordnance Survey map of 1906 to the south of Killymoon north Lodge. The pavilion is no longer depicted on the Ordnance Survey map of 1935 and the area is now part of a field system.	Modern	Negligible
67	NISMR TYR029:066 DIER 1995:264	282690, 377084	Bronze Age industrial complex	Event	Killymoon Demesne	The asset consists of three mounds composed of alternating layers of baked clay and charcoal that has been dated to 1,000 BCE. Excavations of the mounds revealed a layer of ashy soil overlain by spreads of charcoal and charred barley. Finds included two gold objects, a ‘dress-fastener’ and a ‘sleeve-fastener’, as well as a bronze socketed axe, a stone bead, saddle querns, spindle-whorls, woollen twine and cloth, hair (some of it human), and considerable quantities of coarse pottery. Beneath the uppermost layer of peat, over which the ashy soil lay, was a 1m-wide band of wooden stakes running east-west across the site.	Prehistoric	Medium
68	HB 09/15/003	281207, 377086	House	Record Only Historic Building	4-10 Killymoon Street	The asset consists of a terrace of four early 19th century houses, that have been inappropriately altered with the widening of window openings and the addition of modern uPVC windows, chimneystacks, artificial slate roof a door porch and a modern dry dash rendering to the front façade. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
69	HB 09/15/002	281208, 377103	House	Record Only Historic Building	2 Killymoon Street	The asset consists of a one and a half storey, mid-19th century house, which has been inappropriately altered with the widening of window openings and the addition of modern uPVC windows, rainwater goods, chimneystacks and artificial slate roof. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
70	N/A	281836, 377106	Gate Pier and Lodge	Map Regression	Gates and Lodge to Killymoon Estate	The asset consists of the dressed gate piers and gate lodge of the Killymoon Estate as depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure in the centre of the road leading into the estate. The lodge no longer exists and only the southern gate pier survives.	Post-Medieval	Negligible
71	HB 09/15/004	281950, 377168	Lodge	Record Only Historic Building	Gate Lodge, 144 Killymoon Road	The asset consists of the 'Gate Lodge' annotated and depicted on the Ordnance Survey map of 1854, as a small rectangular structure. The lodge is then annotated and depicted on all subsequent Ordnance Survey maps. On the 1906 edition the lodge is shown as two rectangular structures located on either side of the road. The lodge has been demolished and the area redeveloped as part of the golf course.	Post-Medieval	Negligible
72	N/A	280598, 377171	Housing	Map Regression	Gortalowry Housing	The asset consists of housing depicted on the Ordnance Survey map of 1833, comprising three rectangular buildings, one of which located on the eastern side and two located on the western side of Westland Road. On the Ordnance Survey map of 1854, the buildings on the western side of the road now form a long rectangular row with small enclosures located to the rear. The area is now occupied by a large modern housing estate.	Post-Medieval	Negligible
73	N/A	281968, 377176	Ruins of an Old Meeting house	Map Regression	Ruins of an Old Meeting House	The asset consists of a T-shaped structure annotated and depicted on the Ordnance Survey map of 1833 as 'Ruins of Old Meeting Ho.' located within the northern limits of the Killymoon estate. The ruins are no longer depicted on the Ordnance Survey map of 1906, with the golf course extending over the area, continuing to do so to this day. A commemoration plaque engraved with ‘First Presbyterian Church Cookstown’ gives the date of the building as 1701-1704. No upstanding remains of the building were discovered and the golf course still occupies this area.	Post-Medieval	Negligible
74	N/A	280221, 377177	Buildings	Map Regression	Gortalowry North Mill Buildings	The asset consists of two buildings located to the north-east of Derryloran Bleach Mill, depicted on the Ordnance Survey map of 1833 comprising two rectangular structures located between the Ballinderry River and the Mill Race. The mill comprises three buildings on the Ordnance Survey map of 1854 with the most northerly structure adjoining the Mill Race. In the Ordnance Survey map of 1906, the buildings are shown consisting of two structures again set within an enclosure. The area is now occupied by woodland and possible remains of these structures may exist within this woodland.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
75	HB 09/15/001	281248, 377220	Church	Grade B+ Historic Building	St Luran's Church of Ireland	The asset consists of the Grade B+ Listed St Luran's Church of Ireland located at 96 Church Street, comprising a Gothic revival style with two main phases of building: an entrance tower and spire designed by architect John Nash, dating from 1822; and a cruciform, chancel and transepts with north porch designed by Dublin architect Joseph Wellan and constructed in 1859-61.	Post-Medieval	High
76	NISMR TYR029:004 DIER - 2009:783	280380, 377220	Rath	NISMR	Westbury Hill	The asset consists of the remains of a Rath, located to the south-west of Cookstown, comprising a bank enclosing a bow like interior measuring 25 m wide, with the bank measuring 5 m wide by 0.4 m high. There is no surface evidence of internal features and an entrance to the enclosure was not visible. Investigations in 2009 revealed an external ditch around the bank measuring 34 m in width, with features uncovered out with and within the interior, mainly comprising pits and post holes, as well as a possible kiln. Like the majority of other raths in the area it is depicted and annotated as a 'Fort' on the Ordnance Survey map of 1833.	Early Medieval	Medium
77	HB 09/15/011	281196, 377241	House	Record Only Historic Building	Gortalowry House	The asset consists of a former listed building that has been demolished and redeveloped.	Post-Medieval	Negligible
78	N/A	280591, 377243	School	Map Regression	Gortalowry School	The asset consists of Gortalowry National School, depicted on the Ordnance Survey map of 1833, comprising a medium sized rectangular building located on the eastern side of Westland Road. Gortalowry Primary School opened in 1833, but later closed in 1967, and no remains of the building exist at this location, with the area now part of a graveyard.	Post-Medieval	Negligible
79	HB 09/15/008	280652, 377264	Church	Record Only Historic Building	R C Chapel behind 104 Westland Road South	The asset consists of a former listed building that has been demolished and redeveloped.	Post-Medieval	Negligible
80	N/A	282165, 377297	Boundary Wall	Walkover Survey	Estate Boundary Wall 3	The asset consists of a section of wall located along the northern extent of Killymoon Golf Course, that relates to the former Killymoon estate boundary.	Post-Medieval	Low
81	N/A	282863, 377304	Farmstead	Map Regression	Claremount North	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular structure accompanied by a large rectangular enclosure to the north. The farmstead is no longer depicted on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
82	N/A	282291, 377364	Farmstead	Map Regression	Clare B	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising four rectangular structures accompanied by four square enclosures to the south. The farmstead is no longer depicted on the Ordnance Survey map of 1854, having been replaced by the Dungannon and Cookstown Railway.	Post-Medieval	Negligible
83	NISMR TYR029:003	280860, 377370	Rath	Scheduled Monument	Gortalowry Platform Rath	The asset consists of a roughly circular bank enclosing an area measuring 48.5 m by 49.5 m internally, located on top of a drumlin within the south-west extent of Cookstown. The surrounding bank measured 9.7 m wide by 1.5 m high internally, and the outer edge of the bank is badly eroded and cut along the north and western extents. The ditch has been infilled and is difficult to trace, particularly along the western and southern extents, where the ground is level. Investigations carried out in 1977 and 2005 found the interior of the Rath was reasonably level except for a large, modern, rectangular hole in the centre, measuring 1.25 m long by 0.8 m wide and 0.5 m deep. To the north and north-east of the rath, a small linear feature and two circular pits were discovered, but no datable artefacts were found. A study of aerial photography has revealed the site now lies within a wooded area, which is set between a residential area to the east and a cemetery to the west.	Early Medieval	High
84	N/A	282175, 377380	Farmstead and Quarry	Map Regression	Clare C	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising one rectangular structure and a small L-shaped range, set within a rectangular enclosure. A limestone quarry that is annotated as 'L.S Quarry' is located directly to the north of the farmstead and due to its close proximity may have shared some association with the farmstead. On the Ordnance Survey map of 1854, the farmstead is depicted as a single rectangular building set within a rectangular enclosure, with the limestone quarry no longer depicted. The farmstead no longer exists on the Ordnance Survey map of 1906 and the area is part of a field system.	Post-Medieval	Negligible
85	HB 09/14/020	280678, 377405	Cemetery	Record Only Historic Building	Cookstown Cemetery	The asset consists of a relatively modern cemetery, with the headstones dating from the latter part of the 19th century up to the present. The building is not deemed worthy of a full second survey.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
86	N/A	282464, 377417	Farmstead	Map Regression	Clare A	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising two rectangular structures. The structures are joined on the Ordnance Survey map of 1854, forming a Z-shaped structure accompanied by two square enclosures to the south. The farmstead is no longer depicted on the Ordnance survey map of 1906 and the area is part of a field system with some tree cover.	Post-Medieval	Negligible
87	HB 09/14/023	281132, 377441	Terraced Housing	Record Only Historic Building	37/51 Church Street	The asset consists of a terrace of eight, two-storey houses. The end house has been demolished while the remainder have been inappropriately altered with the widening of window openings and doorways, the addition of uPVC windows, modern doors and a door porch and artificial slate roofs. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
88	HB 09/14/001	281113, 377475	Terraced Housing	Record Only Historic Building	17/25 Church Street	The asset consists of a short terrace of five houses date from the latter part of the 19th century. No.23 and 25 Church Street have been demolished while the remainder of the terrace now inappropriately altered, with the addition of upvc windows, modern doors and door porches, a new chimneystack and dry dash render to the front façade. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
89	HB 09/13/001 (B-C)	281160, 377566	House	Record Only Historic Building	86-88 Chapel Street	The asset consists of a housing row located in the centre of Cookstown that is first depicted on the Ordnance Survey map of 1833 comprising a long rectangular row of housing, fronting onto the main road to the west and accompanied with burgess plots to the rear. Recent photographs of the area show the building is in good condition and still appears to be used for private accommodation. The building is no longer deemed worthy of a full second survey following an explosion.	Post-Medieval	Low
90	NISMR TYR029:032	282690, 377580	Enclosure / Rath	NISMR	Enclosure East of Cookstown	The asset consists of an enclosure, located to the east of Cookstown, first depicted and annotated as a 'fort' on the Ordnance Survey map of 1833. The enclosure measures 50 m by 30 m that has been cut through its centre by an access track. On the Ordnance Survey map of 1854, a kink in the road line has truncated part of the enclosure, and it is no longer visible on the Ordnance Survey map of 1906. The site of the enclosure is now agricultural fields, and it can be assumed that this site is the remains of a possible Rath given the size, shape, and annotation as a fort matching similar sites.	Early-Medieval / Unassigned	Low
91	HB 09/13/001 A	281158, 377584	House	Grade B2 Historic Building	Glenlowry House	The asset consists of the Grade B2 Listed Glenlowry House, comprising a two-storey house constructed in 1859 with a pitched, two-storey return to the rear and a single-storey lean-to abutting the rear of the return. There is a yard located at the rear containing two outbuildings, a pitched, two-storey outbuilding, and an additional single-storey lean-to with a metal roof.	Post-Medieval	High
92	HB 09/13/002 (A-B)	281159, 377602	House	Grade B1 Historic Building	Loy House	The asset consists of the Grade B1 Listed Loy House located at 80 and 82 Chapel Street, constructed around 1830 and comprising a two-storey former dower house that was connected to Killymoon house. The house was originally constructed as one structure and has been noted as a possible design of John Nash. The house has a hipped, two-storey return to the rear, with a further hipped, two-storey extension which abuts the return, and a single-storey, glazed lean-to extension that was constructed around 1970.	Post-Medieval	High
93	HB 09/14/002	281110, 377603	Building	Record Only Historic Building	77/79 chapel Street	The asset consists of former listed buildings that have been demolished and redeveloped.	Post-Medieval	Negligible
94	N/A	281859, 377607	Farmstead	Map Regression	Coolnafranky	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising two small rectangular structures located along the road. The farmstead is no longer depicted on the Ordnance Survey map of 1854 and the area is partly the location of a modern house.	Post-Medieval	Negligible
95	HB 09/13/003 (A-D)	281154, 377637	House	Record Only Historic Building	70-76 Chapel Street	The asset consists of a terraced house dating to the early 20th century comprising a terraced house belonging to a group of four. The building has been drastically and inappropriately modified with the addition of upvc windows, doors and RW goods, artificial slate roof and a modern chimney stack. The building is no longer deemed worthy of a full second survey.	Modern	Low
96	N/A	282613, 377697	Farmstead	Map Regression	Cloghog Road	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising two rectangular structures set within a large rectangular enclosure. A small well is also annotated and depicted at the most northern point of the farmstead. On the Ordnance Survey map of 1854, the larger western range is still untouched but the smaller range has been removed and a new building built to the east. On the ordnance Survey map of 1906 there are several new buildings added around the original farmstead, which still exists today with modern buildings surrounding it.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
97	N/A	283072, 377716	Farmstead	Map Regression	Terressan A	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising one long rectangular range accompanied with two smaller square buildings which are set within four enclosures. The farmstead is then depicted as a single rectangular range on the Ordnance Survey map of 1906, accompanied by a rectangular enclosure to the east. On the Ordnance Survey map of 1929, the site is shown as a single rectangular unroofed structure, set within a large open agricultural field, and the farmstead no longer exists today.	Post-Medieval	Negligible
98	HB 09/14/019	281098, 377717	Hall	Record Only Historic Building	Irish National Forresters	The asset consists of an early 20th century, vaguely Art Deco Style hall that was formerly a listed building but has been mainly demolished and redeveloped.	Modern	Negligible
99	N/A	282896, 377724	Farmstead	Map Regression	Clare Lane	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising one rectangular structure set within a rectangular enclosure to the north of Cloghog Road, and a single small rectangular building on the other side of the road. Neither of the buildings are depicted on the Ordnance Survey map of 1906, the area is now part of a field system.	Post-Medieval	Negligible
100	NISMR LDY048:026	283280, 377730	Rath	Scheduled Monument	Terressan Rath	The asset consists of a roughly circular bank measuring 38 m by 36 m, located directly to the east of Clare Road. The bank is eroded, surviving to variable heights along its length, and is slightly cut into along its eastern extent by farm buildings. Along the western extent the bank was recorded at 3 m wide, 1 m high internally and 1.85 m externally. No surrounding ditch is visible, but pools of water were noted lying in several places around the bank that likely represent the location of the ditch. The Rath now lies within a wooded area surrounded by a former farmstead.	Early Medieval	High
101	IHR 04672:000:00	282170, 377780	Limestone Quarry & Limekiln	IHR	Tullygare Limestone Quarry & Limekiln	The asset consists of limestone quarries and limekilns, located to the east of Cookstown in Tullygare, to the north of Cloghog Road. These quarries and kilns are depicted on the Ordnance Survey map of 1833, but not on subsequent historic mapping, suggesting there were no longer any upstanding remains. The area is now part of an agricultural field.	Post-Medieval	Negligible
102	HB 09/14/003	281016, 377818	Church	Grade B+ Historic Building	Holy Trinity Roman Catholic Church	The asset consists of the Grade B+ Listed Holy Trinity Roman Catholic Church, located on Chapel Street, comprising a mid-19th century church in a Gothic Revival style of Early English type, consisting of a nave, two aisles, chancel and square buttressed tower with a broach spire. The church was built in 1855-60 to the designs of J.J. McCarthy of Dublin; stone carving was by Purdy and Outhwaite of Dublin; the reredos was carved by Lane of Dublin; and the east window was by John Hardman & Co of Birmingham. Additional works carried out by Ralph Henry Byrne in the 1930s.	Post-Medieval	High
103	N/A	282318, 377834	Farmstead	Map Regression	New Buildings South	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising two rectangular structures accompanied by two rectangular enclosures to the north. On the Ordnance Survey map 1854, the farmstead comprises a large Z-shaped range with four enclosures to the north. The farmstead is mainly demolished by the time of the Ordnance Survey map of 1906 with only a small square building in its location with a narrow rectangular building extending to the north. The current buildings on the site relate to this 20th century depiction.	Post-Medieval	Negligible
104	NISMR TYR029:002	282120, 377840	Standing Stone	NISMR	Standing Stone at Kidds Bridge	The asset consists of a standing stone, located to the south-east of Kidd's Bridge, comprising a roughly triangular stone which tapers to a rounded point, measuring around 1.5 m in height, by 0.8 m by 1.2 m. The apex of the triangle formed by the stone points due north. The stone is not depicted until the Ordnance Survey map of 1854, which may suggest that instead of Prehistoric origins, the stone may have actually functioned as a Post-Medieval marker post. The stone was visited during the walkover survey, showing the stone now sits within a private carpark surrounded by modern concrete kerb stones and temporary fencing.	Prehistoric / Post-medieval	Low
105	HB 09/14/024 B	281045, 377849	Church	Grade B1 Historic Building	Chapel of the Annunciation St Brigid's Convent	The asset consists of the Grade B1 Listed Chapel of Annunciation, located at St Brigid's Convent on Convent Road, and constructed in 1965, comprising a two-storey building designed by Laurence McConville of Rooney & McConville, of Belfast. It was added to the convent to provide nine new cells for nuns on the ground floor and a chapel for thirty on the first floor. The beaten metal sculptures on the exterior, and the similar crucifix and tabernacle in the interior were designed and made by Patrick McElroy; stained glass windows by Patrick Pye; sculpted stone altar by Michael Biggs; and enamelled copper stations of the cross by Brother Benedict Tutty. This was one of the most architecturally radical churches in Ireland in its time being one of the first that was entirely modern in layout and design; it was also one of the first demonstrations of a renewed interest in the patronage of Irish artists by the church in Ireland and the successful integration of their work into a unified expression both inside and outside. Sometime prior to 1993 the bottom two courses of precast panels on the first floor were replaced in the original style.	Modern	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
106	HB 09/14/024 A	281025, 377856	Religious House	Grade B1 Historic Building	St Brigid's Convent and National School	The asset consists of the Grade B1 Listed St Brigid's Convent and National School located on Convent Road, comprising a three-storey, gabled stone building designed in a subdued Gothic revival style, and constructed in 1891. The main building is accompanied with a long two-storey return to the rear, which functioned as the former National School. The first floor of the building contains a Gothic-arched niche with a projecting label moulding, which sits above a rectangular panel of sandstone which has been inscribed 'St Brigid's Convent National Schools 1891' and is also decorated with incised shamrocks. The grounds to the rear of the building open up onto the Holy Trinity Roman Catholic Church.	Post-Medieval	High
107	HB 09/13/004	281144, 377863	Court House	Grade B1 Historic Building	Court House	The asset consists of a Grade B1 Listed former Court House, located at 2-4 Chapel Street comprising a detached two-storey, rock-faced sandstone courthouse, which was constructed around 1900 to the designs of architect Vincent Craig and county surveyor, J.W.Leebody. The building replaced an earlier 'Police Barrack & Court House' which was situated on the south side of Molesworth Street. The former courthouse is roughly rectangular in plan and is accompanied with a square tower in the north-west corner, a two-storey pitched return to the rear, and a single-storey lean-to extension. A further single-storey glazed lean-to is located along the southern extent.	Modern	High
108	HB 09/13/006 C	281129, 377888	Office	Grade B1 Historic Building	56-58 Loy Street	The asset consists of a Grade B1 Listed Building comprising an end-of-terrace, two-and-a-half-storey, former house and office, which was built around 1880. The house has a two-storey pitched roof return to the rear, which is accompanied with an adjoining single-storey lean-to. The ground floor has a doorway to the left and a shopfront to the right, which was constructed in 1956. The remainder of the house is typical of a late Victorian style.	Post-Medieval	High
109	HB 09/13/006 B	281128, 377895	House	Grade B2 Historic Building	54 Loy Street	The asset consists of a Grade B2 Listed Building comprising a terraced, two-storey former house, which was constructed around 1880. The house has a two-storey pitched roof return to the rear. The house is a typical late Victorian style that is well maintained and has kept much of its original character. The internal layout has been largely retained, allowing an understanding of the simple Victorian townhouse plan, prior to its change of use.	Post-Medieval	High
110	HB 09/13/006 A	281127, 377900	House	Grade B2 Historic Building	52 Loy Street	The asset consists of a Grade B2 Listed Building comprising a terraced, two-and-a-half storey former house constructed around 1880, which is now in use as a dental practice. The house has a two-storey, flat-roofed return and adjoining single-storey flat-roofed return to the rear.	Post-Medieval	High
111	HB 09/14/004	280927, 377922	Rectories/ Manses etc	Grade B2 Historic Building	Parochial House	The asset consists of the Grade B2 Listed parochial house, located at 1 and 3 Convent road, which was constructed in 1904 to the designs of E. & J. Byrne of Belfast. The building comprises of a four-bay, two-storey house built of sandstone to the front and east side, but rendered to the west side and rear, with hipped slated roofs. The second bay from the right on the first floor contains a pair of narrower windows than elsewhere flanking each side of a Gothic stone canopied niche containing a white marble statue of the Virgin Mary, which is supported on a large projecting canted corbel decorated with carved stone shamrocks and inscribed 'St Mary's 1904'.	Modern	High
112	N/A	281968, 377922	Tennis Playing Field	Map Regression	Pavilion Lawn Tennis Grounds	The asset consists of the Pavilion Lawn Tennis Grounds, first depicted on the Ordnance Survey map of 1906. The grounds are shown as large open rectangular area but the grounds no longer exist with a large slaughter house now at this location.	Modern	Negligible
113	N/A	281906, 377947	Farmstead and Well	Map Regression	Coolnafranky North	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular range, with a small square outbuilding, and a well, set within a rectangular enclosure. The farmstead is no longer depicted on the Ordnance Survey map of 1854 with a large road and rail intersection having removed it.	Post-Medieval	Negligible
114	IHR 04678:000:00	282900, 377950	Flax Pool	IHR	Clare Flax Pool	The asset consists of a flax pool noted on the IHR. However, there is no annotation for this site on any historical mapping. Flax was one of the main crops grown across Northern Ireland, and provided the basic ingredient of the countries linen industry. After the flax had been grown, cut and then bundled, the flax had to submerged for a week to ten days. This process was called retting the flax. It is noted that most farmers would have their own pools or dams, to carry out this process. Aerial photography of the area does not show any remains either, with the site part of an agricultural field.	Post-Medieval	Negligible
115	HB 09/13/023	281118, 377953	Terraced Housing	Record Only Historic Building	30/38 Loy Street	The asset consists of an early 20th century, two storey terraced building consisting of five houses. The buildings have been altered inappropriately with the addition of upvc windows, doors, artificial slate roofs, and modern chimneystacks. The building is no longer deemed worthy of a full second survey.	Modern	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
116	HB 09/14/018	281050, 377955	University/ College Building	Grade B1 Historic Building	Cookstown Technical College	The asset consists of the Grade B1 Listed Cookstown Technical College, located at 19 Loy Street, and was constructed in 1929. The college comprises a tall, square, parapet-roofed building in neo-Georgian style, consisting of two storeys on a raised basement storey, of rustic brick with artificial stone cornice, keystones, and other dressings, with a two-storey hipped block in plain red brick to its rear. As the date stone states, this building was constructed in 1929 to designs by the Government architects' office under the direction of its chief architect Roland Ingle by Smith FRIBA. The building remained a technical college until 2006, but is now a community playgroup and credit union.	Modern	High
117	N/A	282541, 377961	Farmstead and Gravel Pit	Map Regression	New Buildings South	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising two rectangular ranges, accompanied by a small rectangular enclosure containing a well. Located to the south-east of the buildings is a circular area that has been marked as a gravel pit. On the Ordnance Survey map of 1854, the farmstead is depicted as a single rectangular range set within an L-shaped enclosure, and the gravel pit and well are no longer depicted. The farmstead is then shown on the Ordnance Survey map of 1906, as consisting of one long rectangular range and three square outbuildings set within a small circular enclosure, and a road has been constructed leading north from the farmstead to Coagh Road. The farmstead and gravel pit no longer exist with the area now occupied by modern housing.	Post-Medieval	Negligible
118	NISMR TYR029:067 DIER 2005:1476 2007:1757	281086, 377963	Settlement	Historic Nucleated Urban Settlement	Cookstown	The asset consists of the town of Cookstown, which is set within a drumlin landscape close to the Ballinderry River. Cookstown is located in the townlands of Cookstown, Loy, Gortalowry and Coolnafranky and takes its name from Dr Allen Cooke, who was an English ecclesiastical lawyer, who received a grant from King Charles I to build a market town at this location. The town of Cookstown was originally built during the Plantation by Allan Cook, but was mostly destroyed in 1641. The estate was eventually acquired by William Stewart of Killymoon Castle, in 1750, who embarked on one of the boldest attempts at town building in Ulster's history, sparing no expense to make the place attractive to settlers.	Post-Medieval	Medium
119	HB 09/13/007	281119, 377978	Rectories/ Manses etc	Grade B2 Historic Building	Methodist Manse	The asset consists of the Grade B2 Listed Methodist Church Manse located at 28 Loy Street comprising a two-storey, three-bay, mid-Victorian, stucco house, that was constructed around 1858. The manse has been constructed in a very plain form of Italianate style, which is accompanied with a projecting rectangular porch. The manse is immediately adjacent to the Methodist church to which it is joined by a short stone balustrade. Abutting each corner of the house at the front are short runs of stone balustrading, the one to the north connecting with the church alongside.	Post-Medieval	High
120	N/A	283004, 377980	Farmstead	Map Regression	South Drain	The asset consists of a small farmstead first depicted on the Ordnance Survey map of 1833 comprising two small rectangular structures located within a larger square enclosure. The farmstead is then shown as a single rectangular structure on the Ordnance Survey map of 1854, with large Flax Pools located directly to the west. By the Ordnance Survey map of 1906, the farmstead no longer exists and the area is now part of a field system.	Post-Medieval	Negligible
121	HB 09/13/008	281123, 377992	Church	Grade B1 Historic Building	Methodist Church	The asset consists of the Grade B1 Listed Methodist Church, located at 26 Loy Street, that was constructed around 1858. The church is a mid-19th century Romanesque-style church building, that is well proportioned and ornamentally treated, with a hall-type plan typical of non-conformist churches. The manse, located at 28 Loy Street, is joined to the church by a short stone balustrade. In a wider more national context it is of considerable interest due to its architectural association with a small number of other Methodist churches of the same period elsewhere in Ulster, Ballymoney, Antrim, Newtownards in Co Down, and Donegal town in the Republic of Ireland, which are almost identical in plan and appearance and are clearly by the same architect whose identity has not yet been recorded.	Post-Medieval	High
122	HB 09/14/027	281055, 377993	House	Record Only Historic Building	Gortaleagh	The asset consists of a detached two-storey house, built around 1891, which is now in use as a 'Rural Development Office'. It has a two-storey return to the rear and a two-storey extension. External walls are stone to the ground floor and brick to the upper floor. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
123	HB 09/13/005 B	281585, 378006	House	Grade B1 Historic Building	Coolnafranky House	The asset consists of the Grade B1 Listed Coolnafranky House, located along Molesworth Road. The former estate house comprises a detached, sandstone, two-storey house, constructed around 1858 for local landowner James Gunning. Gunning had formed a partnership with James Moore, with whom had bought much of the Stewart Cookstown estate in 1851. A two-storey return and a single-storey, hipped extension are located to the rear of the house. The house is designed in a mild classical style which is in marked contrast with a Victorian character of the gate lodge.	Post-Medieval	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
124	NISMR TYR029:031	282390, 378010	Rath	NISMR	Rath East of Cookstown	The asset consists of the remains of a Rath, located to the east of Cookstown, measuring 24 m in diameter. The rath is enclosed by a bank measuring 3 m in width, 0.65m high internally and 1.5 m above an outer ditch, which measured 2 m. The ditch was noted as most visible in the southern half and can just be made out within the north-western quadrant. Two breaks in the bank were noted along the western and eastern extent with the western break noted as possibly marking the original entrance, was measured at 2.5 m in width. There are no internal features noted within the interior. The Rath is first depicted and annotated as a 'Fort' on the Ordnance Survey map of 1833, and is still depicted on all subsequent historical maps.	Early Medieval	Medium
125	HB 09/14/005	281055, 378014	Church Hall	Grade B1 Historic Building	Derryloran Parish Hall	The asset consists of the Grade B1 Listed Derryloran Parish Hall, located on Loy Street. The hall comprises a classical style, single storey, T-shaped building with projecting entrance bay and a long return added to the rear. The hall was built originally in 1835 as a Presbyterian Meeting House consisting of an original modest gabled hall with a main lateral block running north to south which was added later, sometime after 1857, thus giving a classical front façade with a central projecting front entrance bay. Later it became the church hall for Derryloran Church of Ireland Parish. The new minor hall to the rear was opened in 1982, and the main hall refurbished in 1989.	Post-Medieval	High
126	HB 09/14/006	281050, 378039	House	Record Only Historic Building	11 Loy Street	The asset consists of a detached two-storey former house and doctor's surgery, constructed around 1804, which is now in use as a funeral home. It is roughly rectangular in plan with a two-storey lean-to return to the rear, a further pitched and hipped single-storey extension constructed around 1990, and a single-storey lean-to extension with a metal roof. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
127	HB 09/14/026	280888, 378055	Office	Grade BI Historic Building	Social security Office	The asset consists of the Grade B1 Listed Social Security Office comprising a detached, rustic-brick, single-storey social security office, constructed around 1940 on the south side of the Fairhill Road. The building is a U-shaped block to the front, with a further two-storey flat-roofed rectangular block to the rear. There is also a single storey flat-roofed link block joining the front and rear. On the rear return, there is a single-storey flat-roofed entrance porch.	Modern	High
128	HB 09/14/029	280925, 378057	Orange Hall	Record Only Historic Building	Cookstown Orange Hall	The asset consists of a two-storey pedimented Classical-style Orange Lodge, constructed in 1894. There is a painted central keystone and a centrally located datestone at cornice level, inscribed 'COOKSTOWN ORANGE AND PROTESTANT HALL. A.D. 1894' The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
129	HB 09/14/007 C	281065, 378057	House	Grade B2 Historic Building	9 Loy Street	The asset consists of a Grade B2 Listed Building comprising a terraced, three-storey house constructed around 1870. The building has a three-storey return, with a further two-storey return to the rear, and several single-storey outbuildings. The building is part of three matching terraced buildings, located within a long row of mixed terrace buildings along the western side of Loy Street.	Post-Medieval	High
130	HB 09/13/009	281112, 378059	Police Station	Record Only Historic Building	6 Loy Street	The asset consists of the Police Station comprising a three-storey former house constructed around 1867-68 by a James McMillan before being converted to an RIC Barracks in 1905. The building has had many functions but mainly served as a police barracks until the 1970's. The property now has multiple uses, as a volunteer centre, a chiropodist, a Chinese clinic, and a hair studio. The collective changes to the building throughout its use have resulted in a building that, although well maintained, does not have sufficient architectural or historic interest to be listed.	Post-Medieval	Low
131	HB 09/14/007 B	281064, 378062	House	Grade B2 Historic Building	7 Loy Street	The asset consists of a Grade B2 Listed Building comprising a terraced, three-storey house constructed around 1870. The house is accompanied with a return to the rear, with several single-storey outbuildings. The building is part of three matching terraced buildings, located within a long row of mixed terrace buildings along the western side of Loy Street. The house aa built on the location of two thatched dwellings depicted on the Ordnance Survey map of 1833-34.	Post-Medieval	High
132	HB 09/14/028	280946, 378066	Masonic Lodge / School	Grade B1 Historic Building	Cookstown Masonic Lodge	The asset consists of a Grade B1 Listed Building that was a former school house, located on Fairhill Road and constructed around 1884, comprising single storey, sandstone building with brick dressings. The school closed 1929 when it was bought to become a Masonic Lodge. It is a well detailed and proportioned middle-size building, designed and constructed to a late-Victorian and Edwardian style.	Post-Medieval	High
133	HB 09/14/007 A	281062, 378067	House	Record Only Historic Building	5 Loy Street	The asset consists of a terraced three-storey, former house, which was initially constructed around 1870, but is now in use as a solicitor's office. The building is rectangular in plan with a three-storey pitched return to the rear and several single-storey outbuildings. The building is part of three matching terraced buildings, located within a long row of mixed terrace buildings along the western side of Loy Street. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
134	N/A	282188, 378070	Farmstead	Map Regression	New Buildings South-West	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising a U-shaped rectangular range with a small square outbuilding located to the east, which are set within a square enclosure. The farmstead is then depicted as a long rectangular range, set within a large rectangular enclosure on the Ordnance Survey map of 1854. The farmstead is then depicted on the Ordnance Survey map of 1906 comprising a much smaller rectangular building with two smaller outbuildings, with the main road now terminating at this location. A further rectangular structure is visible on the Ordnance Survey map of 1935 but no remains of the original farmstead exist today and a modern house and grounds now occupies this area.	Post-Medieval	Negligible
135	HB 09/14/008 B	281062, 378073	House	Record Only Historic Building	3 Loy Street	The asset consists of a terraced, two-storey house constructed around 1850, which is now in use as an accountant's office. Access to the rear yard is through a coach arch shared with the adjacent building to the east. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
136	HB 09/14/008 A	281063, 378079	House	Record Only Historic Building	1 Loy Street	The asset consists of an end-of-terrace, two-storey, former house that was constructed in 1850. It is roughly rectangular in plan with a two-storey return to the rear, and a single-storey lean-to extension. Access to the rear yard is through a coach arch shared with the adjacent building to the west. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
137	N/A	282000, 378092	Farmstead	Map Regression	Kidds Bridge East	The asset consists of a farmstead first depicted on the Ordnance Survey map of 1833 comprising two L-shaped rectangular ranges on either side of the road through this area. On the Ordnance Survey map of 1854, the farmstead is depicted as a rectangular range to the north and a larger L-shaped range to the south, with a small square outbuilding set within a triangular enclosure. The farmstead sits to the immediate south of the newly built Coagh Road. The original farmstead buildings are demolished by the time of the Ordnance Survey map of 1906, replaced by four rectangular structures set in a square formation, with an open court yard at its centre. This 20th century farmstead still exists today.	Post-Medieval	Negligible
138	HB 09/13/010 (A-C)	281108, 378105	House	Grade B2 Historic Building	66-70 James Street	The asset consists of a Grade B2 Listed Building comprising an three-storey, terraced former house constructed around 1878. The house is accompanied by a three-storey, lean-to return to the rear, with a single-storey flat-roofed extension, an additional single-storey, flat-roofed extension, and an abutting outbuilding constructed around 1880. The building forms part of three matching terraced buildings, located along James Street set within a mixed terrace.	Post-Medieval	High
139	HB 09/14/009	281064, 378117	Rectories/ Manses etc	Grade B1 Historic Building	First Presbyterian Church Manse	The asset consists of the Grade B1 Listed First Presbyterian Church Manse, located at 73 James Street, comprising a detached, two-storey manse constructed around 1855 that is set on a slight rise in a prominent position on the corner of James Street and Fairhill Road. The manse is accompanied by a two-storey return to the rear, a single-storey lean-to, a single-storey, flat roofed extension, and a modern single-storey garage. The current manse most likely post-dated the church construction, replacing an earlier manse that had a substantial number of thatched outbuildings.	Post-Medieval	High
140	HB 09/13/037 IHR 02338:005:00	281830, 378117	Bridge	Grade B2 Historic Building	Kidd's Bridge	The asset consists of a Grade B2 Listed Bridge, located on Coagh Road, comprising a three-arch, squared stone railway bridge constructed around 1867. The brick arches are arranged in three rows of red brick, with a projecting rounded yellow brick row to the outer perimeter. The arches are supported on two rock faced cut stone piers to the central arch. The bridge measures approximately 6 metres in width and forms part of a series of railway bridges that were part of the former GNR railway network. This section of the railway opened in July 1879 and later closed to passengers in January 1956, only to be used commercially and was shut down completely in January 1965. It is well preserved and in near original condition.	Post-Medieval	High
141	HB 09/13/011 (D-F)	281106, 378131	House	Grade B2 Historic Building	60-64 James Street	The asset consists of a Grade B2 Listed Building comprising a two-storey, terraced house constructed around 1838. The building forms part of a mixed terrace within a long row of buildings that are located along James Street. In 1878 a portion of the south end of the building, which appears to have amounted to a large curved bay, was demolished to make way for the present no.66.	Post-Medieval	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
142	HB 09/14/010	281033, 378137	Church	Grade B1 Historic Building	First Cookstown Presbyterian Church	The asset consists of the Grade B1 Listed First Cookstown Presbyterian Church, located at 71 James Street. The church comprises a two-storey classical style Presbyterian church constructed in 1841, and is prominently set on a rise on the west side of James Street. It is accompanied by a large, single storey hall constructed in 1875, and a two-storey manse to the south-east. The church grounds are enclosed from the street by a rendered wall with stone coping and decorative cast-iron railings. The church was located on the site of an earlier church dating from 1764. Prior to this the congregation, which was formed in 1646, had met in a building that stood in Coolreaghs at the south end of the town, eventually moving to Scotstown in 1701. The present building, with a small projection to the rear, is shown on the Ordnance Survey map of 1857, along with the manse and its attendant returns and outbuildings. It is possible that the manse was built at the same time as the church, but the design of its bay windows suggests it may be slightly later, perhaps around 1855. The present pipe organ was installed in 1907 and the church was renovated in 1975-76 following 'extensive' bomb damage, however, apart from modern style lighting, much of the internal detailing appears to have been preserved. In more recent years a large extension has been added to the west side of the rear projection and an equally large extension added to the west side of the neighbouring hall.	Post-Medieval	High
143	HB 09/13/011 (A-C)	281101, 378147	Shop	Grade B2 Historic Building	54-58 James Street	The asset consists of a Grade B2 Listed Building comprising a three-storey former house, shop and public bar that was constructed around 1835. The building was originally built as one house together with an adjacent building, now accompanied by a two-storey lean-to to the rear and several outbuildings. The building forms part of a mixed terrace within a long row of buildings that are located along James Street.	Post-Medieval	High
144	N/A	282874, 378153	Farmstead and well	Map Regression	New Buildings East	The asset consists of a small farmstead and well first depicted on the Ordnance Survey map of 1833 comprising a long rectangular range accompanied by a small square building, set within six rectangular enclosures. By the time of the Ordnance Survey map of 1853, the farmstead is shown as a single L-shaped range set within three enclosures, and the well is no longer depicted. On the Ordnance Survey map of 1906, the farmstead is then depicted as three rectangular ranges set within an L-shaped enclosure. A large modern farmstead now occupies this location, although remaining structures from the original farmstead may still survive as outbuildings.	Post-Medieval	Low
145	HB 09/13/012	281100, 378167	Police Station	Grade B2 Historic Building	50-52 James Street	The asset consists of a Grade B2 Listed Building comprising a two and half storey house that was once split into three small properties including a former house, offices and a police barracks. The building is part of a long row of mixed terrace buildings that are a located along James Street. The main central doorway is an early 19th century Regency style and is set into a semi-circular headed recess. Rounded fluted pilasters with Ionic capitals are located to each side of the door and set on cut-stone plinth blocks.	Post-Medieval	High
146	HB 09/13/013 (A-C)	281098, 378182	House	Grade B1 Historic Building	44-48 James Street	The asset consists of a Grade B1 Listed Building comprising a former three-storey house constructed around 1896, accompanied with a two-storey lean-to return, and a single-storey extension added in the 1960's. The building forms part of a matching terrace group, within a long row of attached buildings along James Street. All the original brick chimneys have been blocked up and removed. The roundel located to the right has a cut granite datestone inscribed '1896'.	Post-Medieval	High
147	N/A	282976, 378189	Farmstead	Map Regression	Crossing	The asset consists of a small rectangular farmstead first depicted on the Ordnance Survey map of 1833. The building is extended into a longer rectangular range on all subsequent maps. The farmstead no longer exists and the area is now part of a field system.	Post-Medieval	Negligible
148	N/A	283064, 378191	Farmstead	Map Regression	Border	The asset consists of a farmstead first depicted on the Ordnance Survey map of 1833, comprising four small rectangular structures accompanied by a large rectangular enclosure directly to the east of a crossroads. On the Ordnance Survey map of 1906, the farmstead has been converted into an L-shaped range with a small square structure located on the opposite side of the access road. The farmstead no longer exists with the area now occupied by a modern farmstead and yard.	Post-Medieval	Negligible
149	HB 09/14/011	281051, 378201	Shop	Grade B2 Historic Building	55 James Street	The asset consists of a Grade B2 Listed Building comprising a terraced, two-storey house and shop, constructed around 1833. The building is rectangular in plan with two extensions located to the rear which were constructed in the 1980's. The building forms part of a long row of mixed terrace buildings along James Street. It has a dramatic decorative feature that advertised the previous use, but otherwise it is of modest scale and simple proportions. The survival of the clock feature elevates the building in importance and is the main feature of interest, supported by the well-detailed shop front.	Post-Medieval	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
150	N/A	282228, 378201	Farmstead	Map Regression	Coagh Road Bend	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833 comprising two small rectangular structures and one small square outbuilding, accompanied with a rectangular enclosure to the south. On the Ordnance Survey map of 1854, the farmstead has been extended to form a large T-shaped structure set within a large enclosure. The farmstead is then shown as an L-shaped range accompanied by two small square outbuildings, set within three small enclosures on the Ordnance Survey map of 1906. The farmstead no longer exists and now the area is occupied by a modern house.	Post-Medieval	Negligible
151	HB 09/13/014	281095, 378203	House	Record Only Historic Building	40/42 James Street	The asset consists of former listed buildings that have been demolished and redeveloped.	Post-Medieval / Modern	Negligible
152	HB 09/13/034 (A-B)	281585, 378205	House	Record Only Historic Building	18-20 Molesworth Road	The asset consists of a brick faced, semi-detached, two-and-a-half storey house, that was constructed in 1897. The house was built along with the adjacent semi-detached house and is roughly square in plan with a two-storey return to the rear. There is an L-shaped single-storey lean-to outbuilding to rear yard. The house is set back from Molesworth Road within the North-eastern suburbs of Cookstown. There is a small garden to the front of the building with a gated path leading to the entrance door. The wall has simple square pillars with vermiculated quoins and pyramidal stone caps. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
153	HB 09/13/033 (A-B)	281560, 378216	House	Record Only Historic Building	14-16 Molesworth Road	The asset consists of a rendered, semi-detached, two-and-a-half storey house, constructed around 1897. The house was built along with the adjacent semi-detached house and is roughly square in plan with a two-storey return to the rear. There are two single-storey lean to outbuildings to the rear yard. The front elevation has a carved stone surround with a central carved fluted keystone over. The house is set back from the main Molesworth Road behind a low boundary wall with cast-iron railings. There is a small garden to the front with a gated path leading to the entrance door. The boundary wall has simple square pillars and pyramidal stone caps. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
154	HB 09/14/025	281045, 378221	Post Office	Record Only Historic Building	Post Office, 49-51 James Street	The asset consists of a two-storey post office building, constructed in 1962, and located at the end of a mixed terrace. It is rectangular in plan with a two-storey lean-to return to the rear, a modern, single-storey extension constructed in 1970, and a single-storey garage. External walls to the front and side are painted render with a polished granite base, with the rear elevation faced with concrete brick. The building is no longer deemed worthy of a full second survey.	Modern	Low
155	HB 09/13/032	281431, 378233	Telephone Exchange	Grade B2 Historic Building	Telephone Exchange Molesworth Road	The asset consists of the Grade B2 Listed telephone exchange building located on Molesworth Road. The building consists of a T-shaped in plan structure that was constructed around 1956 and a two-storey, flat-roofed telephone exchange building, built around 1969. External walls have been constructed from pre-cast concrete panels and both buildings are set back from Molesworth Road within the north-eastern suburbs of Cookstown. A date stone is inscribed with the date '1956'. It is designed in a modern vernacular style, and is well proportioned and detailed. The rear telephone exchange building, having been designed only 13 years later, has a clearly modernist appearance.	Modern	High
156	HB 09/13/017 A	281160, 378239	Public House	Grade B2 Historic Building	19 Molesworth Street	The asset consists of a Grade B2 Listed Building, which once functioned as a police barracks and court, and was constructed in stages between 1850 and 1880. Now a public house, it forms part of a row of mixed three-storey buildings comprising a long, narrow and rectangular plan building, which extends south and is accompanied with a further two-storey return. A further single storey extension was added onto the two-storey return in the 1960's. The building has used dressed stone and brick as the primary building material. Brick surrounds, laid in English bond, has been used to decorate openings and protruding dressed stone quoins have been used to decorate edges.	Post-Medieval	High
157	HB 09/13/017 D	281185, 378245	House	Grade B2 Historic Building	25 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house, which is rectangular in plan, and comprises three-storey's, with a stepped two-storey return located to the rear. A two-storey modern building abuts the return, which creates a courtyard enclosure with the adjacent building. Access to this courtyard is gained through a coach arch located along the front of the building. The building forms part of a long row of mixed three-storey buildings, that were built in stages between 1850 to 1880, which have now largely been converted to shops, pubs and offices. The present no.25 was built in 1873 as an addition to the existing dwelling to the west, nos.21 and 23, built in 1861 by a William S. Crawford.	Post-Medieval	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
158	HB 09/13/018	281326, 378246	Church	Grade B1 Historic Building	Molesworth Street Presbyterian Church	The asset consists of a Grade B1 Listed Church located at 69 Molesworth Street, Cookstown. The church consists of a two-storey, rectangular church constructed around 1835. The building is accompanied with a single-storey lean-to and a two-storey hall to the rear of the building. A church manse is located to the east of the site, which is contemporary with the main church building. The church was constructed by the Cookstown Third Presbyterian congregation and a date stone, located within the frontal tympanum, that suggests the building was constructed in 1835. However, although this date stone was placed in that year, work was said to have been delayed due to storm damage, resulting in the church not opening until 1837. The church has undergone several modern alterations but remains largely untouched. The classical design with the accompaniment of cast iron railings and gates, emphasizes its considerable social significance to the area.	Post-Medieval	High
159	HB 09/13/017 B	281170, 378247	House	Grade B2 Historic Building	21-23 Molesworth Street	The asset consists of a Grade B2 Listed Building that formerly housed two dwellings comprising a long narrow, rectangular building constructed around 1861. The building extends to towards the south with an L-shaped, two-storey range that faces onto a courtyard. Access to this courtyard is gained through an integral coach arch which is located along the frontal elevation along the northern extent of the building.	Post-Medieval	High
160	HB 09/13/005 A	281415, 378250	Gates / Screens / Lodges	Grade B1 Historic Building	Gate Lodge, Coolnafranky House	The asset consists of a Grade B1 Listed former Gate Lodge that belonged to Coolnafranky House, located at 3 Molesworth Road. The building comprises a detached one and a half-storey stone faced former gate lodge, which was constructed around 1878, to the possible designs of John Lanyon. The rear of the building is accompanied with a one and a half-storey return and a single-storey lean-to. The lodge is slightly set back from Molesworth Road on the corner of the main driveway into Coolnafranky House, with the building enclosed by a low-rise snecked stone wall. The house is set to the north-eastern side of the town centre and marks the beginning of the mainly Victorian suburban Molesworth Road. The gate lodge is designed in a picturesque Victorian style, which is in marked contrast to the classical character of the main house. Combined with the nearby railway related structures and various houses in the area the gate house adds much to the overall Victorian character and appearance of the area.	Post-Medieval	High
161	IHR 05385:000:00	281480, 378250	Saw Mill	IHR	Molesworth Road Saw Mill	The asset consists of a saw mill, located at the east side of Cookstown, which is first depicted on the Ordnance Survey map of 1906. The saw mill is surrounded by several buildings that relate to the Cookstown railway and station, providing an easily accessible link to the rail network. The mill is no longer depicted on the Ordnance Survey map of 1935, and the area is now occupied by modern houses and shop fronts.	Modern	Negligible
162	HB 09/13/017 E	281194, 378251	House	Grade B2 Historic Building	27-29 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house constructed in 1872 comprising three-storeys accompanied by a two-storey return at the rear. The building forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850 to 1880, which have largely converted into shops, pubs and offices.	Post-Medieval	High
163	HB 09/13/017 G	281203, 378252	House	Grade B2 Historic Building	31-33 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house constructed in 1872 comprising three-storeys accompanied by a two-storey return at the rear. The building forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850 to 1880, which have largely converted into shops, pubs and offices.	Post-Medieval	High
164	HB 09/13/017 (I-J)	281209, 378252	House	Grade B2 Historic Building	35-37 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house constructed in 1874, comprising three-storeys accompanied by a two storey return to the rear with a further single storey lean to. The building forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850 to 1880, which have largely converted into shops, pubs and offices. The front elevation which is located along the northern extent of the building, contains a shop fronts, that were constructed in the 1908.	Post-Medieval	High
165	N/A	283216, 378253	Farmstead	Map Regression	Terressan North A	The asset consists of a small rectangular farmstead first depicted on the Ordnance Survey map of 1833 comprising a long rectangular range accompanied by a small square building to the north, both set within a rectangular enclosure. The buildings and the enclosures are no longer evident on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
166	HB 09/13/017 K	281227, 378255	House	Grade B2 Historic Building	39-41 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house constructed in 1874, comprising three-storeys accompanied by a two storey return to the rear with a further single storey lean to. The building forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850 to 1880, which have largely converted into shops, pubs and offices. The front elevation which is located along the northern extent of the building, contains a shop fronts, that were constructed in the 1908.	Post-Medieval	High

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
167	HB 09/13/017 N	281245, 378257	House	Grade B2 Historic Building	45 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house comprising three-storeys accompanied with a two-storey lean-to return at the rear, and a two-storey pitched return, also located in the rear. The building forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850-80, which have largely converted into shops, pubs and offices. The former house exhibits high quality ashlar sandstone external walls.	Post-Medieval	High
168	HB 09/13/017 M	281236, 378258	House	Record Only Historic Building	43 Molesworth Street	The asset consists of a house once located at 43 Molesworth Street comprising a single storey house, constructed in around 1872. The house was once part of a complex of outbuildings belonging to the large neighbouring house to the west, constructed by William Mason. The asset consists of a former listed building that has been demolished and redeveloped.	Post-Medieval	Negligible
169	HB 09/13/017 O	281259, 378258	House	Grade B2 Historic Building	47-49 Molesworth Street	The asset consists of a Grade B2 Listed Building that was a former house comprising three-storeys accompanied with a two-storey lean-to return at the rear, and a two-storey pitched return, also located in the rear. The building is separated from its neighbour by a coach arch, and it forms part of a long row of mixed three-storey buildings that were constructed in stages between 1850-80, which have largely converted into shops, pubs and offices.	Post-Medieval	High
170	HB 09/13/017 Q	281264, 378259	House	Grade B2 Historic Building	51-53 Molesworth Street	The asset consists of a Grade B2 Listed Building constructed in 1879/1880, comprising a three-storey former Victorian House accompanied with a single storey return abutting the rear and an additional two-storey rendered lean-to return to the east.	Post-Medieval	High
171	HB 09/13/017 T	281272, 378260	Shop	Record Only Historic Building	57-59 Molesworth Street	The asset consists of a three-storey rendered end-of-terrace building, constructed around 1880-1881. The property contains a shop to ground floor and apartments to the upper levels. The building forms part of a long row of mixed three-storey buildings, built in stages between 1850-80, now largely converted to shops, pubs and offices. It is rectangular in plan with a two-storey pitched roofed return to the right of the rear elevation. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
172	HB 09/13/015	281128, 378269	Shop-Terrace	Record Only Historic Building	14-16 Molesworth Street	The asset consists of a two-storey former town hall, masonic hall and offices, that was constructed around 1884, possibly to designs by John Lanyon. The building is long and rectangular in plan, with a two-storey flat roofed return to rear and is now in retail and office use. The building is no longer deemed worthy of a full second survey.	Post-Medieval	Low
173	HB 09/13/030	281312, 378291	Railway Station	Record Only Historic Building	46 Molesworth Street	The asset consists of a detached two-storey red brick, former station house, constructed around 1910. The building is located adjacent to the former LMS railway terminus and forms part of a series of railway buildings related to the Randalstown and Cookstown railway line. The building is roughly rectangular in plan, with a 1990's two-storey extension to the rear. A single-storey porch projection is located to the centre of the front elevation and flemish bond brick has been used for the external walls. This former station house is street-fronted with continuous level access directly onto the street. The building is no longer deemed worthy of a full second survey.	Modern	Low
174	HB 09/13/021 B	281090, 378298	Shop	Record Only Historic Building	18-20 James Street	The asset consists of former listed buildings that have been demolished and redeveloped.	Post-Medieval	Negligible
175	HB 09/13/031 IHR 02338:008:00, and 02195:053:00	281532, 378305	Goods Shed	Grade B1 Historic Building	Former Goods Shed Molesworth Street	The asset consists of a Grade B1 Listed Building comprising the Former Goods Shed at Molesworth Street, constructed around 1870 and is now in use as a council storage warehouse. It is long and rectangular in plan with a single-storey extension to the west elevation. It forms part of a series of railway buildings, all part of the Great Northern Railway (GNR). There is a low-rise wall abutting the rear elevation supporting a raised timber water tank. There is a high-rise boundary wall abutting the rear elevation, and to the south of the building there is a distinctive double-riveted wrought-iron arched gateway, set on replacement tall rock-faced pillars. The archway contains painted wrought-iron lettering depicting 'GREAT NORTHERN RAILWAY'. The goods shed still has its original relationship with the listed GNR railway station on Molesworth Street.	Post-Medieval	High
176	N/A	282445, 378305	Farmstead	Map Regression	Tullygare	The asset consists of a large farmstead first depicted on the Ordnance Survey map of 1833, comprising two rectangular ranges, two square buildings, and five rectangular enclosures of varying size. On the Ordnance Survey map of 1854, the farmstead comprises three rectangular ranges set within seven rectangular enclosures of various size. By the time of the Ordnance Survey map of 1906 there are only two rectangular ranges set within two rectangular enclosures. The majority of the farmstead has now been demolished with a modern house now occupying the area, but a small barn structure may belong to the original farmstead.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
177	HB 09/13/019	281337, 378308	Railway Station Structures	Grade B+ Historic Building	Former LMS Railway Terminus	The asset consists of the Grade B+ Listed Building comprising the former railway terminus and platform, located on Molesworth Street. The building comprises a long single-storey sandstone building that was constructed between 1855-56 and designed by architect Charles Lanyon. The terminus was part of the line between Randalstown and Cookstown until it closed in 1950. The terminus building has two parts, the former station to the south, and former platform, which is now enclosed as part of the restaurant, to the north. The former station is rectangular in plan, with a projecting central entrance porch. It is situated to the north east of the town centre, adjacent to an assortment of former railway buildings. The building represents an important element of the growing prosperity of Cookstown and its railway during the mid to late nineteenth-century. The building is well composed with high quality stone masonry and detailing to the exterior. Much of the good quality interior detail has remained intact, adding to the sense of style and importance of this building. The exposed roof structure has been well-maintained and the minor amendments do not detract from character of the original fabric. The building has a strong street presence along Molesworth Street, and is a good example of the work of the renowned architect Charles Lanyon.	Post-Medieval	High
178	IHR 04671:000:00	282310, 378310	Limestone Quarry & Limekiln	IHR	New Buildings Limestone Quarries & Limekilns	The asset consists of limestone quarries and limekilns, located to the east of Cookstown in Tullygare along the northern extent of Coagh Road. These quarries and kilns are depicted on the Ordnance Survey map of 1833, but not on subsequent historic mapping, suggesting there were no longer any upstanding remains. The area is now part of an agricultural field.	Post-Medieval	Negligible
179	HB 09/13/016 IHR 02195:055:00, and 02338:009:00	281413, 378316	Railway Station Structures	Grade B+ Historic Building	48 Molesworth Street	The asset consists of a Grade B+ Listed Building comprising the former station, stationmaster's house, and iron arch located at 48 Molesworth Street. The station was built between 1874 and 1879 to serve the Great Northern Railway line which ran between Cookstown and Dungannon. It was designed by the GNR's Chief Civil Engineer, W.H. Mills. The station and the attendant station buildings are recorded in the valuation of 1916 as consisting of the 'Passenger station house, platform roofs and sheds, store and weigh house'. The Cookstown-Dungannon line was closed to passengers in January 1956 and ceased operations completely in January 1959. This is a detached two-storey former GNR railway terminus, built around 1876. The former railway terminus is long and rectangular in plan, whereas the adjoining former stationmasters' house is L-shaped with a projecting two-storey porch to the inner corner of the L-shape. There are two long covered station platforms running parallel to the rear of the former station. The single-storey front South elevation to terminus is set back from the main road and has Flemish bond brick to external walls. The small town of Cookstown is unusual in that it was initially served by two separate railway companies. The building was noted as being well composed and detailed and in quite original condition.	Post-Medieval	High
180	HB 09/13/020	281253, 378333	House	Record Only Historic Building	63/67 Union Street	The asset consists of former listed buildings that have been demolished and redeveloped.	Modern	Negligible
181	IHR 04677:000:00	283130, 378340	Flax Pool	IHR	Cranfield Flax Pool	The asset consists of a flax pool noted on the IHR. However, there is no annotation for this site on any historical mapping. Flax was one of the main crops grown across Northern Ireland, and provided the basic ingredient of the countries linen industry. After the flax had been grown, cut and then bundled, the flax had to submerged for a week to ten days. This process was called retting the flax. It is noted that most farmers would have their own pools or dams, to carry out this process. Aerial photography of the area does not show any remains either, with the site part of an agricultural field.	Post-Medieval	Negligible
182	HB 09/14/012	281036, 378346	House	Record Only Historic Building	1-3 James Street	The asset consists of a former pair of Victorian dwellings now in use as two shops with storage accommodation over. The original windows, shopfronts, and interior detailing have been lost. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
183	N/A	282496, 378375	Farm building	Walkover Survey	Coagh Road Farm Building	The asset consists of a small farm building located to the north of Coagh Road comprising a rectangular rough cut stone and mortar constructed building with a corrugated iron roof. Rectangular cast concrete copings have been used to finish each gable end. The building is orientated east to west with a large door, and a smaller door and window at the southern end. The building is separated into two rooms.	Post-Medieval	Low
184	HB 09/13/036	281599, 378381	Bridge	Record Only Historic Building	Limekiln Lane Bridge	The asset consists of a single-arch rubble stone road bridge over a former railway line, that was constructed around 1855. It has a part overgrown snecked rock faced stone outer walls. The wall at road level has rounded stone capping to the centre and rubble stone capping to the outer edges. There is a single segmental-headed arch with rubble stone voussoirs, and rubble stone soffits. The bridge spans a former Belfast Ballymena railway company line from Randalstown and forms part of a series of railway bridges, built as part of the line between Dungannon and Cookstown. The bridge is no longer deemed worthy of a full second survey.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
185	HB 09/13/022	281079, 378394	Shop	Grade B+ Historic Building	48/50 William Street	The asset consists of a Grade B+ Listed Building located at 48/50 William Street. The building comprises a two-and-a-half storey terraced house with a return to the rear, constructed around 1897. A further single-storey flat-roofed extension also stretches back to the rear. The building has been constructed with red dressed sandstone on the ground level and red brick in Flemish bond for the upper. Dressed yellow sandstone blocks have been used as corner and edge quoin decorations on the floors above. There is a carved stone frieze depicting the lettering 'J. MAC MAHON'. In the 1859 valuation a house is recorded on this site, occupied by a John Quinn, with John Harbison the immediate lessor, and the rateable value £13. In 1882 or 1888 the rateable value is noted as rising to £23, seemingly on account of the addition of a store to the rear. A John McCormack is recorded as the occupant in 1888. In 1895 a Joseph McMahon became the leaseholder, and by 1897 he had rebuilt the property, which after that date is recorded as a 'house, shop, store, yard and garden', with a rateable value of £49. McMahon acquired the freehold of the property in 1912. The building was still in the hands of the MacMahon family in 1972. The terraced house was an elaborate and rare example of a late-Victorian townhouse and shop. The front elevation is lively with contrasting plasterwork and brick detailing together with a fine mid twentieth century polished shopfront. The plasterwork depicting animals is particularly important. Inside the butcher's shop there are increasingly rare pictorial representations in glazed tiles.	Post-Medieval	High
186	HB 09/14/013	281029, 378417	Shop	Record Only Historic Building	33/35 William Street	The asset consists of a former pair of Victorian dwellings now in use as two shops with storage accommodation over. The original windows, shopfronts, and interior detailing have been lost. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
187	HB 09/13/024	281071, 378430	Shop	Record Only Historic Building	32/34 William Street	The asset consists of a former pair of Victorian dwellings now in use as two shops with storage accommodation over. The original windows, shopfronts, and interior detailing have been lost. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
188	IHR 05383:000:00	281470, 378430	Limekiln	IHR	Cookstown Limekiln	The asset consists of a limekiln located to the east of Cookstown in Tullygare, and is first depicted on the Ordnance Survey map of 1833. The site is no longer depicted on subsequent historic mapping, suggesting the limekiln was no longer upstanding or visible, and aerial photographs show the location to be part of an agricultural field.	Post-Medieval	Negligible
189	HB 09/13/025	281079, 378438	Public House	Grade B2 Historic Building	Central Bar	The asset consists of a Grade B2 Listed Building located at 30 William Street. The building comprises a three-storey house and late Victorian pub that are located in a building originally constructed in the early 18th century. It is roughly rectangular in plan with a three-storey pitched return to the rear. There is a further two-storey extension attached to the rear. The building is located to the east side of William Street within the commercial area of Cookstown. In the first valuation of 1835 the building is noted as a 'not new' structure, in the possession of a Doctor Young. The building was accorded the rateable value of £10-11-5, rising to £14 in the valuation revision of 1838. By 1859 the house was in the hands of a Mary White, with a Robert Harkness the immediate lessor, and the building rated at £24. In 1862 a William is recorded as the occupant, followed by a Joseph McAleer in 1863. In 1868, the property was subdivided and a Jane Newberry is noted as having use of one of the outbuildings. James E. Treanor became the occupant of the main portion of the building in 1874, with an Elizabeth McGivern succeeding him in 1884, James Malone 1885, and Anne Jane Malone in 1888. In the valuation revision book of 1889-99 the property is noted for the first time as a public house, however it may have been so for some years prior to this for both the aforementioned Joseph McAleer and James E. Treanor are recorded as publicans / 'spirit and porter dealers' of William Street in 1870s and 1880s directories. In 1913, Thomas McGurk became the tenant, followed by Robert Turner in 1921, Jane Turner in c.1940, and Geraldine Turner in around 1955. Geraldine Green acquired the freehold in 1963, by which stage a Patricia McCann is recorded as the occupant. The building is a good example of a commercial building of an urban vernacular style that has developed into a middle-sized townhouse and late Victorian pub, refurbished in the 1930s but retaining the atmosphere of a small, local drinking establishment.	Post-Medieval	High
190	HB 09/14/014 C	281021, 378441	House	Record Only Historic Building	27 William Street	The asset consists of a three-storey terrace house and pub, constructed around 1840. It is roughly rectangular in plan with a three-storey pitched roof return to the rear. There is a further two-storey pitched extension, and an additional single-storey flat-roofed extension to the rear. The two-storey extension has a coach arch to the ground floor leading to a further series of two-storey rendered out-buildings. The building forms part of a ten-bay matching terrace on the West side of William Street within the commercial district of Cookstown. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
191	HB 09/13/026	281070, 378444	Shop	Grade B2 Historic Building	26-28 William Street	The asset consists of a Grade B2 Listed Building located at 26-28 William Street. The building consists of a shop and house, and is roughly rectangular in plan, with a single-storey lean-to to the rear that was constructed around 1830. There is also a further single-storey flat-roofed outbuilding to the rear built in around 1897. The building forms part of a long row of mixed terrace buildings along William Street. By 1859, the property was in the hands of a Thomas Bell, with a Robert Black the immediate lessor, and the property rated at £14-10-0. Bernard Henry took over the tenancy in 1862, followed by a Peter Donnelly in 1872, Bernard Donnelly 1879. 'P & B. Donnelly' of William Street are listed under 'linen and woollen drapers and haberdashers' in Slater's 1870 directory. John Early, a grocer, was the next occupant, in 1891, also acquiring the lease. In 1897, Early held on to the lease until 1915, when it and the tenancy were taken over by another grocer, Henry B. Eastwood. Eastwood was succeeded by the 'Browne Brothers' in 1928, and by 1936 a Robert Brown is recorded as the tenant and a George Faulkner the immediate lessor. Martha Brown and Mary Faulkner are listed as tenant and leaseholder respectively in 1951. In 1964 the property is noted as vacant, and appears to have remained so up until at least 1972. The building is a well composed example of a late Georgian house that retains its essential character with the ground floor converted for commercial use in the Victorian era. Its modest scale and simple proportions are a good example of the type.	Post-Medieval	High
192	HB 09/14/014 B	281019, 378448	House / shop	Grade B1 Historic Building	Henry & Faulkner, 25 William Street	The asset consists of a Grade B1 Listed Building located at 25 William Street Cookstown. The building comprises a three-storey terrace house and shop, that was originally constructed around 1840. It is roughly rectangular in plan with a three-storey pitched return to the rear. There is a two-storey outhouse building to the rear yard. The building forms part of a ten-bay matching terrace on the west side of William Street. This property is recorded in the 1859 valuation as occupied by an Isaac Houston, a grocer, with Thomas Black the immediate lessor, and the building rated at £34. In 1863, a Hugh and James MacMillan, (listed in the directories under 'milliners and dressmakers'), took over the lease of this and the two similarly-styled neighbouring properties to the north and south. By 1884, Isaac Houston was occupying the property jointly with a Thomas J. Jones. A Francis P. Devlin acquired the lease in 1895, holding both this property and its neighbour to the south (no.27). An Isaac H. Henry, a 'pharmaceutical chemist', is recorded as the occupant in 1896, followed by a George Faulkner in 1918, after which the shop area of the building served as a chemist and grocers, under the name 'Henry & Faulkner'. The tenancy remained with the Faulkner family and the lease with the Devlin family up until at least 1972. The building is a well-composed early Victorian Regency style house and shop that, as part of a matching terrace of three, makes a significant contribution to the historic character and appearance of the town. The building provides a good example of a mid-19th century matching terrace alongside the adjacent buildings.	Post-Medieval	High
193	HB 09/14/017	281046, 378451	Memorial	Record Only Historic Building	Cenotaph	The asset consists of a monolithic granite cenotaph, erected around 1922 as a memorial to those who lost their lives in the Great War of 1914-1918. It is closely modeled on the Whitehall Cenotaph in London, designed by Sir Edwin Lutyens. It occupies a prominent location in the centre of the main thoroughfare of William Street and is set on a raised plinth with a cut-granite base with carved cornicing to the first tier. The plaques have splayed stone surrounds, with the northern plaque inscribed '1939 – 1945' with a list of names below. The eastern and western plaques are inscribed 'IN GRATEFUL MEMORY OF THE MEN FROM COOKSTOWN AND DISTRICTS WHO IN THE GREAT WAR GAVE THEIR LIVES FOR FREEDOM', and a further list of names below. The southern plaque of the cenotaph is inscribed 'OUR GLORIOUS DEAD' in raised lettering. The third tier has a carved stone wreath on the northern and southern faces. The fourth tier is inscribed with '1914' and '1918' in raised lettering.	Modern	Low
194	HB 09/14/014 A	281023, 378456	House	Record Only Historic Building	23 William Street	The asset consists of a three-storey terraced house and shop, that was constructed around 1840. The building is roughly rectangular in plan with a three-storey return to the rear. There is a further single-storey flat-roofed extension beyond to the rear West. The building forms part of a ten-bay matching terrace on the West side of William Street within the commercial district of Cookstown. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
195	HB 09/14/015	281024, 378467	Shop	Record Only Historic Building	19/21 William Street	The asset consists of a pair of former Victorian three storey terraced houses with storage to upper floors and shops to the ground floor. Much of the interior layout has been lost along with the original shopfront and windows. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
196	HB 09/14/016	281023, 378482	Shop	Record Only Historic Building	15/17 William Street	The asset consists of Victorian three storey terraced houses with storage to upper floors and shops to the ground floor. Much of the interior layout has been lost along with the original shopfront and windows. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
197	N/A	282799, 378521	Farmsteads	Map Regression	Cranfield Farmsteads	The asset consists of six farm buildings that form Cranfield Farmsteads, first depicted on the Ordnance Survey map of 1833. The farmsteads are shown as six rectangular range structures, set within five large rectangular enclosures. One of the ranges is extended by the time of the Ordnance Survey map of 1854, and the current buildings in the area may relate to these original structures that have been modified or updated.	Post-Medieval	Low
198	HB 09/12/001	281012, 378579	Hotel	Record Only Historic Building	Old Town Street Hotel	The asset consists of former listed buildings that have been demolished and redeveloped.	Post-Medieval / Modern	Negligible
199	HB 09/12/002	281011, 378600	Shop	Record Only Historic Building	16/18 Oldtown Street	The asset consists of a Victorian three storey terrace with storage to upper floors and shops to the ground floor. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
200	N/A	282939, 378615	Farmstead	Map Regression	Cranfield North-West	The asset consists of a small farmstead first depicted on the Ordnance Survey map of 1833 comprising a single rectangular range located within a large rectangular enclosure. Some alterations were made to the farmstead, as in the Ordnance Survey map of 1854 it can be seen that the original structure now consists of an L-shaped range set within a small triangular enclosure. The farmstead then remains unchanged on all subsequent mapping and still exists today.	Post-Medieval	Low
201	HB 09/12/003 (A-C)	281008, 378644	House	Record Only Historic Building	32a/b to 36a/b Oldtown Street	The asset consists of a terraced two and a half storey house with a single-storey basement, that was constructed around 1870. It is roughly rectangular in plan with a three-storey pitched extension to the west. There is a further two-storey extension and an attached two-storey outbuilding to the rear. The building is set back from Oldtown Street on a rising slope behind a low rendered wall with cast-iron railings. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
202	N/A	282771, 378646	Farmstead	Map Regression	Cranfield North	The asset consists of a small farmstead first depicted on the Ordnance Survey map of 1833 to the north of Old Coagh Road, comprising two rectangular structures set within two large rectangular enclosures. A third small, square structure is added by the time of the Ordnance Survey map of 1854 and a fourth added to the north of the original farmstead by the time of the Ordnance Survey map of 1906. A large farmstead with two modern houses now occupies the area, but a single garage may relate to the original buildings.	Post-Medieval	Low
203	N/A	282158, 378657	Farmstead and location of Mile Stone	Map Regression	Mile Stone Farm	The asset consists of a farmstead first depicted on the Ordnance Survey map of 1833 to the north of Old Coagh Road, comprising three rectangular ranges. The Ordnance Survey map of 1854 also depicts a marker post next to the farmstead, annotated as '53 Mile Post (from Belfast)'. The marker post is not depicted on subsequent Ordnance Survey maps, but the farmstead remains relatively unchanged until the Ordnance Survey map of 1906, annotated as 'Tullygare House'. One of the rectangular ranges still survives on the site as an upstanding structure and is used as out buildings for the modern house.	Post-Medieval	Low
204	HB 09/12/004	281001, 378698	House	Record Only Historic Building	52 Oldtown Street	The asset consists of former listed buildings that have been demolished and redeveloped.	Post-Medieval / Modern	Negligible
205	HB 09/13/035	281039, 378728	House	Record Only Historic Building	63 Oldtown Street	The asset consists of a terraced two-storey house, built around 1830. The building is largely rectangular in plan with a single storey lean to open trellis/veranda to the front elevation and a further two-storey return adjoining the rear. The house is set back from Oldtown Street and there is a low rendered wall to the roadside and a long narrow stepped garden rising towards the house. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
206	HB 09/12/005	280997, 378751	Terraced Housing	Record Only Historic Building	68/74 Oldtown Street	The asset consists of a later Victorian terrace of four dwellings. The interior has been lost and the windows and doors have been recently replaced. The buildings are no longer deemed worthy of a full second survey.	Post-Medieval	Low
207	N/A	282378, 378891	Railway Line	Map Regression	Cookstown and Randallstown Railway	The asset consists of the Cookstown and Randallstown Railway, first depicted and annotated on the Ordnance Survey map of 1854, comprising a south-west to north-east aligned railway and embankment terminating at the east edge of Cookstown at Molesworth Road. The Belfast and Ballymena Railway opened a railway station in Cookstown on 10 November 1856 at the terminus of the line, and in 1860 the line became the Belfast and Northern Counties Railway that is absorbed by the Midland Railway in 1903. The rail line is no longer in use but still exists as a large embankment in some sections.	Post-Medieval	Low
208	HB 09/13/027	281046, 378934	Terraced Housing	Record Only Historic Building	2/20 Moneymore Road	The asset consists of two terraces of five houses that are now amalgamated as one. Some houses have been combined to make larger dwellings and original windows and doors have been lost. The buildings are no longer deemed worthy of a full second survey.	Modern	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
209	N/A	283004, 379046	Farmstead	Map Regression	Lismoney Fort South-West	The asset consists of a farmstead located to the south of Lismoney fort, first depicted on the Ordnance Survey map of 1833 comprising two rectangular structures set within a large enclosure. The farmstead is no longer depicted on the Ordnance Survey map of 1906 and the area part of a field system.	Post-Medieval	Negligible
210	N/A	281350, 379099	Cottages	Map Regression	Waterloo Cottages	The asset consists of cottages located at the crossroads of Moneymore Road and a farm track, first depicted and annotated on the Ordnance Survey map of 1854, comprising three small ranges set within a single enclosure and accompanied with three small enclosures to the east. The cottages appear on all subsequent Ordnance Survey maps and change very little in layout over time. The cottages still exist today but have undergone severe modern alterations, with sections of the cottages having been demolished for modern housing and the corner cottage having been modified and now used as a small gatehouse.	Post-Medieval	Low
211	N/A	282700, 379133	Farmstead	Map Regression	Lismoney Fort East	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising three rectangular structures set within three enclosures. The farmstead has been removed by the construction of the Midlands Railway according to the Ordnance Survey map of 1906. Three rectangular structures are set within a small enclosure to the east of the original buildings and may be replacements for those demolished. The area is now part of a field system.	Post-Medieval	Negligible
212	NISMR TYR029:001	282090, 379150	Fortification	NISMR	Ballymenagh Castle	The asset consists of the remains of the former Ballymenagh Castle, located to the north-east of Cookstown, comprising a 3 m length of wall standing two courses high, that may be the north-western return of the castle. Local information reports that most of the remains were levelled in the 1930s and that demolition had been on-going. The castle ruins are first depicted on the Ordnance Survey map of 1833, as a rectangular structure that is clearly annotated as a 'Ruin'. The site is then annotated on subsequent mapping as 'Ballymenagh Castle (in Ruins)'. From the information available it is not clear if the castle belonged to an early 17th century plantation castle or was perhaps a later monument.	Post-Medieval	Low
213	NISMR TYR029:035	281930, 379340	Enclosure	NISMR	Enclosure	The asset consists of a large circular enclosure, located to the north-east of Cookstown in Ballymenagh, first depicted on the Ordnance Survey map of 1833. The enclosure is no longer depicted on the Ordnance Survey map of 1854, and it is likely that the upstanding remains of the enclosure have been removed by agricultural activity, with the site no longer visible on the ground.	Unassigned	Low
214	N/A	281883, 379342	Well	Map Regression	Ballymenagh Well	The asset consists of a well depicted and annotated on the Ordnance Survey map of 1833 on a corner of Moneymore Road. The well is no longer depicted on the Ordnance Survey map of 1854, and the area is now surrounded by the main road and a passing place.	Post-Medieval	Negligible
215	N/A	281747, 379414	Farmstead	Map Regression	Moneymore Road North	The asset consists of a small farmstead located to the north of Moneymore Road on the Ordnance Survey map of 1833, comprising a small rectangular building, accompanied with a small square outbuilding, set within a small square enclosure. The farmstead is no longer depicted on the Ordnance Survey map of 1854 and the area is now occupied by a small modern house and garages.	Post-Medieval	Negligible
216	HB 09/07/010	283555, 379436	House	Grade B1 Historic Building	20 Lismoney Road	The asset consists of a Grade B1 Listed farmstead located at 20 Lismoney Road, Cookstown. The farmstead is first depicted on the Ordnance Survey map of 1832 consisting of two rectangular ranges and two smaller square buildings that form a square in plan. The farmstead is then shown on the Ordnance survey map of 1906, as consisting of four ranges, three of which form the square in plan. Aerial photographs show that the listed farmstead consists of the northern range from the Ordnance Survey map of 1832, and the eastern range dates from the Ordnance Survey map of 1906.	Post-Medieval	High
217	N/A	282593, 379452	Farmstead	Map Regression	Ballymenagh Ruins	The asset consists of the remains of ruins and a small farmstead, first depicted and annotated on the Ordnance Survey map of 1833, comprising a long rectangular range accompanied with three smaller rectangular buildings, with ruins depicted along the northern extent of the farm buildings. The remains of these building are still upstanding but in a ruined condition, with a modern range having superseded them.	Post-Medieval	Low
218	N/A	282539, 379471	Farmstead	Walkover Survey	Ballymenagh Farmstead	The asset consists of a derelict house to the west of the Ballymenagh ruins ***(Site 217)***, comprising a rectangular rough cut stone and mortar, two storey building with a dilapidated slate roof. The building is orientated east to west, with each gable end housing a small chimney stack. Three window openings are closed up with corrugated iron sheeting along the buildings' northern extent and the doorways and entrances along the buildings southern extent have had their lintels removed. The building roughly measured 9 m by 15 m and had a small boundary wall located to the east of the building.	Post-Medieval	Low

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
219	N/A	282359, 379528	Farmstead	Map Regression	Ballymenagh House Farmstead	The asset consists of a small farmstead, first depicted on the Ordnance Survey map of 1833, comprising two small square structures that are accompanied by a medium sized rectangular enclosure. The building is later altered to a long rectangular range according to the Ordnance Survey map of 1854, accompanied with several large rectangular enclosures. The farmstead is no longer depicted on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
220	N/A	283054, 379569	Farmstead	Map Regression	Lismoney Road Ruins B	The asset consists of a small group off ruins depicted and annotated on the Ordnance Survey map of 1833, comprising two small rectangular buildings to the south of Lismoney Road. The ruins are no longer depicted on the Ordnance Survey map of 1906 as the Midlands Railway Northern Counties Section was constructed over the site. The area is now part of a field system since the dismantling of the railway.	Post-Medieval	Negligible
221	N/A	282119, 379670	Farmstead	Map Regression	Ballymenagh House West	The asset consists of a farmstead to the west of Ballymenagh House, first depicted on the Ordnance Survey map of 1833, comprising three rectangular structures accompanied with two enclosures. The farmstead remained unchanged up until the Ordnance Survey map of 1906, where the farmstead is shown as two large L-shaped buildings set within a large rectangular enclosure. The farmstead still exists with several modern additions.	Post-Medieval	Low
222	N/A	282966, 379683	Ruins	Map Regression	Lismoney Road Ruins A	The asset consists of the ruins of a rectangular structure first annotated and depicted on the Ordnance Survey map of 1833, located along the northern extent of Lismoney Road. The ruins lie in close proximity to a large farmstead to the north, which may have shared some association with the site. The ruins are no longer depicted on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
223	N/A	282293, 379735	House	Map Regression	Ballymenagh House	The asset consists of Ballymenagh House, first depicted on the Ordnance Survey map of 1833 comprising a small rectangular range set within a triangular enclosure. An access road is located along the eastern extent of the farmstead, leading north to the main road. The farmstead is altered into a long rectangular range on the Ordnance Survey map of 1854, set within two large triangular enclosures. Another rectangular range has been added to the house on the Ordnance Survey map of 1906, to the north of the original range to form a T-shaped structure. A small square outbuilding was also added, to the east. The Ordnance Survey map of 1935, which depicts several new additions to the farmstead, also annotates the site as 'Ballymenagh House'. The new additions include an L-shaped range, five square structures, and a sheep wash. The farmstead still exists with several modern additions.	Post-Medieval	Low
224	N/A	281818, 379753	Farmstead	Map Regression	Tamlaghtmore Road West B	The asset consists of a small farmstead located to the west of Tamlaghtmore Road, first depicted on the Ordnance Survey map of 1832 comprising a rectangular range structure accompanied by a small square structure, set within a small square enclosure. The farmstead has increased in size on the Ordnance Survey map of 1906, which shows the farmstead containing two large rectangular adjoining ranges set within a much larger enclosure. Further expansion is highlighted on the Ordnance Survey map of 1929, where the farmstead is shown as two ranges to the north-east and south-west of the enlarged square in plan farmstead buildings. Two small square outbuildings are also shown located to the south-west of the farmstead, set within their own rectangular enclosure. Several of these ranges still exist at this location accompanied with several modern farm building additions.	Post-Medieval	Low
225	N/A	281523, 379849	Farmstead and well	Map Regression	Glasgow Hill North-East	The asset consists of a farmstead and well to the north-east of Glasgow Hill, first depicted on the Ordnance Survey map of 1833, comprising four separate rectangular structures set within four enclosures, with the well located within the north-western extent of the enclosures. The farmstead is then depicted on the Ordnance Survey map of 1906 as two large rectangular ranges surrounded by small enclosures. The farmstead still exists and has grown in size, with several modern additions.	Post-Medieval	Low
226	N/A	281736, 379884	Farmstead	Map Regression	Tamlaghtmore Road West C	The asset consists of a small farmstead located south of a well ***(Site 229)*** to the west of Tamlaghtmore Road, first depicted on the Ordnance Survey map of 1832 comprising a small rectangular range, set within a larger rectangular enclosure. The farmstead is no longer depicted on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
227	N/A	281925, 379928	Farmstead	Map Regression	Tamlaghtmore Road West A	The asset consists of a farmstead located west of Tamlaghtmore Road, first depicted on the Ordnance Survey map of 1833, comprising one medium sized range structure, accompanied with a small square and two small square enclosures. By the Ordnance Survey map of 1906, the farmstead has been modified into a single long-range structure set within a small square enclosure and accompanied with a long rectangular enclosure to the east. The farmstead no longer exists and the area is now part of a field system.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
228	N/A	282116, 379929	Farmstead	Map Regression	Tamlaghtmore Road	The asset consists of a farmstead, first depicted on the Ordnance Survey map of 1833, comprising a small rectangular structure within an enclosure, which becomes two smaller structres within two separate enclosures on the Ordnance Survey map of 1854. The farmstead is then depicted on the Ordnance Survey map of 1906, shown as a smaller single square structure, set between two small enclosures. The farmstead is no longer extant with the area is now occupied by 12 modern houses.	Post-Medieval	Negligible
229	N/A	281824, 380026	Well	Map Regression	Tamlaghtmore Road Well	The asset consists of a well, depicted on the Ordnance Survey map of 1833, located at a cross roads between three farmsteads. The well is not depicted on the Ordnance Survey map of 1906 and the area is now part of a field system.	Post-Medieval	Negligible
230	NISMR LDY048:024 DIER 2017:452	282710, 380080	Enclosure	NISMR & Event	Dunman Enclosure	The asset consists of the remains of an enclosure to the north-east of Cookstown, previously noted within the SMR and then revealed within archaeological investigations in 2017. The enclosure was formed by a ditch aligned north to south within the excavation area, with a slight eastwards curve, suggesting it is larger than a typical rath. It is assumed that the ditch continues north beyond the limit of the excavation area, but to the south it will have been disturbed by a farm lane, with the area beyond this reduced by sand extraction. A likely contemporary post-hole was found within the interior of the enclosure. Following recording of the features the area was preserved in situ, sealed with a geotextile membrane and backfilled.	Unassigned	Low
231	N/A	282356, 380103	Farmstead and well	Map Regression	Dunman Farmstead	The asset consists of a farmstead, first depicted on the Ordnance Survey map of 1833, comprising a rectangular range accompanied by a small square enclosure and a well to the north. The well is no longer depicted on the Ordnance Survey map of 1906, and the farmstead has been replaced by a smaller rectangular range by the ordnance Survey map of 1929. This smaller structure still exists on site today.	Post-Medieval	Low
232	N/A	282216, 380104	House	Map Regression	Dunman House	The asset consists of a farmstead, first depicted on the Ordnance Survey map of 1833, comprising three rectangular structures set within three large enclosures. The buildings are then annotated as ‘Dunman House’ on the Ordnance Survey map of 1906. By the time of the Ordnance Survey map of 1952, the buildings merge into one large block, and aerial photographs show that the buildings still exist with several modern extensions.	Post-Medieval	Low
233	N/A	281931, 380186	Hall	Map Regression	Tamlaghtmore Orange Hall	The asset consists of an orange lodge, first depicted on the Ordnance Survey map of 1833 as a small rectangular building set in a small enclosure to the south of Springbank farmstead. The building is not annotated as an orange lodge until the Ordnance Survey map of 1906, and the building is still in use today.	Post-Medieval	Low
234	IHR 02321:000:00	282870, 380200	Saw and Flax Mill	IHR	Dunman Saw and Flax Mill	The asset consists of a saw and flax mill to the north-east of Cookstown, first depicted on the Ordnance Survey map of 1906. The mill complex contains several buildings including a saw mill, flax mill, smithy, mill house, ford, mill pond, mill race, sluice and weir. A study of aerial photographs of the area has revealed that several of the structures appear to still exist on site, but it is likely they have been altered and modified for modern use. The mill is one of several sites that highlights the transitional period in the area when society moved from an agriculturally based system to an industrial based system.	Post-Medieval	Low
235	N/A	282714, 380271	Farmstead	Map Regression	Dunman Bridge South C	The asset consists of a small farmstead located to the south of Dunman Bridge, first depicted and annotated on the Ordnance Survey map of 1833, comprising three small rectangular structures, accompanied by a large rectangular structure to the south. The asset is later depicted on the Ordnance Survey map of 1906 and 1929 as a single rectangular structure located along a branch off the main road, terminating at a Saw and Flax mill located to the south east. The site is now occupied by a small modern housing estate.	Post-Medieval	Negligible
236	N/A	282745, 380339	Farmstead	Map Regression	Dunman Bridge South B	The asset consists of a small farmstead located to the south of Dunman Bridge, first depicted and annotated on the Ordnance Survey map of 1833, comprising two small rectangular structures located along a branch off the main road. The asset is no longer depicted on the Ordnance Survey map of 1906 and the area is now occupied by an industrial creamery and housing estate.	Post-Medieval	Negligible
237	N/A	282674, 380369	Farmstead	Map Regression	Dunman Bridge South A	The asset consists of a small farmstead and well located to the south of Dunman Bridge shown in detail on the Ordnance Survey map of 1882, comprising a small rectangular structure accompanied with a large rectangular enclosure to the north-west. The well is depicted and annotated to the north-east of the farmstead along the road. By the Ordnance Survey map of 1906 the farmstead is shown consisting of three building set within three enclosures. The site is then shown with a small square addition to the south-east on the Ordnance Survey map of 1929. The site is now occupied by a petrol station.	Post-Medieval	Negligible

Site No	Reference No.	Grid ref	Site Type	Designation	Site Name	Description	Period	Value
238	N/A	282293, 380395	Farmstead and well	Map Regression	Derryloran A	The asset consists of a small farmstead and well depicted and annotated on the Ordnance Survey map of 1833 comprising three rectangular structures set within three rectangular enclosures, with a well located to the north-east of the buildings. On the Ordnance Survey map of 1906, the buildings are joined to create a large L-shaped range with central courtyard. An additional rectangular structure is constructed to the south of the main ranges before the Ordnance Survey map of 1929. Aerial photographs show that a large farmstead still exists at this location, some of which may relate to the original buildings.	Post-Medieval	Low
239	IHR 02320:000:00	282790, 380450	Bridge	IHR	Dunman Bridge	The asset consists of Dunman Bridge, located to the north-east of Cookstown along Moneymore Road, which is first depicted and annotated on the Ordnance Survey map of 1833. A bridge is depicted on all subsequent historical mapping at this location but the current bridge is a modern construction.	Post-Medieval	Negligible
240	N/A	282840, 380472	Farmstead	Map Regression	Dunman Bridge North	The asset consists of a small farmstead comprising a small rectangular structure located to the north of Dunman Bridge on the Ordnance Survey map of 1833, with a second small square building depicted to the south on the Ordnance Survey map of 1906. Modern aerial photographs show that a farmstead still occupies this area, although the buildings look relatively modern which may indicate the original buildings have been destroyed and this modern farmstead built in its place.	Post-Medieval	Negligible
241	HB 09/03/001	282789, 380846	Rectories/ Manses etc	Grade B+ Historic Building	Lissan Rectory	The asset consists of a Grade B+ Listed Building, located at 150 Moneymore Road, Cookstown. The rectory, constructed in 1807, was designed in an Italian villa style, by architect John Nash, comprising a two-storey building, constructed from rough casted, stone walls, gabled roofs with an entrance tower located to the front and a stone arcade to the rear. The tower contains an open porch on the ground floor, entered through a large semi-circular stilted stone archway, which has rendered walls, and a plain plastered ceiling, and stone flagged floor. The arcade consists of six semi-circular arches of ashlar sandstone carried on monolithic square piers of sandstone stop-chamfered to form octagonal shafts, set on square sandstone bases all on a sandstone plinth. Lissan has lost some original interior features such as plasterwork details and fireplaces, as well as suffering changes to its roof-form. However, enough original features and design survives to make it a valuable addition to Nash's' body of work in both Britain and Ireland.	Post-Medieval	High

APPENDIX B-10:
BIODIVERSITY: PRELIMINARY ECOLOGICAL APPRAISAL

Preliminary Ecological Appraisal for Proposed A29 Cookstown Bypass Scheme At lands in Cookstown, Co. Tyrone

Report prepared by Woodrow Sustainable Solutions Ltd. on behalf of WSP (on behalf of Department for Infrastructure Western Division)

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November 2019

DOCUMENT CONTROL

Document	Preliminary Ecological Appraisal for Proposed A29 Cookstown Bypass Scheme At lands in Cookstown, Co. Tyrone
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Checked internally	Will Woodrow 20/11/2019.
Checked by client	Thomas Goater 21/11/2019
Status / Version / Date	F/ 1/ 20.11.2019

STATEMENT OF AUTHORITY

This report is written by, Kristi Leyden B.Agr.Sc. (Hons) M.Sc. GradCIEEM and Patrick Quinn B.Sc (Hons) and has been checked and approved by Will Woodrow M.Sc. M.Sc. (Arch) CEcol MCIEEM.

Kristi Leyden is an Ecologist with Woodrow Sustainable Solutions Ltd. ("Woodrow"). She has completed an honours B.Agr.Sc. in Agri-Environmental Sciences and M.Sc. in Ecological Assessment. She is a graduate member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting on baseline surveys, input into Ecological Impact Assessment and to inform the Appropriate Assessment process. Furthermore, the author has over five years' experience in ecological surveys including habitat surveys, mammal surveys, bat surveys and incidental bird surveys for a number of large infrastructure schemes, commercial and residential projects.

Patrick Quinn is an Ecologist with Woodrow. He has completed an honours B.Sc. in Environmental Science, a degree in Environmental Protection and a Higher Certificate in Science in Fisheries Management. Patrick is an Associate member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and the Institute of Fisheries Management. He regularly carries out field work and reporting on baseline freshwater surveys. Furthermore, the author has experience in habitat surveys, bird surveys for a number of large infrastructure schemes, commercial and residential projects. Patrick is also an experienced Ecological Clerk of Works (ECoW) for transmission line and wind farms construction.

The report has been approved by Will Woodrow. Will is a Director at Woodrow Sustainable Solutions. He is an experienced ecologist with over 30 years of experience in ecological surveys and assessment. Will is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and a Chartered Ecologist.

All staff at Woodrow abide by the CIEEM Code of Professional Conduct.

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EXECUTIVE SUMMARY

Woodrow Sustainable Solutions Ltd. (Woodrow) was commissioned to undertake ecological surveys and prepare a report, this Preliminary Ecological Assessment (PEA), on the findings of an Ecology Survey Area centred on a Proposed Development in Cookstown, Co. Tyrone, Northern Ireland.

The Proposed Development comprises *c.* 4.5 km of a single carriageway and junctions between the A29 Dungannon Road roundabout south of Cookstown, Co. Tyrone to a proposed new roundabout tie in point on the A29 Moneymore Road to the north in the vicinity of the termination of the Moneymore dual carriageway. It also includes the upgrading of the carriageway connecting the A29 Dungannon Road roundabout to the A505 Omagh Road via the Sandholes Road.

Woodrow undertook a desk study within a specified Ecology Survey Area. Woodrow undertook terrestrial field surveys within a Terrestrial Ecology Survey Area and aquatic field surveys within an Aquatic Ecology Survey Area. The terrestrial field surveys included an extended Phase 1 habitat survey (which entailed a Phase 1 habitat survey and preliminary bird, Irish hare (*Lepus timidus hibernicus)*, hedgehog (*Erinaceus europaeus*), red squirrel (*Sciurus vulgaris*), herpetofauna suitability, invasive alien species surveys and appraisals), targeted preliminary bat roost assessments, badger (*Meles meles)* and otter (*Lutra lutra*) surveys. The aquatic field surveys included river habitat surveys, appraisal of potential fish spawning habitat, freshwater pearl mussel (*Margaritifera margaritifera)*, white-clawed crayfish (*Austropotamobius pallipes*) suitability and otter activity surveys (also undertaken in Terrestrial Ecology Survey Area). Basic water quality parameters were also taken within the Ballinderry River within the Aquatic Ecology Survey Area to collect baseline data on the receiving watercourse and biological sampling such as macroinvertebrates. All field surveys undertaken followed standard good practise techniques.

The key findings of this PEA are as follows[1]:

- Three designated sites of international importance have hydrological / ecological links with the Proposed Development;
- Four designated sites of national importance have hydrological / ecological links with the Proposed Development;
- Three designated sites of local importance have hydrological links with the Proposed Development;
- Four Northern Ireland (NI) Priority Habitats identified in the Ecology Survey Area: Broad-leaved woodland semi-natural woodland; broad-leaved plantation woodland; running water; and hedgerows;
- Protected/ notable bird species that may be impacted by the Proposed Development include: an assemblage of wintering birds, in particular whooper swans (*Cygnus cygnus*), associated with Lough Neagh; kingfisher (*Alcedo atthis),* grey heron (*Ardea cinerea*) associated with Brookend ASSI; barn owl (*Tyto alba*); and black-headed gull (*Larus ridibundus*).
- Protected mammals identified as using the Ecology Survey Area include: otter and badger.
- Protected mammals identified as possibly present.

Methods employed for these surveys followed best practice guidance and health and safety protocol for field surveying.

Some areas of the aquatic ecology survey area could not be surveyed due to lack of access, inaccessibility, or for health and safety issues.

Results concluded that there are areas within the Ballinderry River and the proposed site boundary that have suitable salmonid spawning habitat along with suitable white-clawed crayfish and freshwater pearl mussel habitat and potential otter activity. Biological sampling suggests water quality is moderately polluted in these receiving waters.

It is recommended that targeted surveys for the presence of protected species such as white-clawed crayfish and freshwater pearl mussel within areas that may be impacted by the proposed works. Also, further otter and badger surveys with in-situ recording equipment to determine potential otter holt usage if any.

1. INTRODUCTION

1.1 Background

1.1.1 Project Background

The Department for Infrastructure (DfI) Western Division of Northern Ireland is proposing a bypass scheme of the A29 road ("the Proposed Development") at lands in Cookstown, Co. Tyrone in Northern Ireland (centroid UK grid reference: NV 94920 37335). The Proposed Development comprises *c*. 4.5 km of a single carriageway and junctions between the A29 Dungannon Road roundabout south of Cookstown, Co. Tyrone to a proposed new roundabout tie-in point on the A29 Moneymore Road to the north in the vicinity of the termination of the Moneymore dual carriageway (hereafter referred to as "Moneymore Section"). The Moneymore Section is within a largely rural setting that is adjacent to an urban area. The Proposed Development also includes the upgrading of the carriageway connecting the A29 Dungannon Road roundabout to the A505 Omagh Road via the Sandholes Road (hereafter referred to as "the Sandholes Link Road Section"). The Sandholes Link Road Section is a small section situated in an urban built-up setting. There are currently three route options (Red, Purple A, Purple B) plus the Sandholes Link Road section under consideration. The Proposed Development is illustrated in **Section 7**, **Figure 1.**

1.1.2 Ecological Background

Woodrow Sustainable Solutions Ltd. ("Woodrow") was commissioned by WSP in May 2019 on behalf of the Department for Infrastructure (DfI) Western Division to undertake a Preliminary Ecological Appraisal ("PEA") of the Proposed Development. This PEA entailed undertaking a suite of ecological surveys (described in **Section 2**) and producing this PEA report.

This PEA is informed by previous ecology surveys undertaken for the Proposed Development but is a stand-alone report. In 2009 ecology surveys, which included badger (*Meles meles*), bat and Phase 1 habitat surveys, were undertaken for the Proposed Development by Mouchel on behalf of the Roads Service. An ecology walkover of the Proposed Development, documented in a technical note, was conducted by WSP in 2019 in order to highlight the key project ecological constraints (WSP, 2019). Both sources of existing ecological data are described in more detail in **Section 2.1.1**.

The Ecology Survey Area of the Proposed Development is detailed in **Sections 2.1.2 – 2.1.3**.

1.2 Scope of Report

The Scope of this PEA report is as follows:

- Present the findings of the ecological desk study and field study which:
  - Identify designated sites within the Zone of Influence of the Proposed Development (this Zone of Influence is defined in **Section 2.1.1**);
  - Identify and categorise habitats present within the Terrestrial Ecology Survey Area;
  - Identify protected and notable habitats and species of conservation concern within the Terrestrial and Aquatic Ecology Survey Areas (which are defined in **Section 2.1.3**);
  - Undertake an appraisal of the habitats recorded to support protected or notable species of conservation concern; and,
  - Recommend further ecological surveys required to inform the baseline of an Ecological Impact Assessment (EcIA).

1.3 Relevant Legislation and Policy

Listed below are the relevant legislation and policy relating in Northern Ireland which has been referred to when producing this PEA report. A fuller account of this legislation and policy is presented in **Appendix A**.

Relevant legislation and policy relating to this PEA report are as follows:

1.3.1 National Legislation

- The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017;[2]
- Conservation (Natural Habitats &c.) Regulations (Northern Ireland) 1995 (as amended)[3];
- The Wildlife (Northern Ireland) Order 1985 (as amended)[4] (the "Wildlife Order"); and,
- The Environment (Northern Ireland) Order 2002 (as amended)[5].

1.3.2 National Planning Policies

- Strategic Planning Policy Statement for Northern Ireland (SPPS)[6]; and,
- Planning Policy Statement 2 'Natural Heritage'[7].

[2] The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017. Available at: http://www.legislation.gov.uk/nisr/2017/83/made. [Accessed November 2019.]
[3] The Conservation (Natural Habitat, etc.) Regulations (Northern Ireland) 1995. Available at: http://www.legislation.gov.uk/nisr/1995/380/contents/made [Accessed October 2019].
[4] The Wildlife (Northern Ireland) Order 1985. Available at: http://www.legislation.gov.uk/nisi/1985/171/contents [Accessed October 2019].
[5] The Environment (Northern Ireland) Order 2002. Available at: http://www.legislation.gov.uk/nisi/2002/3153/contents [Accessed October 2019].
[6] Department of the Environment (2015). Strategic Planning Policy Statement for Northern Ireland (SPPS) Planning for Sustainable Development. Available at: https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf [Accessed October 2019].
[7] Department of the Environment (2013). Planning Policy Statement 2 Natural Heritage. Available at: https://www.planningni.gov.uk/index/policy/planning_statements_and_supplementary_planning_guidance/definitive_final_july_2013_pps_2_-_natural_heritage-3.pdf [Accessed October 2019].

1.3.3 International Wildlife Legislation

- EU Birds Directive;[8]
- EU Habitats Directive[9];
- Bern[10] and Bonn[11] Convention; and,
- The Water Framework Directive[12].

1.3.4 Stakeholder Consultations

WSP carried out stakeholder consultations separate to this PEA. This will be reported upon separately.

[8] The Council of the European Communities (2009). Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (EU Birds Directive). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147 [Accessed October 2019].
[9] The Council of the European Communities (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive). Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm [Accessed October 2019].
[10] Council of Europe (1979). Convention on the Conservation of European Wildlife and Natural Habitats. (Bern Convention. Available at: https://www.coe.int/en/web/conventions/full-list/-/conventions/rms/0900001680078aff [Accessed October 2019].
[11] United Nations Environment Programme (1979). Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). Available at: https://www.cms.int/sites/default/files/instrument/CMS-text.en_.PDF [Accessed October 2019].
[12] The European Parliament and the Council of the European Union (2000**).** 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 (The Water Framework Directive). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060 [Accessed October 2019].

2. METHODS

2.1 Overview

Desk study research and field surveys were undertaken to inform this PEA. For the purposes of this report the area considered the Zone of Influence, the desk study survey area and the field survey area are described in **Section 2.1.1** – **2.1.3**.

2.1.1 Potential Zone of Influence of the Proposal

The Zone of Influence of a project is the area over which ecological features may be subject to biophysical changes as a result of the proposed project and associated activities. The Zone of Influence may vary according to a feature's sensitivities to environmental change, as well as the scope of works associated with a development (CIEEM, 2017). As described in **Section 1.1.1**, the proposal includes the updating and construction of a bypass road scheme within an urban and rural setting.

Direct impacts resulting from the proposal are likely to be limited to the loss of existing habitats and/or species within the area of the Proposed Development. Indirect impacts of the proposal are likely to be broader, and may include disturbance of wildlife by dissecting their foraging range and changes to hydrology affecting habitats in the area surrounding the proposal.

2.1.2 Desk Study Survey Area

An area of 2 km radius of the Proposed Development was interrogated for biological records (10 km for bat species records) from local databases (see **Section 2.2** below). All internationally and nationally designated sites within a 20 km[13] radius of the Ecology Survey Area and non-statutory local sites within a 5 km radius of the Ecology Survey Area have been considered as being potentially within the Zone of Influence of the proposal. Using ArcGIS, the distance between each designated site (at the closest point) to the Proposed Development footprint was measured using the 'measuring tool' in ArcGIS. Similarly, where a hydrological link was identified between the designated sites and Proposed Development footprint within the aforementioned radii, the distance of the hydrological link between the two was measured using the 'measuring tool' in ArcGIS. The Zone of Influence of a proposal is dependent upon other factors, for example the sensitivity and range of specific features, and the extent of biological connectivity with the Proposed Development.

2.1.3 Field Survey Area

The field survey area was established on the basis of ensuring that the Proposed Development footprint, including all options, as well as a sufficient distance from the Proposed Development footprint was covered to determine the potential for secondary (for example disturbance) effects on both terrestrial and aquatic ecological receptors.

The field surveys were undertaken within the "Ecology Survey Area" which encompassed the extent of the "Terrestrial Ecology Survey Area" and the "Aquatic Ecology Survey Area". The buffer distance applied to the Terrestrial Ecology Survey Area was 100 m either side of the outer limits of the Proposed Development. The buffer distance applied to the Aquatic Ecology Survey Area was the

[13] The potential for any designated areas to fall within a zone of influence of the project will depend on an impact source, a pathway and a potential receptor, rather than necessarily simple proximity. From a precautionary perspective, a 20km search area was used to identify international (and national) designated sites of nature conservation interest surrounding the Proposed Development.

Terrestrial Ecology Survey Area plus 200 m upstream and downstream of that buffer. The Terrestrial Ecology Survey Area and Aquatic Ecology Survey Area are illustrated in **Section 7, Figure 2**.

The Ecology Survey Area was further separated into Area A (the northern section) and Area B (the southern section) as is illustrated as blue and yellow areas, respectively, in **Section 7, Figure 1**. The rationale for the distinction between Area A and Area B is surveying effort and ultimately cost. In Area A, the three route options have a greater distance between them and thus it was deemed most effective (in terms of survey effort and cost) at this preliminary stage to only undertake the extended Phase 1 habitat survey of this area, with more detailed / dedicated surveys to be undertaken at a later date along the final, selected route option. Area B has three route options (plus the Sandholes Link Road Section) which are closely aligned and so it was feasible to conduct more detailed / dedicated protected species surveys, along with the extended Phase 1 habitat survey, and dedicated aquatic surveys with limited extra surveying effort.

2.2 Desk Study

A desk survey was undertaken to gather information on protected areas in proximity to the Proposed Development and the likely distribution of species in the general area prior to the survey visits, so that a targeted approach to surveying could be undertaken.

Primary sources of information included drawings provided by WSP, orthophotographs, datasets on designated areas available from Northern Ireland Environmental Agency (NIEA), and species records from Ulster Museum's Centre for Environmental Data and Recording (CEDaR), and data and figures produced from previous ecological surveys undertaken for the Proposed Development by Mouchel (2009) and WSP (2019). The CEDaR database search was enhanced with a data search from the National Biodiversity Data Centre (NBDC)[14] for two species: otter (*Lutra lutra)* and freshwater pearl mussel (*Margaritifera margaritifera*).

2.2.1 Designated Sites

Information on statutory sites of international and national importance designated for their ecological features within 20 km of the Proposed Development were obtained and statutory and non-statutory sites of local importance within 10 km of the Proposed Development were obtained, and the potential for connectivity of these sites with the Proposed Development was assessed using available datasets and professional judgement (such as resulting from adjoining watercourses, associated species foraging ranges or those in close proximity to the Proposed Development). Shapefiles of designated areas in Northern Ireland, including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), Wetlands of International Importance (Ramsar Sites) and Areas of Special Scientific Interest (ASSIs) and Nature Reserves (NRs) were downloaded from the NIEA website and imported into ArcGIS.

A summarised legal context of designated statutory and non-statutory sites within Northern Ireland is provided in **Appendix A**.

2.2.2 Existing Ecological Records

The database for CEDaR was consulted in order to establish historic records of protected and notable species of conservation concern, or the likelihood of their occurrence (through range information).

[14] National Biodiversity Data Centre Biodiversity Mops. Available at: https://maps.biodiversityireland.ie/Map [Accessed August 2019].

Protected and notable species of conservation concern include those identified in the Schedules of the Wildlife (Northern Ireland) Order (1985) and in the EU Habitats and Birds Directive, as well as red- and amber-listed UK birds of conservation concern Eaton et al. (2015) and BirdWatch Ireland's *Birds of Conservation Concern in Ireland* (Colhoun and Cummins, 2013).

CEDaR maintains records specific to Northern Ireland and collects data that may not be accessible through NBDC. NBDC collects and manages biodiversity data for the island of Ireland and incorporates data from a number of different sources. The CEDaR database was interrogated for all biological records within a 2 km radius of the Proposed Development and surrounds, and a 10 km radius search for records of bat species. The CEDaR database search was enhanced with a data search from NBDC for two species: otter and freshwater pearl mussel. In this instance, the Ballinderry River catchment, rather than a specified distance from the Ecology Survey Area was searched.

2.3 Field Surveys

Field Surveys within the Ecology Survey Area were undertaken following specific guidelines for habitats and species as outlined in the following sections.

The ecology field surveys began in the Ecology Survey Area (see **Section 7, Figure 2**) in August 2019 and were finalised in September 2019. **Table 1** below provides the dates and details of the ecology surveys undertaken, as well as the names and the positions held by survey personnel.

Field surveys undertaken within Area A of the Terrestrial Ecology Survey Area included an extended Phase 1 habitat with incidental surveys for the following protected species: otter and badger. Although only an incidental preliminary bat roost assessment was required in Area A, the survey personnel carried out a dedicated preliminary bat roost assessment of buildings, structures and trees. Field survey undertaken within Area A complies with the CIEEM guidance on PEA which states "*species surveys undertaken at the PEA stage are characterised as preliminary risk assessments or assessments of habitat suitability for a particular species, rather than detailed field surveys"* (CIEEM, 2017).

Field surveys undertaken within Area B of the Terrestrial Ecology Survey Area included an extended Phase 1 habitat survey, and the following dedicated surveys for otter, badger and preliminary bat roost assessments of buildings, structures and trees.

Field surveys undertaken within the Aquatic Ecology Survey Area included a baseline water quality assessment, a characterisation of the aquatic areas, and dedicated surveys for otter and suitability surveys for freshwater pearl mussel and white-clawed crayfish (*Austropotamobius pallipes*).

Sections 2.3.1 – **2.3.3.4** below describes the methods used to undertake specific habitats, and protected and notable species of conservation concern and water quality surveys.

Table 1 Ecology Surveys undertaken within the Ecology Survey Areas

Survey date	Survey type	Survey Area[15]	Survey Personnel
26/08/2019 – 28/08/2019	Biological Q-Value assessment; Chemical aquatic assessments; Salmonid, Freshwater Pearl Mussel and White-clawed Crayfish suitability surveys; and, River Habitat Survey (RHS) / River Hydromorphology Assessment Technique (RHAT).	Aquatic Ecology Survey Area	Patrick Quinn, Ecologist with Woodrow
26/08/2019 – 29/08/2019	Extended Phase 1 Habitat Survey & Targeted Otter, Badger and Preliminary Tree and Building Assessments	Terrestrial Ecology Survey Area	Kristi Leyden, Ecologist with Woodrow
28/08/2019 – 29/08/2019	Extended Phase 1 Habitat Survey & Targeted Otter, Badger and Preliminary Tree and Building Assessments	Terrestrial Ecology Survey Area	Rachel Irwin, Assistant Ecologist with Woodrow
05/09/2019 – 06/09/2019	Extended Phase 1 Habitat Survey & Targeted Preliminary Tree and Building Assessments and Incidental Otter and Badger Surveys	Terrestrial Ecology Survey Area	Dave Allen, Ecologist and Director with Allen & Mellon Environmental
05/09/2019 – 06/09/2019	Extended Phase 1 Habitat Survey & Targeted Preliminary Tree and Building Assessments and Incidental Otter and Badger Surveys	Terrestrial Ecology Survey Area	Clive Mellon, Ecologist and Director with Allen & Mellon Environmental

[15] As illustrated in **Section 7, Figure 2**.

2.3.1 Habitat Survey

A Phase 1 habitat survey was carried out within the Terrestrial Ecology Survey Area, as part of the extended Phase 1 habitat survey, between 26/08/2019 and 06/09/2019 (see **Table 1**) following the standard approach of the *Handbook for Phase 1 habitat survey – a technique for environmental audit* (Joint Nature Conservation Committee (JNCC), 2010). For the Phase 1 habitat survey, the Terrestrial Ecology Survey Area was walked, ecological features of interest were noted, and habitats were classified into recognised habitats as outlined by JNCC (2010). The habitat survey gave cognisance to the presence of any habitats which had the potential to correspond to EU Habitats Directive habitats[9] and Northern Ireland Priority Habitats[16]. Habitat types were mapped in the field by annotating paper field maps, and during the survey consideration was given to identifying protected and notable habitats of conservation concern that could be used by protected species. Habitat descriptions and target notes were accompanied by a photo and six figure grid references, using 'EcoLog' software operating on a mobile phone. As a result, the data collected could then be used in a Geographical Information System ("GIS").

A Phase 1 habitat map was produced post-field work using ArcGIS to digitize the annotated field maps. Post-survey habitat analysis was conducted by cross-referencing habitat types to EU Habitats Directive habitats[9] and Northern Ireland Priority Habitats[16], using respectively, the National Biodiversity Network dictionary habitat correspondence table[17] and NIEA priority habitats guidance[18].

2.3.2 Protected Species Assessment

2.3.2.1 Bird Survey

During the extended Phase 1 habitat survey undertaken within the Ecology Survey Area between 26/08/2019 and 06/09/2019 (for further details see **Table 1**), birds or signs of birds (*e.g.* nests), encountered within and adjacent to the Ecology Survey Area were recorded. Bird records were accompanied by a six-figure grid reference.

Post-habitat survey analysis was conducted by assessment of habitats within and immediately adjacent to the Ecology Survey Area for their likelihood of providing foraging or nesting opportunities for important or protected bird species.

2.3.2.2 Mammal Surveys (excluding bats)

An incidental mammal survey and a dedicated mammal survey was conducted by the ecologists undertaking the extended Phase 1 surveys within, respectively, Area A and Area B of the Terrestrial Ecology Survey Area between 26/08/2019 and 06/09/2019 (for further details see **Table 1**). In addition to the dedicated mammal survey (which included otter) undertaken in Area B, a dedicated otter survey was also undertaken in the Aquatic Ecology Survey Area which included 200 m upstream and downstream of the Terrestrial Ecology Survey Area.

A particular focus of these surveys was to identify any potential holts / layups, used by otter, and to identify the presence of badger and/or their resting places/setts. A dedicated otter survey was conducted along the watercourses intersected by the Proposed Development and their associated buffer zones within the Aquatic Ecology Survey Area, and within Area B of the Terrestrial Ecology

[16] Northern Ireland List of Priority Habitats. Available at: https://www.daera-ni.gov.uk/publications/northern-ireland-list-priority-habitats [Accessed October 2019].
[17] The National Biodiversity Network dictionary habitat correspondence table. Available at: http://archive.jncc.gov.uk/default.aspx?page=4266 [Accessed October 2019].
[18] Northern Ireland Priority Habitat Guides. Available at: https://www.daera-ni.gov.uk/articles/northern-ireland-priority-habitat-guides [Accessed October 2019].

Survey Area, all of which were in compliance with the *Otter Surveys NIEA Specific Requirements*[19]. A dedicated badger survey was conducted within Area B of the Terrestrial Ecology Survey Area and an incidental badger survey was conducted within Area A, all of which are in compliance with *Badger Surveys NIEA Specific Requirements*[20].

The extended Phase 1 habitat survey included any incidental observations or detected evidence for other notable mammals of conservation concern which might be using the site (*e.g.* Irish hare (*Lepus timidus hibernicus*) and hedgehog (*Erinaceus europaeus*)). The survey approach entailed a thorough walkover of the Terrestrial Ecology Survey Area. This included the identification of suitable habitat, detection of field signs such as tracks, markings, feeding signs, droppings and scent-points, as well as through direct observation. Mammal target notes were accompanied by a photo and six figure grid reference.

2.3.2.3 **Bat Surveys**

Although only an incidental preliminary ecological appraisal for bats was required for Area A of the Terrestrial Ecology Survey Area, in fact a dedicated appraisal was conducted throughout. Therefore, a dedicated preliminary ecological appraisal of whole Terrestrial Ecology Survey Area was undertaken for bats. During the extended Phase 1 habitat survey, records were made of any habitat suitable for bats to roost, commute and forage. The Phase 1 habitat map produced as part of the habitat survey provided a means of assessing the suitability of the habitat within the Terrestrial Ecology Survey Area for commuting and foraging bats. The methods used for undertaking preliminary roost assessments of features (structures and trees) are described below.

A preliminary roost assessment of structures (*e.g*. buildings, walls, bridges) within the Terrestrial Ecology Survey Area was undertaken according to the Bat Conservation Trust (BCT) *Bat Surveys for professional Ecologist: Good Practise Guidelines* (Collins, 2016) ("the BCT Guidelines"). Following the BCT Guidelines, structures within the Terrestrial Ecology Survey Area (or potentially affected by the proposal) were assigned as having either a 'negligible, low, moderate or high' status[21] in terms of their potential to providing bat roosting opportunities, referred to in the BCT Guidelines as the presence of Potential Roost Features (PRFs)[22]. These structures were assessed from the ground, using binoculars where necessary. Every effort was made to provide PRFs per building, however given the large scale of this project and its proximity to an urban setting, and thus the survey effort, in instances where a large number of buildings, for example a housing estate, have the same PRFs, these buildings were grouped together and assigned the PRF collectively.

Preliminary ground level assessment of trees within the Terrestrial Ecology Survey Area was undertaken according to the BCT Guidelines (Collins, 2016). Following the BCT Guidelines, trees within the Terrestrial Ecology Survey Area or with the potential to be affected by the Proposed Development were assigned as having either a 'negligible, low, moderate or high' status[21] in terms of their potential to provide bat roosting opportunities, referred to in the BCT Guidelines as the presence of Potential Roost Features (PRFs). These trees were assessed from the ground, using binoculars where necessary. Every effort was made to provide the PRF status for each individual tree, however given the large scale of this project, and thus the survey effort, in instances where groups of trees, for

[19] (NIEA,2017). Otter Surveys NIEA Specific Requirements. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf [Accessed October 2019].
[20] (NIEA, 2007). Badger Surveys NIEA Specific Requirements. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/badger-survey-specifications.pdf [Accessed October 2019].
[21] Using Table 4.1, page 35 of the BCT Guidelines. Available at: https://www.bats.org.uk/resources/guidance-for-professionals/bat-surveys-for-professional-ecologists-good-practice-guidelines-3rd-edition. [Accessed October 2019].
[22] In instances where the status of a feature was identified as intermediate between its potential to provide bat roosting features (e.g. low – moderate as per the BCT Guidelines), the precautionary principle was applied and the feature was assigned the higher status (in the e.g. this would be moderate).

example within a woodland stand or a treeline, had the same PRFs, these trees were grouped together and assigned the PRF status collectively.

All bat target notes were accompanied by a photo (where possible) and six figure grid reference.

2.3.2.4 Herpetofauna Suitability Surveys

As part of the extended Phase 1 habitat survey, a thorough walkover of the Terrestrial Ecology Survey Area was undertaken, which included the identification of suitable habitat for herpetofauna (reptile and amphibians), particularly common lizard (*Zootoca* vivipara), smooth newt (*Lissotriton vulgaris*) or common frog (*Rana temporaria*). Herpetofauna target notes were accompanied by a photo and six figure grid reference.

2.3.2.5 Invasive Alien Species

As part of the extended Phase 1 habitat survey, a thorough walkover of the Terrestrial Ecology Survey Area was undertaken, which included the recording of presence of non-native alien invasive species (IAS). IAS target notes were accompanied by a photo and six figure grid reference.

2.3.2.6 Salmonid Suitability Surveys

The Aquatic Ecology Survey Area was assessed for salmonid suitability. Salmonid suitability surveys were carried out using the Life Cycle Unit (LCU)[23] approach devised by the Loughs Agency. This method evaluates habitat into units and grades depending on the substrate available, water depths and flow velocities.

2.3.2.7 White-clawed Crayfish Suitability Surveys

White-clawed crayfish suitability surveys were carried out following the guidance from *Monitoring the White-clawed crayfish*[24] and *A Technical Manual for Monitoring White-clawed Crayfish Austropotamobius pallipes in Irish Lakes*.[25]. Table 2 within this technical manual references substrate particle size suitable for crayfish as adapted from the JNCC (2010). Suitability surveys were based on habitat preferences as stated within this document to include boulder size, river flow, refuge availability and bankside margins.

2.3.2.8 Freshwater Pearl Mussel Suitability Surveys

Suitability surveys for freshwater pearl mussel followed guidance from Skinner *et al* (2003). Habitat requirements within this document include suitable water quality, quantity, substrate, channel structure and management. Other factors to determine suitability is the presence of host fish stocks such as salmonids.

2.3.3 Water Quality Assessments

The water quality assessments described in **Sections 2.3.3.1 – 2.3.3.**4 below were undertaken between 26/08/2019 – 28/09/2019 within the Aquatic Ecology Survey Area.

[23]Department of Agriculture for Northern Ireland. Fisheries Division (Undated). Advisory Leaflet Number 1: The Evaluation of Habitats for salmon and Trout. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/dcal/provision-of-salmon-and-trout-habitat-leaflet.pdf [Accessed August 2019].
[24] Monitoring the White-clawed Crayfish. Available at: file:///C:/Users/pquinn/Downloads/crayfish_monitoring[1]%20(5).pdf [Accessed August 2019].
[25] A Technical Manual for Monitoring White-clawed Crayfish *Austropotamobius pallipes* in Irish Lakes. Available at https://www.npws.ie/sites/default/files/publications/pdf/IWM45.pdf [Accessed August 2019].

2.3.3.1 Q-Value Assessments

The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Individual macroinvertebrate species are ranked for their sensitivity to organic pollution and the Q-value is assessed based primarily, on their relative abundance within a biological sample. EPA indices and water quality status are interpreted in **Table 2** below.

Table 2: EPA indices and water quality status

Biotic Index	EPA Quality Status	Water Quality
Q5	Unpolluted	Good
Q4-5	Unpolluted	Fair-to-Good
Q4	Unpolluted	Fair
Q3-4	Slightly Polluted	Doubtful-to- Fair
Q3	Moderately Polluted	Doubtful
Q2-3	Moderately Polluted	Poor-to-Doubtful
Q2	Seriously Polluted	Poor
Q1-2	Seriously Polluted	Bad-to-Poor
Q1	Seriously Polluted	Bad

Biological Q-Value aquatic assessments were carried out on the receiving watercourses within the Aquatic Ecology Survey Area. The methodology undertaken follows EPA guidance provided in the document *Water Quality in Ireland 2001 – 2003* (Toner *et al.,* 2005) for Q-value assessment[26]. Biological samples were taken from the aquatic environment upstream and downstream of the location where they intersected with the Proposed Development within the Aquatic Ecology Survey Area. Biotic indices reflect average water quality at any location due to the presence/absence of certain invertebrate species.

2.3.3.2 Chemical Assessments

Basic water quality parameters were measured using an in-situ portable water meter to provide a baseline profile of temperature, pH, dissolved oxygen, conductivity and turbidity in the Ballinderry River. An Aquaread portable probe-type instrument was used for the analysis of water quality parameters[27]

2.3.3.3 River Habitat Survey

River habitat surveys were carried out at ten equally spaced spot-check locations along a 500 m stretch (if obstacles do not impend access to these locations), or in this case, where the Proposed Development intersected the watercourses. Land use and valley form were considered along with a record of the vegetation types and basic geomorphological features. Guidance followed the *River Habitat Survey in Britain and Ireland* document as complied by the Environment Agency[28].

[26] EPA. (2005). Water Quality in Ireland 2001-2003. Available at: https://www.epa.ie/pubs/reports/water/waterqua/EPA_water_quality_2001-3.pdf [Accessed October 2019].
[27] Aquaread Manual. Available at: https://www.aquaread.com/aquaread-content/downloads/manuals/AP-700-AP-800-and-AP-2000-Instruction-Manual.pdf [Accessed August 2019].
[28] Environment Agency. (2003). River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual:Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/311579/LIT_1758.pdf [Accessed August 2019]

2.3.3.4 River Hydromorphology Assessment Technique (RHAT)

A River Hydromorphology Assessment Technique classifies river hydromorphology based on a departure of naturalness and assigns a morphological classification directly related to that of the Water Framework Directive: high, good, moderate, poor and bad based on eight criteria:

- Channel morphology and flow types
- Channel vegetation
- Substrate diversity and condition
- Barriers to continuity
- Bank structure and stability
- Bank and bank top vegetation
- Riparian land cover
- Floodplain interaction

Classification of hydromorphology can be used to contribute to the status classification of waterbodies at high ecological status only. However, RHAT plays a vital role in identifying why a waterbody might be failing to achieve good ecological status, deciding what indirect and direct efforts are needed to improve status and in helping to prevent further deterioration[29] .

2.4 Notes and Limitations

2.4.1 Terrestrial Ecology Survey Area

A limited number of areas with restricted access locally limited the extent of surveying in a small number of areas within the Terrestrial Ecology Survey Area; these are described by the target notes in **Appendix D, D01** and presented in **Section 7, Figure 3**. These restrictions were of particular note for mammal surveying.

All surveys, except the bird surveys, undertaken within the Ecology Survey Area were carried out[30] at the appropriate times of year for the identified species and habitats to ensure that robust ecological data has been gathered to inform this proposal.

2.4.2 Aquatic Ecology Survey Area

Not all of the Aquatic Ecology Survey Area was surveyed for otter. Approximately three quarters (150 m of the 200 m) of the Aquatic Ecology Survey Area spur in the north west of the Sandholes Link Road Section, which is upstream of where the Proposed Development intersects the Ballinderry River (see **Section 7, Figure 3**) was inaccessible due to areas of fencing running along the river's edge behind a factory. This area was also not accessible from the opposite bank due to a housing development and associated high boundary walls. Furthermore, there was restricted access on the southern bank of the north eastern spur of the Sandholes Link Section (downstream of the where the Proposed Development intersects with the Ballinderry River) where brash impeded access (see **Appendix D, Table D01, TN # 5**; and **Section 7, Figure 3, TN # 5**). In the Moneymore Section of the Aquatic Ecology Survey Area, there was restricted access within the south-west spur on the northern side and a dangerously steep bank on the southern side (both upstream of the of where the Proposed Development interests the Ballinderry River) (see **Section 7, Figure 3**).

[29]NIEA (2009) *River Hydromorphology Assessment Technique (RHAT) Training guide* 2009. http://www.epa.ie/wfdstatus/rivers/RW_RHAT_training_guide_final_20_04_09.pdf [Accessed August 2019]
[30] For timings of field surveys see **Section 2.3, Table 1**.

3. RESULTS

The results of the desk study research undertaken within the Desk Study Survey Area (outlined in **Section 2.1.2**) and the field surveys undertaken within the Ecology Survey Area (outlined in **Section 2.1.3**) which inform this PEA are presented below.

3.1 Designated Sites

A number of statutory and non-statutory designated sites surround the Proposed Development, as described in **Sections 3.1.1 - 3.1.3** below.

3.1.1 Statutory Sites

3.1.1.1 Statutory Sites of International Importance

A table listing all of the statutory designated sites of international importance which occur within 20 km of the Ecology Survey Area is presented in **Appendix B, Table B01**. This table includes the designated site name and code, a summary of qualifying interests for the SAC and SPA/ qualifying criteria for Ramsar Sites, the closest point to the Proposed Development footprint and any connectivity between the statutory designated site and the Proposed Development footprint. Figures illustrating the location of the statutory designated sites of international importance which occur within 20 km of the Ecology Survey Area are presented in **Section 7, Figure 4.1** and **4.2**.

Eleven designated sites of international importance occur within 20 km of the Ecology Survey Area, of which seven are SACs, one is a SPA, and three are Ramsar Sites (for further details see **Appendix B, Table B01)**. Three of these sites have a connection to the Proposed Development footprint. Summarised below are the qualifying interests / qualifying criteria for which these three sites were designated, and the connection between them and the Ecology Survey Area.

- **Upper Ballinderry River SAC (site code: UK0030296)**
    - The primary reasons for designation of the Upper Ballinderry River SAC are as follows: watercourses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation; freshwater pearl mussel; and otter. Other Annex I habitats within the SAC are: old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; and alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion alvae*).
    - Part of this site occurs within the Ecology Survey Area, it is adjacent to north east of the Sandholes Link Road Section of the Proposed Development (see **Section 7, Figure 4.1** and **4.2**). Thus, it has a hydrological connection to the Proposed Development footprint.

- **Lough Neagh and Lough Beg SPA (site code: UK9020091)**
    - The primary reason for designation of the Lough Neagh and Lough Beg SPA are as follows: Pochard (*Aythya ferina*); tufted duck (*Aythya fuligula*); goldeneye (*Bucephala clangula*); Bewick's swan (*Cygnus columbianus bewickii*); Whooper swan (*Cygnus Cygnus*); common tern (*Sterna hirundo*) and waterbird assemblage.
    - This SPA is located *ca.* 20 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308330) which occurs within the south east of the Proposed Development footprint (see **Section 7**, **Figure 4.1**). Thus, the Proposed Development is hydrologically connected to the SPA. The site also has potential ecological connectivity if the qualifying bird species of the SPA forage / commute within the Proposed Development footprint. The site is *ca.* 11.5 km in direct distance south east (at the closest point) of the Proposed Development.

- **Lough Neagh and Lough Beg Ramsar (site code: UK 74)**
    - The following are summarised accounts of the criteria under which the site qualifies as a Ramsar Site (for a more detailed account see **Appendix B**, **Table B01**): largest freshwater lake in the UK; supports over forty rare or local vascular plants; the site regularly supports substantial numbers of individuals from particular groups of waterfowl which are indicative of wetland values, productivity and diversity; supporting an important assemblage of breeding birds; it regularly supports internationally important number of wintering Bewick's and whooper swans and supporting a population of Pollan (*Coregonus autumnalis*) a salmonid fish found in only a few locations in Ireland and two in the UK.
    - As with the Lough Neagh and Lough Beg SPA, the Ramsar Site is located *ca.* 20 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308330) which flows through the southern part of the Proposed Development footprint (see **Section 7**, **Figure 4.1**). Thus, it has a hydrological connection to the Proposed Development. The site also has a potential ecological connection if the qualifying bird species of the Ramsar Site forage / commute within the Proposed Development footprint. The site *ca.* 11.8 km in direct distance south east at the closest point of the Proposed Development.

3.1.1.2 Statutory Site of National Importance

A table listing all of the statutory designated sites of national importance which occur within 20 km of the Ecology Survey Area is presented in **Appendix B, Table B02**. This table includes the designated site name and code, a summary of qualifying features of the ASSI, the closest point to the Proposed Development footprint and any connectivity between the statutory designated site and the Proposed Development. A figure illustrating the location of the statutory designated sites of national importance which occur within 20 km of the Proposed Development footprint is presented in **Section 7, Figure 5**.

Twenty-four designated sites of national importance occur within 20 km of the Ecology Survey Area, of which 21 are ASSIs, two are NRs and one is a NNR (for further details see **Appendix B, Table B02)**. Four of these sites have a connection to the Proposed Development. Summarised below are the features for which these sites were notified, and the connection between them and the Proposed Development footprint.

- **Upper Ballinderry River ASSI (site code: 199)**
    - Upper Ballinderry River ASSI is designated for the physical features of the river, and its associated riverine flora and fauna.
    - Part of the site occurs within the Proposed Development footprint, it is adjacent to north east of the Sandholes Link Road Section of the Proposed Development (see **Section 7**, **Figure 5**). Thus, it has a hydrological connection to the Proposed Development.

- **Brookend ASSI (site code: 334)**
    - Brookend ASSI is designated for its breeding colony of grey herons (*Ardea cinerea*).
    - The site is situated *ca.* 11 km in direct distance south east of the, it is adjacent to north east of the Sandholes Link Road Section of the Proposed Development.
    - The site has a potential ecological connection if grey heron from the ASSI forage / commute within the Proposed Development footprint.

- **Lough Neagh ASSI (site code: 30)**
    - Lough Neagh ASSI is designated for its flora, fauna (including breeding and wintering birds) and geological and physiographical features.
    - The site has a hydrological connection via the Ballinderry River (RWB Code UKGBNI1NB030308330) which occurs in the south east of the Ecology Survey Area. The hydrological link is *ca.* 20 km (along the river) east of the Ecology Survey Area. The site has a potential ecological connection of *ca.* 11.7 km (in direct distance) if the qualifying breeding and wintering birds from the ASSI forage / commute within the Proposed Development footprint.

- **Lough Neagh Islands NR**
    - Designated for its island and bird interest.
    - The site has a hydrological connection via the Ballinderry River (RWB Code UKGBNI1NB030308330) in the south east of the Moneymore Section of the Proposed Development; this site is *ca.* 20 km (along the river) east of the Ecology Survey Area. The site which is *ca.* 14.2 km (in direct distance) has a potential ecological connection if the qualifying birds from the NR forage / commute within the Proposed Development footprint.

3.1.2 Non-Statutory Sites

3.1.2.1 Non-statutory Sites of Local Importance

A table listing all of the non-statutory designated sites of local importance which occur within 5 km of the Ecology Survey Area is presented in **Appendix B, Table B03**. This table includes the designated site name, the closest point to the Proposed Development footprint and any connectivity between the non-statutory designated site and the Proposed Development. A figure illustrating the location of the non-statutory designated sites of local importance which occur within 5 km of the Ecology Survey Area is presented in **Section 7, Figure 6**.

Fifteen non-statutory designated sites of local importance, all of which are Sites of Local Nature Conservation Importance (SLNCIs), occur within 5 km of the Ecology Survey Area. One of these sites has a hydrological connection to the Ecology Survey Area, while a further two have the potential for a hydrological connection, as described further below.

- **Kilymmon Estate Wood SLNCI**
    - This SLNCI is *ca.* 0.6 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308330) from the Proposed Development footprint.

- **Tullylagan Manor Wood SLNCI**
    - This SLNCI is *ca.* 7.4 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308330) from the Proposed Development footprint.

3.2 Existing Species Records

Records of protected and notable species (as described in **Section 2.2.2**) recorded within a 2 km radius (10 km for bats) were obtained from the CEDaR database. This search was enhanced for otter and fresh water pearl mussel by records from the NBDC database. Details of protected species (excluding species vulnerable to persecution) are summarised in **Appendix B, Table B04**. Details of protected species vulnerable to persecution recorded within 2 km of the Proposed Development are provided in the confidential **Appendix F, Table F01**. The likelihood of these species occurring within

the Ecology Survey Area is also listed on this table. Where available, IAS records have also been provided here.

3.3 Habitat Survey Results and Assessment

A Phase 1 habitat survey was carried out within the Terrestrial Ecology Survey Area using the method described in **Section 2.3.1** between 26/08/2019 and 06/09/2019 (see **Section 2.3**, **Table 1**). The habitats recorded within the Terrestrial Ecology Survey Area are listed in **Section 3.3.1**, **Table 2** below. Descriptions of these habitats are provided in **Sections 3.3.1.1 – 3.3.1.8**. A Phase 1 habitat map illustrating the habitats recorded within the Terrestrial Ecology Survey Area is presented in **Section 7, Figure 7.1 – Figure 7.3** (view in conjunction with **Section 3.3.1, Table 2** for habitat classifications). The plant species recorded within the Terrestrial Ecology Survey Area during the Phase 1 habitat survey are listed, with both common and scientific names, in **Appendix C**, **Table C01**. Target notes taken during the Phase 1 habitat survey are presented in **Appendix D**, **Table D02**, and the location of these target notes can be viewed in **Section 7**, Figures **10.1 – 10.4**.

3.3.1 Overview

The Sandholes Link Road of the Terrestrial Ecology Survey Area is located within a built-up area composed predominately of industrial housing, residential housing and broad-leaved woodland plantation and broadleaved treelines. The Moneymore Section of the Terrestrial Ecology Survey Area is in a rural setting, largely comprised of improved grassland, but also including residential housing and occasional industrial buildings. The Killymoon Golf Course is also a feature of this, as is the presence of a wooded network with small stands of woodland and abundant treelines, hedgerows and scattered trees.

Table 3 below lists the habitats recorded within the Terrestrial Ecology Survey Area, as classified according to JNCC (2010), and assesses their correspondence with the Northern Ireland Priority Habitats and Annex I Habitats of the EU Habitats Directive.

3.3.1.1 Woodland and Scrub Habitats

Woodland, scrub and treelines are widespread throughout the Terrestrial Ecology Survey Area. Whilst both woodland and scrub occupy a relatively small area, there is a considerable wooded network, particularly with respect to treelines and hedgerows.

A limited area of **broad-leaved semi-natural woodland (A1.1.1)** occurs within the Terrestrial Ecology Survey Area (see **Appendix E, Table E01, Plate # 1**). Where this habitat does occur, it is small in area and blends quickly into planted broad-leaved woodland. The broad-leaved semi-natural woodland that does occur within the Terrestrial Ecology Survey Area is often supporting an ash-hazel-male-fern composition. Other species include pedunculate oak, elder and holly, with field layers including opposite-leaved saxifrage, enchanter's nightshade, bramble, herb-Robert, meadowsweet, ivy and bluebells.

A notable example of broad-leaved semi-natural woodland is present in the south of the Terrestrial Ecology Survey Area, on the south bank of the Ballinderry River. This woodland, which blends into a broad-leaved planation woodland, supports a line of mature oak and beech (a non-native tree in Northern Ireland, which was likely to have been planted), which are remnants of an Ancient Woodland, in a site named Cabin Wood and managed by the Woodland Trust, which blends into a narrow stand of younger (but still semi-mature) woodland, composed of an ash-hazel-scaly male-fern composition, amongst rocky outcrops, with a field layer that include abundant herb-Robert and frequent scaly male-fern and enchanter's nightshade.

Table 3 Habitats recorded within the Terrestrial Ecology Survey Area as classified according to JNCC (2010), and their correspondence with Northern Ireland Priority Habitats and Annex I Habitats of the EU Habitat Directive

Broad Habitat Categories	JNCC Phase 1 habitat classification code	JNCC Phase 1 habitat classification	Potential correspondence to Northern Ireland Priority Habitats[31]	Potential correspondence with Annex 1 Habitats of the EU Habitats Directive?[32]
Woodland and Scrub	A1.1.1	Broad-leaved semi-natural woodland	Yes, according to NIEA Priority Habitat Guide: Oakwoods[33] and NIEA Priority Habitat Guide: Mixed Ashwood[34] Location: In Cabin Wood, managed by the Woodland Trust, there is a treeline of remnant ancient woodland (with mature oak and planted beech), and a narrow stand of semi-mature ash woodland.	Oak treeline, although very limited in area, has links with old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (91A0)'.[35]
	A1.1.2	Broad-leaved plantation woodland	Yes, according to NIEA Priority Habitat Guide: Mixed Ashwood[34] Location: a number of broad-leaved plantation woodland stands within the Terrestrial Ecology Survey Area (see target notes in **Appendix D**, **Table D02**)	No
	A1.1.2 / A2.1	Broad-leaved plantation woodland / dense scrub	No	No
	A1.2.2	Coniferous plantation woodland	No	No
	A1.3.2	Mixed plantation woodland	No	No
	A2.1	Dense scrub	No	No
	A2.2	Scattered scrub	No	No
	A2.2 / A3.1	Scattered scrub / scattered broad-leaved trees	No	No
	A2.2 / C3.1	Scattered scrub / tall ruderal	No	No

[31] NIEA List of Priority Habitats. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/ni_priority_habitats_april__10.pdf [Accessed November 2019].
[32] EU Habitats Directive. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20130701 [Accessed November 2019].
[33] NIEA Priority Habitat Guide: Oakwoods. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Habitat%20Guide%20-%20Oakwood.PDF [Accessed November 2019].
[34] NIEA Priority Habitat Guide: Mixed ashwoods. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Habitat%20Guide%20-%20Mixed%20ashwood.PDF [Accessed November 2019].
[35] (EC, 2009). EU Interpretation Manual. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf [Accessed November 2019].

Broad Habitat Categories	JNCC Phase 1 habitat classification code	JNCC Phase 1 habitat classification	Potential correspondence to Northern Ireland Priority Habitats[31]	Potential correspondence with Annex 1 Habitats of the EU Habitats Directive?[32]
	A3.1	Scattered broad-leaved trees	No	No
	A3.2	Scattered coniferous trees	No	No
	A3.3	Mixed trees	No	No
Grassland and marsh	B2.2	Semi-improved neutral grassland	No	No
	B4	Improved grassland	No	No
	B5	Marshy grassland	No	No
	B5 / C3.1	Marshy grassland / tall ruderal	No	No
	B5 / B2.2 / A2.2	Marshy grassland / semi-improved neutral grassland / scattered scrub	No	No
	B5 / J1.3	Marshy grassland / ephemeral perennial	No	No
	B6	Poor semi-improved grassland	No	No
	C3.1	Tall ruderal	No	No
Swamp	F1	Swamp	No	No
Open water	G2	Running water	Yes, according to the NIEA List of Priority Habitats[31]	No
Cultivated land	J1.2	Amenity grassland	No	No
	J1.3	Ephemeral perennial	No	No
	J1.4	Bare ground	No	No
Boundaries	J2.1.1	Native species-rich intact hedge	Yes, according to NIEA Standing Advice: Hedgerows[36]	No

[36] NIEA Standing Advice: Hedgerows. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Hedgerows%20-%20November%202017.pdf [Accessed November 2019].

Broad Habitat Categories	JNCC Phase 1 habitat classification code	JNCC Phase 1 habitat classification	Potential correspondence to Northern Ireland Priority Habitats[31]	Potential correspondence with Annex 1 Habitats of the EU Habitats Directive?[32]
	J2.1.2	Species poor intact hedge	Yes, according to NIEA Standing Advice: Hedgerows[36]	No
	J2.2.1	Species-rich defunct hedge	Yes, according to NIEA Standing Advice: Hedgerows[36]	No
	J2.2.2	Species poor defunct hedge	Yes, according to NIEA Standing Advice: Hedgerows[36]	No
	J2.3.1	Native species-rich hedge with trees	Yes, according to NIEA Standing Advice: Hedgerows[36]	No
	J2.3.2	Species poor hedge with trees	Yes, according to NIEA Standing Advice: Hedgerows[36]	No
	J2.4	Bare ground	No	No
	J2.5	Wall	No	No
	J2.6	Dry ditch	No	No
Built-up Areas	J3.6	Buildings	No	No
	J3.6 / J1.2	Buildings / amenity grassland	No	No
	J5	Other habitats	No	No

Stands of **broad-leaved plantation woodland (A1.1.2)** are limited but widespread within the Terrestrial Ecology Survey Area (see **Appendix E, Table E01, Plate # 2**). These stands of broad-leaved plantation woodland support a range of different species; however, ash, sycamore (a non-native species) and beech are frequent in the canopy. Other canopy species include alder, willow, hawthorn, cherry laurel and rare horse chestnut, alder, pedunculate oak and rowan with hawthorn also and hazel occurring at shrub layer. Much of these stands of broad-leaved plantation woodland are semi-mature, with a smaller number of young plantations. The semi-mature woodland often supports a developed field layer which are variable but may include soft-rush, woundwort, bramble, male-fern, creeping buttercup, herb-Robert, common nettle, ivy and ash seedlings.

A small number of **coniferous woodland plantation (A1.2.2)** stands occur within the Terrestrial Ecology Survey Area, largely associated with the Killymoon Golf Course, such as the Scots pine plantation within the course.

A small number of **mixed plantation woodland (A1.3.2)** stands occur within the Terrestrial Ecology Survey Area. These plantations include semi-mature Lawson's Cypress and alder trees adjacent to a house, and a young woodland in an industrial estate, which includes frequent silver birch cultivar, sycamore and occasional Scots pine.

Dense Scrub (A2.1) and **scattered scrub (A2.2)** occur occasionally within the Terrestrial Ecology Survey Area. Scrub species present include bramble, and occasional elder and willow.

One stand of **scattered scrub / scattered broad-leaved trees (A2.2 / A3.1)** mosaic occurs in an industrial estate in the Sandholes Road Link Section.

A large mosaic of **scattered scrub / tall ruderal (A2.2 / C3.1)** is present in the north of the Sandholes Road Link Section on an area of disturbed ground, with shallow soil; it is a revegetated field with abundant bramble and willow scrub and rosebay willowherb.

Scattered broadleaved trees (A3.1), in particular in the form of treelines, are a strong ecological feature, along with hedgerows, in the Terrestrial Ecology Survey Area (see **Appendix E, Table E01, Plate # 3**). Many of these trees are semi-mature ash. Other tree species occurring in isolation or part of a treeline include hawthorn, sycamore, grey willow, wych elm, sycamore, poplar sp., copper beech, pedunculate oak, sweet chestnut, lime sp. and horse chestnut.

Scattered coniferous trees (A3.2) in the Terrestrial Ecology Survey Area largely occur in the form of treelines, and include the following trees: Scots pine, Lawson Cypress, and Sitka spruce. In a cemetery in the north of the Sandholes Link Road Section there are frequent semi-mature Irish yew trees growing within the amenity grassland.

Mixed scattered trees (A3.3) in the Terrestrial Ecology Survey Area include the following species: Turkey oak, Lawson Cypress and sycamore.

3.3.1.2 Grassland and Marsh Habitats

Much of the Terrestrial Ecology Survey Area is composed of grassland, in particular improved grassland.

Semi-improved neutral grassland (B2.2) is widespread but rare within the Terrestrial Ecology Survey Area, often occurring on sloping corners of improved fields (see **Appendix E, Table E01, Plate # 4**). The semi-improved grassland includes false oat grass, Yorkshire-fog, ribwort plantain, common bird's-foot trefoil and willowherb sp. A high-quality herb abundant stand of semi-improved grassland occurs just south east of the sewage treatment works in the south of the Moneymore Section. It supports abundant common knapweed, ribwort plantain, greater bird's-foot-trefoil, Yorkshire-fog, common bent, and meadow buttercup.

Improved grassland (B4) is the dominant habitat within the Terrestrial Ecology Survey Area (see **Appendix E, Table E01, Plate # 5**). It is largely species poor with typical species including dominant perennial rye-grass, locally abundant Yorkshire-fog and locally frequent broad-leaved dock.

Marshy grassland (B5) occurs infrequently as small stands in damp corners of fields from the middle to the north of the Moneymore Section. This grassland includes locally dominant creeping-bent, locally dominant meadow foxtail, locally abundant soft-rush, creeping buttercup, silverweed and greater bird's-foot-trefoil. A mosaic of **marshy grassland / tall ruderal (B5/ C3.1)** vegetation occurs in the south of the Sandholes Link Road Section on waste ground which supports locally abundant soft-rush and greater bird's-foot-trefoil and willowherb sp. (see **Appendix E, Table E01, Plate # 6**). A small intricate mosaic of **marshy grassland / semi-improved neutral grassland / scattered scrub (B5 / B2.2 / A2.2)** occurs in the south of the Moneymore Section. The damper areas support dominant soft-rush, abundant meadowsweet, greater bird's-foot-trefoil and Yorkshire-fog, whilst the drier areas support locally abundant wavy hair-grass, common knapweed, greater bird's-foot-trefoil, sweet vernal-grass, Yorkshire-fog, meadow buttercup and creeping thistle, whilst the scrub is largely composed of bramble, with localised areas of common nettle. Ground modified for landscaping supports a mosaic of **marshy grassland / ephemeral perennial (B5 / J1.3)** vegetation with the disturbed ground hosting a mixture of rush-pasture and ephemeral vegetation.

A small amount of grassland within the Terrestrial Ecology Survey Area is **poor semi-improved grassland (B6)**, with species including dominant creeping-bent, locally abundant broad-leaved dock and creeping buttercup, with frequent perennial rye grass, locally frequent creeping thistle, meadow foxtail, and occasional Cock's-foot grass.

3.3.1.3 Tall herb Habitats

Tall ruderal (C3.1) vegetation often with rosebay willowherb, is present in the north and south of the Terrestrial Ecology Survey Area, along and in mosaic with other habitats, associated with disturbed ground.

3.3.1.4 Swamp Habitats

A small number of wet drainage ditches with vegetation which includes locally dominant floating sweet-grass, classified as **swamp (F1)**, are present within the Terrestrial Ecology Survey Area. Swamp is not mapped as the area was limited but it is included in the target notes in **Appendix D**, **Table D02**, **TNs# 2, 9 and 33** and the location is mapped in **Section 7, Figure 10.1**.

3.3.1.5 Open Water Habitats

Running water (G2) occurs in several locations within the Terrestrial Ecology Survey Area (see **Appendix E, Table E01, Plate # 7**). The Ballinderry River and its tributary are present in the south, and wet drainage ditches and streams are present in the north of the Terrestrial Ecology Survey Area, (see **Appendix E, Table E01, Plate # 3**).

3.3.1.6 Cultivated / Disturbed Land Habitats

Amenity grassland (J1.2) occupies a significant area of the Terrestrial Ecology Survey Area due to the presence of the Killymoon Golf Club in the Moneymore Section, as well as a cemetery in the Sandholes Road Link Section and gardens associated with housing and public spaces throughout.

Small stands of recolonising **ephemeral perennial (J1.3)** vegetation, such as coltsfoot, are present on disturbed ground within the Terrestrial Ecology Survey Area.

Ornamental **introduced shrub (J1.4)**, most of which cover areas too small to map, are present in a number of locations, primarily at roadsides within the Terrestrial Ecology Survey Area.

3.3.1.7 Boundary Habitats

As previously stated, the Terrestrial Ecology Survey Area does have a considerable wooded network, particularly with respect to treelines and hedgerows.

Native species-rich intact hedges (J2.1.1) are present occasionally in the central and northern parts of the Moneymore Section (see **Appendix E, Table E01, Plate # 8**). These hedges are often low and well-managed. One such hedgerow in the centre of the Moneymore Section was quite scrub-like in form. These hedgerows include hawthorn, ash, elder, sycamore (a non-native species), and bramble. **Species poor intact hedges (J2.1.2)** are abundant within the Terrestrial Ecology Survey Area. These hedges are largely composed of hawthorn, but other species they support include elder, sycamore, holly and the IAS snowberry, cherry laurel, butterfly bush, fuchsia and Lawson Cypress.

Species-rich defunct hedges (J2.2.1) occur occasionally within the central and northern parts of the Moneymore Section. These hedgerows include hawthorn, grey willow and silver birch. **Species poor defunct hedges (J2.2.2)** occur frequently within the central and northern parts of the Moneymore Section. These non-stock proof hedgerows include hawthorn, and occasionally elder, blackthorn, hazel and the IAS *Cotoneaster* sp.

Native species-rich hedges with trees (J2.3.1) are locally frequent in the north of the Moneymore Section, with **species-poor hedges with trees (J2.3.2)** occurring more in the central parts. These hedgerows are primarily composed of hawthorn, with the semi-mature ash trees.

Old stone **walls (J2.5)** covered in ivy are present in the south of the Terrestrial Ecology Survey Area, in particular in association with the Killymoon Golf Club. Parts of these old stone walls are collapsing. A small number of modern walls, composed of breeze block were also present within the Terrestrial Ecology Survey Area.

A small number of **dry ditches (J2.6)**, most of which are too small to be mapped, occur in the central part of the Moneymore Section, and are included in the target notes in **Appendix D**, **Table D02**.

3.3.1.8 Built-up Areas

The Sandhole Link Road Section of the Terrestrial Ecology Survey Area is located within a built-up area with **buildings (J3.6)** composed of primarily industrial estates and residential housing (see **Appendix E, Table E01, Plate # 3)**. The Moneymore Section is within a largely rural area which includes a small number of industrial buildings, and residential housing typically at the periphery of this area. Significant parts of the Terrestrial Ecology Survey Area have been classified as **buildings /**

amenity grassland (J3.6 / J1.2) which represent areas which support an intricate mosaic of residential housing and associated gardens and other amenity grassland.

Other habitats (J5) within the Terrestrial Ecology Survey Area include a small solar farm in the northern part of the Moneymore Section and hardstanding throughout (see Appendix E, Table E01, Plate # 2). Protected and Notable Species Survey Results and Assessment

As described in **Section 2.3.2**, surveys for protected species were undertaken during a number of field visits to the Ecology Survey Area. These included surveys for field signs using standard methodologies appropriate to different species (e.g. badger, otter, bats etc.), and also habitat suitability assessments in order to evaluate the potential for different species to occur within the Proposed Development and the wider Ecology Survey Area. The surveys also included searches for evidence of species previously recorded in the general area, as identified during the desk study.

3.4 Protected Species Survey Results and Assessment

3.4.1 Bird Species Results

The desk study established that a number of protected and notable birds have been recorded within 2 km of the Ecology Survey Area, these are presented in **Appendix B, Table B04**.

Breeding bird surveys did not form part of the site walkovers, since it was undertaken within an inappropriate season. However, incidental bird species records made during the field surveys within the Ecology Survey Area (see **Section 2.3**, **Table 1** above) are listed in **Table 4** below, together with their Irish conservation status (Colhoun and Cummins, 2013) and habitat requirements. An illustration of the location of the bird species listed in **Table 4** is presented **Section 7**, **Figure 8**.

Table 4 Bird species recorded within the Ecology Survey Area during field surveys (undertaken in August - September 2019)

Common name	Scientific name	Conservation status[37]	Activity noted	Likelihood of breeding in the Ecology Survey Area
Blackbird	*Turdus merula*	Green	Alarm calling from hedgerow	Likely breeding in the vicinity
Dipper	*Cinclus cinclus*	Green	Flying upstream of the Ballinderry River	Possibly breeding within the Ecology Survey Area
Grey heron	*Ardea cinerea*	Green	Flying past	Likely breeding outside of the Ecology Survey Area
Kingfisher	*Alcedo atthis*	Amber	Flying upstream of the Ballinderry River	Possibly breeding within the Ecology Survey Area
Wood pigeon	*Columba palumbus*	Green	Roosting in mature elder tree	Likely breeding in the vicinity

Red-listed birds species identified in **Appendix B, Table B04** which were not recorded within the Ecology Survey Area during field surveys but for which the Phase 1 habitat survey results indicate that there is suitable habitat are as follows:

- Barn owl (*Tyto alba*);
- Black-Headed Gull (*Larus ridibundus*) (foraging); and,
- Yellowhammer (*Emberiza citrinella)* (Limited foraging potential as no arable land was recorded within the Ecology Survey Area; breeding potential within the hedgerows).

[37] According to Colhoun, K. and Cummins, S. (2013)

Post-survey analysis was conducted by assessment of habitats within or immediately adjacent to the Terrestrial Ecology Survey Area with the potential to provide foraging or nesting opportunities for important or protected bird species.

The site is likely to hold a variety of bird species during both the breeding and non-breeding seasons. This has the potential to include overwintering waterfowl (notably potentially swans, where foraging within suitable agricultural fields), farmland birds (notably passerines within hedgerow habitats), and raptors / owls. The importance of the bird population will only be known following full and detailed surveys at the appropriate time.

3.4.2 Mammal Results

The results of mammal surveys (including an assessment of habitat suitability based on the Phase 1 habitat survey results) for otter, an Annex II species of the EU Habitats Directive, badger protected under the Wildlife Order, and Irish hare and hedgehog, both Northern Ireland Priority Species are presented in **Sections 3.4.2.1 – 3.4.2.6** below.

3.4.2.1 Otter

The desk study established that otter is a Northern Ireland Priority Species and an EU Habitats Directive Annex Species, and that the species has been recorded previously within 2 km of the Ecology Survey Area (CEDaR database) and within the Ballinderry River catchment (NBCD database) (see **Appendix B**, **Table B04**).

The NBDC database established that a live record of an otter was recorded, as well as several records along the Ballinderry River for sightings and spraints.

Field signs recorded within the Aquatic Ecology Survey Area were: a potential holt; remains of dead crayfish; and spraints along the Ballinderry River. The potential otter holt is located approximately 10 m from the river's edge (see **Section 7, Figure 9**, **signs in middle of three signs – located on northern bank**; **Appendix D, Table D02, TN #185;** and **Appendix E, Table E01, Plate # 9**). Although this potential holt seemed to be disused it could potentially be inhabited by otter: a musty smell was noted. The remains of crayfish were located on a rock outcrop along the river's edge where otter was potentially actively hunting prey. Spraint was also recorded in two locations in close proximity to the river's edge on large boulders (see **Section 7, Figure 9**, **most northern and southern of three signs – located on northern bank**; see **Appendix E, Table E01, Plate # 10**). See **Section 7, Figure 9** for mapped otter activity along the Ballinderry River within the Aquatic Ecology Survey Area.

Possible field signs recorded within the Terrestrial Ecology Survey Area were: a faint mammal slide into a stream (see **Appendix D, Table D02, TN # 59**; and **Section 7, Figure 10.2, TN # 59**); a mammal track (see **Appendix D, Table D02, TN # 78**, and **Section 7, Figure 10.2, TN # 78)**; a cavity under bedrock which could be used by a number of mammals, including by otter, as a holt (see **Appendix D, Table D02, TN # 228 – on southern bank**; **Section 7, Figure 10.3, TN # 228**; and **Appendix E, Table E01, Plate # 11**); and a large**.** cave-like structure (possibly associated with the historical mill in this location) providing a potential for a range of species, including otter, to use as a holt (see **Appendix D, Table D02, TN # 244**; **Section 7, Figure 10TN # 244**; and **Appendix E, Table E01, Plate # 12**).

3.4.2.2 Badger

The desk study established that badger is protected under the Wildlife Order and was previously recorded within 2 km of the Ecology Survey Area. Figures illustrating the results of previous surveys undertaken by Mouchel (2009) establish that badger setts were identified within the Ecology Survey Area. Badger surveys undertaken to inform this PEA identified high levels of badger activity within the Ecology Survey Area. Further information is presented in **Appendix F- Confidential Specie Data.**

3.4.2.3 Irish Hare

The desk study established that Irish hare is a Northern Ireland Priority Species and that the species has been recorded previously within 2 km of the Ecology Survey Area (see **Appendix B**, **Table B04**).

No Irish hare was seen nor were signs recorded during the extended Phase 1 habitat survey within the Terrestrial Ecology Survey Area.

The habitats present within the Moneymore Section of the Terrestrial Ecology Survey Area are highly suitable for Irish hare[38]. These habitats include: semi-improved neutral grassland, improved grassland, marshy grassland, amenity grassland at Killymoon Golf Club and woodlands stands, and hedgerows and treelines.

3.4.2.4 Hedgehog

The desk study established that hedgehog is a Northern Ireland Priority Species and that the species has been recorded previously within 2 km of the Ecology Survey Area (see **Appendix B**, **Table B04**). No hedgehogs were seen nor were signs recorded during the extended Phase 1 habitat survey within the Terrestrial Ecology Survey Area.

The habitats present within the Terrestrial Ecology Survey Area are highly suitable for hedgehog[39]. These habitats include: semi-improved neutral grassland, improved grassland, amenity grassland including residential gardens, and hedgerows, treelines and woodland.

3.4.2.5 Other Mammals

Signs of deer were abundant (in particular hoof prints and browsing) within a broad-leaved woodland plantation in the south of the Moneymore Section of the Terrestrial Ecology Survey Area, as described in the target notes in **Appendix D**, **Table D02, TN # 181,** and as illustrated in **Section 7, Figure 10.1 and 10.2**, **TN # 181.** The only deer species returned via the desk study search for species within 2 k m of the Ecology Survey Area was of fallow deer (*Dama dama*).

Likely squirrel feeding signs (nuts cleanly halved) were recorded under a hazel tree in the middle of the Terrestrial Ecology Survey Area, as described in the target notes in **Appendix D**, **Table D02, TN # 219,** and as illustrated in **Section 7, Figure 10.3**, **TN # 219.** It is not possible to ascertain from feeding signs alone the squirrel species responsible for said signs. No records for either the native red squirrel (*Sciurus vulgaris*) or the invasive alien grey squirrel (*Sciurus carolinensis)* were returned from the desk study search for species within 2 km of the Ecology Survey Area. However, it is known that red squirrel, a Northern Ireland Priority Species, does occur within the wider area[40] and grey squirrels were confirmed within the Terrestrial Ecology Area (see **Section 3.4.7** below).

[38] As informed by the Northern Ireland Priority Species website Irish Hare page. Available at: http://www.habitas.org.uk/priority/species.asp?item=42516 [Accessed November 2019].
[39] As informed by the Northern Ireland Priority Species website Hedgehog page: http://www.habitas.org.uk/priority/species.asp?item=5078 [Accessed November 2019].
[40] As informed by Ulster Wildlife's *Where to see Red Squirrels* page. Available at: https://www.ulsterwildlife.org/explore/where-see-wildlife-ni/where-see-red-squirrels [Accessed November 2019].

3.4.2.6 Bat Surveys

The desk study indicated that at least eight species of bat have been recorded within 10 km of the Ecology Survey Area, these species are: brown long eared bat (*Plecotus auritus*), common pipistrelle bat (*Pipistrellus pipistrellus*), Daubenton's bat (*Myotis daubentonii*), Leisler's bat (*Nyctalus leisleri*), Nathusius' pipistrelle bat (*Pipistrellus nathusii*), Natterer's Bat (*Myotis nattereri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and whiskered / Brandt's bat (*Myotis mystacinus / brandtii)*, all of which are protected under Annex IV of the EU Habitats Directive (see **Appendix B**, **Table B04**). Three of these eight bats: brown long eared bat, Nathusius' pipistrelle bat and soprano pipistrelle are Northern Ireland Priority Species.

The Terrestrial Ecology Survey Area supports an abundance of suitable commuting and foraging habitat for bats as evidenced by the result of the Phase 1 habitat surveys as it consists of open agricultural land with scattered stands of woodland and an abundance of linear features including hedgerows, treelines and watercourses.

Many features, in particular trees and structures within the Terrestrial Ecology Survey Area provide bat roosting features. The results of the preliminary roost assessment of both tree and structures (buildings, walls *etc*.) are presented in **Appendix D**, **Table D03**. Figures that illustrated these results are presented in **Section 7**, **Figure 11.1-1.3**.

In summary, the preliminary roost assessment of features (trees and structure) for bats within the Terrestrial Ecology Survey Area identified:

As presented in ***Appendix D, Table D03*** and illustrated in ***Section 7, Figure 11.1-1.3****:*

- Twenty-five features with high bat roost features;
- Sixty-six features with moderate bat roost features;
- Eight-six features supporting low bat roost features;
- Ten features with negligible bat roost features; and
- Four features which due to limited access could not be provided a level of roosting potential

As presented in ***Appendix D, Table D02, TN # 244*** and illustrated in ***Section 7, Figure 10.3 TN # 244*** and **Appendix E, Table E01, Plate # 13**:

- A potential winter roost location (a large cave-like structure, likely associated with the historic mill, facing the Ballinderry River).

3.4.3 Herpetofauna

The desk study established that common lizard is a Northern Ireland Priority Species but it did not return a record of within 2 km of the Ecology Survey Area, however this does not preclude their existence within the study area, as it may be a result of under-recording.

In Northern Ireland, common lizard is typically found in coastal areas, bog land and upland habitats[41], thus the Ecology Survey Area provides suboptimal habitat for this reptile. During the extended Phase 1 habitat survey, two locations were noted as holding potential for reptile refugia and hibernaculum, an old fallen stone wall (**TN # 70**) and brash on a south facing slope (**TN # 95**). The target notes and location of these can be seen in **Appendix D**, **Table D02** and **Section 7**, **Figure 10.2.** However, the

[41] As informed by the Northern Ireland Priority Species Common Lizard page. Available at: http://www.habitas.org.uk/priority/species.asp?item=5069 [Accessed November 2019].

wider area in general, notably comprising agricultural grassland, hedgerow and woodland, does not provide optimal habitat for this species.

The desk study did not return any records of amphibians, either smooth newt or common frog, within 2 km of the Ecology Survey Area, however this does not preclude their existence within the study area, as it may be a result of under-recording. No lakes or ponds were identified within the Terrestrial Ecology Survey Area, and while wet ditches were identified in three locations, providing breeding opportunities for common frog, they provide suboptimal breeding opportunities for smooth newt.. The wet ditches are not mapped as they are limited in area. Target notes relating to these ditches are presented in **Appendix D**, **Table D02**, **TNs # 2, 9 and 33** and their locations are mapped in **Section 7, Figure 10.1**.

3.4.4 Salmonid Suitability Surveys

Salmonid suitability surveys resulted in all three habitat classifications available to salmonids within the Aquatic Ecology Survey Area. The most abundant habitat available is Holding Areas Grade 1, where adult fish hold up and rest on migration routes. The second most available habitat that exists along the Ballinderry River within the Aquatic Ecology Survey Area is Holding Area Grade 2. There is an area within the watercourse that classifies as a Nursery Area Grade 1, where juvenile fish feed and take refuge during this life stage within the watercourse. This habitat is indicative of larger stones and boulders where juvenile fish can take cover. The most sensitive habitat classified is the Spawning Habitat which salmon use to spawn and fertilise eggs. Spawning habitat is available at locations within the Ballinderry River and has been classified at Grade 2 (S2) due to substrate condition and gravel depths. See **Section 7**, **Figure 12.1 and 12.2** for mapped salmonid suitability habitats along the Ballinderry River within the Aquatic Ecology Survey Areas. **Appendix G** explains habitat classifications due to the available substrates, flows and gravel depths.

3.4.5 White-clawed Crayfish Suitability Surveys

Suitable habitat for white-clawed crayfish consists of stones and boulders where specimens have refuge between the spacings of these materials. Shallow areas where stony substrates are located are likely to hold crayfish, however they may also be within the deeper waters of the river. Suitability was mapped on visible substrate areas available. These areas match the potential salmon nursery areas where stones and boulders are located that can act as refuge for crayfish to inhabit. Suitable areas have also been mapped where potential crayfish habitat exists where they may be isolated boulders and stones within these areas that could potentially act as refuges for crayfish. See **Section 7, Figure 13** for mapped crayfish suitability habitat along the Ballinderry River within the Aquatic Ecology Survey Area.

3.4.6 Freshwater Pearl Mussel

The desk study established that freshwater pearl mussel was previously recorded within 2 km of the Ecology Survey Area. The results of the desk study and field surveys are presented in **Appendix F Confidential Species Data**.

3.4.7 Invasive Alien Species

Flora

A number of IAS were recorded within the Terrestrial Ecology Survey Area. They are summarised below, details are also presented in **Appendix D**, **Table D02**.

- Japanese knotweed (*Fallopia japonica)*

  - Substantial stand of Japanese knotweed in amongst scrub edge on steep bank on the perimeter of farm (see **Section 7, Figure 10.1, TN #19**).
  - A Japanese knotweed hedgerow is growing either side of a track (see **Section 7, Figure 10.1, TN #50**).
  - Small stand of Japanese knotweed and giant hogweed see **Section 7, Figure 10.4, TN #131**).
- Giant hogweed (*Heracleum mantegazzianum)*
  - Locally abundant throughout the Ecology Survey Area, in particular in close proximity to the Ballinderry River. As the IAS is so abundant, it was not recorded at all locations, target notes of some locations it occurs include **Section 7, Figures 10.1 - 10.4, TN # 131, 133, 138, 149, 156, 157, 163, 194, 195, 196, 209, 231, 239, 243, 257, 258, 263, 275, 277, 291.**
- Other invasive alien species recorded within the Terrestrial Ecology Survey include:
  - Snowberry, see **Section 7, Figures 10.1 -10.4, TN # 43, 49, 125, 126, 154, 157 and 161.**
  - Cherry laurel, see **Section 7, Figures 10.1 -10.4, TN # 97, 98, 99, 145, 146, 153, 157, 168, 172, 174, 190, 193, 199, 202, 205, 212, 215, 233, 240, 241.**
  - Rhododendron, **see Section 7, Figure 10.3-10.4, TN # 182, 216, 284, 287.**
  - Butterfly bush, see **Section 7, Figures 10.1 -10.3, TN # 240, 241, 242.**
  - Coteneaster sp., see **Section 7, Figures 10.3 -10.4, TN # 104, 105, 116, 287.**
  - Japanese rose, see **Section 7, Figures 10.3, TN # 204, 205, 206.**
  - Red currant, see **Section 7, Figures 10.3, TN # 267**

Fauna

Several grey squirrels were recorded at Killymoon Golf Course, see **Appendix D, Table D02, TN # 107** and **Section 7, Figure 10.2, TN # 107.**

3.4.8 Other Important and Protected Species

Protected invertebrate species

The desktop survey established that several Northern Ireland Priority invertebrate species have been recorded within 2km of the Ecology Survey Area. These are:

- Flounced chestnut moth (*Agrochola helvola*) last recorded at an unknown date, listed as being of 'Least Concern' (LC)[42] on the island of Ireland. This Northern Ireland Priority Species is associated with peatland habitat;
- Garden dart moth (*Euxoa nigricans*) last recorded at an unknown date, listed as Near Threatened (NT) in the island of Ireland[42]. This Northern Ireland Priority Species is found most readily in costal dune systems.
- Grey mountain moth (*Entephria caesiata*) last recorded at an unknown date, listed as Near Threatened (NT) in the island of Ireland[42]. This Northern Ireland Priority Species is associated with moorland and mountain habitats;
- Marsh fritillary butterfly (*Eurodryas aurinia*) last recorded in 1918, listed as Vulnerable 'VU' in the island of Ireland[43]. This Annex I species of the EU Habitats Directive and Northern Ireland Priority Species is associated with mires, damp grasslands, dune heath and dune grassland habitats;
- Wall butterfly (*Lasiommata megera*) last recorded between 1957- 1977, listed as Critically Endangered 'CE' in Northern Ireland; in the remainder of Ireland it is considered Endangered 'E'[44]. This Northern Ireland Priority Species is associated with low rocky coastal habitats.

[42] NPWS (2016). Ireland Red List No.9: Macro-moths (Lepidoptera). Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL9%20Moths%20final%20version%20for%20webpage.pdf [Accessed October 2019].
[43] NPWS (2010). Ireland Red List No 4: Butterflies. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL_2010_Butterflies.pdf [Accessed October 2019].

The above species largely occur in habitat types which are not within the Terrestrial Ecology Survey Area[44].

During the extended Phase 1 habitat survey, it was noted that a broad-leaved woodland plantation / scrub mosaic, and a tall ruderal habitat, both with meadow vetchling provided potential for cryptic wood white butterfly (*Leptidea juvernica*), a Northern Ireland Priority Species, give the presence of scrub and grassland (its associated habitat) and meadow vetchling (the larval foodplant)[45]. The target notes related to provided potential for cryptic wood white butterfly are presented in **Appendix D, Table D01, TN # 14** and **TN # 39** and these locations are mapped in **Section 7**, **Figure 10. 1**, **TN # 14** and **39**.

Protected plant species

Three plant species listed under Schedule 8 Part 1 of the Wildlife (Northern Ireland) Order 1985 have been recorded within 2 km of the Ecology Survey Area. These plants are as follows:

- Bee orchid (*Ophrys apifera)* last recorded in 1951 is listed as Least Concern (LC) in the island of Ireland[46]. According to the Online Atlas of the British and Irish Flora)[47]occurs in a range of habitats on well drained, calcareous soils. It was not recorded within the extended Phase 1 habitat survey of the Terrestrial Ecology Survey Area. However, the surveys were undertaken in August to September, whilst the typical flowering period of this species is May to July. This is not considered a limitation as the species is unlikely to occur within the Terrestrial Ecology Survey Area given that no calcareous influenced habitats were identified.
- Bird's-nest orchid (*Neottia nidus-avis*) last recorded between 1987-1999 is listed as Least Concern (LC) in the island of Ireland[46]. According to Flora of Northern Ireland[48], this plant is associated with beech trees, but also occurs in oak woods. It was not recorded within the Terrestrial Ecology Survey Area. However, the surveys were undertaken in August to September, whilst the typical flowering period of this species is typically May to July. The Terrestrial Ecology Survey Area does support beech trees and small stands of oak woodland, so there is a potential the species could occur there.
- Wood crane's-bill (*Geranium sylvaticum*) last recorded at an unknown date is listed as Endangered (E) in the island of Ireland[46]. According to the Botanical Society of Britain and Ireland[49], this plant is of moderately acidic or neutral soil and is found in grasslands, hay-meadows, roadside verges and stream-sides. It was not recorded within the Terrestrial Ecology Survey Area (the species flowering period is June to July and the extended Phase 1 survey was undertaken in August- September) but has the potential to be there.
- Alpine clubmoss (*Diphasiastrum alpinum)* last recorded in 1981 is listed as Near Threatened (NT) in the island of Ireland[46]. It was not recorded within the Terrestrial Ecology Survey Area (it is an evergreen herb so would have been identifiable within the timing of the extended Phase 1 surveying which took place in July to August) and is unlikely to be present given it is a plant of moorland.

Two plant species that are listed on Schedule 8 Part 2 of the Order (for the protection of wild plants) have been recorded within 2km of the Ecology Survey Area. These are:

[44] The habitat types associated with the moths and butterflies above were informed by the individual Northern Ireland Priority Species pages. Available at: http://www.habitas.org.uk/priority/ [Accessed November 2019].
[45] As informed by the Northern Ireland Priority Species Cryptic Wood White page. Available at: http://www.habitas.org.uk/priority/species.asp?item=430857 [Accessed November 2019].
[46] NPWS (2016). Ireland Red List No. 10: Vascular Plants. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL10%20VascularPlants.pdf [Accessed October 2019].
[47] Information sourced from the Online Atlas of the British and Irish Flora. Available at: https://www.brc.ac.uk/plantatlas/plant/ophrys-apifera [Accessed November 2019].
48 As informed by Flora of Northern Ireland. Available at: http://www.habitas.org.uk/flora/species.asp?item=2301 [Accessed November 2019].
[49] *Germanium sylvaticum* Species account. Available at: https://bsbi.org/wp-content/uploads/dlm_uploads/Geranium_sylvaticum_species_account.pdf [Accessed November 2019].

- Vegetative bluebell (*Hyacinthoides non-scripta)* was recorded (the typical flowering period is April to May) during the Phase 1 habitat survey within a small stand of broad-leaved semi-natural woodland in the Terrestrial Ecology Survey Area.
- Primrose (*Primula vulgaris)* was not recorded during the Phase 1 habitat survey due to the time the surveys were undertaken (the typical flowering period is March to May) but is likely to occur within / near wooded habitats within the site.

Other notable red listed plant species that have been recorded within 2 km of the Terrestrial Ecology Survey Area include all of the following Near Threatened (NT) are: Allseed (*Radiola linoides*) (unknown date), bur parsley (*Anthriscus caucalis*) (unknown), common cudweed (*Filago vulgaris*) (1915), common gromwell (*Lithospermum officinale*) (1888), common wintergreen (*Pyrola minor*) (unknown date) and dwarf spurge (*Euphorbia exigua*) (1896).

Notable fungus

During the Phase 1 habitat survey, the fungus earth-star (*Geastrum triplex)* was recorded in a broad-leaved woodland plantation near the north of the Terrestrial Ecology Survey Area. This fungus is rare in the island of Ireland: there are 64 records in Northern Ireland[50] and 1 record in the Republic of Ireland[51].The target note relating to can is located in **Appendix D, Table D02, TN #23**. The location of the fungus is presented in **Section 7, Figure 10.1**, **TN # 23**.

3.5 Water Quality Assessment

3.5.1 Q-value Assessment

All Q -value sites resulted in a value of Q3, freshwater shrimps *Gammarus spp.* were the dominant organism from the four sampling sites. See **Table 5** below for results and **Section 7, Figures 14** for sampling point locations.

- Water quality site 1 consisted of three taxa in total. Nine freshwater shrimp, one mayfly (*Heptageniidae*) and three non-biting midge larva (*Chironomidae*). Result - Q3 (Class C)
- Water quality site 2 also consisted of three taxa in total. Eleven freshwater shrimp, four caddisfly (*Tricoptera*), three uncased and one cased and two non-biting midge larva were present (*Chironomidae*). Result - Q3 (Class C)
- Water quality site 3 consisted of one taxon in total. Six freshwater shrimp. Result - Q3 (Class C)
- Water quality site 4 consisted of three taxa in total. Two freshwater shrimp, one uncased caddisfly and seven non-biting midge lava were present. Result - Q3 (Class C).

Table 5 Macroinvertebrate family diversity and resulting Q-value

Site	Family diversity	Q-value	EPA status
Site 1	3	3	Moderately polluted
Site 2	3	3	Moderately polluted
Site 3	1	3	Moderately polluted
Site 4	3	3	Moderately polluted

[50] As informed by NBN Atlas Northern Ireland. Available at: https://northernireland-species.nbnatlas.org/species/NBNSYS0000041480 [Accessed November 2019].
[51] As informed by NBDC Biodiversity maps. Available at: https://maps.biodiversityireland.ie/Species/162546 [Accessed November 2019].

3.5.2 Chemical Assessments

Chemical analysis for water quality parameters is shown below in **Table 6** below and sampling points are illustrated in **Section 7, Figures 14.**

Table 6 Water quality parameter results

Site	*Temp °C*	*pH*	*DO mg/l*	*EC µs/cm*	*Turbidity NTU*
Site 1	15.4	7.94	8.07	264	1.2
Site 2	15	8	7	256	1
Site 3	16	8	9	295	1
Site 4	15	7	7	259	1

River temperatures for all four sites are similar and expected values for the Ballinderry River. Salmonid waters such as the Ballinderry River would be expected to have pH levels of 6 to 9, and this is reflected in the results with values recorded close to neutral or slightly above for all four sites. Dissolved oxygen levels obtained show expected values for salmonid waters with readings of between 7mg/l to 9mg/l across the four sample sites.

3.5.3 River Habitat Survey

River habitat survey results are compiled on field data sheets to determine valley forms, artificial features, and physical attributes. Three areas along the Ballinderry River were assessed for these features presence/absence and results are captured within the assigned field sheets.

River habitat survey results for this section of the Ballinderry River resulted in no obvious realignment or over-deepening of the river with features such as pools and riffles present. Concave/bowl was the predominant valley form and no evidence of water being impounded by weirs/dams. River banks consisted mostly of earth banks with no channel modifications. Flow type for the Ballinderry River consisted of a smooth flow classification. Channel substrate resulted in gravel/pebble areas with boulder substrates also available. Some substrates were not visible due to water depths and classified as NV. Improved/semi-improved grassland, broadleaf/mixed woodland and suburban/urban development classifications were assigned for land uses within 5m of the river bank. Channel vegetation types consisted of filamentous algae and no classification where solid substrates were present. Bank profiles were assigned with a classification of natural/unmodified banks with a profile of vertical banks with toe present.

3.5.4 River Hydromorphology Assessment Technique (RHAT)

The RHAT classifies river hydromorpology based on a departure of naturalness and assigns a morphological classification directly related to that of the Water Framework Directive: high, good, moderate, poor and bad classification based on eight criteria. These are listed below in **Tables 7** and **8** below with the corresponding scores. See **Section 7, Figures 15.1** and **15.2** for the sampling point locations.

Table 7 RHAT results - Site 1 – Bal001

RHAT Criteria and Score	Bedrock	Cascade/step-pool	Pool-riffle-glide	Lowland meandering
Channel form and flow types	N/A	N/A	N/A	4/4
Channel vegetation	N/A	N/A	N/A	4/4
Substrate	N/A	N/A	N/A	2/4
Bank structure & stability L&R	N/A	N/A	N/A	2/4
Barriers to continuity	N/A	N/A	N/A	4/4
Bank vegetation L&R	N/A	N/A	N/A	3/4
Riparian land cover	N/A	N/A	N/A	2/4
Floodplain connectivity L&R	N/A	N/A	N/A	3/3
Total				**24/32**
Hydromorph score*				**0.75**
WFD Class				**Good**

Table 8 RHAT results - Site 2 – Bal002

RHAT Criteria and Score	Bedrock	Cascade/step-pool	Pool-riffle-glide	Lowland meandering
Channel form and flow types	N/A	N/A	N/A	3/4
Channel vegetation	N/A	N/A	N/A	4/4
Substrate	N/A	N/A	N/A	2/4
Bank structure & stability L&R	N/A	N/A	N/A	4/4
Barriers to continuity	N/A	N/A	N/A	3/4
Bank vegetation L&R	N/A	N/A	N/A	1/4
Riparian land cover	N/A	N/A	N/A	0/4
Floodplain connectivity L&R	N/A	N/A	N/A	3/3
Total				**20/32**
Hydromorph score*				**0.62**
WFD Class				**Moderate/Good**

4. DISCUSSION AND RECOMMENDATIONS

The discussion and recommendations based on the findings of the surveys that informed this PEA are presented in **Table 9** below.

4.1 Discussion and Recommendations

Table 9 Designated Sites and Protected and Notable Species relevant to the Proposed Development and further surveys required

A separate discussion and recommendation for confidential species is presented in Appendix F.

Category	Feature	Survey Undertaken?	Further Surveys required?	Comment
International Designated Statutory Sites	Upper Ballinderry River SAC (site code: UK0030296)	N/A	See comment	It is understood that release of freshwater pearl mussel into the Upper Ballinderry River SAC has been undertaken in the past and that individual mussels have been washed down by floods. Dedicated surveys for freshwater pearl mussel are therefore recommended. Otter in the vicinity of the proposal have the potential to be part of the Upper Ballinderry River SAC population. Salmonids in the vicinity of the proposal have the potential to be linked to the Upper Ballinderry River SAC population (and also potentially linked to the freshwater pearl mussel population). Further, detailed surveys required for freshwater pearl mussel, otter and salmonids.
	Lough Neagh and Lough Beg SPA (site code: UK9020091)	N/A	See comment	Potential for adverse effects is likely to be largely in the form of water quality impacts. Baseline surveys (e.g. macro-invertebrates) are required in this respect. Qualifying interest species with potential to occur in the Zone of Influence include whooper swan. Much of the area is of limited suitability for foraging whooper swans, but some of the more open areas in the northern part of the Ecology Survey Area hold suitability. Surveys to include foraging areas used by whooper swans and other overwintering waterfowl and wading birds.
	Lough Neagh and Lough Beg Ramsar (site code: UK 74)	N/A	See comment	As for Lough Neagh and Lough Beg SPA.
National Designated Statutory Sites	Upper Ballinderry River ASSI (site code: 199)	N/A	See comment	As for Upper Ballinderry River SAC.

Category	Feature	Survey Undertaken?	Further Surveys required?	Comment
	Brookend ASSI (site code: 334)	N/A	See comment	Detailed bird surveys to include consideration of heron (foraging).
	Lough Neagh ASSI (site code: 30)	N/A	See comment	As for Lough Neagh and Lough Beg SPA.
	Lough Neagh Islands NR	N/A	No	As for Lough Neagh and Lough Beg SPA.
Local Designated Non-Statutory Sites	Killymoon Estate Wood SLNCI	N/A	No	
	Tullylagan Manner Wood SLNCI	N/A	No	
Protected / Notable Habitats	Broad-leaved semi-natural woodland (A1.1.1)	Yes, Phase 1 habitat survey	No if avoided	If the area cannot be avoided, surveys must conform to NIEA requirements for Priority Habitats (Woodlands).
	Broad-leaved plantation woodland (A1.1.2)	Yes, Phase 1 habitat survey	No if avoided	If the area cannot be avoided, surveys must conform to NIEA requirements for Priority Habitats (Woodlands).
	Running Water (G2)	Yes, Phase 1 habitat survey	Yes	Surveys need to include IAS (aquatic plants) as well as aquatic flora during the appropriate season
	Hedgerows (J2) including: J2.1.1; J2.1.2; J2.2.2; J2.3.1; J2.3.2.	Yes, Phase 1 habitat survey	Yes	Hedgerows are a NI Priority Habitat. For the hedgerows that cannot be avoided, surveys will need to be undertaken at an appropriate time of year to identify the ground flora importance and classify the importance of the hedgerow.
Protected / Notable Bird Species	An assemblage of wintering birds associated with Lough Neagh	No	Yes	Notable species potentially foraging within agricultural land (whooper swan in particular)
	Kingfisher	No, recorded during extended Phase 1 habitat survey	Yes	Wider area breeding season survey of river corridors

Category	Feature	Survey Undertaken?	Further Surveys required?	Comment
	Grey heron associated with Brookend ASSI	No, recorded during extended Phase 1 habitat survey	Yes	Grey heron to be included in with particular focus within generic breeding bird surveys
	Barn owl	No	Yes, if suitable outbuildings are to be impacted	Barn owl to be included in target species for bird surveys (nesting) if any outbuildings to be lost.
	Black-Headed Gull	No	Yes	Black headed-gull (foraging) to be included in winter surveys within agricultural land and also in generic breeding bird surveys (for foraging)
	Yellowhammer	No	Yes	Yellowhammer to be included with particular focus within generic breeding bird surveys.
Protected / Notable Mammals	Otter	Yes	Yes	Otter signs were recorded in the Ecology Survey Area. Further otter surveys are required. The purpose of such surveys would be to undertake an intensive survey (given a number of inconclusive burrows were found in the area surrounding the TNs provided below) to update the finding of this survey, and to deploy trail cameras on the potential holt locations (see **Appendix D, Table D02, TN # 228; and Appendix D, Table D02, TN # 244)** and other inconclusive burrows in this area. Further trail camera surveys are recommended in the locations where otter signs have been recorded such as spraint and prey remains to determine the usage of these areas by otter (see **Section 7, Figure 9**). Survey must be conducted under license. As already stated in the limitations section not all areas of the Aquatic Ecology Survey Area were surveyed for otter signs due to inaccessibility and health and safety issues.
	Badger	Yes	Yes	Further surveys required to monitor status of badger setts and determine territorial boundaries, particularly in order to identify potential territory segregation by the Proposed Development.
	Irish hare	Yes, extended Phase 1 habitat survey	Yes	Not recorded during Phase 1 surveys but likely to occur. Surveys to be included in wider mammal walkover surveys.
	Hedgehog	Yes, extended Phase 1 habitat survey	No	The species is likely to occur within specific habitat types. However, surveys are unlikely to provide further detail on usage levels. Mitigation is likely to be appropriate within the detailed design stage.
	Red squirrel	No	Yes	Species occurs in wider area, and a likely squirrel feeding sign was recorded within the Ecology Survey Area. If potential habitat is affected by the proposed route then surveys will be required.

Category	Feature	Survey Undertaken?	Further Surveys required?	Comment
	Bats	Yes, preliminary roost assessments undertaken	Yes	Surveys will include detailed roost potential assessments, roost surveys and activity surveys in targeted areas potentially affected by the final proposed route.
Herpetofauna	Common lizard	Yes, extended Phase 1 habitat survey	No	Habitat considered sub-optimal for the species. Two locations (see **TN # 70** and **95**, **Section 7, Figure 10.2**) within the Terrestrial Ecology Survey Area are considered to hold reptile hibernaculum potential.
	Smooth newt	Yes, extended Phase 1 habitat survey	Likely	Will be required for any areas where slow-flowing drains / standing water may be affected by the proposed route.
	Common frog	Yes, extended Phase 1 habitat survey	No	Species will occur across the Ecology Survey Area. Surveys are unlikely to provide further detail. Mitigation will be required within the proposal application.
Protected aquatic species	Atlantic salmon	Yes, habitats suitability survey undertaken	Yes	Instream surveys for Atlantic salmon are recommended to inform baseline data on the presence of this, and other fish species in the receiving environment, especially in areas that may be directly impacted by the Proposed Development or are in close proximity to large scale works. Surveys must conform to DAERA guidance notes and be carried out under a permit issued under Section 14 of The Fisheries Act (Northern Ireland) (1966)[52]. Surveys should be carried out in low flow summer conditions that would also avoid the sensitive spawning season (winter) for salmonids.
	White-clawed crayfish	Yes, habitats suitability survey undertaken	Yes	Instream surveys for white-clawed crayfish are recommended to inform baseline data on the presence of this species in the receiving environment, especially in areas that may be directly impacted by the Proposed Development or are in close proximity to large scale works. Constraints exist for survey times for white clawed crayfish due to females carrying young and the preferred time for surveys is early August to avoid berried females. Survey must be conducted under license.
	Freshwater Pearl Mussel	Yes, habitats suitability survey undertaken	Yes	The desk study established that freshwater pearl mussel was previously recorded within 2 km of the Ecology Survey Area. The results of the desk study and field surveys are presented in **Appendix F Confidential Species Data**.

[52] Department of Agriculture, Environment and Rural Affairs https://www.daera-ni.gov.uk/publications/application-permit-under-section-14-fisheries-act-ni-1966 [Accessed November 2019]

Category	Feature	Survey Undertaken?	Further Surveys required?	Comment
Invasive Alien Species	Several alien invasive plant species recorded, of particular concern are Japanese knotweed and Giant hogweed	Yes, extended Phase 1 habitat survey	Yes, an update survey will be required for an Invasive Alien Management Plan	Surveys to be undertaken for terrestrial plant IASs during the core growing season (optimum timing: July-August).
	Grey squirrel	Yes, extended Phase 1 habitat survey	No	
Protected invertebrate species	Cryptic wood white butterfly	Yes, extended Phase 1 habitat survey	Yes – if areas of suitable habitat will be potentially affected	The species has not been recorded in the locality. However, targeted butterfly surveys should be undertaken in potentially suitable areas (e.g. Target Note locations 14 and 39 in Figure 10.1) if potentially affected by the works.
Protected plants species	Wood crane's-bill	Yes, extended Phase 1 habitat survey	Yes, targeted protected flora surveys.	Recommended protected flora surveys to be undertaken of potentially suitable habitats if affected by the proposal (including species-rich grasslands, hay-meadows, roadside verges and stream sides).
	Bird's-Nest Orchid	Yes, extended Phase 1 habitat survey	Yes (targeted protected flora surveys)	Recommended protected flora surveys to be undertaken of potentially suitable habitats if affected by the proposal (beech and oak woodlands)
Notable fungus	Earth-star	Yes, extended Phase 1 habitat survey	No	

4.2 Preliminary Avoidance, Mitigation and Compensation Measures

Table 10 Preliminary Avoidance, Mitigation and Compensation Measures relevant to Designated Sites and Protected and Notable Species relevant to the Proposed Development

A separate Preliminary Avoidance, Mitigation and Compensation Measures Table for confidential species is presented in Appendix F.

Category	Feature	Avoidance	Mitigation	Compensation Measures
International Designated Statutory Sites	Upper Ballinderry River SAC (site code: UK0030296)	Not possible – Part of the Upper Ballinderry River SAC occurs within the Proposed Development footprint – however direct impacts with the river should be avoided	- There is a hydrological link between the Proposed Development and the SAC (the Ballinderry River runs through the south the Ecology Survey Area). Good practise in relation to working near water must be adhered to in order to prevent water pollution of the SAC during the construction and the operation of the Proposed Development.	TBC as appropriate
	Lough Neagh and Lough Beg SPA (site code: UK9020091)	N/A – Lough Neagh and Lough Beg SPA is *ca.* 11.5 km south east of the Proposed Development footprint (in direct distance) and ca. 20 km east of the Proposed Development (via the hydrological link).	- There is a hydrological link between the Proposed Development and the SAC. Good practise in relation to working near water must be adhered to in order to prevent water pollution of the SPA during the construction and the operation of the Proposed Development. - There is a very limited potential ecological link between the Proposed Development and the SPA, if water birds (the qualifying interests of the SPA) from the SPA forage within the Ecology Survey Area. Though this is unlikely, if found to be the case, grassland lost due to the Proposed Development to be minimised, screening to be used if appropriate.	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Lough Neagh and Lough Beg Ramsar (site code: UK 74)	N/A – Lough Neagh and Lough Beg SPA is *ca.* 11.8 km south east of the Proposed Development footprint (in direct distance) and ca. 20 km east of the Proposed Development (via the hydrological link).	- There is a hydrological link between the Proposed Development and the Ramsar. Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development. - There is a very limited potential ecological link between the Proposed Development and the Ramsar, if water birds (three of the sites' qualifying criteria) from the Ramsar forage within the Ecology Survey Area. Though this is unlikely, if found to be the case, grassland lost due to the Proposed Development to be minimised, screening to be used if appropriate.	TBC as appropriate
National Designated Statutory Sites	Upper Ballinderry River ASSI (site code: 199)	Not possible – Part of the Upper Ballinderry River ASSI occurs within the Proposed Development footprint – however direct impacts with the river should be avoided.	- There is a hydrological link between the Proposed Development and the ASSI (the Ballinderry River runs through the south the Ecology Survey Area). Good practise in relation to working near water must be adhered to in order to prevent water pollution of the ASSI during the construction and the operation of the Proposed Development.	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Brookend ASSI (site code: 334)	N/A - Brookend ASSI is *ca.* 11 km east of the Proposed Development footprint.	- There is a potential ecological link between the Proposed Development and the ASSI, if grey heron (for which the ASSI is designated) from the ASSI forage within the Ecology Survey Area. Good practise in relation to working near water must be adhered to in order to prevent water pollution (in which watercourses the grey heron may forage) during the construction and the operation of the Proposed Development.	TBC as appropriate
	Lough Neagh ASSI (site code: 30)	N/A – Lough Neagh and Lough Beg ASSI is *ca.* 11.7 km south east of the Proposed Development footprint (in direct distance) and *ca*. 20 km east of the Proposed Development (via the hydrological link).	- There is a hydrological link between the Proposed Development and the ASSI. Good practise in relation to working near water must be adhered to in order to prevent water pollution of the ASSI during the construction and the operation of the Proposed Development. - There is a very limited potential ecological link between the Proposed Development and the ASSI, if water birds (for part of which the ASSI is designated) from the ASSI forage within the Ecology Survey Area. Though this is unlikely, if found to be the case, grassland lost due to the Proposed Development to be minimised, screening to be used if appropriate.	TBC as appropriate
	Lough Neagh Islands NR	N/A.	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development.	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
Local Designated Non-Statutory Sites	Killymoon Estate Wood	N/A.	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development.	TBC as appropriate
	Rusky Cottage Wood	N/A.	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development.	TBC as appropriate
	Broad-leaved semi-natural woodland (A1.1.1)	Avoid if possible.	If removing broad-leaved natural woodland is unavoidable, the following should be adhered to[53]: - Avoid sections of woodland with semi-mature / mature trees; - Retain connectivity where possible; - Integrate woodland into the development as boundary features to ensure their long-term management and retention; - New planting should link existing landscape features such as patches of woodland to watercourses or ponds; - New planting should be with native species; and some non-native species can be acceptable in an urban environment where screening is required. However, they should not be used in rural areas or for replacement of hedgerows of higher biodiversity value; - Any woodland removal must be undertaken outwith the breeding bird season.	If the loss of this habitat is unavoidable, compensatory broad-leaved woodland (with trees of native provenance) must be planted.

[53] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Hedgerows. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Hedgerows%20-%20November%202017.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
Protected / Notable Habitats	Broad-leaved plantation woodland (A1.1.2)	Avoid if possible	If removing broad-leaved plantation woodland is unavoidable, the following should be adhered to[53]: - Avoid sections of woodland with semi-mature / mature trees; - Retain connectivity where possible; - Integrate woodland into the development as boundary features to ensure their long-term management and retention; - New planting should link existing landscape features such as patches of woodland to watercourses or ponds; - New planting should be with native species; and some non-native species can be acceptable in an urban environment where screening is required. However, they should not be used in rural areas or for replacement of hedgerows of higher biodiversity value; - Any woodland removal must be undertaken outwith the breeding bird season.	If the loss of this habitat is unavoidable, compensatory broad-leaved woodland (with trees of native provenance) must be planted.
	Running Water (G2)	Avoid working instream and near the banks of any river, stream or drain identified within the Ecology Survey Area	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development. - Maintain appropriate natural buffer zones to watercourses - If any in-river works are undertaken (e.g. culverting) these will need to be under appropriate licences ensuring continued fish passage and avoidance of removal of benthic substrate	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Hedgerows (J2) including: J2.1.1; J2.1.2; J2.2.2; J2.3.1; J2.3.2.	Avoid if possible	If removing hedgerows is unavoidable, the following should be adhered to[53]: - Avoid hedgerows with large trees, those that are species rich or those that are town boundaries. If these types of hedgerows are to be lost, surveys of protected and priority species is always required; - Retain connectivity where possible; - Retain hedgerows where they form a significant element of the landscape character; - Integrate hedgerows into the development as boundary features or part of the open space provision to ensure their long-term management and retention; - New planting should link existing landscape features such as patches of woodland to watercourses or ponds; - New planting should be with native species; and some non-native species can be acceptable in an urban environment where screening is required. However, they should not be used in rural areas or for replacement of hedgerows of higher biodiversity value; - Any hedgerow removal must be undertaken outwith the breeding bird season.	If the loss of this habitat is unavoidable, compensatory hedgerow (with 'like for like' replanting) must be planted.
	An assemblage of wintering birds associated with Lough Neagh (existence not known)	Avoid works on any field identified as foraging habitat for wintering birds.	- Reduce the amount of suitable forging habitat (agricultural grassland) lost due to the Proposed Development. - Retain connectivity between suitable habitats even in areas where this habitat is to be impacted.	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
Protected / Notable Bird Species	Kingfisher	Avoid any area that is identified as a kingfisher breeding site.	- Any works on banks identified to support breeding kingfisher must be undertaken (within a safe buffer) outwith the breeding bird season.	TBC as appropriate
	Grey heron (*Ardea cinereal*) associated with Brookend ASSI	N/A	- Good practise in relation to working near water (including Ballinderry River and drains) must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development.	TBC as appropriate
	Barn owl	Avoid any suitable outbuildings.	- Reduce the number of suitable outbuildings lost - If the loss of suitable outbuildings cannot be avoided, they must be dismantled outwith the breeding bird season.	If potentially suitable outbuildings are lost, compensatory owl nesting boxes may be put in place in suitable locations.
	Yellowhammer	Avoid hedgerow loss as far as possible	- Minimise hedgerow loss	Include like-for like hedgerow replanting in project design
	Black-Headed gull	The species is likely to feed opportunistically within suitable fields. There are no realistic avoidance options	- None recommended	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Otter	Avoid otter holts and habitat surrounding these holts.	If works near otter holts are unavoidable the following mitigation is required[54]: - No works of any kind including clearance of vegetation and storage of materials can take place within the protection zones, unless a licence has been issued permitting such activities: an otter holt or couch requires a 30m protection zone; and a natal den requires a 150m protection zone. - Retain all holts where possible, and retain associated habitats (including woodland and scrub) - Provide adequate protection zones during construction and operation of the development. - Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development.	TBC as appropriate
Protected / Notable Mammals	Irish hare	Avoid any suitable habitats for Irish hare.	If the loss of suitable habitats is unavoidable, the following should be adhered to[55]: - If the loss of suitable habitats (semi-improved neutral grassland, improved grassland, marshy grassland, amenity grassland, woodlands stand, hedgerows and treelines) are unavoidable, reduce the amount of such habitat lost. - Retain connectivity between suitable habitats even in areas where this habitat is to be impacted.	TBC as appropriate

[54] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Otters. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Otters%20-%20November%202017.pdf [Accessed November 2019].

[55] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Priority Species. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Priority%20Species%20-%20November%202017.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Hedgehog	Avoid as much suitable habitats for hedgehog as is possible.	- Given that much of the Ecology Survey Area has habitats suitable for hedgehog (semi-improved neutral grassland, improved grassland, amenity grassland including residential gardens, and hedgerows, treelines and woodland), it is likely that habitat for this species will be loss, therefore the following mitigation is proposed: - Retain as much of the said habitats as possible; and, - Retain connectivity between suitable habitats even in areas where this habitat is to be impacted.	TBC as appropriate
	Red squirrel	Avoid any suitable habitat for red squirrel	If the loss of suitable habitats is unavoidable, the following should be adhered to[55]: - If the loss of suitable habitats for breeding, foraging and commuting (woodland [including coniferous woodland], treelines and hedgerows) are unavoidable, reduce the amount of such habitat lost. - Retain connectivity between suitable habitats even in areas where this habitat is to be impacted.	If the loss of this habitat is unavoidable, compensatory woodland, treelines and hedgerows (with 'like for like' replanting) must be planted.

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Bats	Avoid impacts on bats and their roosts through design of the Proposed Development.	Where bats are present on or near a site the following mitigation measures should be applied as a minimum[56]: - Retain all roosting sites and foraging corridors - Retain lines of mature vegetation, water features and areas of woodland - Ensure that lighting does not illuminate habitat features or any bat roosts in the area. - Plant native species of trees and shrubs to provide foraging habitat and to help retain connections with the existing lines of trees and hedgerows in the surrounding area; a helpful tool in achieving connectivity is to look at aerial photographs of the area. - When creating grassland areas within a site include native rough grass and wild flower seed mix where possible as this will provide a flower rich habitat that attracts insects and in turn provides feeding areas for bats. - If there is a river or stream within the site or on the boundary of the site consider planting native trees along the river or stream to provide a wildlife corridor and create dark areas for feeding bats.	For any roosting, foraging and / commuting habitat lost, compensatory habitats will be required. Any roost disturbance or derogation must be carried out under licence.

[56] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Bats. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Bats%20-%20November%202017.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Common lizard	Avoid any suitable habitat for common lizard, in particular two locations identified with hibernaculum potential.	Habitats within the Terrestrial Ecology Survey Area are considered suboptimal for the species; however, the following should be applied in order to reduce the risk on this species[57]: - Retain as much habitat as possible during the Proposed Development; - Reduce the impact of habitat fragmentation as much as possible during the Proposed Development; - Restrict machinery access during the construction of the Proposed Development.	Given the Terrestrial Ecology Survey Area is suboptimal, the primary habitat that would need to be replaced if lost would be connectivity features *i.e.* treelines and hedgerows, these should be replaced with 'like for like' replanting

[57] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: The Common Lizard. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20The%20Common%20Lizard%20-%20November%202017.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
Herpetofauna	Smooth newt	Waterbody and habitat loss and fragmentation should be avoided.	Mitigation for newts could include[58]: - Retaining waterbodies; - Habitat connectivity; - Reducing habitat impacts and permanent loss: and - Ensuring the long-term management does not affect the population. Habitat creation, habitat management including the provision of artificial breeding, and hibernation sites may be used as a means of improving habitats for newt. Newts exhibit significant seasonal variations in behaviour (and in some cases habitat requirements), thus it is often possible for works to be timed to avoid periods when amphibians are most at risk. They breed and are present in waterbodies from February to June and then disperse to the land in summer. - Any loss of a breeding waterbody will always require translocation under licence and may require pond creation.	The creation of new habitats including an artificial breeding pond and hibernation sites.
	Common frog	Waterbodies and habitat loss and fragmentation should be avoided.	Mitigation for common frogs could include[58]: - Retaining waterbodies; - Habitat connectivity; - Reducing habitat impacts and permanent loss: and - Ensuring the long-term management does not affect the population.	The creation of new habitats including an artificial breeding pond and hibernation sites.

[58] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Smooth Newt. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20Smooth%20Newt%20-%20October%202017.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Atlantic salmon	Avoid working instream and near the banks of any river, stream or drain identified within the Ecology Survey Area	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development. - Maintain appropriate natural buffer zones to watercourses, for invertebrate prey items - If any in-river works are undertaken (e.g. culverting) these will need to be under appropriate licences ensuring continued fish passage and avoidance of removal of benthic substrate	TBC as appropriate
Protected Aquatic Species	White-clawed crayfish	Avoid working instream and near the banks of any river, stream or drain identified within the Ecology Survey Area	- Good practise in relation to working near water must be adhered to in order to prevent water pollution during the construction and the operation of the Proposed Development. - If any in-river works are undertaken (e.g. culverting) these will need to be under appropriate licences ensuring avoidance of removal of benthic substrate	TBC as appropriate

Category	Feature	Avoidance	Mitigation	Compensation Measures
	Several alien invasive plant species recorded, of particular concern are Japanese knotweed and Giant hogweed d	Avoid working near invasive alien plant species	If working near invasive alien plant species is unavoidable, the following should be adhered to[59]: - An Invasive Species Management Plan will be required. - As each species has a different life cycle, including different methods of propagation, different management methods are required. Available best practice guidance should be considered when dealing with plans. - Where disposal off the site is considered necessary, it should be acknowledged that a waste licence will be required. Also, that covered licensed vehicles must be used with Waste Transfer Notes in place to move knotweed or giant hogweed material (controlled waste).	TBC as appropriate
Invasive Alien Species	Grey squirrel	N/A	N/A	N/A
	Cryptic wood white butterfly	Avoid the habitats suitable for this butterfly.	If the suitable habitat (scrub and grassland, with meadow vetchling present) cannot be avoided, the following mitigation should be adhered to: - Retain as much of this habitat as possible during the Proposed Development; - Reduce the impact of habitat fragmentation as much as possible during the Proposed Development; - Restrict machinery access during the construction of the Proposed Development; and, - The meadow vetchling seeds should be collected for use in the compensatory habitat.	If the loss of suitable habitat is unavoidable, compensatory scrub adjacent to grassland (with 'like for like' replanting) must be planted. Meadow vetchling (from the collected seed) should be sown into open sections of the compensatory habitat.

[59] As informed by the Department of Agriculture, Environment and Rural Affairs DAERA Environmental Advice for Planning Standing Advice: Invasive Alien Species. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20%20-%20NED%20-%20%20Invasive%20Alien%20Plant%20Species%20-%20January%202018.pdf [Accessed November 2019].

Category	Feature	Avoidance	Mitigation	Compensation Measures
Protected Invertebrate Species	Wood crane's-bill	Avoid habitats suitable for this plant.	If the suitable habitat (roadside verges, grasslands and streamsides) cannot be avoided, the following mitigation should be adhered to: - Retain as much of this habitat as possible during the Proposed Development; - Reduce the impact of habitat fragmentation as much as possible during the Proposed Development; - Restrict machinery access during the construction of the Proposed Development. The following mitigation should be considered, if a species targeted survey identifies the plant within the Proposed Development Footprint: - The plants should be translocated to a receptor location.	If the loss of the suitable habitat is unavoidable, compensatory habitat (with 'like for like' replanting) must be planted. If the plant is recorded within the Proposed Development Footprint, the plant should be translocated to a receptor site.
Protected Plant Species	Bird's-Nest Orchid	Avoid habitats suitable for this plant.	If the suitable habitat (beech tress and ash woodland) cannot be avoided, the following mitigation should be adhered to: - Retain as much of this habitat as possible during the Proposed Development; - Reduce the impact of habitat fragmentation as much as possible during the Proposed Development; - Restrict machinery access during the construction of the Proposed Development. The following mitigation should be considered, if a species targeted survey identifies the plant within the Proposed Development Footprint: - The plants should be translocated to a receptor location.	If the loss of the suitable habitat is unavoidable, compensatory habitat (with 'like for like' replanting) must be planted. If the plant is recorded within the Proposed Development Footprint, the plant should be translocated to a receptor site.

Category	Feature	Avoidance	Mitigation	Compensation Measures
Notable fungus	Earth-star	Avoid the habitat this fungus was recorded in.	If the suitable habitat (broad-leaved woodland plantation) cannot be avoided, the following mitigation should be adhered to: - Retain as much of this habitat as possible during the Proposed Development; - Reduce the impact of habitat fragmentation as much as possible during the Proposed Development; - Restrict machinery access during the construction of the Proposed Development.	If the loss of the suitable habitat is unavoidable, compensatory habitat (with 'like for like' replanting) must be planted.

4.3 Ecological Enhancement Opportunities

Although the Proposed Development will result in the loss of habitat it does provide an opportunity to provide local ecological enhancement. Such ecological enhancements include:

- Use roadside verges along the length of the road. Where planting is appropriate, the verges could be planted with neutral species of native provenance, or seeded appropriately. These roadside verges, which are often (if managed appropriately) herb-rich could provide foraging opportunities, in particular for invertebrates. These verges may also provide a corridor for bats should the illumination be managed appropriately, as discussed below. It is important that the potential future value of verges, and their management considerations, is incorporated into early stage decisions (for example not importing high nutrient soils if sowing with wildflower seed, or creating habitats requiring management in inaccessible areas).
- Plant native species-rich hedgerows and / or treelines, of local provenance, along the length of the road between the roadside verge and adjacent lands. These hedgerows and / or treelines will decrease the disturbance caused to fauna within adjacent lands. These hedgerows and / or treelines may also provide a commuting corridor for bats, and larger mammals on the landward side.
- Both required and voluntary compensatory measures could take cognisance of Northern Ireland Priority Habitats and Species. This would result in the compensatory measures creating Priority Habitats (for example native species-rich hedgerows) or providing for Priority Species (for example barn owl nesting boxes).

5. CONCLUSIONS

Initial desk study and field surveys have identified ecological features that are the most significant potential constraints to the Proposed development within the Ecology Survey Area. These include international, national and local designated sites of nature conservation importance, priority habitats and protected and notable species of conservation concern. The latter includes the presence of otters and badgers and their confirmed/ or potential places of shelter, potential bat roosts and foraging habitats, and aquatic receptors (which, in many cases, are linked to the qualifying interests of the Upper Ballinderry River SAC) within the Zone of Influence. For example, suitable habitats exist within sections of the Ballinderry River immediately up and downstream of the where it intersects with the Proposed Development for spawning salmon, white-clawed crayfish, freshwater pearl mussel and otter.

Further ecological features are, as yet, unknown, with surveys recommended in order to ascertain the extent of these within the potential Zone of Influence. This includes breeding birds (including barn owl and passerine species such as yellowhammer), wintering birds (including whooper swan) and protected flora which may occur on the more species-rich areas and woodlands within the Ecology Survey Area.

The results of the PEA include the identification of suitable habitats that may potentially support other protected and notable species of conservation concern, such as Irish hare and red squirrel. Further surveys are recommended to determine actual presence or likely absence of these species within areas that may be potentially affected by the Proposed Development as well as further, more detailed surveys and monitoring for those species confirmed to be present such as otter, badger, bats and aquatic species. This will determine whether potential negative effects may occur on these species due to the Proposed Development.

Due to access restrictions and health and safety issues, not all of the Ecology Survey Area was accessible to survey for potential otter signs, as detailed in the limitations section. This included an area upstream of where the Sandholes Link Road Section of the Proposed Development intersects with the Ballinderry River and a section downstream of where the Proposed Development intersects with the main route of the Proposed Development in Area B. Further surveys of these areas may require to be undertaken from a canoe or boat in order to obtain full access.

6. REFERENCES

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7. FIGURES

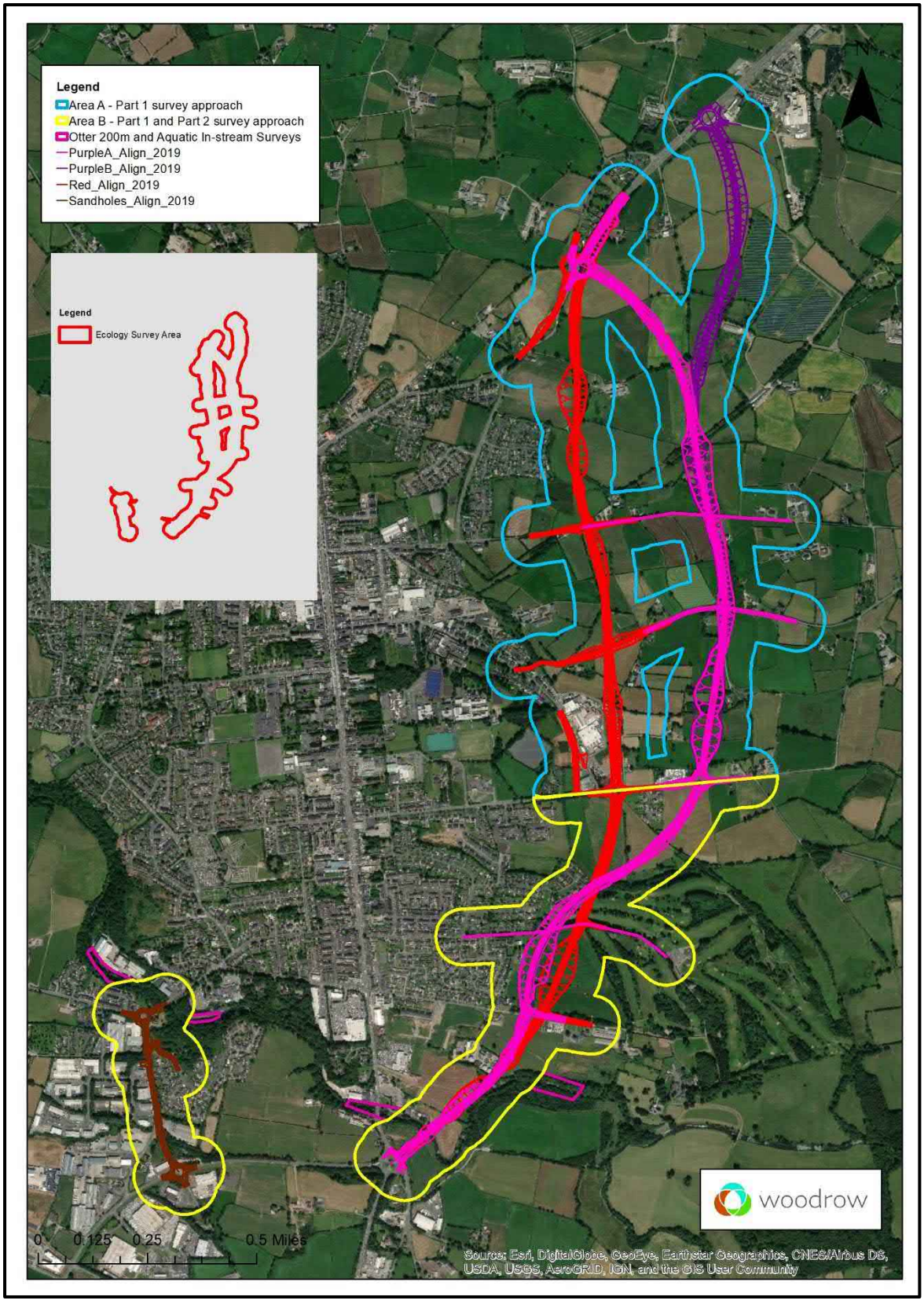

Figure 1 The Proposed Development illustrating the three Route Options: Red; Purple A; and Purple B and the Sandholes Link Road.

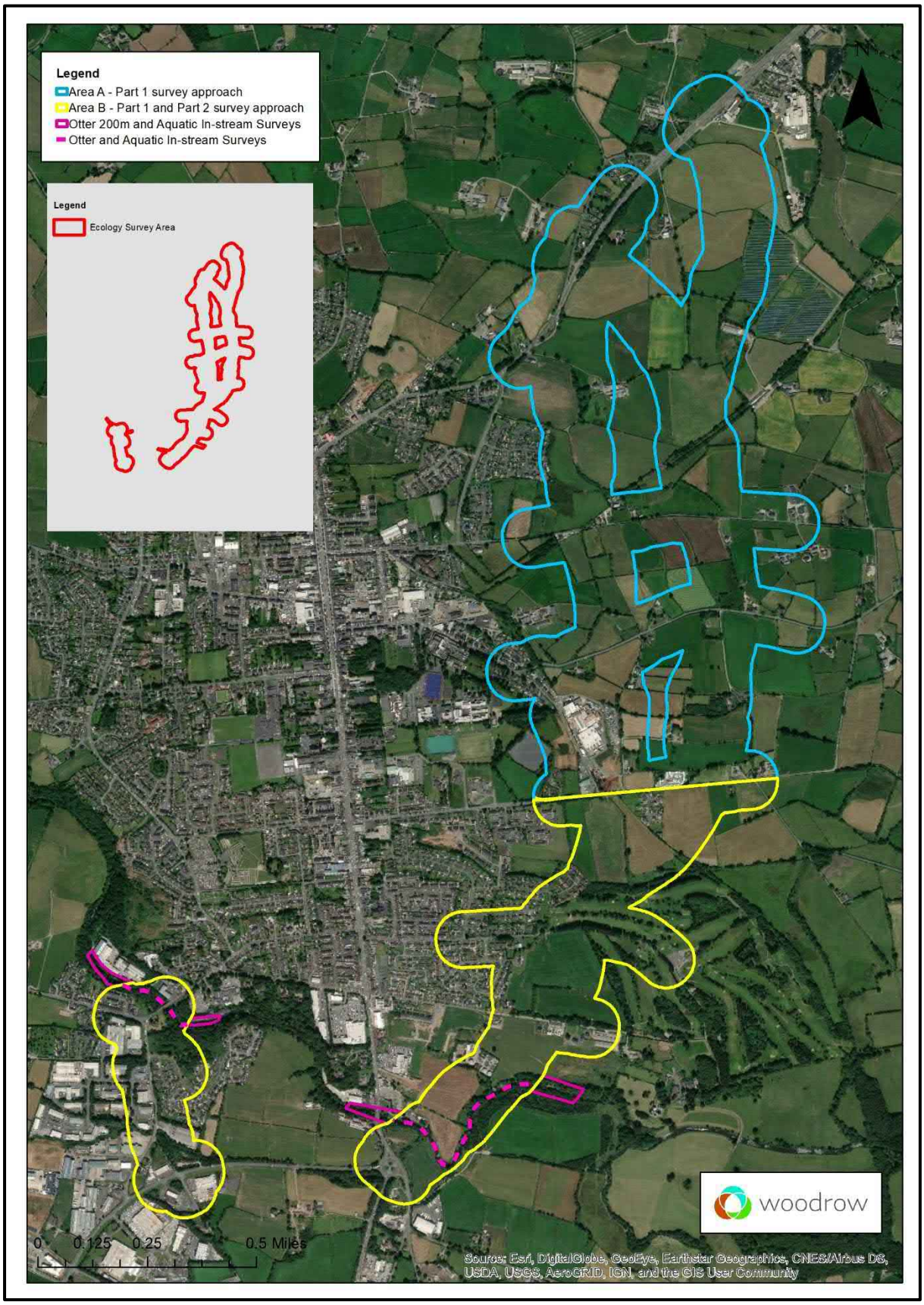

Figure 2 Ecology Survey Area, outlining the Terrestrial Ecology Survey Area, including Area A and B, and the Aquatic Ecology Survey Area

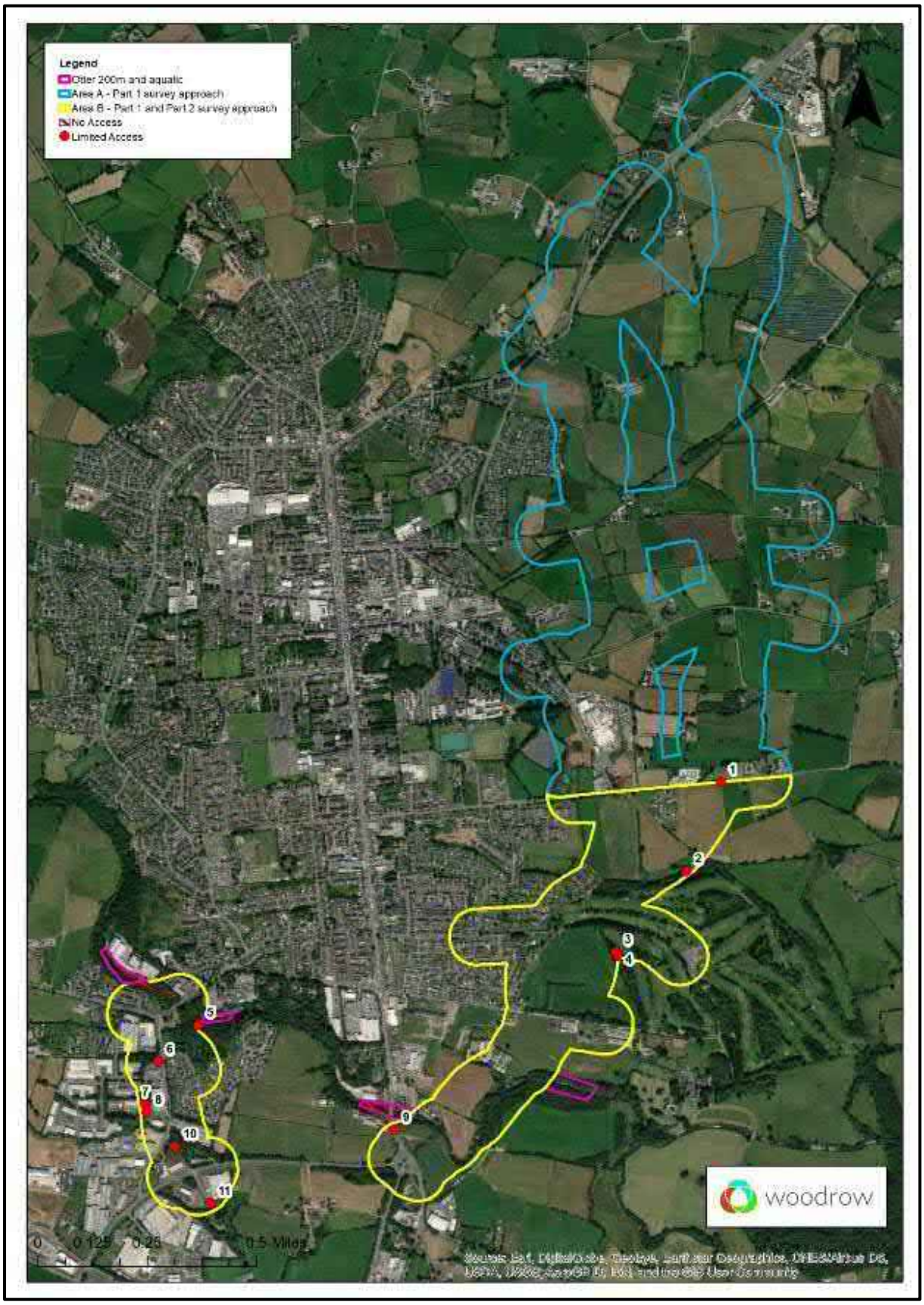

Figure 3 Access Constraints within the Ecology Survey Area. See Appendix D, Table D01 for further details of access constraints.

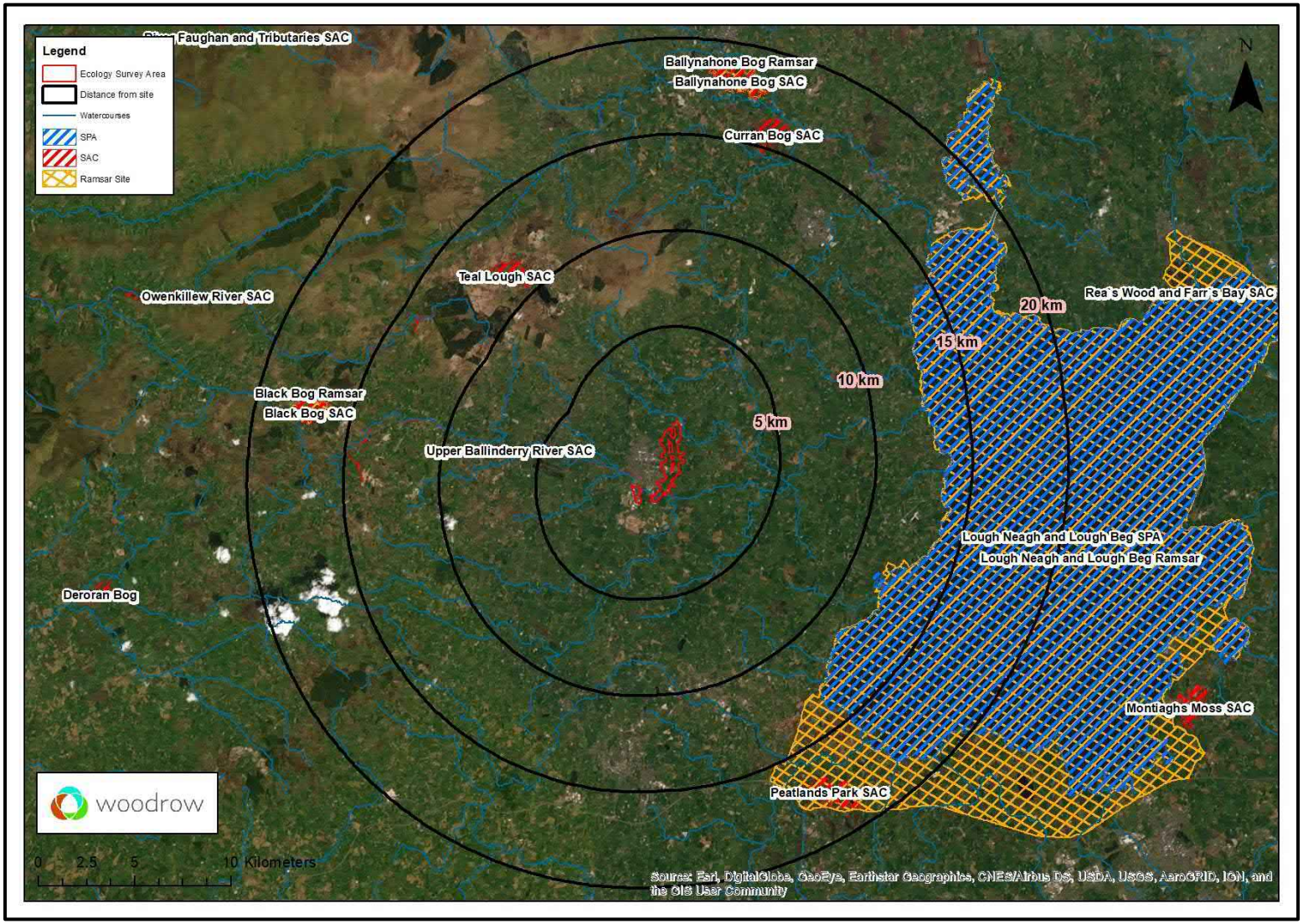

Figure 4.1 Designated Statutory Sites of International Importance within 20 km of the Ecology Survey Area

Figure 4.2 Upper Ballinderry River SAC within the south west of the Ecology Survey Area

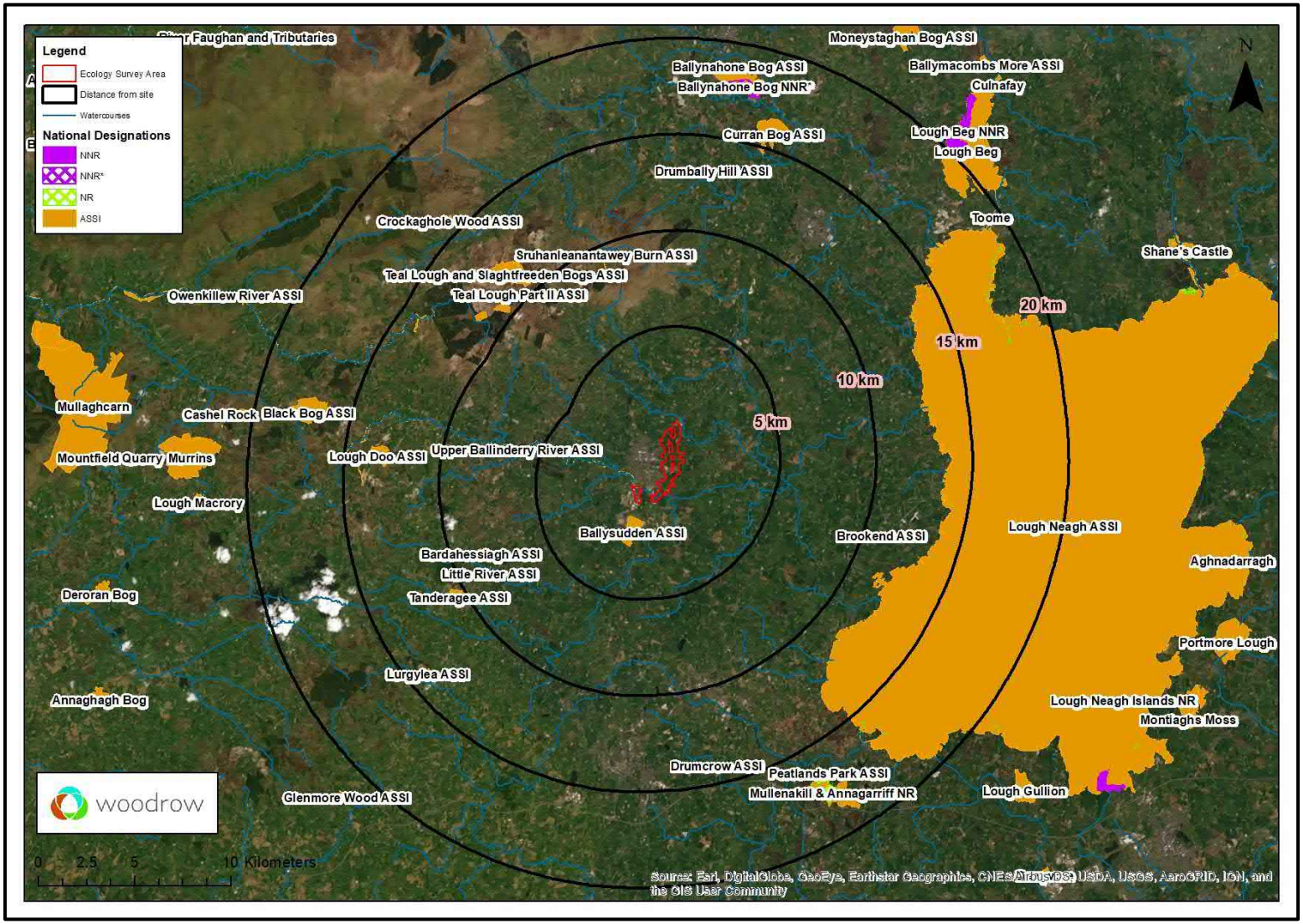

Figure 5 Designated Statutory Sites of National Importance within 20 km of the Proposed Development

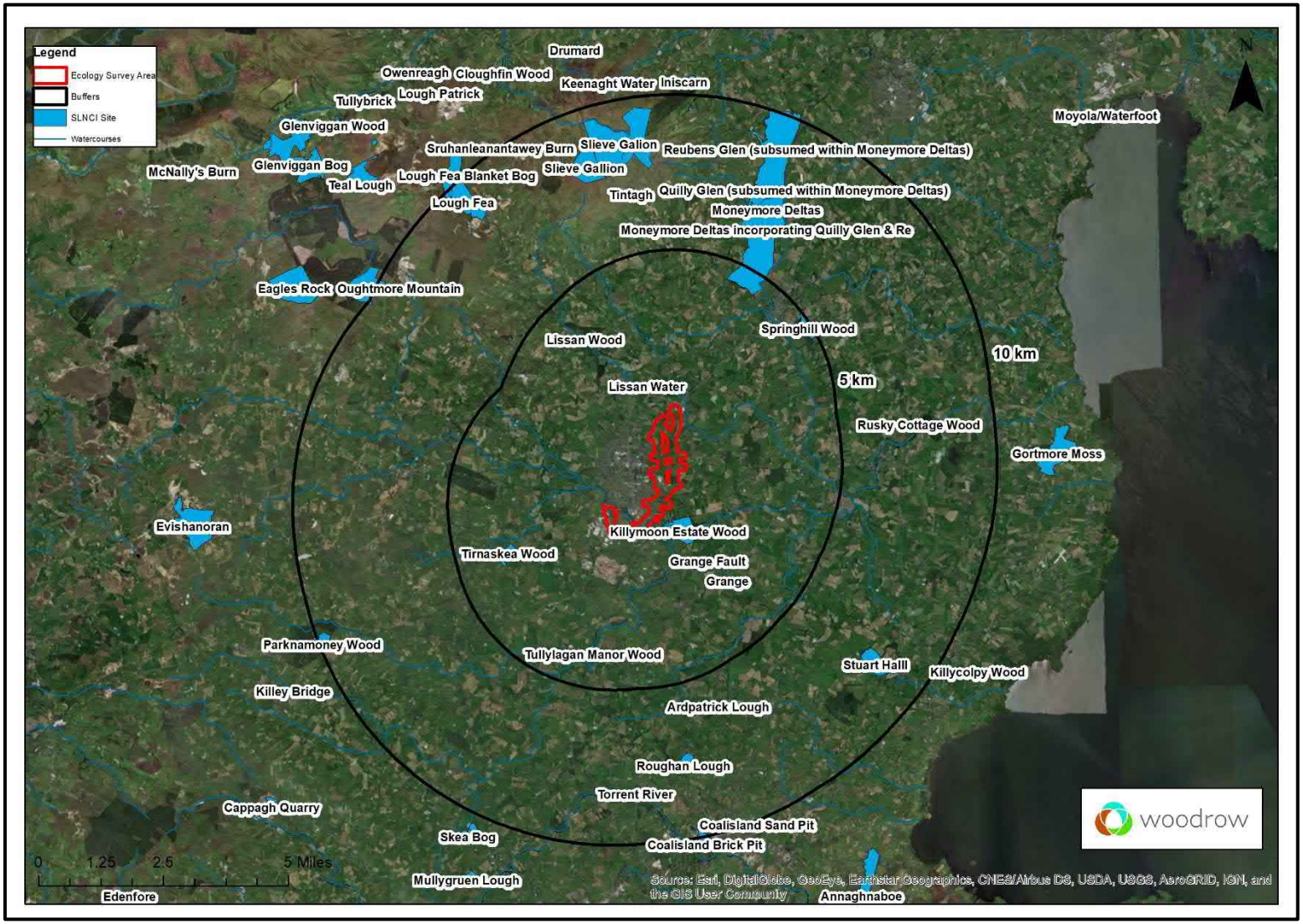

Figure 6 Sites of Local Nature Conservation Importance (SLNCIs) within 5 km of the Ecology Survey Area

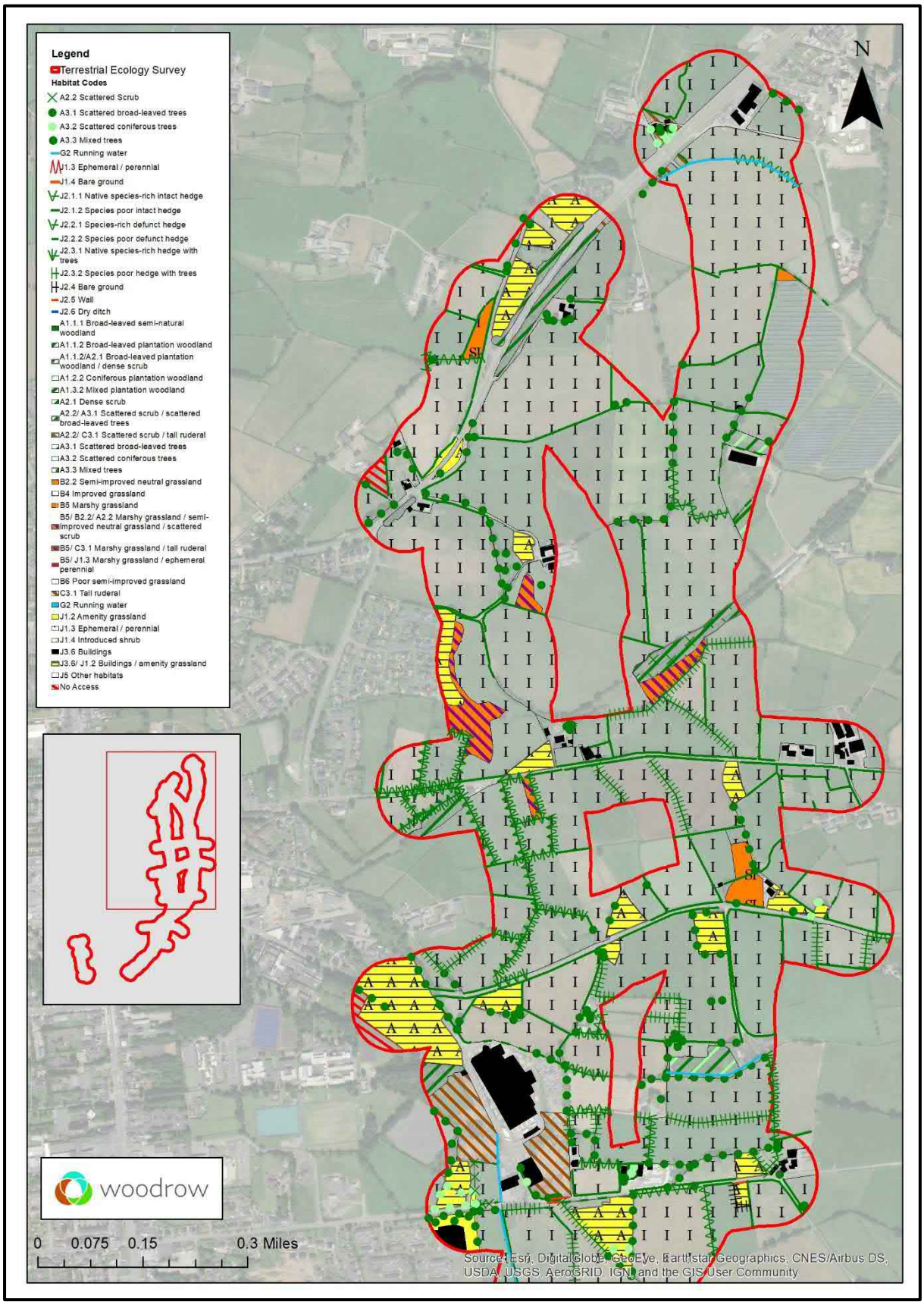

Figure 7.1 Phase 1 Habitat Map of the northern extent of the Moneymore Section of the Terrestrial Ecology Survey Area of the Proposed Development.

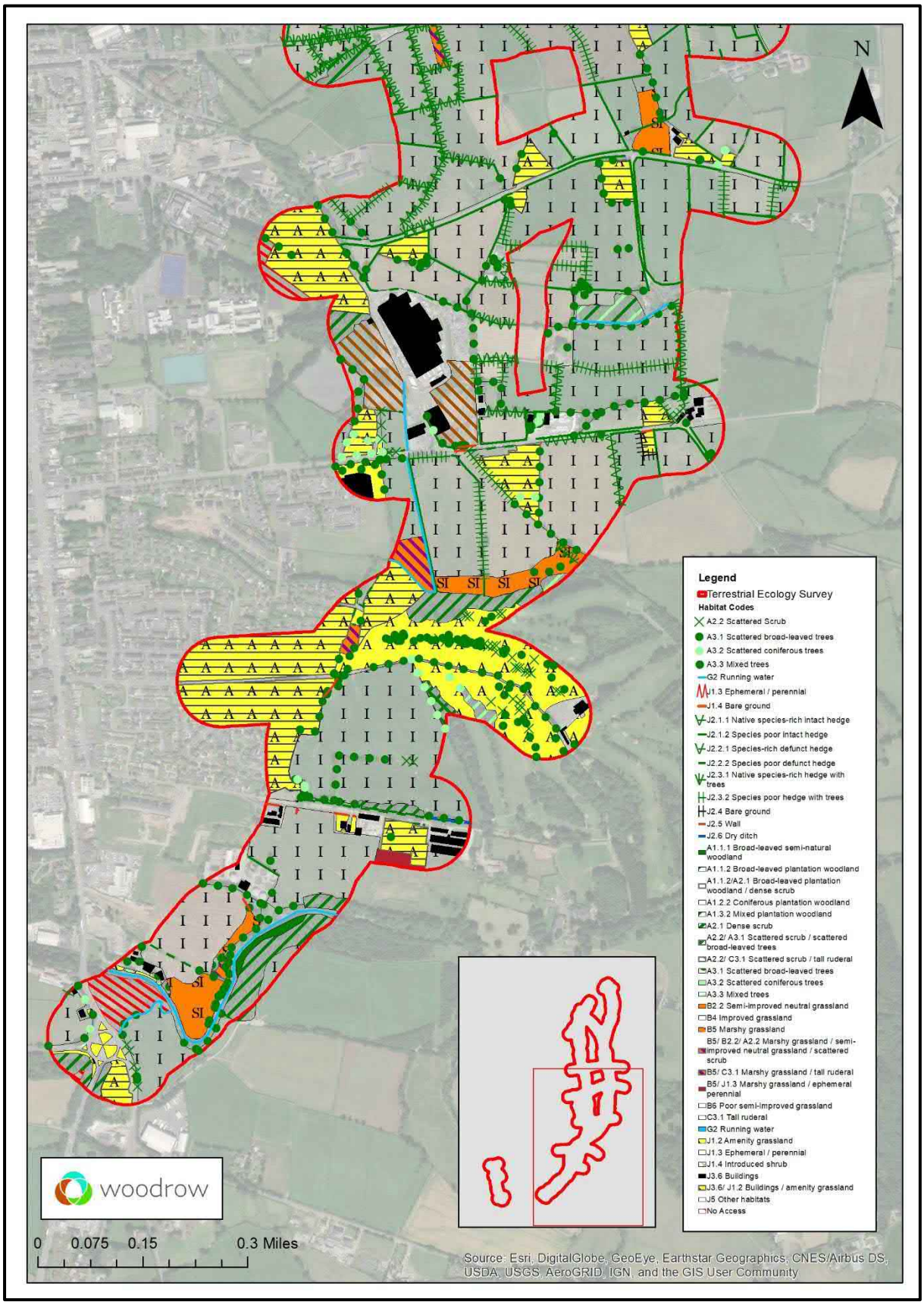

Figure 7.2 Phase 1 Habitat Map of the central extent of the Moneymore Section of the Terrestrial Ecology Survey Area of the Proposed Development

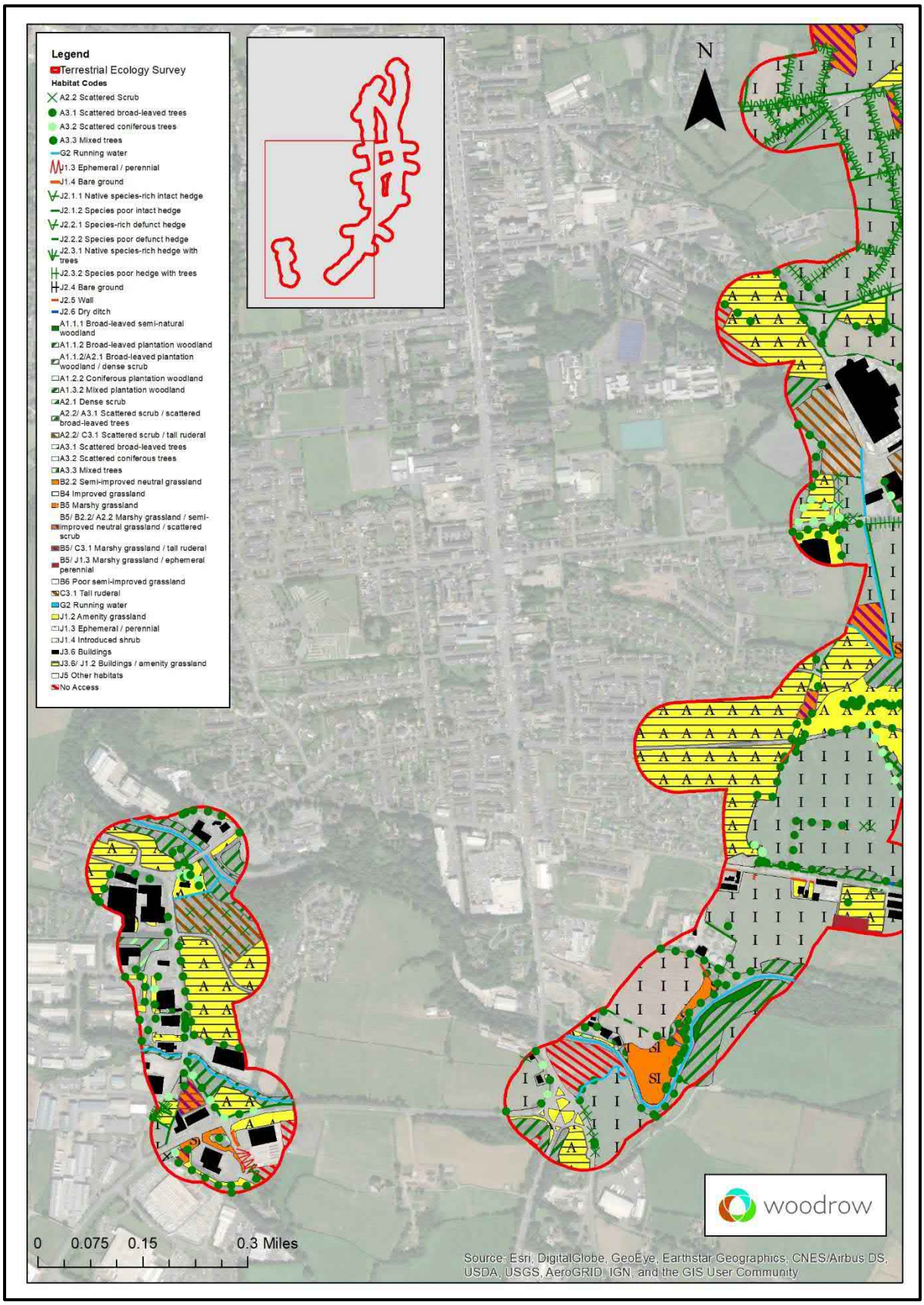

Figure 7.3 Phase 1 Habitat Map of the southern extent, largely the Sandholes Link Road Section, of the Terrestrial Ecology Survey Area of the Proposed Development

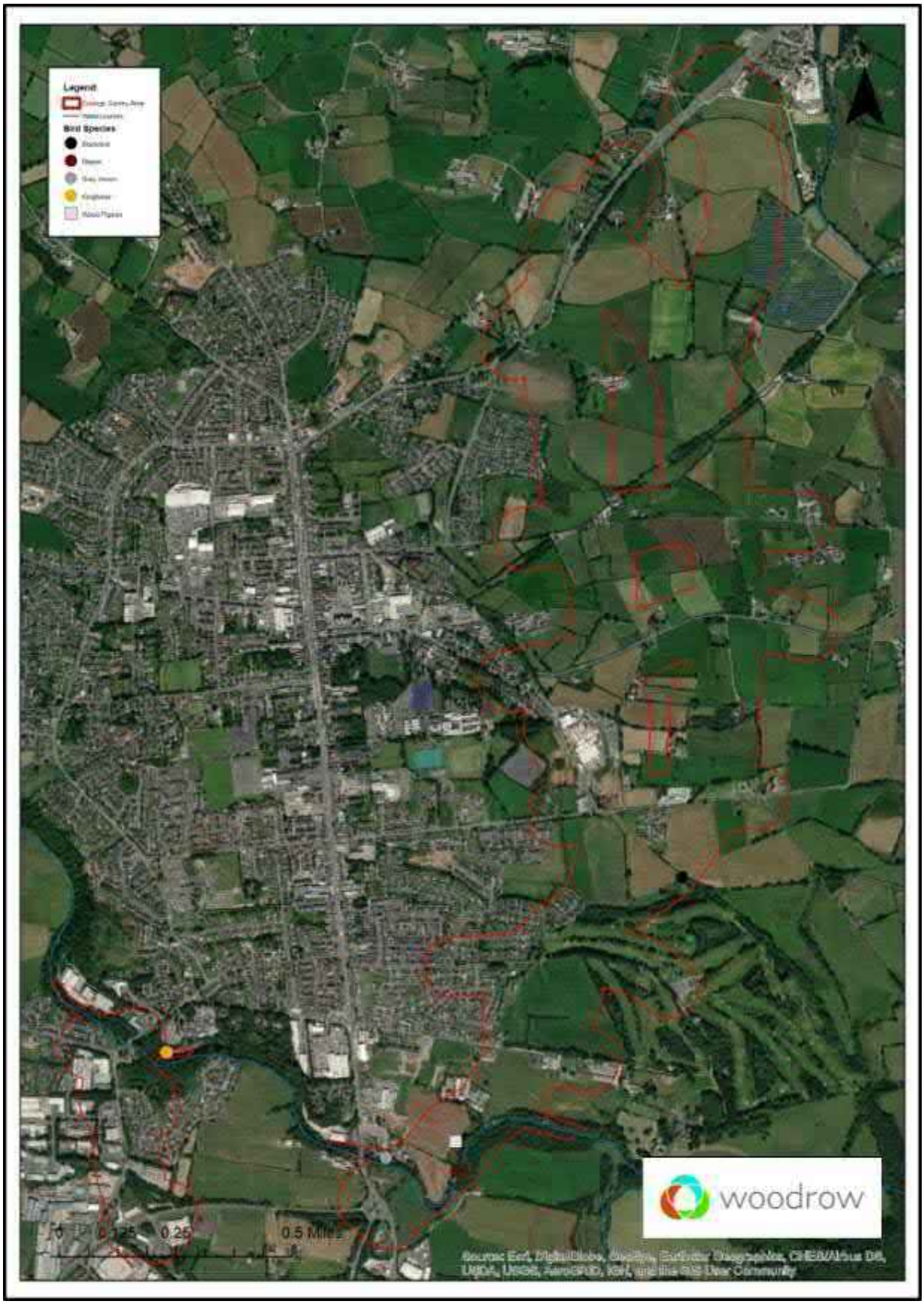

Figure 8 Bird species recorded within the Ecology Survey Area during field surveys

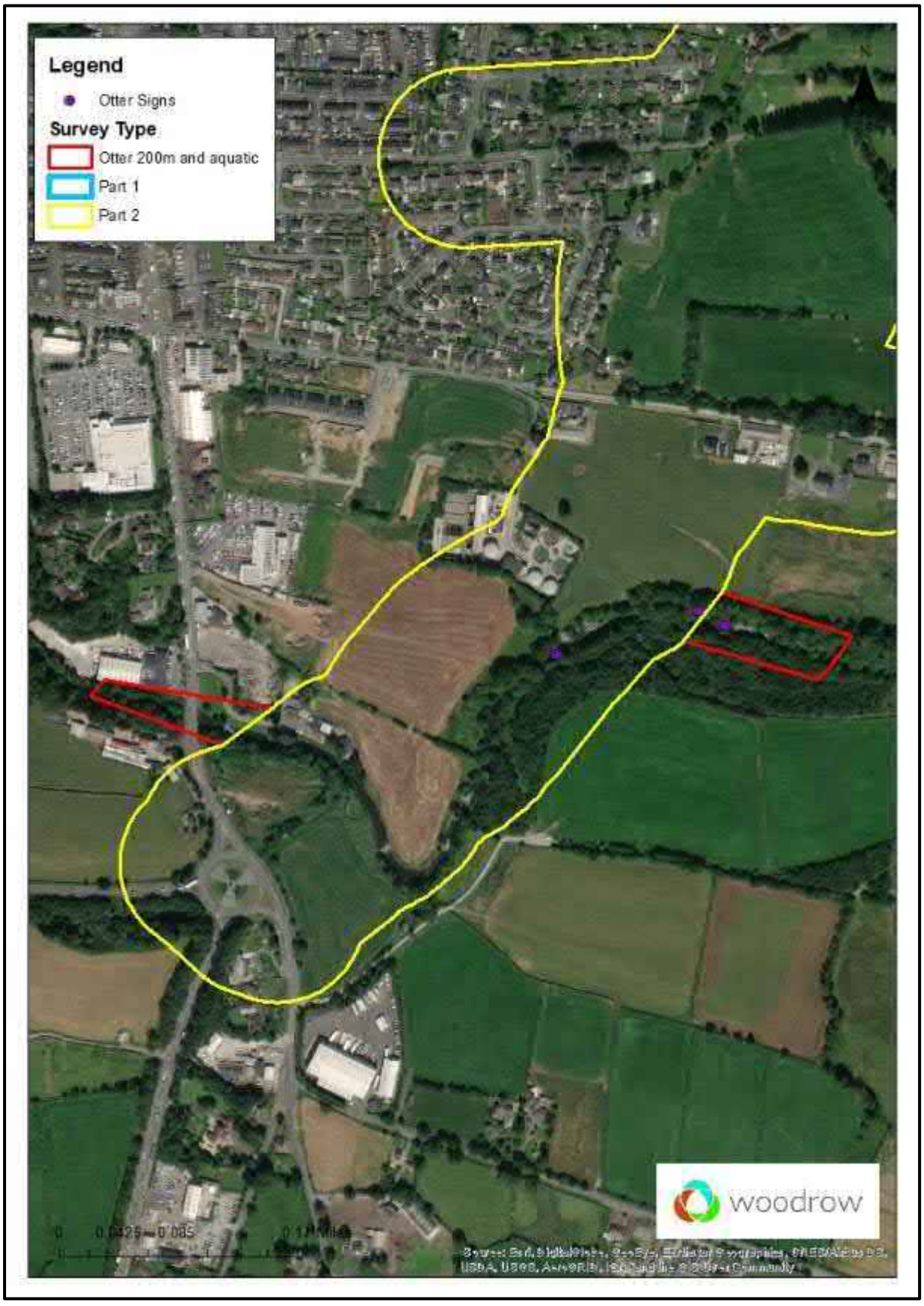

Figure 9 Otter signs recorded within the Aquatic Ecology Survey Area. No fields signs were recorded within the Terrestrial Ecology Survey Area which was also surveyed for otter

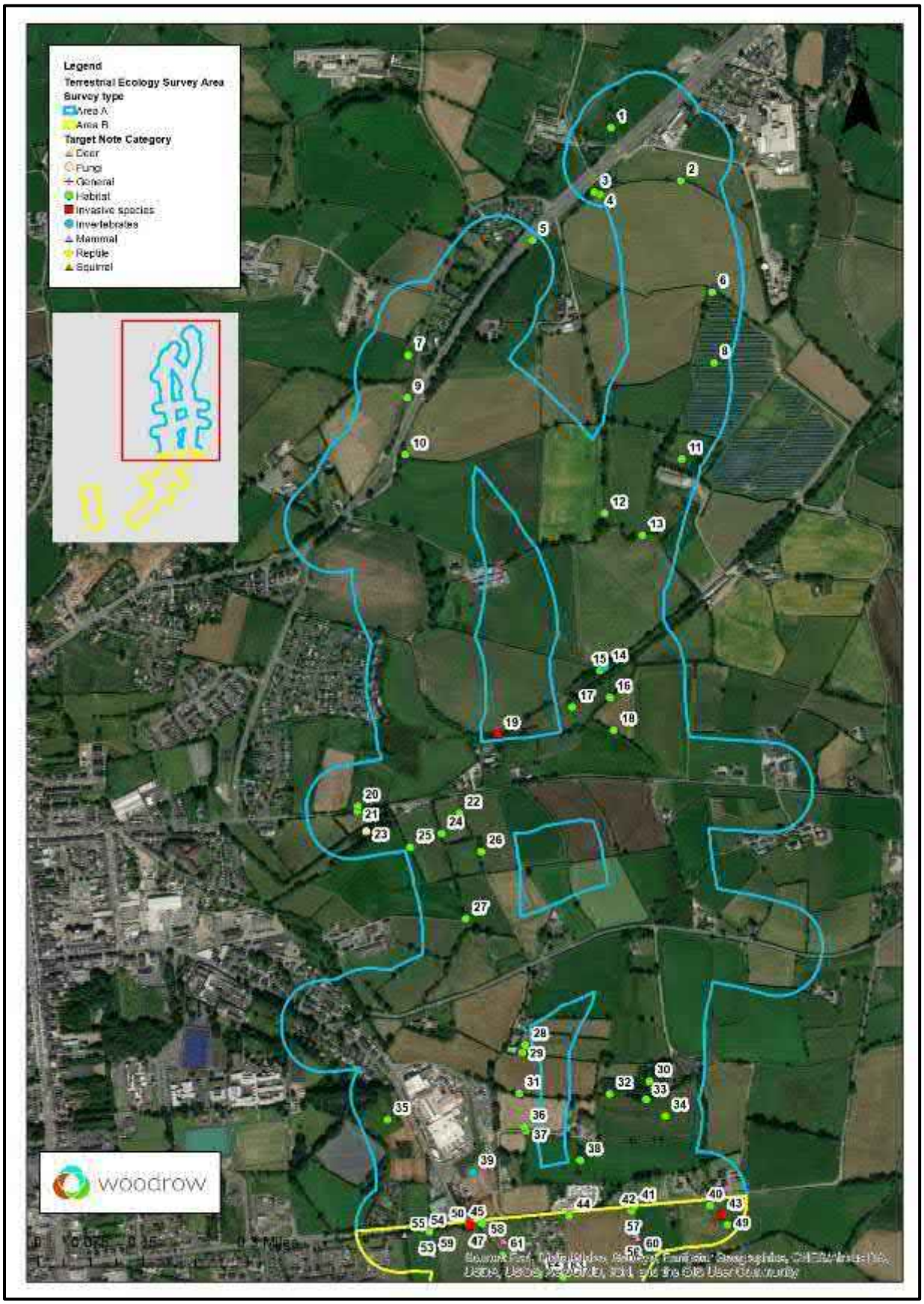

Figure 10.1 Target Notes from the Extended Phase 1 Habitat Survey of the northern extent of the Moneymore Section of the Terrestrial Ecology Survey Area.

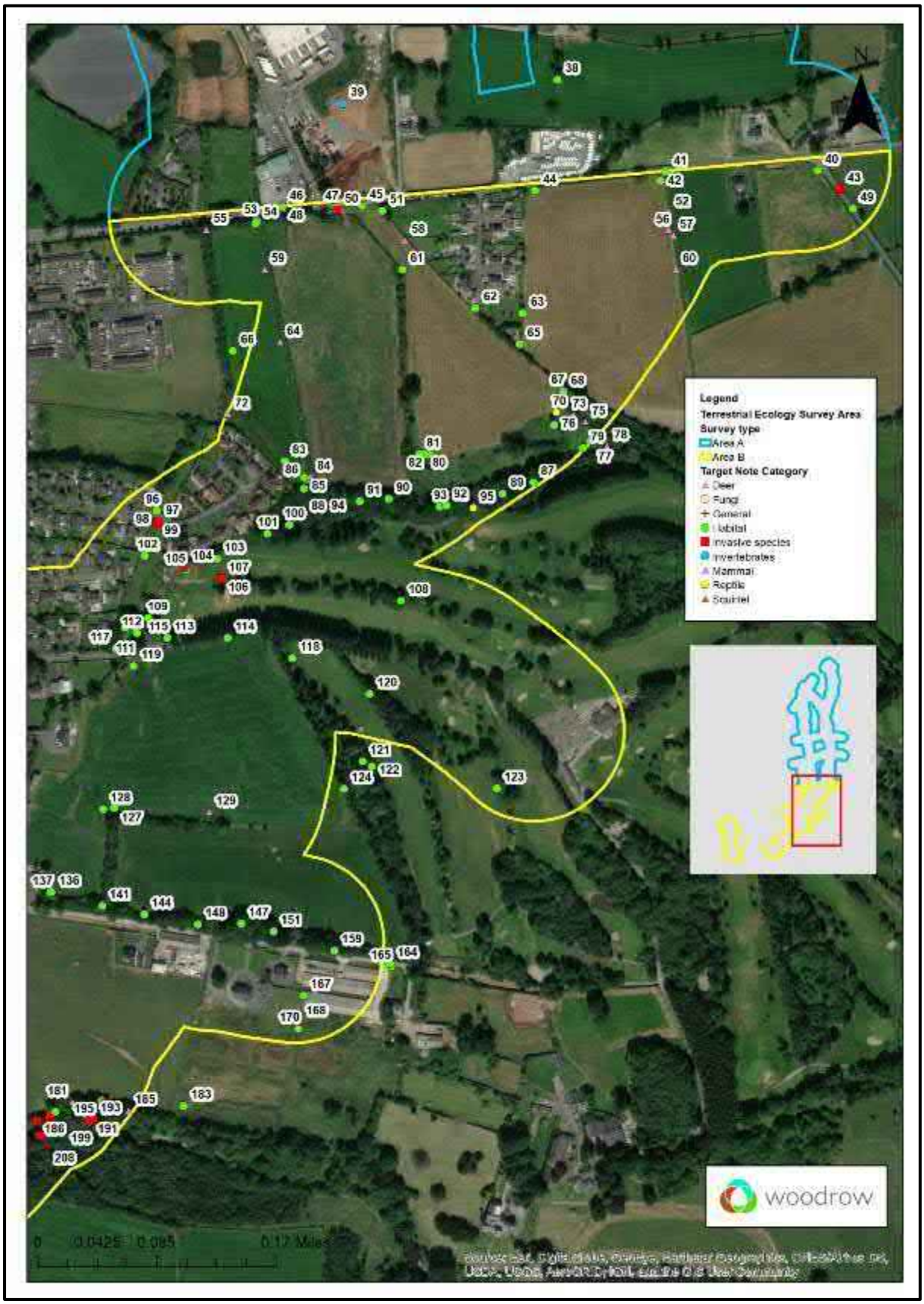

Figure 10.2 Target Notes from the Extended Phase 1 Habitat Survey of the central extent of the Moneymore Section of the Terrestrial Ecology Survey Area.

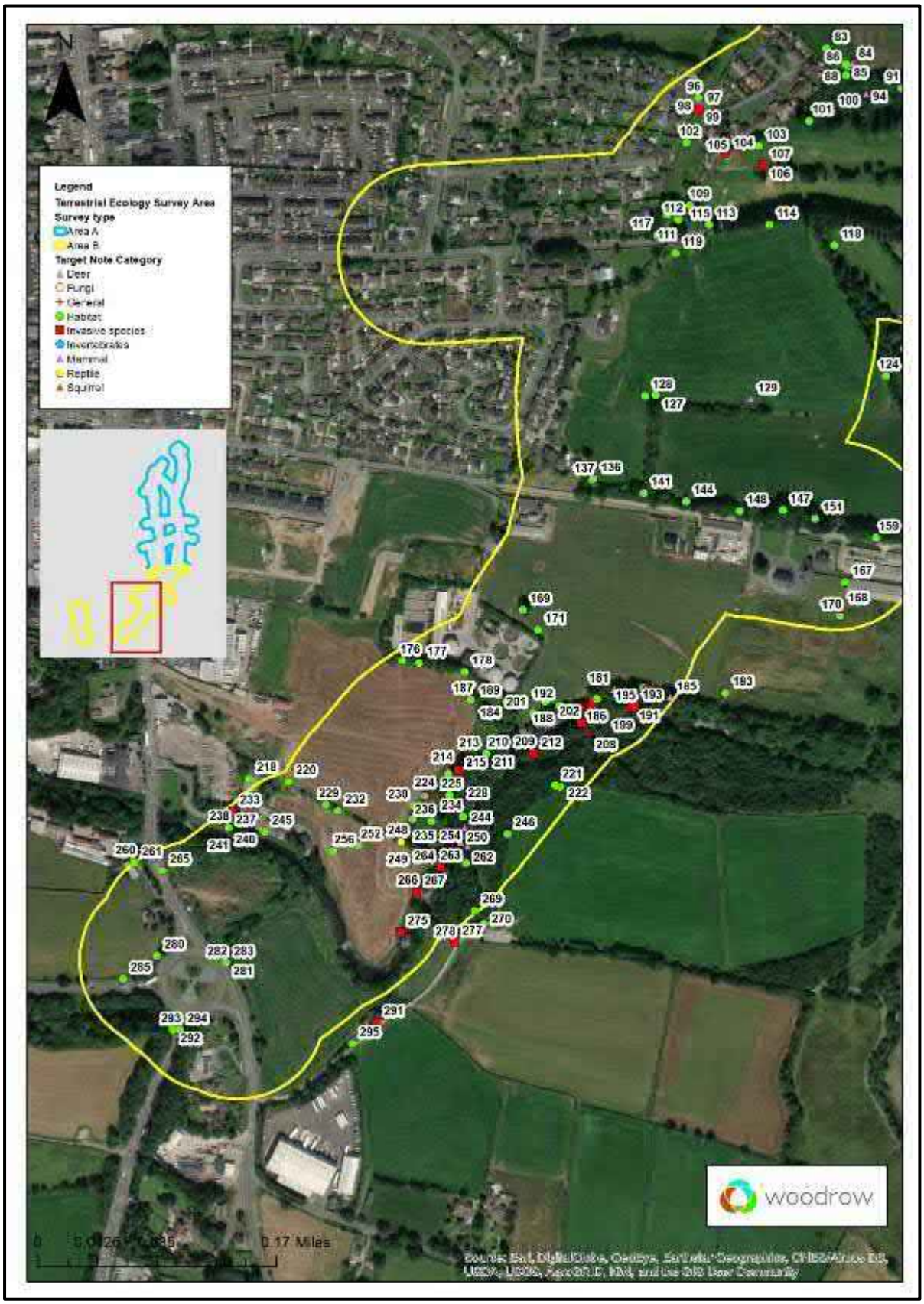

Figure 10.3 Target Notes from the Extended Phase 1 Habitat Survey of the of the southern extent of the Moneymore Section of the Terrestrial Ecology Survey Area

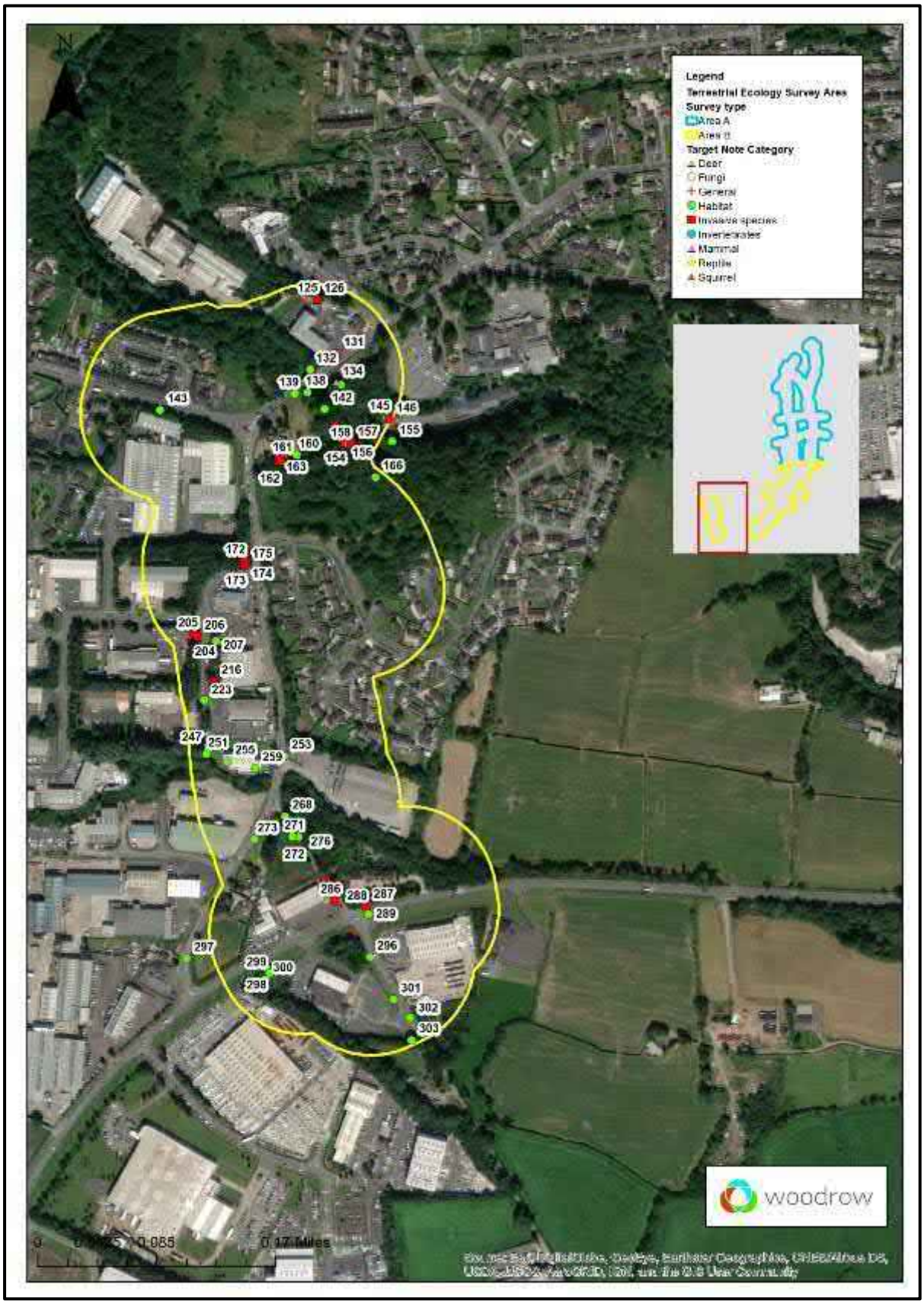

Figure 10.4 Target Notes from the Extended Phase 1 Habitat Survey of the Sandholes Road Link Section of the Terrestrial Ecology Survey Area

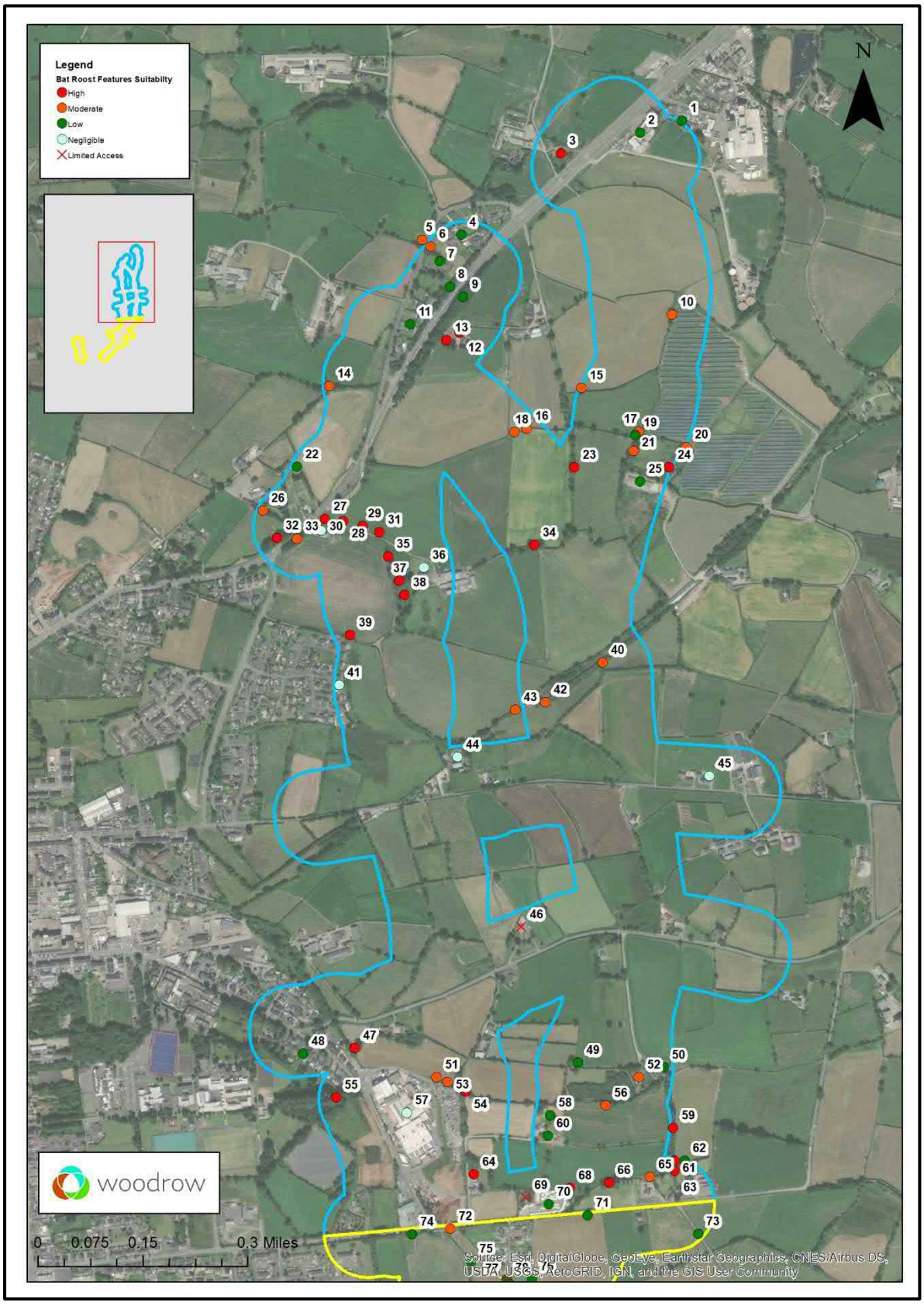

Figure 11.1 Results of the Preliminary Roost Assessments carried out on trees and features within the northern extent of the Moneymore Section of the Terrestrial Ecology Survey Area.

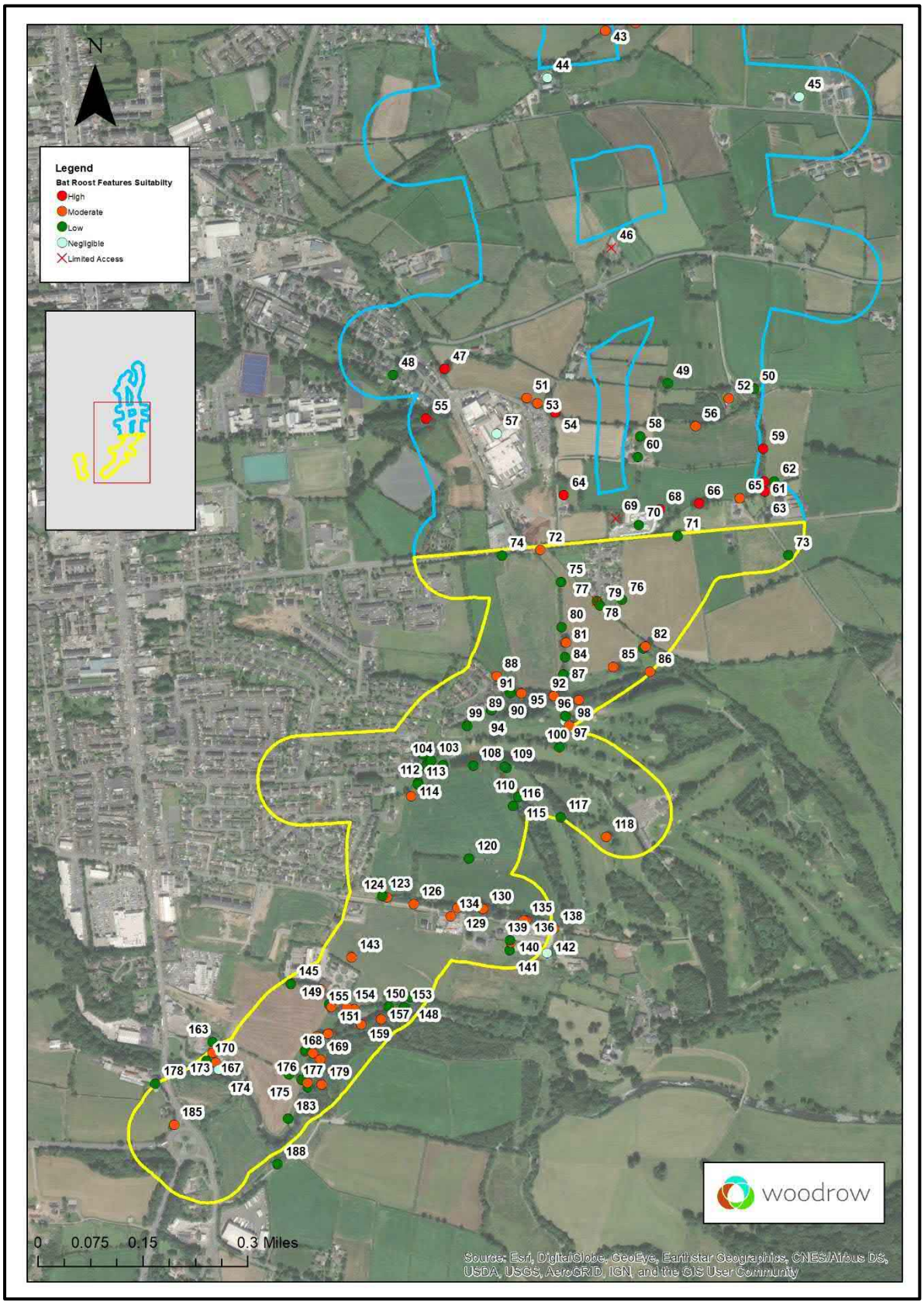

Figure 11.2 Results of the Preliminary Roost Assessments carried out on trees and features within the central extent of the Moneymore Section of the Terrestrial Ecology Survey Area

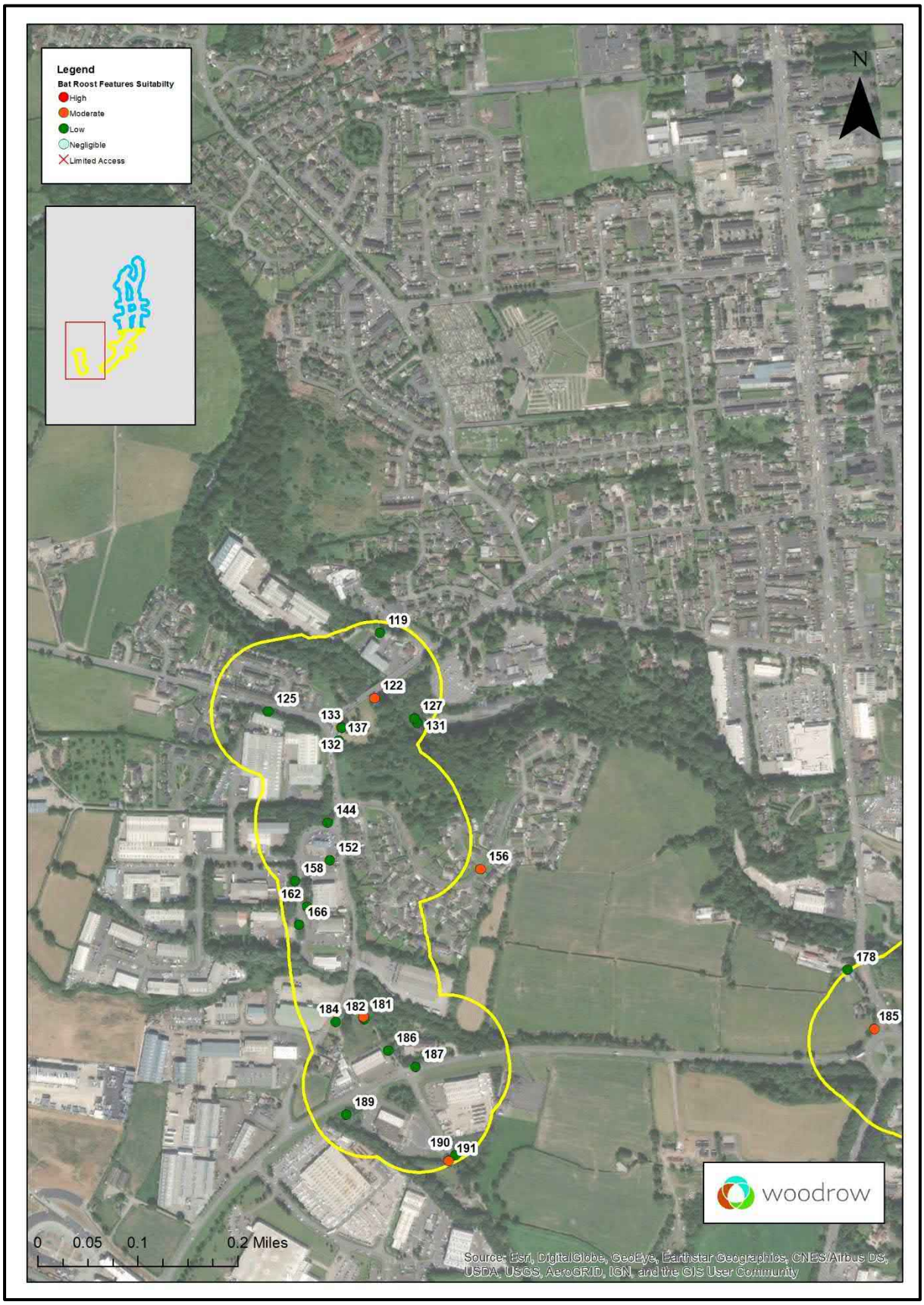

Figure 11.3 Results of the Preliminary Roost Assessments carried out on trees and features within the Sandholes Road Link Section of the Terrestrial Ecology Survey Area

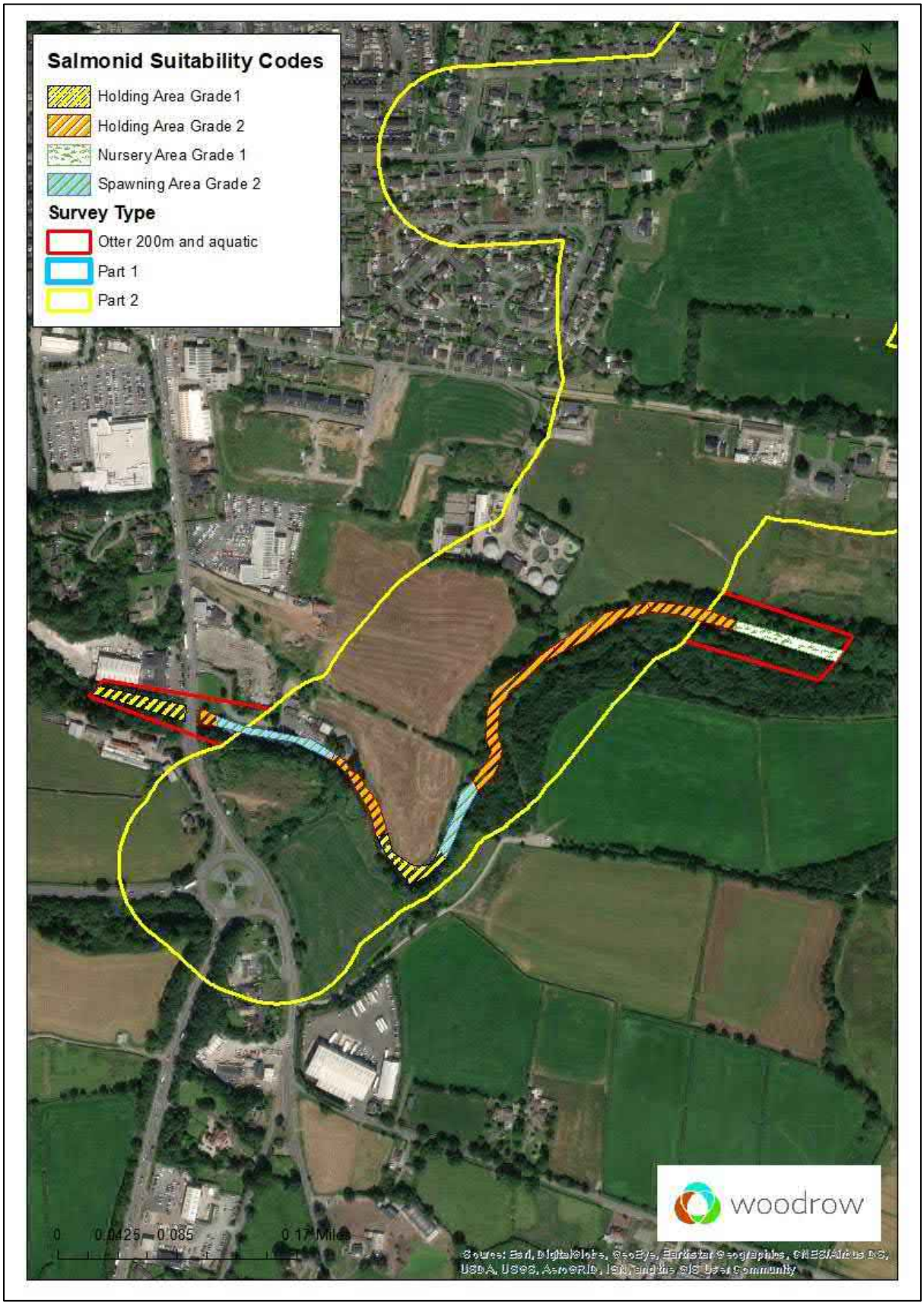

Figure 12.1 Results of the Salmon Suitability Assessment in the eastern section of the Aquatic Ecology Survey Area

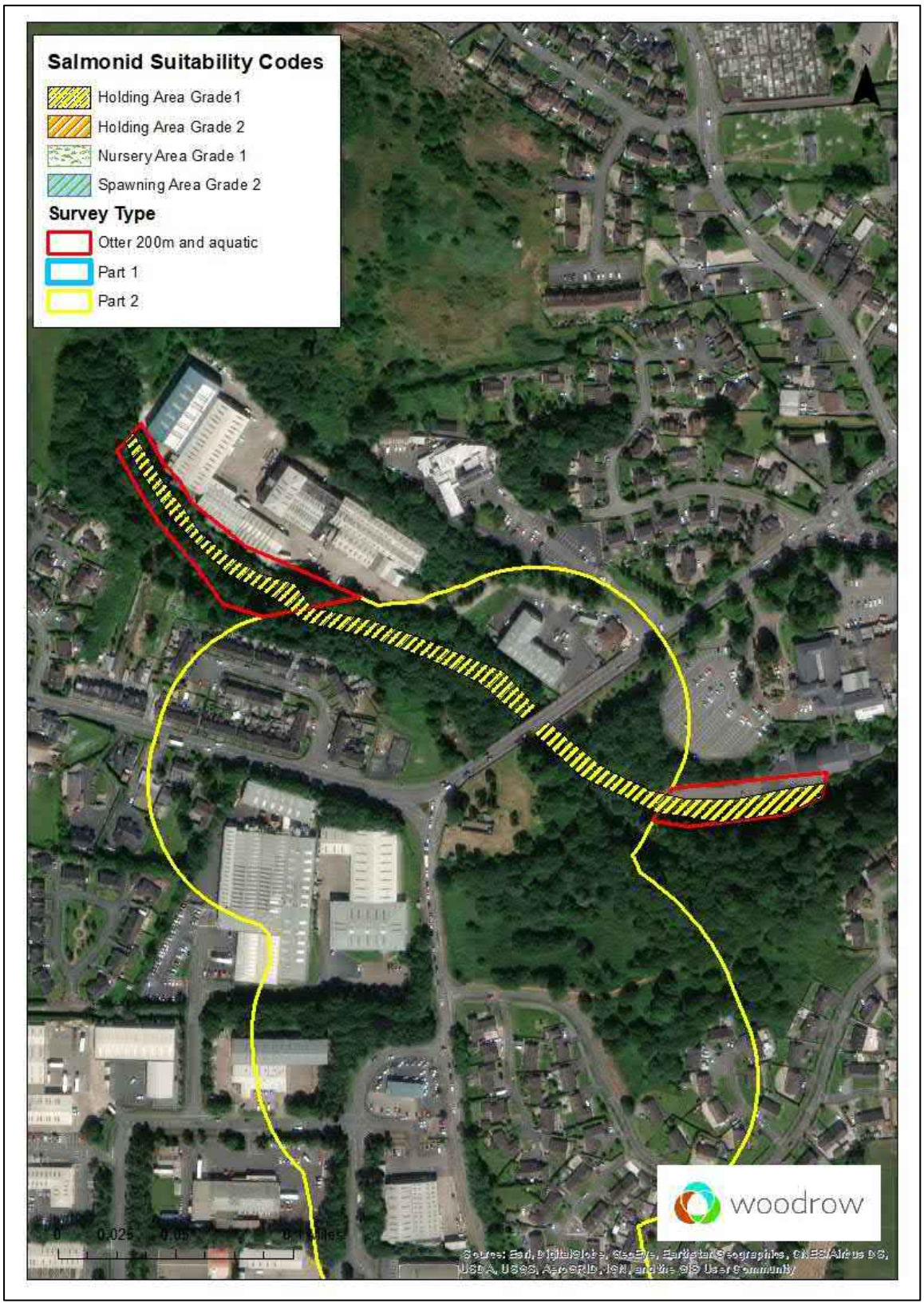

Figure 12.2 Results of the Salmon Suitability Assessment in the western section of the Aquatic Ecology Survey Area

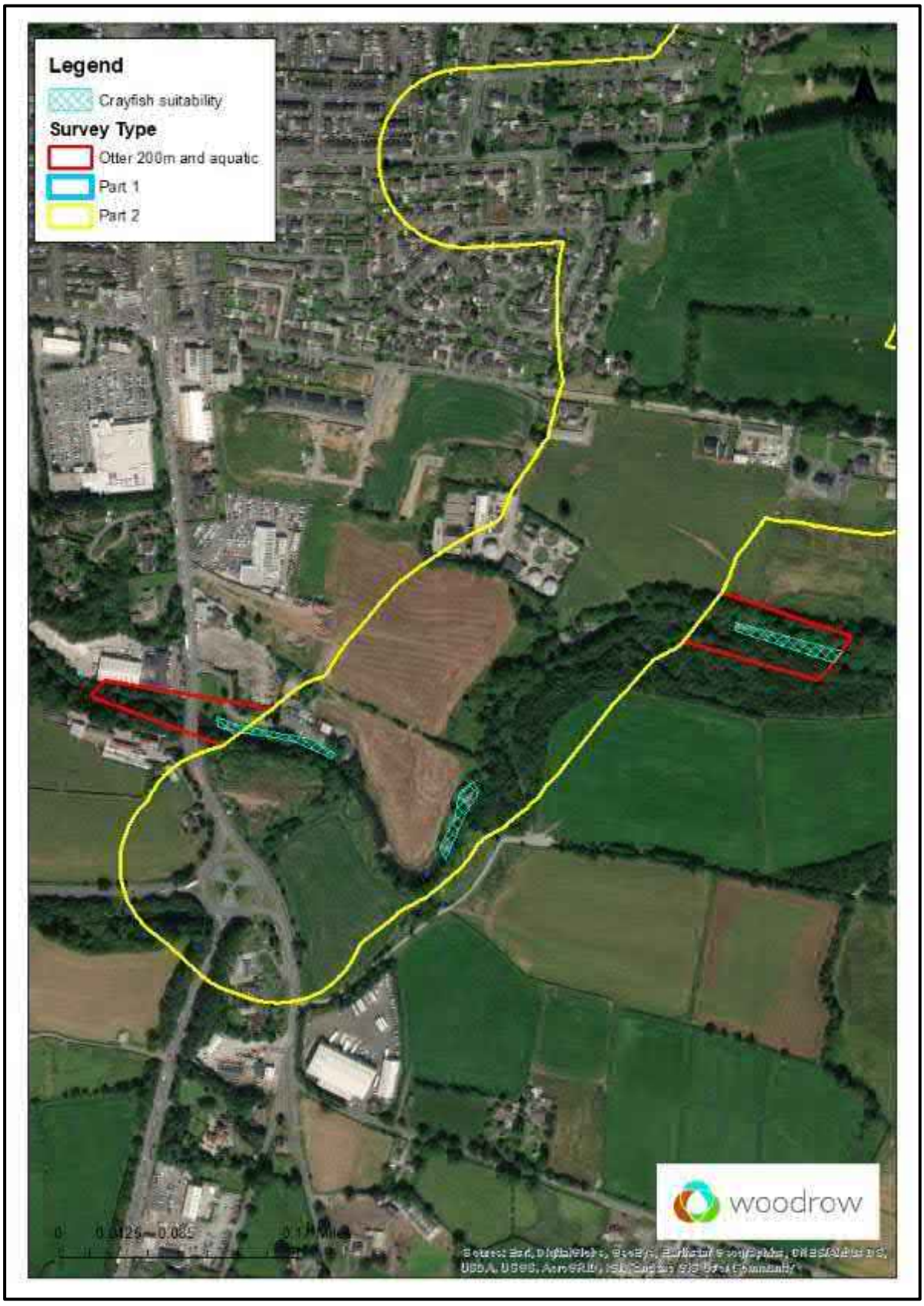

Figure 13 Results of the Crayfish Suitability Assessment in the Aquatic Ecology Survey Area

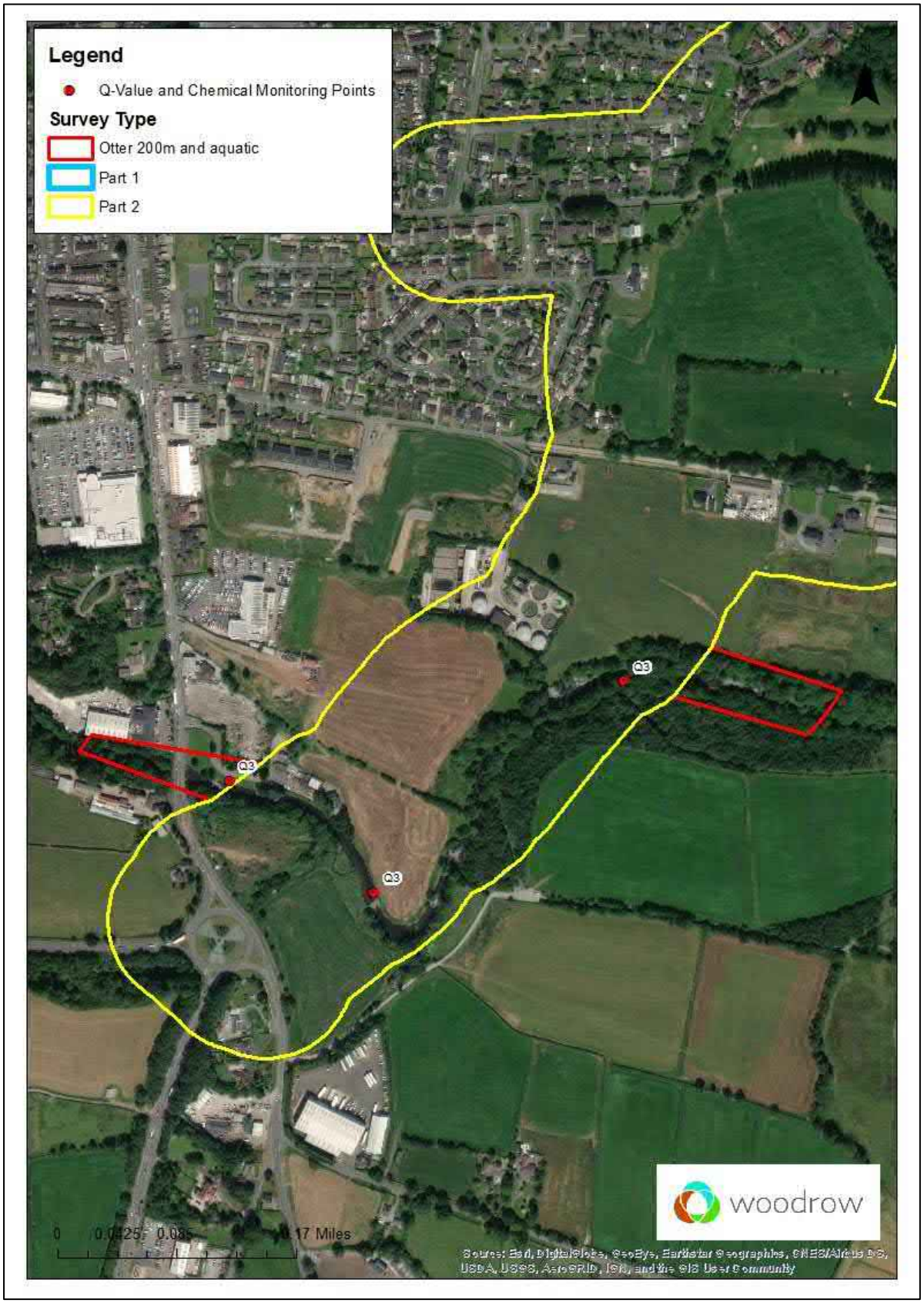

Figure 14.1 Q-value and Chemical Sampling Points within the eastern section of the Aquatic Ecology Survey Area

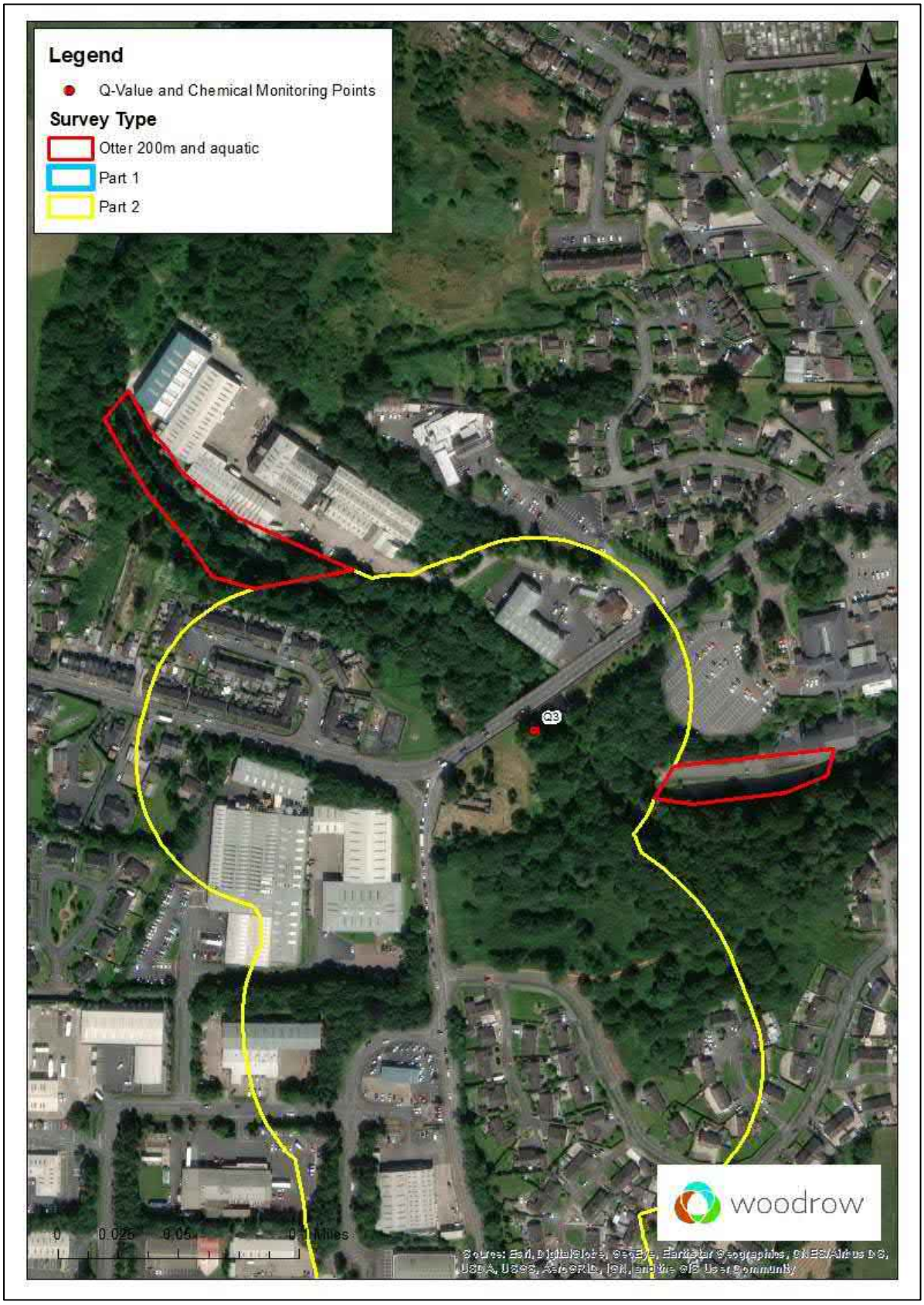

Figure 14.2 Q-value and Chemical Sampling Points within the western section of the Aquatic Ecology Survey Area

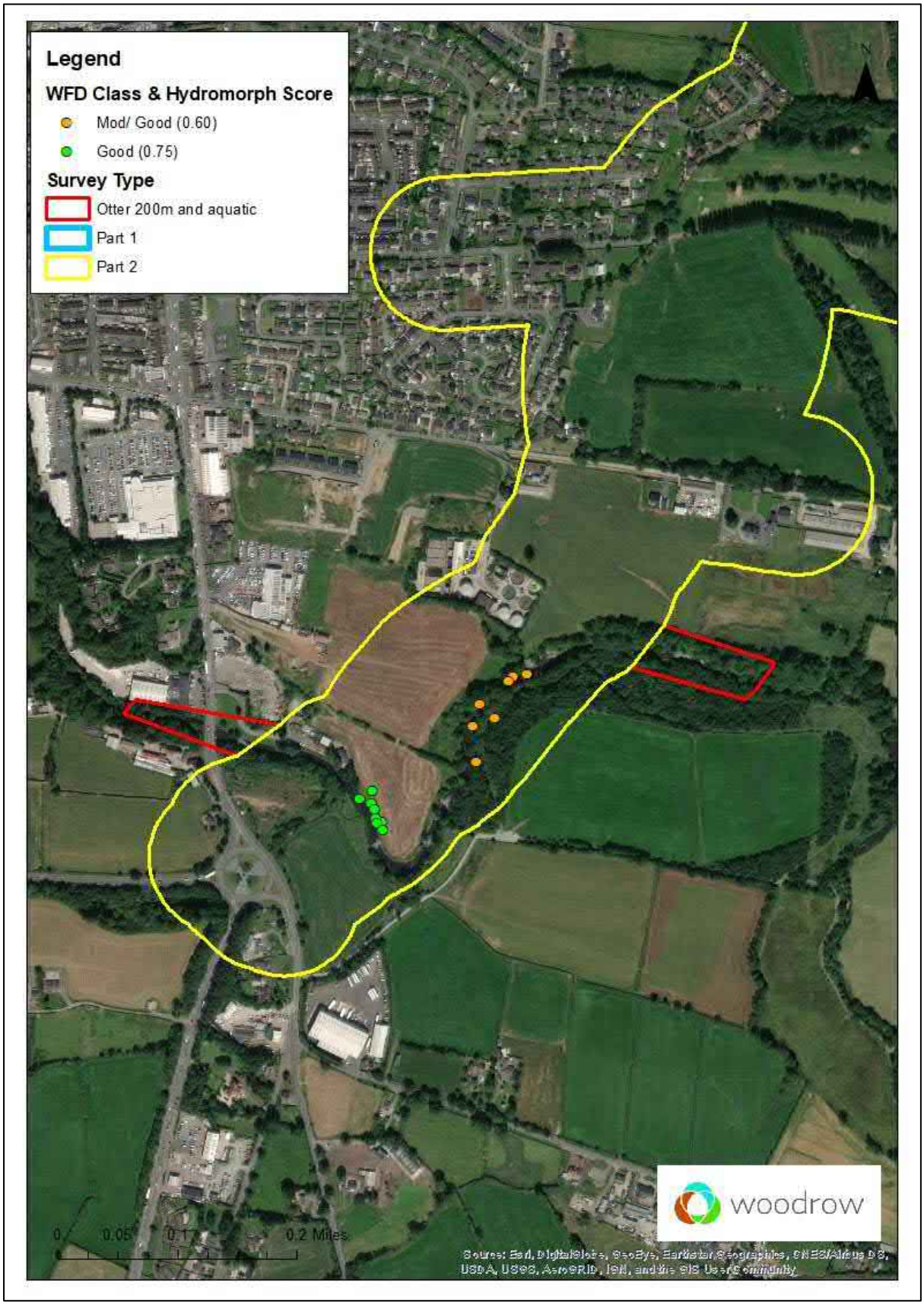

Figure 15.1 River Hydromorphology Assessment Technique (RHAT) Survey Points in the eastern section of the Aquatic Ecology Survey Area

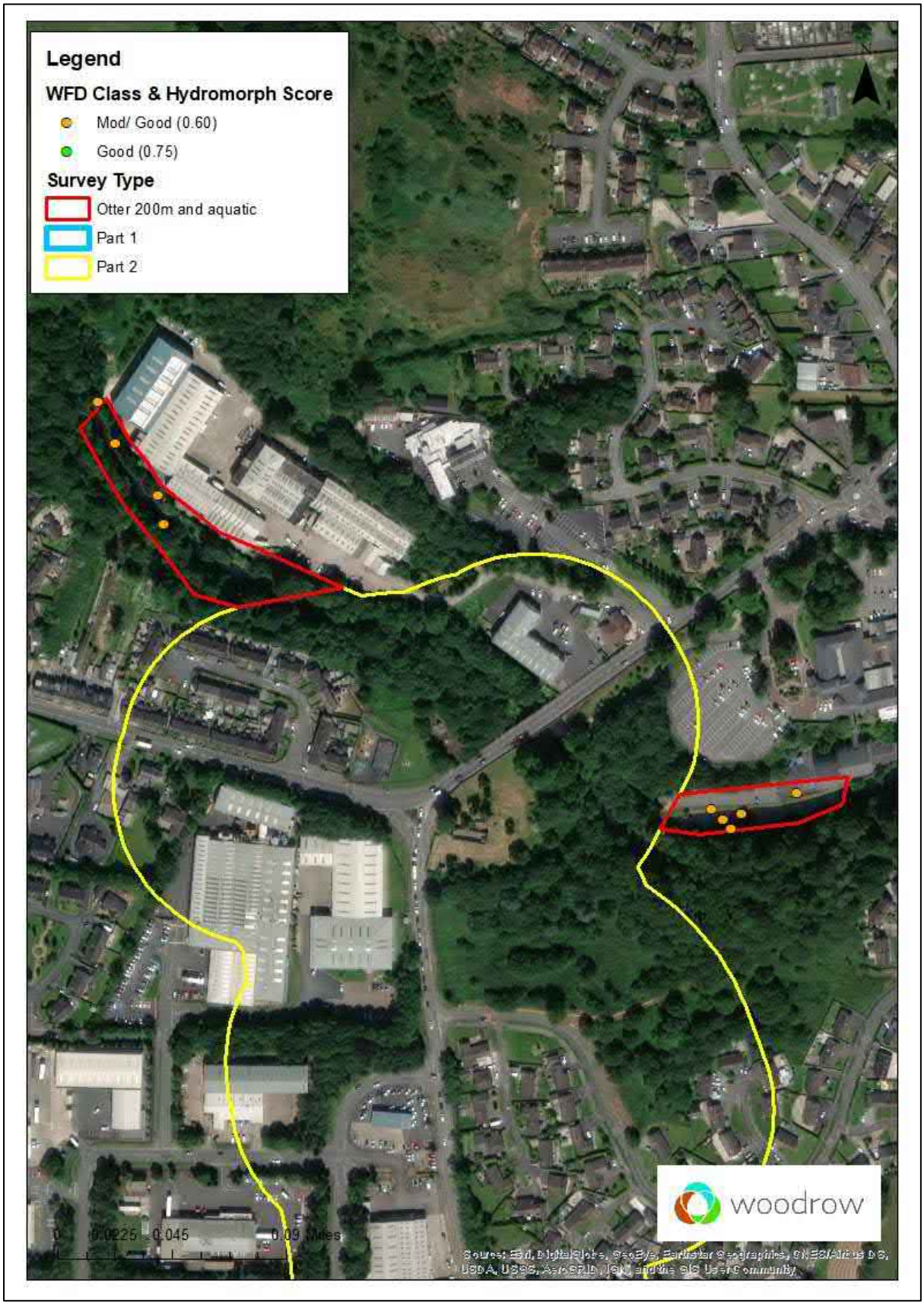

Figure 15.2 River Hydromorphology Assessment Technique (RHAT) Survey Points in the western section of the Aquatic Ecology Survey Area

APPENDICES

Appendix A - Relevant Legislation and Policy

National Legislation

The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017

These Regulations apply the Environmental Impact Assessment (EIA) Directive (Directive 85/337/EEC, as amended) to the planning process in Northern Ireland.

The EIA Directive requires an assessment of the effects of certain public and private projects on the environment before development consent is granted. Ecological Impact Assessments (EcIAs) can be carried out as part of an Environmental Impact Assessment (EIA) process or as a means to provide an appropriate level of ecological assessment for a proposal for which a full EIA is not required. Where an EcIA is undertaken as part of an EIA, it is subject to the relevant EIA Regulations.

Conservation (Natural Habitats &c.) Regulations (NI) 1995 (as amended)

The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) implement the EU Habitats Directive and EU Birds Directive (discussed in Section 1.3.3, below) in Northern Ireland and provide protection to habitats listed in the Habitats Directive Annex 1 and species listed in Annex IV (a), such as bats and otter, through their inclusion in Schedule 2 of the Conservation Regulations.

The Wildlife (Northern Ireland) Order 1985 (as amended)

The Wildlife (Northern Ireland) Order 1985 (as amended) implements the requirements of the European Directives. All wild birds are protected under the Order and a number of species listed in Schedule 1 are also afforded additional protection under the Order. Other animals, such as badger are also protected through their inclusion in Schedule 5 of the Order. This makes it an offence to intentionally kill, injure or to damage, destroy or obstruct access to its resting place. The legislative requirements associated with these protected habitats and species are considered in this report.

The Environment (Northern Ireland) Order 2002 (as amended)

Areas of Special Scientific Interest (ASSIs) were first designated under the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. ASSIs are now designated under the Environment (Northern Ireland) Order 2002. The Order makes it an offence for anyone to intentionally or recklessly damage any natural feature of an ASSI. ASSIs are designated based on their scientific interest relating to the flora or fauna that is found in the area, or because of geological features.

National Planning Policies

Strategic Planning Policy Statement for Northern Ireland (SPPS)

The Planning Policy Statement for Northern Ireland (SPPS) was published in 2015 and consolidates 20 separate policy documents into a single publication, setting out planning policy for a wide range of planning matters. SPPS is linked to the restructuring of local government in Northern Ireland, whereby councils will have responsibility for a number of planning functions including local plan-making, development management and planning enforcement. The policy provisions of Planning

Policy Statement (PPS) 2 'Natural Heritage', which applies to the Site, are retained under SPPS and are discussed below.

Planning Policy Statement 2 'Natural Heritage'

The Planning Policy Statement 2 (PPS2) 'Natural Heritage' (published July 2013) supersedes PPS2 Planning and Nature Conservation (1997). Within the context of the precautionary principal, the objectives of PPS2 are to further improve abundance, diversity and distinctiveness of the region's natural heritage through conservation, enhancement and restoration of existing habitats. The policy document also assists in meeting international, national and local responsibilities. PPS 2 advises that development must be sustainable and take into account the role of biodiversity in contributing to rural and urban regeneration.

This Planning Policy Statement, considered to be a material consideration, directs to further assist compliance with international, national and local commitments in conservation, protection and enhancement of natural heritage within Northern Ireland.

PPS2 encompasses the following hierarchal policies, the following of which deal with ecological occurrences:

1. Policy NH1 – European and Ramsar Sites – International. States that planning permission will only be granted if a proposal, either on its own or in combination with existing or planned projects/proposal does not have a significant effect on a European Site (e.g. Special Area of Conservation (SAC) or Special Protection Area (SPA)) or a Ramsar Site.
2. Policy NH2 – Species Protected by Law – International and National. States that planning permission will only be granted for a development that is not likely to harm a European protected or any other statutorily protected species.
3. Policy NH3 – Sites of Nature Conservation Importance – National. States that planning permission will only be granted to developments that are not likely to have any adverse effect on the integrity of Areas of Special Scientific Interest (ASSI), Nature Reserves, National Nature Reserves, or Marine Nature Reserves.
4. Policy NH4 – Sites of Nature Conservation Importance – Local. States that planning permission will only be granted to developments that are not likely to have an adverse impact on a local nature reserve or a wildlife refuge.
5. Policy NH5 – Habitats, Species or Features of Natural Heritage Importance. States that planning permission will only be granted for developments that are not likely to result in the unacceptable adverse impact on, or damage to known priority habitats, priority species, active peatland, ancient and long-established woodland, features of earth science conservation importance, features of the landscape which are important for wild flora and fauna, rare or threatened native species, wetlands, or other natural heritage features worthy of protection. Each project must be considered on a case by case basis and the benefits of the proposed Development are a material consideration under Policy NH5 *"A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required".*

International Wildlife Legislation

EU Birds Directive

In Northern Ireland, the provisions of the Birds Directive are implemented through the Wildlife (Northern Ireland) Order 1985; the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 and the Conservation (Natural Habitats, &c.) (Northern Ireland) Regulations 1995 (as amended). The Birds Directive establishes a system of general protection for all wild birds throughout the European Union. Annex I of the Birds Directive comprises 175 bird species that are rare, vulnerable to habitat changes or in danger of extinction within the European Union. Article 4 establishes clearly that wherever those species occur, they should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in the area of distribution. Similar actions should be taken by Member States regarding migratory species, even if they are not listed in Annex I.

EU Habitats Directive

The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) transpose the Habitats Directive in relation to Northern Ireland. The Habitats Directive requires Member States to take action to protect habitats and species listed on the Annexes to the Directive by various measures including the designation of SACs. The Directive requires that species listed under Annex IV of the Directive (including otter and all bats) are protected wherever they occur.

Bern and Bonn Convention

The Bern Convention is implemented by The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended). Under the Bonn Convention, the legal requirement for the strict protection of Appendix I species is provided by the Wildlife (Northern Ireland) Order 1985, and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985.

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

The Water Framework Directive

In response to the increasing threat of pollution and the increasing demand from the public for cleaner rivers, lakes and beaches, the EU developed the Water Framework Directive (WFD). This Directive is unique in that, for the first time, it establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation. The Water Framework Directive is linked to a number of other EU directives in several ways. These include Directives relating to the protection of biodiversity (Birds and Habitats Directives).

Legal Context of Designated Statutory and Non-statutory Sites

Statutory Sites of International Importance

In the context of Northern Ireland, Internationally-designated sites refer to Special Areas of Conservation, Special Protection Areas and Ramsar Sites. Special Areas of Conservation (SACs) are designated under the EU Habitats Directive (92/43/EEEC) and facilitated in Northern Ireland through the Conservation (Natural Habitats, & c.) (Amendment) Regulations (Northern Ireland) 2007 as

amended. SACs are designated to afford protection to a suite of habitats and species listed on Annex I and Annex II of the EU Habitats Directive. Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EEC) and facilitated in Northern Ireland through the Conservation (Natural Habitats, & c) Regulations (NI) 1995 (as amended). SPAs provide protection to birds listed on Annex I of the EU Birds Directive, and also provide protection to populations of migratory species regularly occurring at a site.

Statutory Sites of National Importance

In the context of Northern Ireland, Nationally-designated sites refer to Areas of Special Scientific Interest (ASSI) which are designated under the Environment (Northern Ireland) Order 2002 (as amended). Designations are given to features of scientific interest and include significant geological features, and areas which support rare or significant flora or fauna populations.

Local Nature Reserves (LNRs) are defined under Article 2 of The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. LNRs are identified for the purpose of conserving flora, fauna or features of geological, physiographical or other scientific or special interest therein, and they are also valuable in that they provide an opportunity to study such features in a controlled environment. District councils have the power to acquire, declare and manage Nature Reserves. Nature Reserves that have been declared by local authorities are known as LNRs.

Non-statutory Site of Local Importance

In the context of Northern Ireland, Sites of Local Nature Conservation Importance (SNCLI) are designated in accordance with Planning Policy Statement 2: Natural Heritage (PPS 2: Natural Heritage)[60]. The SLNCIs are established under the Wildlife (NI) Order 1995, and Local Nature Reserves that may be established by local Councils under the Nature Conservation and Amenity Lands (NI) Order 1985. SNCLI may also include non-statutory nature reserves managed by public agencies or voluntary conservation bodies these sites are of local nature conservation importance on the basis of their flora, fauna or earth science interest. Planning permission will not be granted for development that would be liable to have a significant adverse effect on the intrinsic nature conservation interest of a designated SNCLI.

[60] Department of the Environment (2013). Planning Policy Statement 2 Natural Heritage. Available at: https://www.planningni.gov.uk/index/policy/planning_statements_and_supplementary_planning_guidance/definitive_final_july_2013_pps_2_-_natural_heritage-3.pdf [Accessed November 2019].

Appendix B – Summary of Ecological Desk Study Data

Table B01 Details of Statutory Designated Sites of International Importance occurring within 20 km of the Proposed Development

Designated Sites highlighted in light grey have a connection to the Ecology Survey Area. For a map of these sites see Section 7, Figure 4.2 and 4.2.

Site name	Site code & area (ha)	Primary Reason for Natura 2000 Site Selection[61]	Other Annex I habitats / Annex II species within the Natura 2000 Site[62]	Criteria under which the site qualifies as a Ramsar Site	Closest distance from the Proposed Development footprint?	Connectivity with the Proposed Development?
Special Areas of Conservation (SACs)						
Upper Ballinderry River SAC	UK0030296 58.88 ha	Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation Freshwater pearl mussel (*Margaritifera margaritifera*) (1029) Otter (*Lutra lutra*) (1355)	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion alvae)	-	Part of the site occurs within the Ecology Survey Area. The site is adjacent to the north east of the Sandholes Link Road Section of the Proposed Development.	**Yes, hydrological connection. The Ballinderry River is adjacent to the Proposed Development.**
Teal Lough SAC	UK0016608 198.5 ha	Active blanket bog	Northern Atlantic wet heaths with *Erica tetralix* Natural dystrophic lakes and ponds Depressions on peat substrates of the *Rhynchosporion* European dry heaths	-	*Ca.* 10.5 km north west of the Sandholes Link Road Section of the Proposed Development.	None
Owenkillew River SAC	UK0030233 213.84 ha	Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion*	Brook Lamprey (*Lampetra planeri*)	-	*Ca.* 13. 6 km north west of the Sandholes Link Road Section of the Proposed Development.	None

[61] As informed by Joint Nature Conservation Committee SACs in Northern Ireland webpage. Available at: https://sac.jncc.gov.uk/site/northern-ireland [Accessed November 2019] and by Joint Nature Conservation Committee SPAs in UK webpage. Available at: http://archive.jncc.gov.uk/default.aspx?page=1400 [Accessed November 2019].
[62] As informed by the Department of Agriculture, Environment and Rural Affairs protected areas search page. Available at: https://www.daera-ni.gov.uk/protected-areas [Accessed November 2019].

		Old Sessile Oak woods with *Ilex* and *Blechnum* in the British Isles Bog Woodland Freshwater pearl mussel (*Margaritifera margaritifera*) Atlantic Salmon (*Salmo salar*) Otter (*Lutra lutra*)				
Curran Bog SAC	UK0030322 183.51 ha	Degraded raised bogs still capable of regeneration Active raised bogs	Degraded raised bog still capable of regeneration	-	*Ca.* 14.7 km north of the Moneymore Section of the Proposed Development.	None
Peatlands Park SAC	UK0030236 207.53 ha	Degraded raised bog Bog Woodland Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Active raised bog	-	-	*Ca.* 16. 7 km south east of the Moneymore Section of the Proposed Development.	None
Black Bog SAC	UK0016609 194 ha	Active raised bog Depressions on peat substrates of the Rhynchosporion	Degraded raised bog still capable of regeneration	-	*Ca.* 16.3 km west of the Sandholes Link Road Section of the Proposed Development	None
Ballynahone Bog SAC	UK0016599 54.82	Active raised bog	Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the Rhynchosporion	-	*Ca.* 17.4 km north of the Moneymore Section of the Proposed Development.	None
Special Protection Areas (SPAs)						
Lough Neagh and Lough Beg SPA	UK9020091 40857.18 ha	Pochard (*Aythya ferina*) Tufted duck (*Aythya fuligula*) Goldeneye (*Bucephala clangula*) Bewicks swan (*Cygnus columbianus bewickii*) Whooper swan (*Cygnus cygnus*) Common tern (*Sterna hirundo*)		-	*Ca.* 11.5 km east of the Moneymore Section of the Proposed Development (in direct distance)	**Yes** **Hydrological connection via a river (the RWB Code UKGBNI1NB030308330) in the south east of the Ecology Survey Area. The hydrological link is *ca.* 20 km east**

		Waterbird assemblage				**of the Ecology Survey Area.** **Potential ecological connection if the qualifying bird species forage/ commute in the Ecology Survey Area. The potential ecological link is *ca.* 11.5 km in direct distance**
Wetlands of International Importance (Ramsar Sites)						
Lough Neagh and Lough Beg Ramsar Site	UK 74 50,166 ha	-	-	Criterion 1: Largest freshwater lake in the UK. Criterion 2: Supports over forty rare or local vascular plants which have been recorded since 1970. The most notable are eight-stamened waterwort, marsh pea, Irish lady's tresses orchid, alder buckthorn, narrow small-reed and holy grass. The Lough and its margin are also home to a large number of rare or local invertebrates, including two aquatic and two terrestrial molluscs, a freshwater shrimp (Mysis relicta), eight beetles, five hoverflies, seven moths and two butterflies. Of the rare beetles recorded two, (Stenus palposus) and (Dyschirus obscurus), have their only known Irish location around Lough Neagh. The Lough also supports twelve species of dragonfly. Criterion 3: This site regularly supports substantial numbers of individuals from particular groups of waterfowl which are indicative of wetland values, productivity and diversity. In addition, this site is of	*Ca.* 11.8 km east of the Moneymore Section of the Proposed Development (in direct distance)	**Yes** **Hydrological connecteion via a river (RWB Code UKGBNI1NB030308330) in the south east of the Ecology Survey Area. The hydrological link is *ca.* 20 km east of the Ecology Survey Area.** **Potential ecological connection if the criterion 4 bird species forage/ commute in the Ecology Survey Area. The potential ecological link is *ca.* 11.8 km in direct distance.**

				special value for maintaining the genetic and ecological diversity of Northern Ireland because of the quality and peculiarities of its flora and fauna. A large number of plants and animal species are confined or almost confined to this area within Northern Ireland. Criterion 4: Supporting an important assemblage of breeding birds including, in nationally important numbers, great crested grebe, gadwall, pochard, tufted duck, snipe and redshank. Other important breeding wetland species include shelduck, teal, shoveler, lapwing and curlew. Criterion 6: It regularly supports internationally important numbers of wintering Bewick's and whooper swans and under Article 4.1 by regularly supporting nationally important numbers of breeding common tern. Criterion 7: by supporting a population of Pollan, one of the few locations in Ireland and one of the two known locations in the UK (the other is Lower Lough Erne). The Pollan, a salmonid fish that is common in Lough Neagh, also survives in low numbers in Loughs Erne, Ree and Derg. It is one of the most important species in Ireland in terms of faunal biodiversity since it occurs nowhere else in Europe, and the Irish populations are all well outside the typical range – the Arctic Ocean drainages of Siberia, Alaska and northwestern Canada, where it is known as the Arctic cisco.		

Black Bog Ramsar Site	UK12010 183.42 ha	-	-	Criterion 1: Large, relatively intact example of blanket bog habitat; one the best examples in the UK. Also the site holds nationally important examples of transitional and alkaline fen and oligotrophic/ mesotrophic lakes. Criterion 2: Supports at least six species on nationally scarce vascular plants and up to five species of nationally scarce bird species.	*Ca.* 16.3 km west of the Sandholes Link Road Section of the Proposed Development	None
Ballynahone Bog Ramsar Site	UK12001 243.24 ha	-	-	Criterion 1: Large, relatively intact example of blanket bog habitat; one the best examples in the UK.	*Ca.* 17.4 km north of the Moneymore Section of the Proposed Development	None

Table B02 Details of Statutory Designated Sites of National Importance occurring within 20 km of the Proposed Development

Designated Sites highlighted in light grey have a connection to the Ecology Survey Area. For a map of these sites see Section 7, Figure 5

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
Areas of Special Scientific Interest (ASSI)					
Upper Ballinderry River ASSI	ASSI 199 58.8 ha	Designated for the physical features of the river and its associated riverine flora and fauna. The Upper Ballinderry River ASSI site citation states: "*The Upper Ballinderry River is notable for the physical diversity and naturalness of the bank and channel, and the richness and naturalness of its plant and animal communities. It is one of the most important rivers in Northern Ireland for rare aquatic species. Adjoining stands of woodland enhance bank stability and provide food and shelter for associated animals. In addition, these woodlands are important in their own right for the rich variety of communities, diverse flora and rare plants"*	Part of the site occurs within the Ecology Survey Area. The site is adjacent to the north east of the Sandholes Link Road Section of the Proposed Development.	**Yes, hydrological connection. The Ballinderry River is adjacent to the Proposed Development.**	Upper Ballinderry River ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/upper-ballinderry-river-citation-documents-map.pdf [Accessed October 2019].
Brookend ASSI	ASSI 334 1.49 ha	Designated for its breeding colony of grey heron. The Brookend ASSI site citation states: *"Brookend supports the largest breeding colony of Grey Heron in Co. Tyrone. This site had an average of 39 nests between 2000 and 2003 which was more than 1 % of the estimated all-Ireland population. The site is therefore one of the most important heronries in Northern Ireland."*	*Ca.* 11 km east of the south east of the Moneymore section of the Proposed Development.	**Potential ecological connection if these birds forage/ commute within the Ecology Survey Area**	Brookend ASSI cite citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Brookend-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Lough Neagh ASSI	ASSI 30 39777 ha	Designated for its flora, fauna and geological and physiographical features. The Lough Neagh ASSI site citation states: "The area is of special scientific interest because it is a large shallow eutrophic lake occupying a downwarp in Tertiary basalt with its associated physical, chemical and biological characteristics. More specifically it is of interest for: wintering and breeding birds; its wetland vegetation, which includes a large	*Ca.* 11.7 km south east of the Moneymore Section of the Proposed Development (in direct distance).	**Yes** **Hydrological connection via the Ballinderry River (RWB Code UKGBNI1NB030308330) in the south east of the Ecology Survey Area. The hydrological link is *ca.* 18.2 km (along**	Lough Neagh ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Lough-Neagh-ASSI-citation-documents.pdf [Accessed October 2019].

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		number of rare plant species; and the presence of a number of rare invertebrate and fish species. The site includes the whole water body of Lough Neagh, the largest lake in the British Isles at 38,500 ha, and a marginal fringe of land totalling 39,800 ha together. The shallow, eutrophic Lough is supplied by seven main tributary rivers and is drained by the Lower Bann. The Lough lies within a downwarped block of Tertiary basalt which is at least 35 million years old and has a number of associated geological and physiographical features of scientific interest e.g. the Lough Neagh Clays, evidence of Holocene water-level changes, and contemporary phenomena including mobile sand bars. "		**the river) east of the Ecology Survey Area.** **Potential ecological connection if these birds forage/ commute within the Proposed Development footprint.**	
Ballysudden ASSI	ASSI 133 97.8 ha	Designated for its geological features. The Ballysudden ASSI site citation states: "*Carboniferous outcrop at Ballysudden exposes over 100m of strata in a continuous section. It is the best section ofthe late Visean rocks ofthe Armagh Group in Northern Ireland; these are some 335 million years old (M.y.). The variety oflithologies representing a wide range offacies is remarkable and some ofthe sedimentological structures preserved are spectacular including ancient solution features in limestone."*	*Ca.* 0.9 km south of the Sandholes Link Road Section of the Proposed Development.	No	Ballysudden ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/ballysudden-citation-documents-map.pdf [Accessed October 2019].
Bardahessiagh ASSI	ASSI 98 9.6 ha	Designated for its geological features. The Bardahessiagh ASSI site citation states: "*The southern flank of Craigbardahessiagh hill contains a highly fossiliferous sequence of Ordovician marine shelf or platform sediments some 450 million years old (M.y.). Although poorly exposed, very diverse shelly faunas have been collected from here which are of considerable importance in understanding the geography of the world in Ordovician times. The sequence also records a long continuous subsidence history for this platformal area from*	*Ca.* 8.4 km south west of the Sandholes Link Road Section of the Proposed Development.	No	Bardahessiagh ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Bardahessiagh-ASSI-citation-documents-and-map.pdf [Accessed October 2019].

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		Upper Ordovician, Caradoc (454 M.y.), to Lower Silurian, Llandovery (420 M.y.), times."			
Sruhanleanantawey Burn ASSI	ASSI 312 1.75 (ha)	Designated for its geology. The Sruhanleanantawey Burn ASSI site citation states: *"The area provides access to a range of rocks that are exposed along the stream. The rocks here date from the Ordovician period of Earth history and are some 460 million years old. A mixture of sedimentary, volcanic and other igneous rocks are exposed."*	*Ca.* 8.40 km north of the Moneymore Section of the Proposed Development.	No	Sruhanleanantawey Burn ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Sruhanleanantawey-Burn-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Little River ASSI	ASSI 97 2.1 ha	Designated for its geological features. The Little River ASSI site citation states: *"Around Slate Quarry Bridge, the Little River, and its tributary the Tirnaskea Stream, expose fossiliferous Upper Ordovician and Lower Silurian age rocks, some 430-440 million years old (M.y.). Within this relatively small area the complexity of the Pomeroy Lower Palaeozoic inlier is uniquely exhibited. The site has a significant palaeontological history with pioneering work by Major General Portlock in 1843, since when it has been intensively studied. A number of exposures within the site constitute the type localities for over 60 fossil species including 2 important genotype species. A type locality is the site from which the species were first described. The site is particularly rich in trilobites, gastropods and brachiopods. The site also holds an uninterrupted series of sediments laid down during the Ordovician - Silurian transition, some 430 M.y."*	*Ca*. 8.20 km south west of the Sandholes Link Road Section of the Proposed Development.	No	Little River ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/little%20river-citation-documents-map.pdf [Accessed October 2019].
Tanderagee ASSI	ASSI 218 44.25 ha	Designated for its flora and fauna. The Tanderagee ASSI site citation states*: "The Tanderagee area is of importance in understanding the recent glacial history of Northern Ireland. The landscape has been defined by events that occurred towards the end of the last Ice Age, between 18,000 and 12,000 years ago, a period of gradual climatic*	*Ca.* 10 km south west of the Sandholes Link Road Section of the Proposed Development.	No	Tanderagee ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Tanderagee-ASSI-citation-documents-and-

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		warming. The ice-sheet which covered this area and the highland areas further north, split into two lobes during the final stages of deglaciation, which retreated into the original glacier source areas of the Lough Neagh lowlands and the Omagh basin."			map.pdf [Accessed October 2019].
Teal Lough and Slaghtfreeden Bogs ASSI	ASSI 11 196.3 (ha)	Designated for its flora, fauna and physiographical features. The Teal Lough and Slaghtfreeden Bogs ASSI site citation states*: "The area is of special scientific interest because it contains 3 sites of upland raised bog within an area of blanket peat, which together are thought to be the most extensive and least disturbed examples of this habitat type in Northern Ireland. The largest of these bogs, at Teal Lough, probably has the finest hummock and pool complex of any raised bog in Northern Ireland. Dn all the bogs there are scattered large."*	*Ca.* 10.5 km north west of the Moneymore Section of the Proposed Development.	No	Teal Lough and Slaghtfreeden Bogs ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/teal-lough-and-slaghtfreeden-bogs-citation-documents-map.pdf [Accessed October 2019].
Limehill Farm ASSI	ASSI 96 0.50 ha	Designated for its geological features. The Limehill Farm ASSI site citation states that: *"The shales at Limehill Farm are of Lower Silurian, Llandovery, age, about 420 million years old. The shales contain a graptolite fauna, but differ from typical Llandovery graptolitic rocks by also having a shelly element comprising bivalves and brachiopods. This is one of only two sites in Northern Ireland where shelly fossils of Silurian age occur."*	*Ca.* 11. 5 km south west of the Sandholes Link Road Section of the Proposed Development.	No	Limehill Farm ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Limehill-Farm-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Lough Doo ASSI	ASSI 226 97.94 ha	Designated for its geological and biological importance. The Lough Doo ASSI site citation states: *"In Ireland the last glaciation occurred between 24,000 and 17,000 years ago. Centred on Lough Neagh, the ice built up moving out in several directions, changing the landscape. Then as the climate gradually warmed between 17,000 and 13,000 years ago, the ice melted and retreated leaving vast deposits of sediments. Our understanding of what happened in*	*Ca.* 12.8 km west of the Moneymore Section of the Proposed Development.	No	Lough Doo ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Lough-Doo-ASSI-citation-documents-and-map.pdf [Accessed October 2019].

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		Northern Ireland comes from the detailed study of the landforms left from this time."			
Drumbally Hill ASSI	ASSI 328 0.12 ha	Designated for its earth science interest. Drumbally Hill ASSI site citation states: "*The area provides excellent access to an important exposure of limestone. This exposure is what is left of a large quarry that once existed at the site. There are very few exposures of this rock left in the area. The limestone dates from the Carboniferous period of Earth history and is around 320 million years old."*	*Ca*. 13.5 km north of the Moneymore Section of the Proposed Development.	No	Drumbally Hill ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Drumbally-Hill-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Owenkillew River ASSI	ASSI 213 134.96 (ha)	Designated for its flora, fauna and physiographical features. The Owenkillew River ASSI site citation states: *"The area is of special scientific interest because of the physical features of the river and its associated riverine flora and fauna, with adjacent woodlands providing additional interest. In comparison to other rivers of its type, the Owenkillew River is notable for the physical diversity and naturalness of the bank and channel, and the riclness and naturalness of its plant and animal communities. It is a very important river for rare species and includes the largest known population of the Freshwater Pearl Mussel Margaritifera margaritifera in Northern Ireland."*	*Ca.* 13.6 km north west of the Moneymore Section of the Proposed Development.	No	Owenkillew River ASSI. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/owenkillew-river-citation-documents-map.pdf [Accessed October 2019].
Drumcrow ASSI	ASSI 240 7.60 ha	Designated for its flora and fauna. Drumcrow ASSI site citation states: *"Drumcrow is of special scientific interest for its wetland flora. It is one of the last remaining fragments of what was once a much larger wetland complex which occupied low lying ground to the south of Lough Neagh. The site contains areas of good quality fen, fen meadow, wet grassland and vegetation associated with drains. A wide range of wetland plants occur, some of which are scarce."*	*Ca.* 14. 7 km south east of the Moneymore Section of the Proposed Development.	No	Drumcrow ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Drumcrow-ASSI-citation-documents-and-map.pdf [Accessed October 2019].

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
Curran Bog ASSI	ASSI 74 183.30 ha	Designated for its flora, fauna and physiographical features. The Curran Bog ASSI site citation states: *"The area is of special scientific interest because of its physiographical features and peatland flora and associated fauna. Curran Bog is among the best remaining examples of a lowland raised bog in Northern Ireland. Although there has been extensive turf-cutting around the edge of the bog, it still retains a relatively large intact dome, with a high cover of Sphagnum bog-mosses indicating active peat growth. Curran Bog displays a range of structural features that are typical of more undisturbed sites, including bog pools, hummock-hollow complexes and flat, saturated 'lawns'."*	*Ca.* 14. 7 km north of the north of the Moneymore Section of the Proposed Development.	No	Curran Bog ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Curran-Bog-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Crockaghole Wood ASSI	ASSI 55 8.3 (ha)	Designated for its flora and fauna. The Crockaghole Wood ASSI site citation states: *"The area is of special scientific interest because it displays one of the best examples in the Sperrins of the natural transition from open heathland to a mature woodland climax, through a series of intermediates. The woodland although small in extent is a fine example of an acid Oak wood and exhibits a high degree of naturalness throughout. It extends along both sides of a narrow but deep glen on the lower southern flank of Slieveavaddy, grading into wet heath along its upper reaches. In addition to the woodland the glen also contains a variety of associated physical features such as sections of gorge, waterfalls and large rock faces all adding to the overall complexity of the site."*	*Ca.* 15 km north west of the Moneymore Section of the Proposed Development.	No	Crockaghole Wood ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/crockahole%20wood-citation-documents-map.pdf [Accessed October 2019].
Lurgylea ASSI	ASSI 280 3 ha	Designated for its geological features of interest	*Ca.* 13.8 km south west of the Sandholes Link Road Section of the Proposed Development	No	Lurgylea ASSI site citation. Available at: https://www.daera-ni.gov.uk/protected-areas/lurgylea-assi [Accessed November 2019].

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
Peatlands Park ASSI	ASSI 210 207.30 ha	Designated for its peatland, wetland and woodland flora and fauna. The Peatlands Park ASSI site citation states: *"Several rare species are present. A number of low, wooded drumlins are interspersed by a series of broad, flat plains, with Derryadd Lough to the south-east of the area. The peatland occurs in the flat plains and consists of a large area of remnant lowland raised bog. Peatlands, and lowland bogs in particular, are an increasingly threatened habitat and are home to many of our most unusual and interesting plants, insects and birds."*	*Ca.* 16. 7 km south east of the Moneymore Section of the Proposed Development.	No	Pentlands Park ASSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Peatlands-Park-ASSI-citation-documents-and-map.pdf [Accessed October 2019].
Black Bog ASSI	ASSI 7 194 (ha)	Designated for its flora, fauna and physiographical features. The Black Bog ASSI site citation states: "*The area is of special scientific interest not only because it is currently the largest known area of intact lowland raised bog in Northern Ireland, but also because of the quality of its vegetation. The site is especially important for its extensive hummock-hollow complex, high cover of Sphagnum species and largely intact.."*	*Ca.* 16.3 km west of the Sandholes Link Road Section of the Proposed Development	No	Black Bog ASSSI site citation. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/black%20bog-citation-documents-map.pdf [Accessed October 2019].
Ballynahone Bog ASSI	ASSI 10 244 ha	Designated for its flora, fauna and physiographical features. Ballynahone Bog ASSI is of special scientific interest because the peat sequence holds information on the history of local vegetation and climate and also international vulcanism for much of the Holocene period. Biological features on interest include a diversity range of vegetation types as well as rare and notable peatland flora and fauna including Sphagnum mosses, upland breeding birds and invertebrates.	*Ca.* 17.4 km north of the Moneymore Section of the Proposed Development.	No	Ballynahone Bog ASSI site citation. Available at: ht https://www.daera-ni.gov.uk/protected-areas/ballynahone-bog-assi [Accessed November 2019].
Lough Beg ASSI	ASSI 27 1,125 ha	Designated for its aquatic flora, grassland habitats and breeding and overwintering wetland birds.	*Ca.* 18.7 km north of the Moneymore Section of the	No	Lough Beg ASSI site citation. Available at: https://www.daera-ni.gov.uk/protected-

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		Lough Beg ASSI is of special scientific interest because of its aquatic vegetation as well as wet grassland and unimproved meadow habitats. The support some important vascular plants as well as important numbers breeding and overwintering wetland birds.	Proposed Development.		areas/lough-beg-assi [Accessed November 2019].
Nature Reserves (NRs)					
Lough Neagh Islands NR		Designated for its island and bird interest. Approximately 80 of the islands in Lough Neagh are managed as part of the Lough Neagh National Nature Reserve. Populations of breeding birds are monitored every year. On the islands as a whole, about 500 pairs of mallard, 300 tufted duck, 500 great-crested grebes, 30,000 black-headed gulls, 150 common terns and 60 mute swans nest. These islands are essential to provide secure nesting sites for many species of wetland birds.	*Ca*. 12.9 km north east of Moneymore Section of the Proposed Development.	**Yes** **The Lough Neagh Islands are islands scattered around the shoreline of Lough Neagh. A river (RWB Code UKGBNI1NB030308330) in the south east of the Ecology Survey Area has a hydrological connection *ca.* 20 km (along the river) east of the Ecology Survey Area to the site.** **Potential ecological connection if these birds forage/ commute within the Ecology Survey Area**	Information on Lough Neagh Islands NR: https://www.daera-ni.gov.uk/articles/lough-neagh-islands-nature-reserve [Accessed October 2019].
Mullenakill NR		Designated for its raised bog. Mullenakill is an 8000-year-old raised bog, within whose waterlogged 9 m deep core lies the remains of past surface vegetation. This site supports moths and butterflies, including the rare large heath.	*Ca.* 16.7 km south east of the Moneymore Section of the Proposed Development.	No	Information on Mullenakill NR available at: https://www.daera-ni.gov.uk/articles/mullenakill-nature-reserve [Accessed October 2019].
Ballynahone Bog NNR		Designated for its peatland. Ballynahone Bog is one of the most important lowland raised bogs in Northern Ireland because of its size, diversity of vegetation and structural features, and the presence of rare and notable species. Although a series of shallow peat drains were excavated across the surface in the recent past, these have now been blocked, and the bog is recovering. The intact surface of Ballynahone Bog	*Ca.* 17.4 km north of the Moneymore Section of the Proposed Development.	No	Information on Ballynahone Bog NNR: https://www.daera-ni.gov.uk/articles/ballynahone-nature-reserve [Accessed October 2019}.

Site name	Site code & area (ha)	Summary of qualifying features	Closest distance from the Proposed Development footprint	Connectivity with the Proposed Development footprint?	Statutory Designated Site Data Source
		represents one of the largest remaining areas of uncut lowland raised bog in Northern Ireland, and most of this is included within the NNR.			

Table B03 Summary of Non-Statutory Locally Designated Sites occurring within 5 km of the Proposed Development

Designated Sites highlighted in light grey have a connection potential for connection to the Ecology Survey Area. For a map of these sites see Section 7, Figure 6

Site name	Closest distance from the Proposed Development footprint	Hydrological connection with the Ecology Survey Area?
Site of Local Nature Conservation Interest (SLNCI Sites)		
Kilymmon Estate Wood	*Ca.* 0.5 km (in direct distance) east of the south east of the **Moneymore Section of the Proposed Development.**	Yes, *ca.* 0.6 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308230).
Grange Fault	*Ca.* 2.2 km south east of the south east of **Moneymore Section of the Proposed Development.**	No
Grange	*Ca.* 3.0 km south east of the **Moneymore Section of the Proposed Development.**	No
Lissan Water	*Ca.* 1.1 km (in direct distance) east of the north east of the **Moneymore Section of the Proposed Development.**	No, this site is located 2.3 km upstream from the Proposed Development
Lissan Wood	*Ca.* 3.0 km north west of the north west of **Moneymore Section of the Proposed Development.**	No, this site is located 4.4 km upstream of the Proposed Development.
Tirnaskea Wood	*Ca.* 3.2km south west of the south west of the Sandholes Link Road Section of the Proposed Development.	No
Tullylagan Manor Wood	*Ca.* 4 km south of the south of the **Moneymore Section of the Proposed Development.**	Yes, ca. 7.4 km downstream of the Ballinderry River (RWB code: UKGBNI1NB030308230).
Springhill Wood	*Ca.* 5 km north east of the north east of the **Moneymore Section of the Proposed Development.**	No
Carndaisy Glen	*Ca.* 5.8 km north of the north of the **Moneymore Section of the Proposed Development.**	No
Moneymore Deltas (including Quilly Glen; and Re)	*Ca.* 4.5 km north east of the north east of the **Moneymore Section of the Proposed Development.**	No

Table B04 – Protected and/or notable species that have been identified within 2km of the Proposed Development during the Desk Study (10km for bats)

Species	Scientific Name	Habitats Dir. (Annex II / IV)	Birds Dir. (Annex I)	Wildlife Order	Red List Status[63] [64] [65] [66] [67][68]	Birds of Conservation Concern (2014 – 2019)	NI Priority Species	Likelihood on site *	Likelihood within 2 km *	Most recent record	Record Source
BIRDS											
Barn Owl	*Tyto alba*	-	-	Y	-	Red	Y	3	3	1992	CEDaR
Black-Headed Gull	*Larus ridibundus*	-	Y	-	-	Red	Y	3	2	2015	CEDaR
Cuckoo	*Cuculus canorus*	-	-	-	-	Green	Y	3	3	2007	CEDaR
Dunnock	*Prunella modularis*	-	-	-	-	Green	Y	2	2	2015	CEDaR
Fieldfare	*Turdus pilaris*	-	-	-	-	Green	Y	3	3	2015	CEDaR
Grey Heron	*Ardea cinerea*	-	-	Y	-	Green	-	1	2	2013	CEDaR
House Martin	*Delichon urbica*	-	-	-	-	Amber	-	3	2	2014	CEDaR
Kestrel	*Falco tinnunculus*	-	-	Y	-	Amber	-	3	3	2013	CEDaR
Kingfisher	*Alcedo atthis*	-	Y	Y	-	Amber	-	1	3	2012	CEDaR
Long-Eared Owl	*Asio otus*	-	-	Y	-	Green	-	3	3	2014	CEDaR

[63] NPWS (2009). Ireland Red List No. 3: Terrestrial Mammals. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL3.pdf [Accessed October 2019].
[64] NPWS (2010). Ireland Red List No 4: Butterflies. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL_2010_Butterflies.pdf [Accessed October 2019].
[65] NPWS (2016). Ireland Red List No.9: Macro-moths (Lepidoptera). Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL9%20Moths%20final%20version%20for%20webpage.pdf [Accessed October 2019].
[66] NPWS (2011). Ireland Red List No. 6: Damselflies and Dragonflies (Odonata). Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL6.pdf {Accessed October 2019].
[67] NPWS (2016). Ireland Red List No. 10: Vascular Plants. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL10%20VascularPlants.pdf [Accessed October 2019].
[68] NPWS (2011). Ireland Red List No. 5: Amphibians, Reptiles and Freshwater Fish. Available at: https://www.npws.ie/sites/default/files/publications/pdf/RL5.pdf {Accessed October 2019].

Oystercatcher	*Haematopus ostralegus*	-	-	-	-	Amber	-	3	3	2009	CEDaR
Peregrine	*Falco peregrinus*	-	Y	Y	-	Green	-	4	3	2012	CEDaR
Redwing	*Turdus iliacus*	-	-	-	-	Green	-	2	2	2015	CEDaR
Sand Martin	*Riparia riparia*	-	-	-	-	Amber	-	3	3	2003	CEDaR
Snipe	*Gallinago gallinago*	-	-	-	-	Amber	-	3	3	2013	CEDaR
Song Thrush	*Turdus philomelos*	-	-	-	-	Green	Y	2	2	2014	CEDaR
Sparrowhawk	*Accipiter nisus*	-	Y	Y	-	Green	-	2	2	2012	CEDaR
Starling	*Sturnus vulgaris*	-	-	-	-	Amber	Y	2	2	2012	CEDaR
Stock Dove	*Columba oenas*	-	-	-	-	Amber	-	3	3	2015	CEDaR
Swallow	*Hirundo rustica*	-	-	-	-	Amber	-	2	2	2015	CEDaR
Swift	*Apus apus*	-	-	-	-	Amber	-	3	3	2003	CEDaR
Whooper Swan	*Cygnus cygnus*	-	Y	Y	-	Amber	Y	3	3	2013	CEDaR
Woodcock	*Scolopax rusticola*	-	-	-	-	Amber	-	3	3	2015	CEDaR
Yellowhammer	*Emberiza citrinella*	-	-	-	-	Red	Y	2	2	2015	CEDaR
MAMMALS											
Badger	*Meles meles*	-	-	Y	Least Concern	-	-	1	2	1997	CEDaR
Hedgehog	*Erinaceus europaeus*	-	-	-	Least Concern	-	Y	2	2	1997	CEDaR
Irish Hare	*Lepus timidus* subsp. *hibernicus*	-	-	-	Least Concern	-	Y	3	3	2003	CEDaR
Otter	*Lutra lutra*	Y	-	Y	Near Threatened	-	Y	1	2	2013	CEDaR, NBDC
BATS (within 10km)											
Brown Long-eared Bat	*Plecotus auritus*	Y	-	Y	Least Concern	-	Y	3	2	2015	CEDaR
Common Pipistrelle Bat	*Pipistrellus pipistrellus*	Y	-	Y	Not Threatened	-	-	2	2	2017	CEDaR
Daubenton's Bat	*Myotis daubentonii*	Y	-	Y	Least Concern	-	-	2	2	2018	CEDaR
Leisler's Bat	*Nyctalus leisleri*	Y	-	Y	Near threatened	-	-	2	2	2014	CEDaR
Nathusius' Pipistrelle Bat	*Pipistrellus nathusii*	Y	-	Y	Least Concern	-	Y	3	2	1996	CEDaR
Natterer's Bat	*Myotis nattereri*	Y	-	Y	Least Concern	-	-	3	2	2013	CEDaR
Soprano Pipistrelle Bat	*Pipistrellus pygmaeus*	Y	-	Y	Least Concern	-	Y	2	2	2014	CEDaR
Whiskered / Brandt's Bat	*Myotis mystacinus / brandtii*	Y/Y	-	Y/Y	Least Concern / Data Deficient	-	-	3/4	3/4	2005	CEDaR
FISH											
Atlantic Salmon	*Salmo salar*	Y	-	-	Vulnerable	-	Y	3	2	1999	CEDaR
Brown Trout	*Salmo trutta*	-	-	-	Least concern	-	Y	3	3	1997	CEDaR
MOLLUSC											

Freshwater Pearl Mussel	*Margaritifera margaritifera*	Y	-	-	Endangered	-	Y	3	2	1996	CEDaR, NBDC
INVERTEBRATES											
Brimstone Butterfly	*Gonepteryx rhamni*	-	-	Y	Least Concern	-	-	4	3	1968	CEDaR
Flounced Chestnut Moth	*Agrochola helvola*	-	-	-	Least Concern	-	Y	4	4	Unknown	CEDaR
Garden Dart Moth	*Euxoa nigricans*	-	-	-	Near Threatened	-	Y	4	4	Unknown	CEDaR
Grey Mountain Moth	*Entephria caesiata*	-	-	-	Near Threatened	-	Y	4	4	Unknown	CEDaR
Holly Blue Butterfly	*Celastrina argiolus*	-	-	Y	Least Concern	-	-	3	3	2012	CEDaR
Irish Plume Moth	*Platyptilia tesseradactyla*	-	-	-	-	-	-	4	4	1943	CEDaR
Latticed Heath Moth	*Semiothisa clathrata*	-	-	-	-	-	-	4	4	1992	CEDaR
Marsh Fritillary Butterfly	*Eurodryas aurinia*	Y	-	Y	Vulnerable	-	Y	4	3	1918	CEDaR
Small Heath Butterfly	*Coenonympha pamphilus*	-	-	-	Near Threatened	-	-	3	3	1975 -1977	CEDaR
Variable Damselfly	*Coenagrion pulchellum*	-	-		Least Concern	-		4	3	1987	CEDaR
Wall Butterfly	*Lasiommata megera*	-	-	-	Critically Endangered (in Northern Ireland only; in the Republic of Ireland it is considered Endangered)	-	Y	4	4	1975 -1977	CEDaR
White-Line Dart Moth	*Euxoa tritici*	-	-	-	Least Concern	-	-	4	4	Unknown	CEDaR
Wood White Butterfly	*Leptidea reali*	-	-	-	Least Concern	-	-	3	3	1975 -1977	CEDaR
VASCULAR PLANTS											
Allseed	*Radiola linoides*	-	-		Near Threatened	-	-	3	3	Unknown	CEDaR
Bee Orchid	*Ophrys apifera*	-	-	Y	Least Concern	-	-	4	3	1955	CEDaR
Bird's-Nest Orchid	*Neottia nidus-avis*	-	-	Y	Least Concern	-	-	3	3	1987 - 1999	CEDaR
Bur Parsley	*Anthriscus caucalis*	-	-	-	Near Threatened	-	-	3	3	Unknown	CEDaR
Bluebell	*Hyacinthoides non-scripta*	-	-	-	Least Concern	-	-	3	3	2017	CEDaR
Common Cudweed	*Filago vulgaris*	-	-	-	Vulnerable	-	-	3	3	1915	CEDaR
Common Gromwell	*Lithospermum officinale*	-	-	-	Near Threatened	-	-	4	4	- 1888	CEDaR
Common Wintergreen	*Pyrola minor*	-	-	-	Near Threatened	-	-	3	3	Unknown	CEDaR
Dwarf Spurge	*Euphorbia exigua*	-	-	-	Near Threatened	-	-	4	4	1896	CEDaR
Northern Yellow-cress	*Rorippa islandica*	-	-	-	Least Concern	-	-	4	4	13/09/2016	CEDaR
Primrose	*Primula vulgaris*	-	-	Y	Least Concern	-	-	2	2	25/09/1971	CEDaR
Viper's Bugloss	*Echium vulgare*	-	-	-	Least Concern	-		3	3	1864	CEDaR

Whitebeam	*Sorbus aria*	-	-	-	Least Concern	-		3	3	Unknown	CEDaR
Wood Crane's-Bill	*Geranium sylvaticum*	-	-	Y	Endangered	-	Y	4	4	Unknown	CEDaR
CLUBMOSS											
Alpine Clubmoss	*Diphasiastrum alpinum*	-	-	Y	Near Threatened	-	-	4	4	1981	CEDaR

Key to likelihood of species presence: 1 = Confirmed; 2 = Likely; 3 = Possible; 4 = Unlikely; 5 = None.

Appendix C – Plant Species Recorded

Table C01 Plant Species recorded within the Terrestrial Ecology Survey Area during the Phase 1 Habitat Field Survey

COMMON NAME	SCIENTIFIC NAME
Graminoids	
Cock's-foot	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Creeping-bent	*Agrostis stolonifera*
False oat-grass	*Arrhenatherum elatius*
Floating sweet-grass	*Glyceria fluitans*
Meadow foxtail	*Alopecurus pratensis*
Perennial rye-grass	*Lolium perenne*
Sweet vernal-grass	*Anthoxanthum odoratum*
Wavy hair-grass	*Deschampsia flexuosa*
Yorkshire-fog	*Holcus lanatus*
Herbs	
Bluebell	*Hyacinthoides non-scripta*
Broad-leaved dock	*Rumex obtusifolius*
Coltsfoot	*Tussilago farfara*
Common bird's-foot-trefoil	*Lotus corniculatus*
Common knapweed	*Centaurea nigra*
Common nettle	*Urtica dioica*
Creeping buttercup	*Ranunculus repens*
Creeping thistle	*Cirsium arvense*
Enchanters nightshade	*Circaea lutetiana*
Giant hogweed	*Heracleum mantegazzianum*
Greater bird's-foot-trefoil	*Lotus pedunculatus*
Herb-Robert	*Geranium robertianum*
Lords-and-ladies	*Arum maculatum*
Meadow buttercup	*Ranunculus acris*
Meadowsweet	*Filipendula ulmaria*
Ribwort plantain	*Plantago lanceolata*
Rosebay willowherb	*Chamerion angustifolium*
Silverweed	*Potentilla anserina*
Soft-rush	*Juncus effusus*
Willowherb spp.	*Epilobium spp.*
Woundwort	*Stachys spp.*
Ferns	
Hart's tongue	*Asplenium scolopendrium*
Male-fern	*Dryopteris filix-mas*
Scaly male-fern	*Dryopteris affinis*
Trees and shrubs	
Ash	*Fraxinus excelsior*
Alder	*Alnus glutinosa*
Beech	*Fagus sylvatica*

COMMON NAME	SCIENTIFIC NAME
Birch	*Betula spp.*
Blackthorn	*Prunus spinosa*
Bramble	*Rubus fruticosus*
Butterfly bush	*Buddleja spp.*
Cherry laurel	*Prunus laurocerasus*
Cherry spp.	*Prunus spp.*
Copper beech	*Fagus sylvatica*
Cotoneaster spp.	*Cotoneaster spp.*
Elder	*Sambucus nigra*
Field maple	*Acer campestre*
Fir	*Abies spp.*
Fuchsia	*Fuchsia spp.*
Gorse	*Ulex europaeus*
Grey willow	*Salix cinerea*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Holly	*Ilex aquifolium*
Horse chestnut	*Aesculus hippocastanum*
Irish yew	*Taxus baccata 'Fastigiata'*
Ivy	*Hedera helix*
Japanese knotweed	*Fallopia japonica*
Japanese rose	*Rosa rugosa*
Large-leaved lime	*Tilia platyphyllos*
Lawson's cypress	*Chamaecyparis lawsoniana*
Lime sp.	*Tilia spp.*
Osier	*Salix viminalis*
Pedunculate oak	*Quercus robur*
Poplar sp.	*Populus spp.*
Popular	*Populus spp.*
Privet	*Ligustrum spp.*
Red currant	*Ribes rubrum*
Rhododendron	*Rhododendron spp.*
Rowan	*Sorbus aucuparia*
Scots pine	*Pinus sylvestris*
Silver birch	*Betula pendula*
Sitka spruce	*Picea sitchensis*
Snowberry	*Symphoricarpos albus*
Sweet chestnut	*Castanea sativa*
Sycamore	*Acer pseudoplatanus*
Tulip tree	*Liriodendron tulipifera*
Turkey oak	*Quercus cerris*
Wych elm	*Ulmus glabra*

Appendix D – Target Notes

Table D01 Constraints Target Notes for the Terrestrial Ecology Survey Area

For a map of these target notes see Section 7, Figure 3

Constraint TN #	TN Category	TN
1	Access Constraint	This field could not be accessed as livestock were present, in a series of open fields.
2	Access Constraint	Unable to access bank due to dense bramble and nettles. No tracks observed leading towards this bank.
3	Access Constraint	Could not survey north of this woodland/ scrub mosaic as would need to re-enter golf course which would need to be accompanied.
4	Access Constraint	Unable to access the scrub/ immature woodland mosaic due to the density of the vegetation. Mammal tracks leading into/ from this area however were followed where possible.
5	Access Constraint	A lot of brash has been placed in this section of the woodland, so unable to surveys this area for otter field signs.
6	Access Constraint	As adjacent to an industrial estate, did not access this land to check for mammal field signs.
7	Access Constraint	Could not access gated area to search for mammal field signs.
8	Access Constraint	Woodland and riverbank not accessible due to fencing in this area, could not search for mammal field signs.
9	Access Constraint	No access permitted. High fence in this area.
10	Access Constraint	The woodland was not accessed, as no permission were given, in order to search for mammal field signs.
11	Access Constraint	The woodland was not accessed, as no permission were given, in order to search for mammal field signs.

Table D02 Extended Phase 1 Habitat Survey (EP1HS) Target Notes (TNs) recorded within the Terrestrial Ecology Survey Area

For a map of these target notes see Section 7, Figure 10.1 – 10.4

EP1HS TN #	TN Category	TN
1	Habitat	2.5 m high hedge (J2.4) with alder, ash, hawthorn, blackthorn, holly, elder and guelder rose.
2	Habitat	Low hedge (J2.1.1), along wet ditch, with dog rose, ash, blackthorn, hawthorn, hazel and willow.
3	Habitat	Tall ruderal (C3.1) beside stream.
4	Habitat	Small open stream (G2) flowing to east-north-east.
5	Habitat	Ruderal vegetation (C3.1).
6	Habitat	Poor semi-improved grassland (B6) with soft-rush.
7	Habitat	Poor semi-improved (B6) damp grassland with soft-rush and ragwort.
8	Habitat	Solar panels (J5)
9	Habitat	Wet ditch (C3.1) with bank of tall ruderal vegetation.
10	Habitat	Copse of small ash trees.
11	Habitat	Recent mixed plantation (A1.3.2) with rowan, birch, pine etc.
12	Habitat	Hedge species rich in sections (J2.4/ J.3) with hawthorn, blackthorn, willow, rose, guelder and holly with occasional small ash trees.
13	Habitat	Hedge species rich in sections (J2.4/ J2.3) with hawthorn, blackthorn, willow, rose, guelder and holly with occasional small ash trees.
14	Invertebrates	Broad-leaved plantation/scrub (former hedge on northern side with much hazel /tall ruderal with poor ground flora but meadow vetchling providing cryptic wood white potential.
15	Habitat	Old railway embankment. Broad-leaved plantation/scrub (former hedge on northern side with much hazel /tall ruderal with poor ground flora (A1.1.2/A2.2/C3.1/J2.4).
16	Habitat	Hawthorn/ blackthorn hedges with ash and sycamore trees (J2.3.2).
17	Habitat	Very poor marshy grassland (B5) dominated by soft-rush.
18	Habitat	Hawthorn/ blackthorn hedges with ash and sycamore trees (J2.3.2).
19	Invasive species	Substantial stand of Japanese knotweed in amongst scrub edge on steep bank on the perimeter of farm.
20	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse etc. and occasional ash trees.

21	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse etc. and occasional ash trees.
22	Habitat	Strip of grassland approaching marshy grassland (B5) with devil's bit scabious (R), square-stalked St. John's wort (O), meadow thistle (R), knapweed (O) and ragged robin (O).
23	Fungi	Broad-leaved plantation (A1.1.2) on steep banks with ruderal central patch with very poor ground flora (ivy/bramble) - main badger sett + earthstars: dumping area close to house (eastern end).
24	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse *etc*. and occasional ash trees.
25	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse etc. and occasional ash trees.
26	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse etc. and occasional ash trees.
27	Habitat	Species-rich hedges (J2.4/ J2.3) with co-dominant hawthorn & blackthorn + guelder rose, holly, rowan, hazel, willow, dog rose, ivy, gorse etc. and occasional ash trees.
28	Habitat	Species rich hedgerow with 5 + species.
29	Habitat	Species rich hedgerow with 5 + species.
30	Habitat	Mixed plantation (A1.3.2) with oak, ash, pine and exotics such as maple, turkey oak etc. Western end clear-felled
31	Habitat	Species rich hedgerow with 5 + species.
32	Habitat	Line of alder, ash, hazel
33	Habitat	Treeline (A3.1) along wet ditch (flowing to the east). Ash, alder, hazel and holly main species. Narrows to single line of trees towards western end.
34	Habitat	Hedge line removed - now all one large field of B4.
35	Habitat	Tall ruderal (C3.1) with willowherb, nettles on spoil heaps. Planning Permission granted according to sign.
36	Habitat	Species rich hedgerow with 5 + species.
37	Habitat	Species rich hedgerow with 5 + species.
38	Habitat	Species-rich hedge (J2.3.1) with blackthorn, hawthorn, holly, ash, gorse, plum and wild privet.
39	Invertebrates	Tall ruderal with willow herb and nettles. This area supports spoil heaps and is a general dumping area. It supports meadow vetchling in patches so has cryptic wood white potential.
40	Habitat	Improved grassland (B4) bordered by a hedgerow (J2.1.2) of predominately hawthorn, to the east and west.
41	Habitat	Hedgerow as before, with hawthorn (a) and ash (o) along the northern, west and south-eastern boundary. The north eastern boundary if composed of a breeze block wall (J2.5) associated with a dwelling.
42	Habitat	A hedgerow along the eastern boundary of the field, is the same as the northern.

43	Invasive species	Snowberry hedgerow runs from this location to the road.
44	Habitat	A low stock-proof hedgerow (J2.1.1) which is quite scrub like in form, supports hawthorn (a), ash (f), elder (o), bramble (f) and common nettle (la).
45	Habitat	Habitats present here are an old stone wall (J2.5), partially covered in dense ivy, and an Improved grassland field (B4).
46	Habitat	A treeline (A3.1) with semi-mature ash trees with dense ivy cover. L BRP.
47	Habitat	A track (J5) and short stands of hedgerow (J2.2.2).
48	Habitat	Hedgerow (J2.3.2), with ash trees.
49	Habitat	An improved field (B4), with a hedgerow (J2.1.2) along the western boundary composed of ash and snowberry.
50	Invasive species	A Japanese knotweed hedgerow is growing either side of a track.
51	Habitat	A non-stockproof hedgerow (J2.3.2), locally with Sitka Spruce trees, runs along the east of an improved field (B4).
52	Mammal	Several mammal passes through hedgerow.
53	Habitat	A stream (G2) occurs along the eastern boundary of this field.
54	Habitat	Stock-proof species-rich hedgerow (J2.1.1) east of the stream, with hawthorn, elder and occasional sycamore. Improved grassland (B4 in field west of drain ditch (G1).
55	Mammal	Well-worn track running adjacent to roadside and between bales.
56	Mammal	A small number of mammal passes through the hedgerow in this location.
57	Mammal	Large mammal pass going east.
58	Mammal	A mammal track at the corner of the field
59	Mammal	Evidence of mammals crossing between field and adjacent field to east. Trampled grass and evidence of a faint, possible, otter slide to stream.
60	Mammal	Many mammal passes, of varying sizes, through a hedgerow.
61	Habitat	Mature hawthorn on the western boundary of field leads into mainly bramble, hawthorn and elderberry towards roadside. Max height 6 m.
62	Habitat	A treeline (A3.1), predominately composed of hawthorn with occasional sycamore, is present south of this location.
63	Habitat	A n irregular section of hawthorn treeline (A3.1) along the western field boundary, adjacent to houses. West of this point is amenity grassland (J1.2) in a child's play park.
64	Mammal	Possible badger track from field to adjacent east field through stream. Mammals using this field for commuting or foraging.
65	Habitat	A fenced off triangle with amenity grassland (J1.2) and cement (J5), the north of which is bordered by a Lawson's Cypress treeline (A3.2), is adjacent to a large improved grassland field (B4).
66	Habitat	A treeline (A3.1) with ash (a) and sycamore (a) borders the west and north of this improved grassland (B4).
67	Habitat	Non-stockproof hedgerow (J2.3.2) either side of this point, with hawthorn and occasional ash trees.

68	Habitat	Poor semi-improved grassland (B6) with species including Yorkshire-fog (d), creeping buttercup (a) and creeping bent (a).
69	Mammal	Mammal track into deep bramble.
70	Reptile	Old, fallen stone (J2.5) wall within scrub (A2.2) and poor semi-improved grassland close to south facing bank. Reptile hibernaculum potential.
71	Habitat	Semi-improved neutral grassland (B2.2), with scattered gorse scrub (A2.2).
72	Mammal	Faint track from field to housing estate.
73	Mammal	Previous track that ran into bramble as viewed from opposite side.
74	Habitat	A hedgerow which has become scrub locally (A2.1), dominated by hawthorn with occasional elder.
75	Mammal	Rabbit burrow on bank along thick hedgerow in field adjacent to inaccessible woodland along stream.
76	Habitat	Poor semi-improved grassland (B6), with a hawthorn and ash hedgerow (J2.3.2), with a small number of semi-mature trees.
77	Habitat	Poor semi-improved grassland (B6) and hawthorn hedgerows (J2.2.2).
78	Mammal	Mammal. Track from woodland inaccessible to field across stream could be otter or badger. No setts or holts observed nearby, may just be an access route from woodland to foraging habitats.
79	Habitat	A stream (G2) is present here, flowing, relatively quickly to the east. The stream has a stony substrate, and no vegetation in -stream locally.
80	Habitat	Improved grassland (B4), with species including perennial rye-grass and Yorkshire-fog.
81	Habitat	Hawthorn hedgerow with scattered trees (J2.3.2).
82	Habitat	South of the improved grassland (B4), there is a poor semi-improved grassland (B6) from this location, and it supports scattered hawthorn scrub (A2.2).
83	Habitat	Local stand of marshy grassland (B5) with creeping bent (d), meadow foxtail (ld), creeping buttercup (a), soft-rush (a), silverweed (la) and greater bird's-foot-trefoil (la). A stockproof Lawson's Cypress hedgerow (J2.1.2) is present between the field an
84	Mammal	Track across stream. Inconclusive as to whether this was created by livestock.
85	Habitat	Stream (G2) culverted here. The water is stagnant here, with high levels of silt build-up.
86	Habitat	Drain/ stream along the south side of a field adjacent. No access was permitted to this field.
87	Habitat	A small stand of conifer plantation (A1.2.2).
88	Habitat	An old stone wall (J2.5) around much of the boundary to this point. Parts of which are collapsing/ have collapsed. It supports mosses and ivy.
89	Habitat	Good quality ash woodland (A1.1.1) with semi-mature ash trees on a slope with sycamore and elder, and with bramble and male-fern within the field scrub and field layer.
90	Habitat	Behind an old wall (J2.5) is a drain/ stream (G2).
91	Habitat	A damp drain (G2) here, supporting much wetter vegetation locally. The woodland (A1.1.1) west of here is much more natural in form, the trees species include grey willow (la), with ash and alder (f), with a rich field layer.
92	Habitat	A small stand of ash-oak woodland with bluebells (A1.1.1).

93	Habitat	Two mature beech trees in this location. The woodland composition changes frequently in this area, from a plantation (A1.1.2) in the east, to wetland back to broadleaved with non-native trees.
94	Mammal	A likely fox's den. Entrance dimensions: 35 cm width x 39 cm height. The spoil heap is small, with a tunnel that turns south of the entrance and narrows quickly.
95	Reptile	Reptile refuge potential within brash on south facing slope.
96	Habitat	Poor semi-improved grassland (B6) bordered by a hedgerow (J2.2.2), of predominately willow.
97	Invasive species	Cherry laurel hedge in housing estate.
98	Habitat	Amenity grassland (J1.2) and cherry laurel hedgerow (J2.1.2).
99	Invasive species	Cherry laurel hedgerow.
100	Habitat	Deeper into the woodland, many of the trees are of similar age as that of earlier TNs but there are some differences, with more mature trees present here. The ground is flat and undulating, as though old drains are present.
101	Habitat	A planted broadleaved woodland (A1.1.2), with tree species including sycamore, popular, grey willow and hawthorn, and a field layer which includes common nettle (ld) and ivy (ld). There are also small stands of willow sp. scrub.
102	Habitat	Marshy grassland (B5) and scattered willow scrub (A2.2).
103	Habitat	A treeline (A3.1), with young to semi-mature trees which include alder (a), willow (o), and beech (la).
104	Invasive species	Cotoneaster sp. is present in the hedgerow.
105	Habitat	A low hedgerow (J2.2.2) with cotoneaster sp, elder and hawthorn.
106	Habitat	Scattered young trees (A3.1), including copper beech, wych elm, and pedunculate oak, and sand pit (J5) present here.
107	Invasive species	Grey squirrel running across the Killymoon golf green. Several grey squirrels were recorded within the golf course.
108	Habitat	Young parkland trees (A3.1), as before.
109	Habitat	Scattered trees (A3.1) and amenity grassland (J1.2) on golf course.
110	Habitat	This treeline (A3.1) borders the golf course boundary. It supports localised areas of tall ruderal with creeping thistle (d), bramble (la) and common nettle (a).
111	Habitat	An old stone wall (J2.5) covered in ivy is present on the western aspect. Scattered scrub (A2.2) occurs here too.
112	Habitat	An old mature pedunculate oak tree. Avoid this tree due to its age.
113	Habitat	A hawthorn treeline (A3.1), improved grassland (B4) and a conifer woodland (A1.2.2) is present just outside the Killymoon golf course.
114	Habitat	A hawthorn hedgerow (J2.3.2) with semi-mature trees borders an improved grassland field (B4).
115	Habitat	A long treeline (A3.1) of popular sp. trees adjacent to the Killymoon golf course entrance.
116	Invasive species	Cotoneaster sp. shrub is present within the shrub layer of the treeline.
117	Habitat	A treeline (A3.1), with semi-mature trees and young trees, is present along the western boundary of the Killymoon Golf club. The species within the treeline include wych elm, sycamore and ash, whilst much of the field layer is bramble.

118	Habitat	A small stand of tall ruderal (C3.1), with rosebay willowherb.
119	Habitat	A modern wall, with ivy, acts as a field boundary. Also present are bramble and elder scrub (A2.1) and scattered hawthorn and ash trees (A3.1).
120	Habitat	Scots pine plantation (A1.2.2) in the centre of the Killymoon golf course green.
121	Habitat	Beyond the parkland trees (A3.3), bramble scrub (A2.1) and scattered trees (A3.1) are present in a more open area.
122	Habitat	A young mixed woodlands plantation (A1.3.2) including pedunculate oak, fir and Scots pine, at the boundary of Killymoon golf course green.
123	Habitat	Two mature sweet chestnut trees (A 3.1).
124	Habitat	Habitats here include a treeline (A3.1) adjacent to a dwelling house (J3.6), and improved grassland field (B4), and east of this is is an open area of bramble scrub (A2.2) and a mixed woodland (A1.3.2) with mature silver birch (a), grey willow (f) and s
125	Habitat	A hedgerow (J2.1.2), with species including holly and snowberry is present south of a treeline (A3.1) which supports lime sp. (f), horse chestnut (f) and ash (o).
126	Invasive species	A snowberry hedgerow.
127	Habitat	Non-stock hedgerow (J2.3.2) carries on east, largely composed of mature hawthorn and occasional ash trees. It is supported by a wire-and-wooden-post fence.
128	Habitat	Running south of here, a treeline (A3.1) with semi-mature oak trees, with hawthorn.
129	Mammal	Burrow, with a small spoil heap, along bank in middle of cow pasture. Too small to be badger.
130	Habitat	Terraced houses, with a mixture of tiles and rounded corrugated slates. M BRP in the houses with slate roofs.
131	Invasive species	Small stand of Japanese knotweed and giant hogweed.
132	Habitat	River (G2) and young woodland (A1.1.2), with species including ash (f), wych elm (o), sycamore (lo), beech (o), hawthorn and sycamore (o).
133	Invasive species	Giant hogweed (la) on south bank of river.
134	Mammal	An inconclusive mammal dropping which had disintegrated with age. Likely hedgehog or badger due to the abundance of beetles.
135	Habitat	Ornamental shrubs (J1.4) and amenity grassland (J1.2) occur between the local access road (J5; hard-standing) to Club Riveria and the main road (J5; hard-standing).
136	Habitat	Scrub (A2.1) and Lawson's Cypress trees (A3.2) are adjacent to a dwelling house in this location.
137	Habitat	A field corner with elder scrub (A2.1) and hawthorn trees (A3.1).
138	Habitat	A broadleaved plantation woodland (A1.1.2) is present between the cemetery and the river. The canopy includes mature horse chestnut (a), the understory includes holly scrub, and the field layer includes giant hogweed, creeping buttercup (la), herb-Robert,
139	Habitat	An old cemetery, with amenity grassland (J1.2) with mature parkland trees (A3.3), predominately Irish yew
140	Habitat	A beech treeline (A3.1) and improved grassland fields (B4) are present in this location.
141	Habitat	North of the ditch (F1), a treeline (A3.1), composed of beech, hazel and holly is present. North of this, hawthorn scrub (A2.1) and scattered semi-mature ash and beech trees (A3.1), are present.

142	Habitat	Deeper into the woodland a more naturalised wood (A1.1.1) is present, with the canopy including younger trees of ash (o), holly (f), sycamore (o), and the ground floor is dominated by ivy.
143	Habitat	A young treeline (A3.1), predominately composed of ash, runs parallel with a hawthorn and holly hedgerow (J2.1.2).
144	Habitat	A damp drainage ditch (F1) is present south of the treeline (A3.1).
145	Habitat	Present here is the Club Riveria car park (J5; hardstanding), and a broadleaved woodland plantation (A1.1.2), with semi-mature beech (f), ash (o) and cherry laurel (lf).
146	Invasive species	Cherry laurel hedging and trees present at the south of the woodland (Ia).
147	Habitat	A broadleaved woodland (A1.1.1) supporting mature ash and beech trees. This should be avoided due to the age of the trees.
148	Habitat	A drainage ditch (F1) is present here, dominated locally by floating sweet-grass.
149	Invasive species	Giant hogweed is locally abundant.
150	Habitat	A river (G2) is present to the south of a broadleaved woodland plantation (A1.1.2), composed primarily of beech, along the northern bank.
151	Habitat	A mature beech treeline (A3.1) carries on south of this location, and supports, particularly to north young trees, largely beech.
152	Habitat	A stream entering the river (G2) here.
153	Invasive species	Cherry laurel is locally abundant in the woodland at this location.
154	Invasive species	Snowberry is locally abundant in the woodland at this location.
155	Habitat	A broadleaved woodland plantation (A1.1.1) is present as before, looking north.
156	Invasive species	Giant hogweed is locally abundant along the edge of the stream.
157	Invasive species	Snowberry, giant hogweed and cherry laurel are all abundant within this woodland.
158	Habitat	The woodland composition varies within this narrow stand. On steeper sloping ground it supports an ash-hazel- male-fern composition (A1.1.1) and closer to the river it supports a canopy of mature beech (A1.1.2).
159	Habitat	Present here is a non-stock-proof hedgerow (J2.2) adjacent to the road, north of which is a narrow stand of semi-improved neutral grassland (B2.2), then a narrow ditch (J2.6) and a more formalised treeline (than previous) (A3.1), with mature beech and ha
160	Habitat	A treeline (A3.1) with hawthorn and beech.
161	Invasive species	Snowberry is present within the cemetery.
162	Habitat	A drain (F1) at the boundary of the cemetery. Beyond this is a revegetated field with a mosaic of tall ruderals (C3.1), predominately rosebay willowherb, and scrub (A2.2.), with bramble and willow sp. abundant.
163	Invasive species	Giant hogweed is locally abundant.
164	Habitat	Present here is a wide damp drain (F1), with a broadleaved treeline (A3.1) north of drain, largely composed of grey willow.
165	Habitat	A local road (J5) is present here, north of which there is a1.5 m mixed hedgerow (J2.1.2) and a narrow stand of, primarily planted broadleaved, woodland (A1.1.2).

166	Habitat	Mosaic habitat, as before.
167	Habitat	Semi-improved neutral grassland is present here with Yorkshire-fog (d) and willowherb sp.
168	Invasive species	Cherry laurel hedging around boundary of this dwelling.
169	Habitat	A mature lime tree This tree should be avoided due it's age.
170	Habitat	A newly sown perennial rye-grass ley (J1) and hen-houses (J3.6) are present in this area.
171	Habitat	Hedgerow (J2.2.1) with hawthorn (a), grey willow (f) and silver birch (o) running parallel with a wire-and-post fencing.
172	Invasive species	Cherry laurel acting as a hedgerow surrounding a mixed woodland plantation.
173	Habitat	A young mixed woodland plantation (A1.3.2) with Scots pine (o, silver birch cultivar (f), and sycamore (f), with a cherry laurel hedgerow (J2.1.2) facing the footpath (J5).
174	Invasive species	Cherry laurel hedgerow.
175	Invasive species	Rhododendron is occasional with the mixed woodland plantation.
176	Habitat	A low non stock-proof hedgerow (J2.2) composed of hawthorn (a), hazel (o) and blackthorn (o).
177	Habitat	Treeline (A3.1) predominately composed of ash and beech.
178	Habitat	An old stone wall (J2.5) and a sewage treatment (J3.6) are present north of this treeline (A3.1).
179	Habitat	Improved grassland (B4) present here.
180	Habitat	There are a number of semi-mature trees, including sycamore, within the woodland.
181	Deer	Deer hoof prints recorded in this woodland. Browsing was noted.
182	Invasive species	Rhododendron is locally abundant in the woodland at this location.
183	Habitat	Ground modified for landscaping. It currently supports a mosaic of rush-pasture (B5) closest to the river, and revegetating ground (J1.3) closer to the dwelling.
184	Habitat	Wire fencing and willow treeline (ca. 4 m) (A3.1) border the sewage treatment plant (J3.6).
185	Mammal	An entrance (50 cm wide x 17 cm high) is present under a tree, with two tunnels: one tunnel reduced to a size only suitable to a rabbit, and the other which is out of direct vision is larger. This tunnel is possibly fox, but an otter or badger could also use it.
186	Habitat	Good quality broadleaved woodland (A1.1.1), with invasive plant species present. The woodland has an ash-hazel-scaly male- fern composition, with shrub and field layer species including, bramble, hart's tongue and lords-and-ladies.
187	Habitat	An old stone wall (J2.5) and treeline (A3.1) continue here.
188	Habitat	Downslope of this location there is a localised rush-pasture (B5), which appears to be an inundated semi-neutral grassland, species include soft-rush (la) and creeping buttercup (la).
189	Habitat	Scattered trees (A3.1) and improved grassland (B4) are present at this location.
190	Invasive species	Cherry laurel is locally abundant in the woodland.

191	Habitat	Mature silver birch tree with two unions, no ivy. Could have LBRP due to suitable sized gaps in unions.
192	Habitat	A narrow planted broadleaved woodland (A1.1.2), with tree species including ash (f), alder (f) and hazel (f), and the woodland field layer includes soft-rush, woundwort and bramble.
193	Invasive species	Cherry laurel on bank, semi-mature tree.
194	Invasive species	Giant hogweed is locally abundant in the woodland.
195	Invasive species	Giant hogweed.
196	Invasive species	Giant hogweed is locally abundant along the riverbank.
197	Habitat	A good quality narrow stand of naturalised woodland here, with an ash-hazel canopy (A1.1.1) with developed under flora including male-fern.
198	Habitat	Habitats in this location are a Treeline (A3.3), fencing, footpath (J.5) and narrow strips of amenity grassland (J1.2). The treeline species include sycamore (o), field maple (f), lime (o) and Scots pine (f).
199	Invasive species	Dense semi-mature cherry laurel tree on bank facing river.
200	Habitat	Semi-mature birch trees along rivers edge.
201	Habitat	Stands of young planted broadleaved trees (A1.1.2) are present along the riverbank.
202	Invasive species	Cherry laurel is locally abundant within the woodland.
203	Mammal	Inconclusive burrow. No mammal field signs.
204	Habitat	There is a small stand of mixed woodland plantation (A1.3.2), bordered by a hedging which includes field maple, cherry laurel and Japanese rose.
205	Invasive species	Cherry laurel and Japanese rose are frequent within the industrial estate landscaping.
206	Invasive species	Japanese rose is occasional locally.
207	Habitat	As before, habitats in this location are a Treeline (A3.3), footpath (J.5) and narrow strips of amenity grassland (J1.2).
208	General	An information sign with information regarding this woodland.
209	Invasive species	Giant hogweed is locally abundant along the river edge.
210	Habitat	Semi-improved neutral grassland (B2.2) on southern slope supports abundant common knapweed, rib-worth plantain, greater bird's-foot-trefoil, Yorkshire-fog, common bent, and meadow buttercup.
211	Invertebrates	Semi-improved neutral grassland (B2.2) providing good forage and structural diversity for invertebrates locally. There is a notable abundance of invertebrates in this location, including a common carder bumblebee.
212	Invasive species	Cherry laurel is locally abundant along the river edge.
213	Habitat	In a southern corner an improved agriculture field (B4) adjoins a stand of semi-neutral neutral grassland (B2.2).
214	Habitat	A treeline (A3.1) with semi-mature trees runs north-east of the point.
215	Invasive species	Cherry laurel is locally abundant in this area.

216	Invasive species	Rhododendron is occasional to frequent along the treeline.
217	Habitat	A large old mature beech tree. This should be avoided due to its age.
218	Habitat	Spoil present with willow sp. scrub (A2.1) and pioneer growth (J1.3), largely coltsfoot.
219	Squirrel	Mammal feeding signs under hazel tree: nuts have been cut neatly halved, likely a squirrel.
220	Habitat	A hedgerow (J2.2.2), with species including hawthorn and elder, starts here and runs eastwards. An improved grassland field (B4), with species including perennial rye-grass (d), Yorkshire-fog (la) and broadleaved dock (f).
221	Habitat	A young broadleaved woodland plantation (A1.1.2) with abundant ash, hazel and pedunculate oak.
222	Habitat	Improved grassland field (B4) adjacent to young broadleaved woodland plantation (A1.1.2).
223	Habitat	Large-leaved lime tree (A3.1) in amenity grassland (J1.2), with scattered willow and birch scrub (2.2) within a gated area.
224	General	Litter from fly-tipping is present within this treeline.
225	Habitat	Treelines (A3.1) are present on the upper and lower slope and scrub (A2.2), with bramble and elder, is present in-between.
226	Mammal	A mammal trail is present here under the treeline.
227	Habitat	A treeline (A3.10) on an upper slope supporting semi-mature grey willow (a), elder (a), and gorse (o). The field and shrub layer include common nettle (d), Yorkshire-fog (a), with bramble (la).
228	Mammal	A cavity under bedrock, which could be used by a variety of mammals, including badger and otter. At the widest point the entrance is 30 cm x height of 24 cm, the tunnel then turns out of view.
229	Habitat	A mature hedgerow (J2.2.2) with an understory, the hedgerow species include mature hawthorn (a), holly (o), and elder (o), and the understory includes bramble (la) and lords-and-ladies (f).
230	Habitat	A semi-improved habitat, supporting a mosaic of wet grassland (B5) and scrub (A3.2), as viewed from upslope (within improved agriculture grassland).
231	Invasive species	Giant hogweed is locally abundant along the river bank.
232	Habitat	Adjacent to the new build dwelling (J3.6), there is a small stand of mixed plantation (A1.3.2), with semi-mature trees including Lawson's cypress and alder.
233	Invasive species	A cherry laurel hedgerow is present in this location.
234	Habitat	The woodland (A1.1.1) is more naturalized in this location with a high-quality woodland with ash-hazel-scaly male-fern composition, amongst rocky outcrops (including a low cave) and a field layer which includes herb-Robert (a) and scaly male-fern (f).
235	Habitat	The scrub (A3.1) present here includes abundant bramble, elder, common nettle and creeping thistle.
236	Habitat	Intricate mosaic of marshy grassland (B5), semi-improved neutral grassland (B2.2) and scrub (A2.2). The wetter marshy grassland includes soft-rush (d), meadowsweet (a), greater bird's-foot-trefoil (a) and Yorkshire-fog (a). The drier neutral grassland
237	Habitat	The narrow stand of woodland (A1.1.2) on the riverside bank includes osier (a), willow sp. (f), and sycamore (o), some of which are semi-mature.
238	Habitat	Semi-mature trees in narrow woodland (A3.3).

239	Habitat	River (G2) and broadleaved woodland plantation (A1.1.2) across the river (in non-permitted land). The woodland is young and on a steep bank, species present include willow sp. (d), alder (o) and hazel (f). Giant hogweed is abundant on the river bank.
240	Invasive species	Cherry laurel and butterfly bush in hedgerow, north of narrow woodland.
241	Habitat	Hedgerow (J2.1.1) at edge of restaurant carpark which includes privet, cherry laurel, butterfly bush and fuchsia.
242	Invasive species	Butterfly bush present on boundary between amenity grassland and narrow woodland stand. Giant hogweed present due south on bankside.
243	Invasive species	Giant hogweed present due south on bankside.
244	Mammal	Large entrance facing river. Cave. Could be used by a variety of species including badger, otter. Possible hibernaculum for bats
245	Habitat	Habitats present here include hedgerows (J2.1.2), amenity grassland (J1.2) and the river (G2). The residential area to west of this location support semi-mature trees (A3.1).
246	Habitat	A shockproof hawthorn hedgerow (J2.1.2) borders the woodland plantation, along with a post-and-wire fencing.
247	Habitat	A broadleaved woodland plantation (A1.1.2), with poplar sp. (a), lime (o), and willow (o).
248	Reptile	Reptile refugia suitability present within the brash positioned at the base of the treeline.
249	Habitat	A hawthorn hedgerow (J2.2.2) becomes a hawthorn treeline (A3.1) at this location, with the hawthorn locally ca. 4-5 m high.
250	Mammal	Faint mammal trails leading down bank towards river.
251	Habitat	Treeline (A3.1), ca. 4 m wide, with semi-mature trees, largely grey willow, along the river bank.
252	Habitat	Poor semi-improved grassland field (B6), with species including, meadow foxtail (f) and broadleaved dock (la).
253	Habitat	Treeline (A3.1) as before, north of here.
254	Mammal	Burrow. Entrance dimensions: ca. 8 cm in width on side of bank facing river. Not likely to be badger. No spoil heap.
255	Habitat	Broadleaved woodland (A1.1.1) and scrub (A2.2) mosaic. Short stand of treeline (A3.1) composed of osier.
256	Habitat	Poor semi-improved grassland (B6), with species including creeping-bent (d), creeping thistle (f), perennial rye-grass (f) and Cock's-foot grass (o).
257	Invasive species	Giant hogweed is present here.
258	Invasive species	Giant hogweed is present along the river bank.
259	Habitat	A very small stand of broadleaved woodland (A1.1.1) with alder and grey willow.
260	Habitat	Mixed treeline (A3.3) between road (J5) and farm yard (J5).
261	Habitat	As before, mixed treeline (A3.3) with species including young Turkey oak (la), Lawsons cypress (la) and sycamore (o).
262	Habitat	A line of large mature oak and beech trees adjacent to the river, these are remnants of an Ancient woodland (A1.1.1). This woodland is conserved by the Woodland Trust.
263	Invasive species	Giant hogweed is locally abundant along the river bank.

264	Habitat	Scattered scrub (A3.2), composed of hazel and alder, and a treeline (A3.1) of hazel are present along the river bank.
265	Habitat	Recolonising bare ground (J1.3) with localised scrub (A2.2).
266	Habitat	A treeline (A3.1) ends here.
267	Invasive species	Red currant growing on river bank.
268	Habitat	Ash trees (A3.1) occur occasionally along the western boundary of the road.
269	Habitat	Closer to the river (G2), the woodland (A1.1.2) becomes more open, with older ash trees (*ca*. 30 years old) dominant in the canopy.
270	Habitat	Broadleaved woodland plantation (A1.1.2), with young trees, including horse chestnut, alder, pedunculate oak and Rowan. The trees are densely planted in this location, resulting in a relatively bare field layer. The broad-leaved woodland plantation in this area is
271	Habitat	Broadleaved woodland, at least partially planted (A1.1.2), as evidence by the young trees of similar age. A small number of trees are semi-mature. Canopy species include hawthorn, sycamore, and abundant ash.
272	Habitat	A mosaic of marshy grassland (B5) which includes soft-rush (la) and greater bird's-foot-trefoil (la), and tall ruderal (C3.1) on waste/ spoil ground. .
273	Habitat	Improved grassland (B4), with a treeline (A3.1) to the east with semi-mature beech trees.
274	Habitat	The hawthorn hedgerow (J2.1.2) noted previously starts/ ends here. Local tree species in the broadleaved woodland plantation (A1.1.2) include grey willow, hawthorn and ash.
275	Invasive species	Giant hogweed is locally abundant along the river bank.
276	Habitat	A hawthorn and ash treeline (A3.1) run adjacent to a lower maintained hawthorn hedgerow (J2.1.2).
277	Invasive species	Giant hogweed is locally abundant along the field boundary, adjacent to the river. Note: target note not taken at actual location.
278	Habitat	Poor semi-improved grassland (B6) bounded by treelines (A3.1) and hedgerows (J2.2.2).
279	Habitat	Treeline (A3.2) with Scots pine (f), Lawsons Cypress (o) and Sitka spruce (o).
280	Habitat	Improved grassland field (B4), dominated by perennial rye-grass.
281	Habitat	Bramble scrub (A2.1) on bank, with a drainage ditch/ stream (G2) at the bottom of the slope and a poor semi-improved grassland (B6) field. A treeline (A3.1), is present west of a drain/ stream, composed of young trees (ca. 30 - 50 years old).
282	Habitat	Scrub (A2.1), largely bramble, occurs on a steep bank, with a ditch (G2) present at the bottom of the bank. The bank also supports occasional young sycamore trees (A3.1) and hawthorn scrub (A2.2). The field is improved grassland (B4).
283	Habitat	Stream/ ditch (G2) and west of this a young woodland (A1.1.2) (with *ca*. 30-year-old trees) is present, with species including sycamore and willow sp (la).
284	Invasive species	Two newly planted rhododendron shrubs (J1.4).
285	Habitat	Dry ditch (J2.6) present between amenity (J1.2) and improved grassland (B4).
286	Invasive species	Cherry laurel is present within a hedgerow across the road from this location.
287	Invasive species	A hedgerow adjacent to the mixed plantation woodland, with species including cherry laurel, rhododendron, privet, and cotoneaster sp.

288	Habitat	Treeline (A3.1) with an underlying hedgerow (J2.1.2), species include cherry laurel, lime, cherry sp., silver birch and tulip tree. North of the treeline, there is amenity grassland (J1.2) and a footpath (J5).
289	Habitat	Amenity grassland (J1.2), and a small stand of ornamental shrubs (J1.4) at the western boundary.
290	Habitat	Localised areas of grey willow scrub (A2.2) with occasional ash.
291	Invasive species	Giant hogweed along the river. Note: target note not taken at actual location.
292	Habitat	Broadleaved woodland plantation (A1.1.2) with a canopy supporting ash (f), sycamore (lf), and willow sp. (o). Hazel is occasional in the understory, and the field layer is well developed, and includes dead wood and male-fern. A waterbody (G2) passes through here.
293	Habitat	South of the roundabout, there are narrow stands of planted trees (A3.1), primarily beech, on steep banks.
294	Habitat	The roundabout is composed of gravel (J5), amenity grassland (J1.2) and ornamental shrubs (J1.4). Flowerbeds are present within the road islands.
295	Habitat	A short section of hedgerow (J2.1.2) with hawthorn and elder.
296	Habitat	Semi-improved neutral grassland (B2.2), as before, with semi-mature Lawson's Cypress trees, and young ash trees (A3.3)
297	Habitat	Improved grassland (B4) by banks of bramble, with common nettle scrub (A2.1), and to the east a hawthorn hedgerow occurs (J2.2.2).
298	Habitat	Semi-improved neutral grassland (B2.2), as before, with Lawsons' Cypress(a) and immature ash (f).
299	Habitat	Marshy grassland (B5), with soft-rush and greater bird's-foot-trefoil, with occasional tall ruderal (C3.1) with willowherb and creeping thistle.
300	Habitat	Treeline (A3.1) carries on to the west and gorse scrub (A3.1) to the roadside.
301	Habitat	Semi-improved neutral grassland (B2.2) with false oat-grass (la), ribwort plantain (la), and common bird's-foot-trefoil (la).
302	Habitat	A scrub-like hedgerow (J2.1.1) with gorse (a), grey willow (o) and ash (o).
303	Habitat	Treeline (A3.1), which includes ash, holly and elder, and amenity grassland (J1.2).

Table D03 Results of Bat Roost Features (BRF) identified within the Terrestrial Ecology Survey Area

For a map of these BRF see Section 7, Figure 11.1 – 11.3

BRF Number	Comment	BRF Level
1	Line of young sycamore (A3) with N-L BRF.	Low
2	Modern industrial buildings (J3.6). L BRF.	Low
3	Abandoned house and out-buildings (J3.6) with overgrown garden (C3.1). H BRF.	High
4	Modern houses with gardens. L BRF.	Low
5	Mature road side oak tree. M BRF.	Moderate
6	Mature road side oak tree. M BRF.	Moderate
7	Modern houses with gardens. L BRF.	Low
8	Medium aged plantation along road with ash, sycamore, beech, horse chestnut etc. L BRF.	Low
9	Medium aged plantation (A1.1.2) along road with ash, sycamore, beech, horse chestnut etc. L BRF.	Low
10	Oak tree with M BRF.	Moderate
11	Modern houses with gardens. L BRF.	Low
12	New build with low- negligible BRF but the original house and outbuildings with M-H BRF.	High
13	Mature ash and beech. M-H BRF.	High
14	Mature ash in corner. M BRF.	Moderate
15	Beech tree with L-M BRF.	Moderate
16	Ash tree with M BRF.	Moderate
17	Derelict farm building. M BRF with potential in stone wall cavities.	Moderate
18	Ash tree with M BRF.	Moderate
19	Old stone shed, with a tin roof mostly missing. Previously labelled as H BRF, now L BRF.	Low
20	Ash tree with M BRF.	Moderate
21	Line of mature trees with sycamore, ash and beech. M BRF.	Moderate
22	Modern houses. L BRF.	Low

BRF Number	Comment	BRF Level
23	Line of large ash and sycamore trees with M-H BRF.	High
24	Mature oak tree. H BRF.	High
25	Poultry unit (J3.6). Low BRF.	Low
26	Ash tree with M BRF.	Moderate
27	Scattered ash trees (A3.1) with M-H BRF.	High
28	Scattered ash trees (A3.1) with M-H BRF.	High
29	Scattered ash trees (A3.1) with M-H BRF.	High
30	Building. Negligible BRF.	Negligible
31	Scattered ash trees (A3.1) with M-H BRF.	High
32	Line of beech and horse chestnut (A3.1). M-H BRF.	High
33	Ash trees (A1.1.2) with L-M BRF.	Moderate
34	Copse of ash trees (A1.1.2) with M-H BRF.	High
35	Cluster of ash trees (A3.1) with M-H BRF.	High
36	Modern house and farm buildings. Negligible BRF.	Negligible
37	Mature scattered broad-leaved trees with H BRF.	High
38	Cluster of ash trees (A3.1) with M-H BRF.	High
39	Mature ash tree with holes, splits and ivy. H BRF.	High
40	Ash tree with dense ivy. L-M BRF.	Moderate
41	Modern buildings (J3.6) viewed from distance with no obvious bat potential.	Negligible
42	Ash tree with dense ivy. M BRF.	Moderate
43	Ash with ivy & broken limb/ crack. L-M BRF.	Moderate
44	Modern or renovated buildings (J3.6) viewed from distance with no obvious bat potential.	Negligible
45	Modern buildings with no obvious BRF.	Negligible
46	No access but from a distance a modern build but trees with BRF	Limited Access
47	Group of large sycamores with splits, holes and ivy. M-H BRF.	High

BRF Number	Comment	BRF Level
48	Houses mainly negligible - low BRF. As judged from distance.	Low
49	Small copse with ash, pine and sycamore. L BRF.	Low
50	Modern dwelling (J3.6). L BRF.	Low
51	A number of near mature ash and beech trees with L-M BRF. Not all branches were visible.	Moderate
52	Moderate aged house. Private dwelling so difficult to see but possibly M BRF.	Moderate
53	A number of near mature ash and beech trees with L-M BRF. Not all branches were visible.	Moderate
54	Line of ash and beech with ivy, splits and lifting bark. M-H BRF.	High
55	Mainly broad-leaved plantation (A1.1.2) with mature trees with H BRF. Old building on roadside also with M-H BRF.	High
56	Ash tree with M BRF.	Moderate
57	Industrial complex (buildings and car parks) (J3.6) with no BRF.	Negligible
58	Mature Beech trees. L BRF.	Low
59	Hedge with line of mature ash trees (J2.3.1). M-H BRF.	High
60	Modern building with tin roofed outbuildings. L BRF.	Low
61	Mature ash trees. H BRF.	High
62	Small stone building with tin roof. L BRF.	Low
63	Mature ash trees. H BRF.	High
64	House and outbuilding with tall trees around garden. Landowner confirmed the house had bats and that NIBG visited a few years ago. Landowner said less bats are present now.	High
65	Sycamore with M BRF.	Moderate
66	Hedge with mature trees (J2.3.1). H BRF.	High
67	Farm and outbuildings (J3.6). M-H BRF.	High
68	Hedge with mature trees (J2.3.1). H BRF.	High
69	Abandoned garden with developing woodland including birch, elder and garden exotics. Old building (J3.6) which could not be accessed but may have BRF.	Limited Access
70	Vehicle yard with modern buildings (J3.6). N-L BRF.	Low
71	A semi-mature ash tree, within a hawthorn hedgerow, with dense ivy cover, and shallow rot holes. L BRF.	Low

BRF Number	Comment	BRF Level
72	An old stone wall, which is over all well-pointed, with a limited number of crevices due to missing mortar. There is also a dense cover of ivy in places (it appears to be routinely removed evidence). L-M BRF.	Moderate
73	Semi-mature beech tree along roadside with dense ivy cover. L BRF	Low
74	A treeline (A3.1) with semi-mature ash trees with dense ivy cover. L BRP.	Low
75	Hedgerow at the western boundary of the field, with mature hawthorn trees. L BRF.	Low
76	An irregular treeline with mature hawthorn trees with dense ivy cover. L BRF.	Low
77	North of this point, a mature hawthorn tree with dense ivy cover occurs in an exposed location in a garden of a dwelling house. L BRF.	Low
78	Two modern build houses, with tiles, can be viewed from this field. Likely L BRF.	Limited Access
79	Many of the mature hawthorn trees within the treeline have a dense ivy cover. L BRF.	Low
80	A hedgerow with mature hawthorn trees, with unions and dense ivy cover. L BRF.	Low
81	Mature sycamore tree (*ca.* 5 m from hedgerow), with gaps in joins and some rotten limbs. L-M BRF.	Moderate
82	A semi-mature ash tree with dense ivy cover. One small split in a limb can be seen, however it is difficult to get a detailed view due to full foliage. L-M BRF. If further investigation required, survey in winter.	Moderate
83	A hedgerow with several mature hawthorn trees with dense ivy cover. L BRF.	Low
84	Hedgerow with mature hawthorn trees, rot holes and thick ivy. L BRF.	Low
85	Three semi-mature ash trees with dense ivy over, and rot (rot holes, and a tree with heart rot). Tree features are not fully visible due to dense ivy cover and foliage. M BRF. Further surveys, if required, would be best carried out in winter.	Moderate
86	An old stone wall (J2.5) and semi-mature living and standing dead trees (A3.1) along the boundary of the improved field and golf course. L BRF for dense covered ivy trees. M BRF within localised area of the old stone wall, and a standing dead tree.	Moderate
87	An ash tree with rot holes and ivy cover. L BRF	Low
88	A housing estate with modern build (*ca.* 20-30 years old) semi-attached and terraced housing, with corrugated slates. M BRF.	Moderate
89	An old stone wall with small sections clear of ivy and missing mortar. M BRF.	Moderate
90	A number of willow trees in this area covered with dense ivy. L BRF.	Low
91	The stone wall (*ca.* 3 m high) continues in this area. Also present locally is a mature ash tree with dense ivy and rot holes. M BRF.	Moderate
92	Mature beech tree with rot holes and splitting limbs. M BRF.	Moderate

BRF Number	Comment	BRF Level
93	Two mature beech trees with rot holes. M BRF.	Moderate
94	A large popular sp. tree covered in dense ivy. L BRF.	Low
95	Many trees west of here are covered in dense ivy. L BRF. (Did not record any further trees with similar features in this area).	Low
96	Two silver birch trees with shallow rot holes and heart rot. M BRF.	Low
97	A mature ash tree with the golf course green. It has splitting limbs, but the crevices created are very shallow. Negligible BRF.	Negligible
98	Mature horse chestnut tree with splitting limbs. M BRF.	Moderate
99	Several trees, particularly beech, which have unions. L BRF.	Low
100	Young trees, with occasional peeling providing very limited BRF.	Low
101	Trees along this treeline, like this beech tree, have unions. L BRF	Low
102	An ash tree, covered in moderate ivy, is present in the corner of the boundary.	Low
103	A mature hawthorn tree, covered in dense ivy, and with unions. L BRF.	Low
104	An old stone wall as before (eastern aspect). Gaps are present within the mortar. M BRF.	Moderate
105	An old stone wall with ivy providing. L BRF.	Low
106	An old mature pedunculate oak tree, with ivy (the ivy has been killed but the vines remain) and splitting limbs. L BRF.	Low
107	A mature grey willow tree with splitting bark. L BRF.	Low
108	Hawthorn trees in hedgerow with moderately dense ivy cover. L BRF.	Low
109	Sycamore trees covered with dense ivy. L BRF.	Low
110	A small number of conifer trees covered with dense ivy. L BRF.	Low
111	This treeline supports a variety of young to semi-mature trees covered in dense ivy. L BRF.	Low
112	Semi-mature tree with dense ivy and many unions adjacent to wall. L BRF.	Low
113	Semi-mature hawthorn, with some rot holes and unions providing LBRF.	Low
114	Semi-mature ash and hawthorn trees, with dense ivy cover and unions. L-M BRF.	Moderate
115	A small number of conifer trees are covered in dense ivy. L BRF.	Low
116	Many of the conifer trees have dense ivy cover. L BRF.	Low
117	A number of trees in this woodland, largely Scots pine, are covered in dense ivy. L BRF.	Low

BRF Number	Comment	BRF Level
118	Two sweet chestnut trees with splitting limbs. M BRF.	Moderate
119	A treeline with semi-mature covered in dense ivy. L BRF.	Low
120	Hawthorn trees along bank, with unions and ivy provide some roosting opportunities. L BRF.	Low
121	An old masonry bridge with a modern extension to the south. The old stone arch appears to be well pointed for south.	Low
122	Mature trees in this woodland range from L-M BRF due to the presence of rot holes and the covering of dense ivy.	Moderate
123	Mature hawthorn trees in corner of field with unions and covered in moderate ivy. L BRF.	Low
124	A small number of mature beech trees within this treeline, are covered in dense ivy, or/ and have splitting limbs and rot holes. M BRF.	Moderate
125	A treeline with a small number of trees with a moderate ivy cover. L BRF.	Low
126	An old stone wall, with mortar missing, is present across the road. M BRF.	Moderate
127	Many semi-mature trees with dense ivy are present within the broad-leaved woodland plantation, as viewed from afar. L BRF.	Low
128	A modern dwelling (J3.6), with no bat roosting features visible across the road.	Limited Access
129	A large corrugated asbestos roofed building. Bat ingress is possible under rounded end of the roof where it connects with the guttering. M BRF.	Moderate
130	A beech woodland (A1.1.2) with several M BRF tree (with rot holes) and several L BRF (covered in dense ivy).	Moderate
131	A beech tree is present here with thick ivy vines. L BRF.	Low
132	A mature ash tree with rot holes. M BRF.	Moderate
133	An old church which is well-pointed. There are a small number of gaps in the mortar. L BRF.	Low
134	A large corrugated building with an asbestos roof. Bat ingress is possible under the roof where it joins with the guttering. M BRP.	Moderate
135	A number of mature trees covered with dense ivy, and with splitting limb are present in the treeline west of here. M BRF.	Moderate
136	A mature beech tree with rot holes and splitting limbs. M BRF.	Moderate
137	A cemetery building, which has a small number of crevices where the wall adjoins the ceiling. L BRF.	Low
138	Willow trees with rot holes. M BRF.	Moderate
139	Hen house; the lower wall is cement; the upper wall is timber. There is a pinched corrugated roof. Limited BRF.	Low
140	A modern dwelling house; having spoken to the owner, who informed me there are often bat droppings on the window sills, it seems likely, there is a roost.	Moderate

BRF Number	Comment	BRF Level
141	Hen house; the lower wall is cement; the upper wall is timber. There is a pinched corrugated roof. Limited BRF.	Low
142	The hen houses all connect on this side. Negligible BRF at this location.	Negligible
143	A mature lime tree. Difficult to see features due to full foliage, at least 1- 2 shallow rot holes are visible. Potentially L - M BRF. If further surveys are required, it would be best undertaken in winter.	Moderate
144	Trees in semi-mature mixed woodland, with moderate ivy cover. L BRF	Low
145	Trees in a hedgerow and treeline covered in dense ivy. L BRF	Low
146	An old stone wall with localised dense ivy. M BRF.	Moderate
147	A dying cherry tree. M BRF.	Moderate
148	There a small number of semi-mature trees, such as this sycamore, with dense ivy cover within the woodland.	Low
149	A young ash tree with several shallow rot holes. L BRF.	Low
150	Semi-mature sycamore with dense ivy cover. L BRF	Low
151	A mature sycamore tree with large rot holes. M BRF.	Moderate
152	Typical buildings within the industrial estate consist of a lower section with breeze blocks, and an upper section covered in corrugated metal. L BRF.	Low
153	Semi-mature sycamore with ivy cover, and one union providing suitable gaps. L BRF	Low
154	A dying silver birch tree with partially rotten limbs. Possible M BRF as cannot see these limbs in great detail.	Moderate
155	Standing dead tree in this area. M BRF.	Moderate
156	A housing estate, the houses of which have corrugated slates on the roofs. M BRF	Moderate
157	A small number of trees, in this location, with moderate ivy cover and rot holes. L -M BRF.	Moderate
158	Semi-mature mixed treeline within industrial estate including cherry laurel, elder and sycamore. LBRF due to thick ivy and occasional unions.	Low
159	There are crevices within the upper reaches of an old stone wall (part of the a former saw mills active in the 19th century) adjacent to the river. M BRF.	Moderate
160	Semi-mature beech trees in this area have rot holes and unions. M BRF.	Moderate
161	A large mature pedunculate oak with rotting, splitting limbs. M BRF.	Moderate
162	Treeline, with semi-mature trees, with some rotten limbs and moderate ivy cover. L BRF	Low
163	Willow tree with dense ivy cover occurring between a wall and the spoil. L BRF.	Low
164	Three semi-mature osier trees (A3.1) covered in dense ivy. L BRF.	Low

BRF Number	Comment	BRF Level
165	A mature grey willow tree covered in dense ivy. L BRF.	Low
166	Trees in semi-mature woodland with limited ivy cover. L BRF	Low
167	A barn (J3.6) composed of breeze block, with corrugated tin on the upper sections and roof of this building. A wooden fascia with gaps beneath is present above the doorway. L-M BRF.	Moderate
168	Mature horse chestnut tree on river bank with cracks in bark and a section of rotting heart. M BRF.	Moderate
169	A semi-mature ash tree with a large union. M BRF.	Moderate
170	A Sitka spruce tree covered in dense ivy. L BRF.	Low
171	Disused building (J3.6) with high broken windows providing ingress/ egress points. The building also has an asbestos facia to the south with suitable roosting gaps. Would require a detailed inspection.	Moderate
172	As viewed from a distance, semi-mature Scots pine trees with thin, straight smooth boles which appear to support negligible bat roost potential.	Negligible
173	Private newly built dwelling in modern, modular style. Negligible BRF.	Negligible
174	The Otter Lodge restaurant has rounded terracotta tiles, some of which have gaps underneath, particularly at the horizontal gutter, providing M BRF.	Moderate
175	Hawthorn trees with unions. L BRF.	Low
176	A treeline with occasional unions, and dense ivy cover. L BRF.	Low
177	A beech tree on the river bank, with rot holes and unions. M BRF.	Moderate
178	Farm shed (J3.6) composed of cement and breeze blocks. The upper section of the shed walls and the roof are composed of corrugated metal. L BRF.	Low
179	Large mature oak and beech trees adjacent to the river with splitting limbs and covered in moderate ivy. M BRF. Mature hawthorn tree with union. L BRF.	Moderate
180	Union boles on hazel trees, and dense ivy cover on alder trees, both of which provide L BRF.	Low
181	At least three semi-mature ash trees, with rot holes and dense ivy cover. Possible M BRF.	Moderate
182	Semi-mature ash in mixed woodland, with moderate ivy cover. L BRF.	Low
183	A sycamore tree with a moderate ivy cover. L BRF.	Low
184	Semi-mature treeline, with beech trees, adjacent to small outhouse in field along roadside. Ivy on beech trees may provide LBRF in conjunction with the L BRF of the outhouse.	Low
185	A house, with gaps visible along the roof ridges which covers the slates. M BRF	Moderate
186	Hedgerow, with beech and sycamore, with dense ivy cover. L BRF.	Low
187	Sycamore and beech, within a woodland plantation, with moderate ivy cover. L BRF.	Low
188	A semi-mature ash tree with dense ivy cover. L BRF.	Low

BRF Number	Comment	BRF Level
189	A semi-mature ash tree, within a treeline, with a moderate ivy cover. L BRF.	Low
190	Ash and beech trees, within a treeline, with a cover of ivy. L BRF.	Low
191	A treeline, with several trees, including mature hawthorn, with dense ivy and rot holes. L-M BRF.	Moderate

Appendix E – Photographs

Table E01 Photographs of the Notable Features within the Ecology Survey Area

Plate Number #	Plate Description	Plate
1	Good quality narrow stand of naturalised broad-leaved woodland, with an ash-hazel canopy (A1.1.1) with developed under flora including male-fern.	
2	Hardstanding carpark (J5) and a broad-leaved woodland plantation (A1.1.2) in the north of the Sandholes Link Road Section of the Terrestrial Ecology Survey Area. The broad-leaved woodland includes semi-mature beech, ash and cherry laurel. This plate corresponds with **Section 7, Figure 10.4, TN #145 Appendix D, Table D02, TN # 145.**	

Plate Number #	Plate Description	Plate
3	Planted broad-leaved treelines (A3.1), amenity grassland (J1.2) and buildings (J3.6) are typical in the Sandholes Link Road Section of the Terrestrial Ecology Survey Area.	
4	Herb abundant semi-neutral grassland (B2.2) in the south of the Moneymore Section of the Terrestrial Ecology Survey. This grassland provides locally important forage for invertebrates. This plate corresponds with **Section 7, Figure 10.3, TN # 210 and 211** and **Appendix D, Table D02, TN # 201 and 211.**	
5	Improved grassland (B4) and hedgerows (J2) form a large part of the Terrestrial Ecology Survey Area, as in this field in the central part of the Moneymore Section.	

Plate Number #	Plate Description	Plate
6	A mosaic of marshy grassland and tall ruderal, marshy grassland / tall ruderal (B5 / C3.1) in the south of the Sandholes Link Road Section of the Terrestrial Ecology Survey Area on waste ground. This plate corresponds with **Section 7, Figure 10.4, TN # 272** and **Appendix D, Table D02, TN # 272.**	
7	Ballinderry River (G2) in the south of the Ecology Survey Area, with the invasive alien species (IAS) giant hogweed in the foreground of the photograph.	
8	A species rich intact hedgerow (J2.1.1) in the middle of the Moneymore Section of the Terrestrial Ecology Survey Area, with hawthorn elder and the non-native species sycamore.	

Plate Number #	Plate Description	Plate
9	Potential otter holt within the Ecology Survey Area, the location is mapped as the centre point of three otter points illustrated in **Section 7**, **Figure 9** and **Section 7, Figure 10.3, TN # 128**. A musty smell was noted at this burrow entrance	
10	Otter spraint recorded on a boulder within the Ballinderry River in the south east of the Ecology Survey Area. Two otter spraints were recorded and mapped, see **Section 7, Figure 9** the most northerly and southerly point of the three otter signs.	

Plate Number #	Plate Description	Plate
11	A cavity under bedrock, which could be used by a variety of mammals, including badger and otter. At the widest point the entrance is 30 cm width x height 24 cm, the tunnel then turns out of view. This location of this cavity is mapped in **Section 7, Figure 10.3, TN # 228.**	
12	Large entrance facing river. Cave. Could be used by a variety of species including badger, otter. Possible hibernaculum for bats. This location of this cavity is mapped in **Section 7, Figure 10.3, TN # 244.**	

Plate Number #	Plate Description	Plate
13	An example of a tree assessed as having moderate bat roost features within the Terrestrial Ecology Survey Area. This semi-mature ash tree has rot holes and dense ivy.	
13	An example of a tree assessed as having low bat roost features (to the left of the photograph) within the Terrestrial Ecology Survey Area. This semi-mature ash tree was covered in ivy.	
14	An example of a tree assessed as having moderate bat roost features within the Terrestrial Ecology Survey Area. This semi-mature ash tree has rot holes and dense ivy.	

Plate Number #	Plate Description	Plate
15	This plate opposite illustrates potential salmon spawning habitat present within the Aquatic Ecology Survey Area. This habitat has been assigned a grade 2 with typical water depths of 150-700mm and substrate material size of 30-80mm in diameter.	
16	The plate opposite illustrates potential white-clawed crayfish habitat. Habitat requirements are assessed for boulder and larger stones for refuges and the presence of pools and glides.	
17	Japanese knotweed hedgerow is growing either side of a track in the middle of the Terrestrial Ecology Survey Area. This plate corresponds with **Section 7, Figure 10.2, TN # 50** and **Appendix D, Table D02, TN # 50**.	

Plate Number #	Plate Description	Plate
18	Earth-star (*Geastrum triplex*), a local fungus, recorded in a broad-leaved woodland plantation in the north of the Terrestrial Ecology Survey Area. This plate corresponds with **Section 7, Figure 10.1, TN # 23** and **Appendix D, Table D02, TN # 23**.	

Appendix G –Habitat Evaluation for Salmonid Suitability Explanation

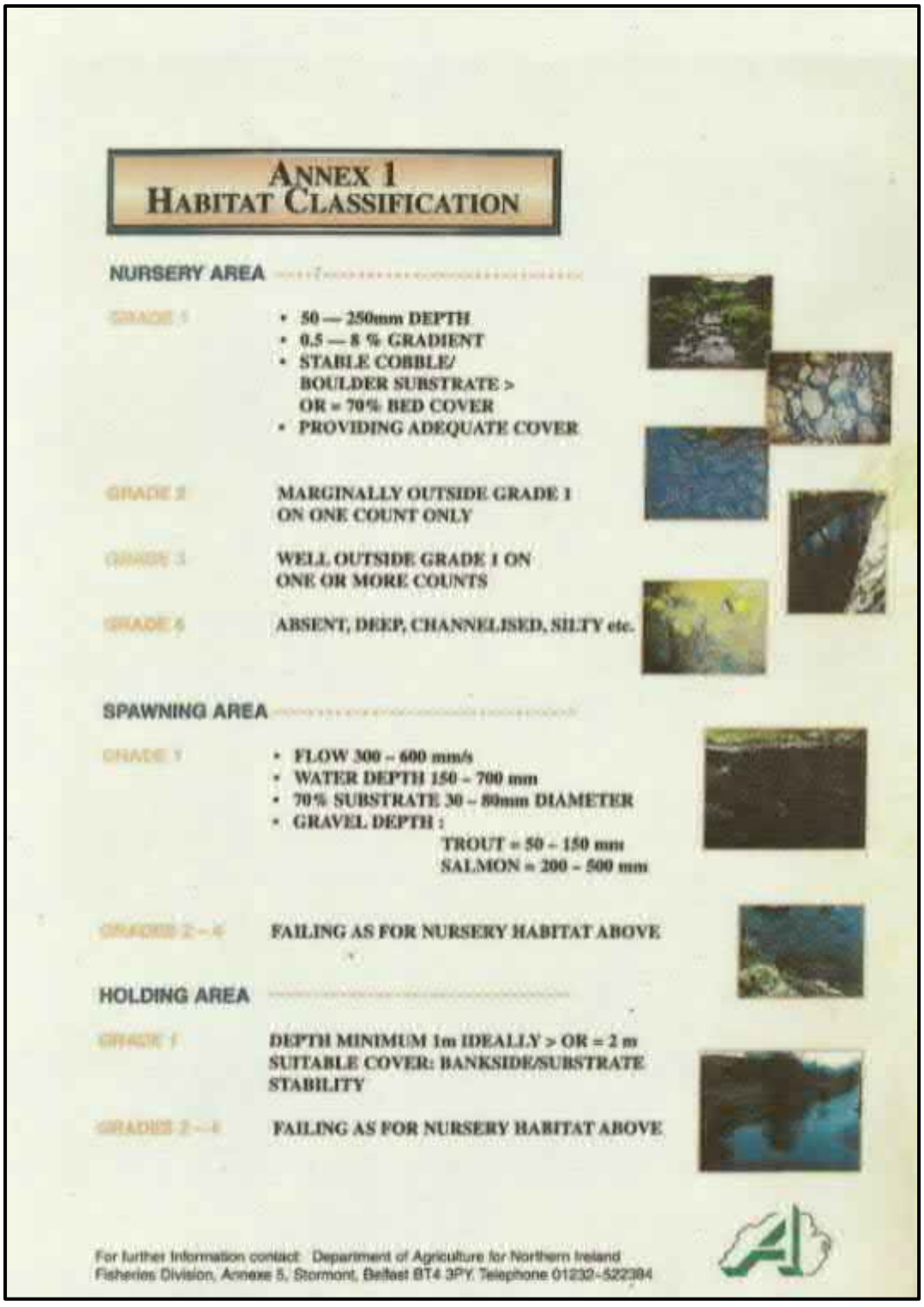

Figure G01 Habitat Evaluation for Salmonid Suitability. Source: Department of Agriculture for Northern Ireland, Fisheries Division, undated

APPENDIX B-11:
NOISE AND VIBRATION: NOISE MONITORING

Department for Infrastructure

A29 COOKSTOWN BYPASS

Noise Monitoring

AUGUST 2020

PUBLIC

Department for Infrastructure

A29 COOKSTOWN BYPASS

Noise Monitoring

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 62241420

DATE: AUGUST 2020

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft			
Date				
Prepared by	D Ward			
Signature				
Checked by				
Signature				
Authorised by				
Signature				
Project number				
Report number				
File reference				

CONTENTS

SITE VISIT AND SURVEYS

1.1.1. Attended noise measurements were made to identify existing noise sources and gain an appreciation of the current local noise environment. The measured noise levels will provide baseline information for the Stage 3 construction noise assessment.

1.1.2. Measurements were recorded at ten locations, identified in Table 1 and presented in Figures 6.8.3 to 6.8.7 (Appendix A Drawing References 718314-WSP-B-D-3000-0194 to 0198). The locations are representative of noise sensitive receptors near to the proposed scheme route options (Red, Purple A, Purple B, Green and Sandholes Link) and are considered appropriate to describe the noise climate in the area of the proposed scheme options.

Table 1 - Noise Survey Locations

ID	Grid Reference	Measurement representative of nearby noise sensitive receptors
MP1	H8044076703	Old Rectory Park
MP2	H8055776286	Sandholes Road
MP3	H8127676402	Loughrey Roundabout / Dungannon Road
MP4	H8159576889	Castle Road
MP5	H8199177353	Golf View
MP6	H8228377602	Festival Park
MP7	H8253578687	Old Coagh Road
MP8	H8190378839	The Dales
MP9	H8200979633	Moneymore Road
MP10	H8230580022	A29 / Moneymore Road

1.1.3. Day and night-time weekday measurements were undertaken between Tuesday the 18th and Friday the 21st June 2019. The survey dates were chosen to be representative of normal conditions, undertaken outside school holidays, local road works were avoided; and the weather conditions noted during the survey was appropriate for environmental noise monitoring, being dry with wind speeds up to 5 m/s, as recommended in BS7445-21.

1.1.4. Daytime attended noise measurements were undertaken over a three-hour period, based on guidance given in CRTN. Night-time attended noise measurements were undertaken over a fifteen-

[1] British Standard 7445-2 (2003) 'Description and Measurement of Environmental Noise'

minute period. All measurements were recorded at approximately 1.5m above ground and in free-field conditions. Summaries of the attended measurements are presented in Table 2 and Table 3.

1.1.5. The noise levels were recorded in terms of A-weighted broadband and octave band L_{Aeq}, L_{A10}, and L_{A90} noise descriptors. The measurements were completed by a suitably qualified WSP acoustic consultant.

1.1.6. The measurements were made at each of the ten locations within the advised hours of 10:00hrs and 1700 during the daytime period given in the Calculation of Road Traffic Noise Memorandum (CRTN)[2] for the measurement of road traffic noise. Night time measurements were also made between the hours of 23:00hrs and 02:00hrs to capture the quietest background levels when residents would be expected to be asleep.

1.1.7. Detailed information relating to the observed noise climate, monitoring periods, equipment used, and the full noise measurement dataset is given in Table 4 and Table 5. A glossary of noise and vibration terminology with an explanation of the noise metrics used is also provided at the end of this Appendix.

Noise Measurement Equipment

1.1.8. Noise measurements were conducted using calibrated 'Type 1' sound level meters. At each position, the microphone was mounted on a tripod in a free-field position at a height of approximately 1.5 m above ground level. The sound level meters underwent field calibration checks before and after the surveys, no calibration drift was observed. The relevant calibration certification for the equipment used is available on request.

Measurement Results

1.1.9. A summary of the baseline measurement results for the day and night-time surveys are set out in the tables below. Further comprehensive details of the survey results are given in the following tables.

Table 2 - Summary of Measured Daytime Noise Levels – Free-field, dB(A)

Location	LAeq, 3hr	LA10, 3hr	LA90, 3hr
MP1	64.4	67.9	51.1
MP2	67.3	70.8	51.8
MP3	66.4	69.7	55.5
MP4	56.4	53.7	47.7
MP5	64.4	61.8	40.2
MP6	46.3	48.3	42.6

[2] Department of Transport and Welsh Office (1988), *Calculation of Road Traffic Noise*

Location	LAeq, 3hr	LA10, 3hr	LA90, 3hr
MP7	67.2	60.3	35.2
MP8	41.6	43.8	38.0
MP9	73.3	77.0	60.5
MP10	75.9	80.7	59.4

Table 3 - Summary of Measured Night Time Noise Levels - Free-field, dB(A)

Location	LAeq, 15min	LA10, 15min	LA90, 15min
MP1	61.1	54.7	38.1
MP2	61.0	57.8	37.9
MP3	61.8	66.6	43.9
MP4	44.3	46.5	40.3
MP5	34.2	35.7	31.7
MP6	32.2	33.2	31.0
MP7	26.0	28.0	23.5
MP8	32.3	34.1	27.5
MP9	69.0	73.7	41.2
MP10	70.1	73.0	45.3

1.1.10. The dominant background noise source at the majority of the locations was moving road traffic on the A29 and other local roads. Road traffic noise was most notably dominant during the night-time measurements, particularly at measurement locations MP1, MP2, MP3, MP4, MP9 and MP10. Secondary sources included general domestic activities and birdsong; distant plant noise was noted at MP8 during both the day and night-time periods.

1.1.11. At MP5, MP6, MP7 and MP8, road traffic noise is less dominant. These locations are most likely to experience noise impacts due to the proposed scheme (for all the proposed scheme options). These measurements locations are representative of dwellings on Golf View, Festival Park, Old Coagh Road and The Dales.

DETAILED SURVEY RESULTS

Table 4 - Daytime Noise Monitoring Data (CRTN period – 1000hrs to 1700hrs)

ID	Site Location	Noise Climate	Meteorological Conditions	Date	Sound Level Meter Set	Measurement Duration	Time of Day	Overall Level		
								dB L_{Aeq}	dB L_{A10}	dB L_{A90}
MP1	Old Rectory Park	Free flowing traffic, dominating the noise climate.	Overcast. Roads dry. Some short patches of light rain but roads stay dry.	20/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	10:46 to 13:46 hrs	64.4	67.9	51.1
MP2	Sandholes Road	Free flowing traffic, dominating the noise climate.	Overcast. Roads dry.	19/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	10:29 to 12:49 hrs	67.3	70.8	51.8
MP3	Loughrey Roundabout	Free flowing traffic, dominating the noise climate.	Overcast. Roads dry. Some short patches of light rain but roads stay dry.	20/06/2019	01dB-METRAVIB Solo Master – Set 2	3 x 15 mins over 3 hrs	10:10 to 13:10 hrs	66.4	69.7	55.5
MP4	Castle Road	Free flowing traffic, dominating the noise climate.	Overcast. Roads dry.	18/06/2019	01dB-METRAVIB Solo Master – Set 2	3 x 15 mins over 3 hrs	10:26 to 13:26 hrs	56.4	53.7	47.7
MP5	Golf View	Intermittent traffic, Not dominating the noise climate. Lawn mower and birdsong audible in background.	Overcast. Roads dry.	19/06/2019	01dB-METRAVIB Solo Master – Set 2	3 x 15 mins over 3 hrs	10:21 to 13:41 hrs	64.4	61.8	40.2
MP6	Festival Park	Intermittent traffic, Not dominating the noise climate. Lawn mower and birdsong audible in background.	Overcast. Roads dry. Light rain at 14:41 for a short period. Roads stay dry.	19/06/2019	01dB-METRAVIB Solo Master – Set 2	3 x 15 mins over 3 hrs	10:41 to 13:00 hrs	46.3	48.3	42.6
MP7	Old Coagh Road	Fairly quiet. Road traffic noise is audible.	Overcast. Roads dry.	18/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	14:18 to 16:48 hrs	67.2	60.3	35.2
MP8	The Dales	Birdsong, distant plant and distant road traffic all contribute to the noise environment.	Overcast. Roads dry.	18/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	13:55 to 16:25 hrs	41.6	43.8	38.0
MP9	Moneymore Road	Dominated by road traffic. Speed limit changing from 40 mph to 60 mph on nearside carriageway.	Overcast. Roads dry. Light rain at 14:41 for a short period. Roads stay dry.	20/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	14:00 to 17:00 hrs	73.3	77.0	60.5
MP10	A29 Moneymore Road	Dominated by road traffic. Vehicles travelling at speed. 60 mph speed limit.	Overcast. Roads dry.	18/06/2019	01 dB CUBE – Set 1	3 x 15 mins over 3 hrs	10:02 to 13:02 hrs	75.9	80.7	59.4

Table 5 – Night time Noise Monitoring Data (2300hrs onwards)

ID	Site Location	Noise Climate	Meteorological Conditions	Date	Sound Level Meter Set	Measurement Duration	Time of Day	Overall Level		
								dB L_{Aeq}	dB L_{A10}	dB L_{A90}
MP1	Old Rectory Park	Intermittent Road passbys. Road still dominant. Background noise is distant road traffic from surrounding network.	Clear, dry night	21/06/2019	01 dB CUBE – Set 1	1 x 15 mins	0:00 hrs	61.1	54.7	38.1
MP2	Sandholes Road	Intermittent Road passbys. Road still dominant. Background noise is distant road traffic from surrounding network.	Clear, dry night	20/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:41 hrs	61.0	57.8	37.9
MP3	Loughrey Roundabout	Intermittent Road passbys. Road still dominant. Background noise is distant road traffic from surrounding network.	Clear, dry night	20/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:21 hrs	61.8	66.6	43.9
MP4	Castle Road / Villas / Water Works	Distant road traffic forms underlying background. No nearby road traffic pass bys.	Overcast. Roads dry.	19/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:13 hrs	44.3	46.5	40.3
MP5	Golf View	Distant road traffic forms underlying background. No nearby road traffic pass bys.	Overcast. Roads dry.	19/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:59 hrs	34.2	35.7	31.7
MP6	Festival Park	Distant road traffic forms underlying background. No nearby road traffic pass bys.	Clear, dry night	19/06/2019	01 dB CUBE – Set 1	1 x 15 mins	1:04 hrs	32.2	33.2	31.0
MP7	Old Coagh Road	Distant road traffic forms underlying background. Intermittent road passbys.	Clear, dry night	19/06/2019	01 dB CUBE – Set 1	1 x 15 mins	0:41 hrs	26.0	28.0	23.5
MP8	The Dales	Distant road traffic forms underlying background. No nearby road traffic pass bys on The Dales. As in the day, some distant plant just audible.	Clear, dry night	19/06/2019	01 dB CUBE – Set 1	1 x 15 mins	0:02 hrs	32.3	34.1	27.5
MP9	Moneymore Road	Intermittent Road passbys. Road still dominant. Background noise is distant road traffic from surrounding network.	Clear, dry night	18/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:40 hrs	69.0	73.7	41.2
MP10	A29 Moneymore Road	Intermittent Road passbys. Road still dominant. Background noise is distant road traffic from surrounding network.	Clear, dry night	18/06/2019	01 dB CUBE – Set 1	1 x 15 mins	23:19 hrs	70.1	73.0	45.3

NOISE TERMINOLOGY

1.1.12. Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

1.1.13. The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB (A). Table 6 below lists the sound pressure level in dB (A) for common situations.

Table 6 - Sound Pressure Levels for a Range of Situations

Typical Noise Levels dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library / Refrigerator humming at 2 m
50	Quiet office, no machinery Boiling kettle at 0.5 m
60	Normal conversation
70	Telephone ringing at 2m / Vacuum cleaner at 3 m
80	General factory noise level
100	Pneumatic drill at 5 m
120	Discotheque – 1 m in front of loudspeaker
140	Threshold of pain

1.1.14. The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy road, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night time noise levels will often be smaller and the levels significantly reduced compared to daytime levels.

1.1.15. The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the average sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period.

1.1.16. The sound power level, L_w is the acoustic energy emitted by a source which produces a sound pressure level at some distance. While the sound power level of a source is fixed, the sound

pressure level depends upon the distance from the source and the acoustic characteristics of the area in which it is located.

1.1.17. With regards to road traffic noise the parameter L_{A10} is prescribed by the relevant guidance and legislation. L_{A10} is the noise level exceeded for 10% of the measurement period. The $L_{A10,18h}$ is defined in the Calculation of Road Traffic Noise as the arithmetic average of the individual 1 hour $L_{A10,1h}$ levels between 06:00 - 00:00.

1.1.18. A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90 % of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a one hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

1.1.19. The L_{Amax} noise level is a measure of the maximum noise level during the monitoring period.

1.1.20. Measurements using a sound level meter can be Fast (F), Slow (S), or Impulse (I) time weighted. These weightings date back to when sound level meters had analogue meters and defined the speed at which the meter moved. Fast corresponds to a 125 millisecond time constant. Slow corresponds to a 1 second time constant. Impulse has a time constant of 35 ms. For the vast majority of environmental noise monitoring situations, the standard approach is to use the Fast time weighting.

1.1.21. Human subjects are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. These findings do not necessarily apply to transient or non-steady noise sources.

1.1.22. Most environmental noise measurements and assessments are undertaken for ‘free-field’, away from any existing reflecting surfaces (other than the ground). However, it is sometimes necessary to consider noise levels immediately external to a façade when considering the impact on residents inside properties and this requires the addition of 3 dB(A) to the predicted (or measured) free-field level due to noise reflection from the façade.

VIBRATION TERMINOLOGY

1.1.23. BS 5228 advises that vibrations, even of very low magnitude can be perceptible to people. It is often assumed that if vibration can be felt then building damage will occur, however much higher levels of vibration are required to damage buildings.

1.1.24. Therefore, vibration from construction works can cause anxiety as well as annoyance. Some individuals are more sensitive to vibration than others.

1.1.25. Vibration from construction is commonly described in terms of the Peak Particle Velocity (ppv) measured in mm/s. This is a measurement of the maximum ground particle movement speed during a given time interval. If measurements are made in 3-axis then the resultant ppv is the vector sum of the maximum velocity components, i.e. the square root of the summed squares of the maximum velocities, regardless of when in the time history those occur.

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APPENDIX B-12:
POPULATION AND HEALTH: BASELINE INFORMATION

Department for Infrastructure

A29 COOKSTOWN BYPASS

Population and Health Baseline

OUR REFERENCE
MARCH 2021

PUBLIC

Department for Infrastructure

A29 COOKSTOWN BYPASS

Population and Health Baseline

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 62244120

OUR REF. NO. OUR REFERENCE

DATE: MARCH 2021

Department for Infrastructure

A29 COOKSTOWN BYPASS

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date				
Prepared by	Sophie Collins / Claire Beard	Sophie Collins / Claire Beard		
Signature				
Checked by				
Signature				
Authorised by				
Signature				
Project number				
Report number				
File reference				

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TABLES

1 POPULATION AND HEALTH BASELINE INFORMATION

POPULATION AND HEALTH

AVAILABLE BASELINE

Population and Health baseline data available to September 2020 is presented below.

Desk Based Data

Table 1-1 identifies desk based datasets which have been procured for the Stage 2 Options assessment.

Table 1-1 – Population and Health Available Baseline

Dataset	Description
Desk Based - GIS Data	
Cabin Wood Walk	Land Ownership of Cabin Wood Walk (polygon) & route of the Cabin Wood Walk/Trail. Source: Mid-Ulster Council
Community Woodland	Source: https://www.woodlandtrust.org.uk/visiting-woods/woods/cabin-wood/
Council Properties	Shapefile (point) containing locations of council properties in Mid-Ulster. Source: Mid-Ulster Council Open Data http://data-midulster.opendata.arcgis.com
GP Practices	A quarterly reference file of active GP Practices and their list size (number of registered patients) at the start of each quarter. https://data.gov.uk/dataset/3d1a6615-5fc9-4f0e-ab2a-d2b0d71fb9ed/gp-practice-list-sizes Source: Open Data NI
Green Belt	Cookstown Area Plan 2010 Source: https://www.planningni.gov.uk/index/policy/development_plans/devplans_az/cookstown_2010/cookstown_library.htm
Leisure and Recreational Centres	Shapefile (point) containing locations of leisure and recreational centres in Mid-Ulster. http://data-midulster.opendata.arcgis.com/ Source: Mid-Ulster Council Open Data
National Cycle Route (Route 95)	National Cycle Route 95 (Sustrans) for Cookstown. Source: Sustrans Map of the National Cycle Network https://osmaps.ordnancesurvey.co.uk/54.61485,-6.56687,11
Sperrins Cycle Route	Sperrins Cycle Route is part of the Sustrans Cycle Network - Route 95

	Source: Sustrans Map of the National Cycle Network https://osmaps.ordnancesurvey.co.uk/54.61485,-6.56687,11
Off Street Car Parks	Shapefile (point) containing locations of off street car parks in Mid-Ulster. Source: Mid-Ulster Council Open Data http://data-midulster.opendata.arcgis.com
Old Burial Grounds	Shapefile (polygon) containing locations of old burial grounds in Mid-Ulster. Source: Mid-Ulster Council Open Data http://data-midulster.opendata.arcgis.com
Public Rights of Way	Shapeline (polyline) containing Public Rights of Way covering Mid-Ulster Council District. Source: Mid-Ulster Council Open Data http://data-midulster.opendata.arcgis.com
School Locations	Shapefile (point) containing location of Mid-Ulster dristrict schools. http://data-midulster.opendata.arcgis.com/ Source: Mid-Ulster Council Open Data
Vulnerable Landscapes	Highly Vulnerable Landscapes Source: Source: Mid-Ulster District Council - as detailed in the last two pages of the following report: https://www.midulstercouncil.org/MidUlsterCouncil/media/Mid-Ulster-Council/Publications/Planning/Local%20Development%20Plan/Prepatory%20Position%20Papers/Position-Paper-Landscape-Assessment-Sept-2015-Final-Doc.pdf

METHOD OF BASELINE DATA COLLATION

DESK STUDY

Data has been collected on the following land use and accessibility topics to build a baseline scenario for the Proposed Scheme:

Land use and accessibility

- Private property & housing
- Community land and assets
- Development land and business
- Agricultural land holdings
- Walkers, cyclists and horse riders (WCH)

A baseline health profile has also been collected, including the following;

- Population age breakdown
- Indicative levels of respiratory and cardiovascular health issues
- Deaths from respiratory and cardiovascular issues
- Proportion of the population with long term illness

- General heath of the population
- Life expectancy of the population
- Income deprivation

SITE VISIT AND SURVEYS

For the purpose of this assessment no site visit or topic-specific surveys were undertaken. This assessment was informed by the Initial Site Walkover conducted on 19 to 20 February 2019 by the WSP Planning and Environment specialists.

It is noted that the Green route option was added subsequent to the site visit conducted on 19 to 20 February 2019.

BASELINE CONDITIONS

The below information is based on a 500m study area, based on guidance from DMRB LA 112, around the three proposed route options (Red, Purple A and Purple B) and Sandholes Link, as shown in Appendix A Figure 6.9.1: Drawing Reference 62241420-WSP-B-D-2800-0138. Baseline information has also been added within the study area for the Green route where possible.

Land Use and Accessibility

The principal land uses associated with the study area are housing and agriculture, with leisure, recreation, industry and commerce uses also present. Housing is located across the study area and around the fringes of the Cookstown generally. Similarly, agricultural land is the dominant land use to the east of the Proposed Scheme options and consists mainly of Agricultural Land Classification (ALC) 2, with Green Belt land also located to the east of Cookstown. Leisure and recreation space are also located across the study area generally. Industrial and commercial land uses are located at the northern and southern ends of the study area and Proposed Scheme options. There are also areas which have been identified for potential new housing and industrial expansion surrounding much of the town.

Private property and housing

A review of three route options (Red, Purple A and Purple B) and Sandholes Link against the available A29 Cookstown Bypass Environmental Web Arc GIS viewer, detailed design drawings and Google maps has been undertaken. Moving from south to north across the extent of the Proposed Scheme, several residential properties are potentially at risk of being impacted as a result of the proposed routes. In particular, the proposed Maintenance Strip (3 m minimum) included in the detailed design drawings encroaches on several properties.

The table below highlights properties and buildings located directly adjacent to the Proposed Scheme routes which could be impacted. The assessment has further been informed by land take data per parcel as registered on the land registry, which is not included here.

Table 1-2 – Private Property and Housing

Property	Location
Route Purple A/Purple B, Red Route	
41 Castle Road	chainage 750-800
Route Purple A/Purple B	
5 Killymoon Road	chainage 9501-00, 5 Killymoon Road, BT80 8JZ
1,3,5,7,9,11 Golf View	chainage 1200-1350, Golf View, BT80 8JF
12 Festival Park	chainage 1700, Festival Park, BT80 8RP
Garden Centre on Clare Lane	chainage 1900
Festival Park 1 and 2	chainage 1900
Cookstown BT80 8RL	chainage 2200, Cookstown, BT80 8RL
17-11 Cookstown	adjacent to Coagh Road, Cookstown, BT80 8RL
Red Route	
39 Castle Road	Castle Road
51 Castle Road	Castle Road
Clare Lane (1 Clare Cottages)	chainage 1650-1700, Clare Lane, BT80 8RP
1 Clare Lane	chainage 1700, 1 Clare Lane, BT80 8RW
Adjacent to the Shiloh Gospel Hall and Parklands Veterinary Group	Molesworth Road, BT80 8NU
56 Old Coagh Road	chainage 2200, Old Coagh Road, BT80 8TF
Sandholes Link	

Fairy Burn House	TBC
11 and 15 Old Rectory Road	chainage 100, BT80 9XR
12 Sandholes Road and an unmarked residential property	chainage 550, Sandholes Road, BT80 9AR

Community land and assets

The following play parks and open spaces are within the 500 m study area of the Proposed Scheme routes.

- Cabin Wood - Tullywiggan Road, Cookstown BT80 8SD (Outdoor trails)
- Clare - Festival Park, Cookstown BT80 8RP (Outdoor Play area with play equipment)
- Coolnafranky - Coolnafranky Road, BT80 8PN (Outdoor play area with play equipment)
- Stewart Avenue - Stewart Ave, Cookstown BT80 8LH (Outdoor play area with play equipment)
- Killymoon - Killymoon Street, BT80 8JZ (Outdoor play area with play equipment)
- Gortalowry - Sweep Road, BT80 8JW (Outdoor play area with play equipment)
- Tullywiggan - Tullywiggan Road, Cookstown BT80 8SD (Outdoor play areas without play equipment)
- Beechway - Beechway, BT80 8LG (Outdoor play area with play equipment)
- Coagh Street - Old Coagh Road, Cookstown BT80 8NG (Outdoor play area with play equipment)
- Cookstown Hockey Club (Sand Based), Cookstown High School, Cookstown BT80 8PQ
- Cookstown High School Playing Fields, Cookstown BT80 8PQ
- Killymoon Golf course, 200 Killymoon Road, Cookstown BT80 8TW

The Cookstown Area Plan (CAP) 2010 Plan Policy ROS 1 zoned 4.1 hectares of land for open space and outdoor recreational use in Cookstown. The site at Ballinderry River, Cabin Wood, has been developed in partnership with Woodland Trust for public access.

Land along the Ballinderry River south west of the town has been identified as an area of potential recreational open space.

Table 1-3 provides a list of community facilities identified in the Study Area.

Table 1-3 – Community Facilities

Community Facility	Location
Red, Purple A, Purple B and Green	
Places of Worship	
Shiloh Gospel Hall	56-70 Molesworth Road, Cookstown BT80 8PJ (Adjacent to Molesworth Road between chainage 50-100)
Cookstown Elim Pentecostal Church	Old Coagh Road, Cookstown BT80 8QG (Approximately 440m west of chainage 2700)

St Brigits Church	Killymand Road, Cookstown BT71 6DE
Education	
Phoenix Integrated Primary School	80 Fountain Road, Cookstown BT80 8QF (Approximately 475m west of chainage 1650)
Cookstown Youth Resource Centre	74 Fountain Road, Cookstown BT80 8QF (Approximately 465m west of Molesworth Road chainage 100)
Cookstown High School	Cookstown BT80 8PQ (Approximately 470m west of chainage 2000)
Community Facilities	
Killymoon Golf Club	200 Killymoon Road, Cookstown BT80 8TW (runs through Killymoon Golf Club from chainage 800-1350)
Cookstown Hockey Club (Sand Based)	30 St Jeans Avenue, Cookstown BT80 8PQ (Approximately 480m west of Molesworth Road chainage 150)
Mid Ulster Women's Aid	27 Old Coagh Road, Cookstown BT80 8QG (Approximately 440m west of chainage 2650)
Asda Superstore	Asda Cookstown, Sweep Road BT80 8JR
Public Buildings	
Cookstown Police Station	19 Molesworth Road, Cookstown BT80 8NT (Approximately 500m west of chainage 2300)
Sandholes Link	
Places of Worship	
Cookstown Free Presbyterian Church	Sandholes Road, Cookstown BT80 9AR (Approximately 130m east of chainage 0.0)
St Luarans Roman Catholic Church	Cookstown BT80 8JB (Approximately 500m north of chainage 50)
Forthill Park Cemetery	88 Westland Road, Cookstown BT80 8QU (Approximately 475m north of chainage 50)

Development Land and Businesses

The following commercial business are located within the 500 m study area. The majority of these are located on the eastern edge of Cookstown.

Development Land and Businesses	Location
Red Route, Purple A, Purple B and Green	
SPAR	42 Dungannon Road, Cookstown BT80 9AE. Approximately 360m south of Red Route chainage 0.
Allingham Transport	6 Grange Road, Cookstown BT80 8SB. Approximately 200m south of Red Route chainage 0.
Egg Vending Machine	Fenella's Farm, 8 Tullywiggan Road, Cookstown BT80 8SD. Approximately 340m south of Red Route chainage 0.
W J Faulkner Farmer,	31 Dungannon Road, Cookstown BT80 9AH. Approximately 35m north of Red Route chainage 0.
Asda Cookstown Superstore	Sweep Road, Cookstown BT80 8JR. Approximately 430m north of chainage 0.
Toymaster	6 Dungannon Road, Cookstown BT80 8TL. Approximately 485m north of Red Route chainage 0.
McAleer and Rushe Ltd	17-19 Dungannon Road, Cookstown BT80 8TL. Approximately 200m north of Red Route chainage 0.
Mace	A29, Cookstown BT80 8TL. Approximately 450m west of Red Route chainage 550.
TJ Hamilton and Co, Volkswagen Car Dealership	18 Dungannon Road, BT80 8TL. Approximately 360m west of Red Route chainage 600.
Mid Ulster Cars Toyota	Brookmount,18, Dungannon Rd, Cookstown BT80 8TL. Approximately 380m west of Red Route chainage 600.
Posh &and Pans/ JD's Catering Supplies	41 Castle Road, Cookstown BT80 8TN. Approximately 170m east of Red Route chainage 800.
Cookstown Caravans	10 Cloghog Road, BT80 8RN. Approximately 150m east of Red Route chainage 1700.

Sherwood Wholesale Foods Ltd	5 Killymoon Road, Cookstown BT80 8LN. Purple A and B run directly over it at chainage 900.
Ivon Clarke	4 Cloghog Road, BT80 8RN. Approximately 160m east of Purple A and B chainage 1900.
Parklands Veterinary Group	81 Molesworth Road, BT 80 8NU. Approximately 115m west of Red Route chainage 1700.
Karro Food Group, Ltd	70 Molesworth Road, BT80 8PJ. Approximately 60m west of Red Route chainage 1850.
Warnock Jas	1 Cedar Heights, Cookstown BT80 8GA. Approximately 330m west of Red Route chainage 3150.
Crooks a S	126 Moneymore Road, Cookstown BT80 9UU. Approximately 100m south-west of Purple B chainage 4350.
Cookstown Print and Design	112A Moneymore Road, Cookstown BT80 9UU. Approximately 295m south-west of Purple B chainage 4350.
Dale Farm	139 Moneymore Road, BT80 9UU. Approximately 225m east of Purple B chainage 4350.
Powermax Engineering Ltd	10 Lismoney Road, BT45 7YQ. Approximately 360m east of Purple B chainage 4350.
The Performance Lab	133 Moneymore Road, Cookstown BT80 9UU. Approximately 70m east of Purple B chainage 4400.
Audi VW Engine Spares	10 Lismoney Rd, Moneymore, Magherafelt BT45 7YQ. Approximately 330m east of Purple B chainage 4350.
Clive Hamilton Motors Ltd	131 Moneymore Rd, Cookstown BT80 9UU. Adjacent to Purple B chainage 4400.
Conway Snooker, Billiards Supply Shop	140 Moneymore Road, Cookstown BT80 9UU. Approximately 235m north-east of Purple B chainage 4400.
E K S Tyres Ltd	Moneymore Road, Cookstown BT80 9UU. Approximately 475m north-east of Purple B chainage 4400.
Sandholes Link	
Macblair	Sandholes Road, Cookstown BT80 9AR. Approximately 40m south of chainage 0.

Premier Protective Coatings	12 Sandholes Road, Cookstown BT80 9AR. Adjacent to chainage 0.
FSL Electronics	First Floor, FSL Ltd, Sandholes Road, Cookstown BT80 9AR. Approximately 115m west of chainage 0.
Foyle Meat wholesaler	Derryloan Industrial Estate, Sandholes Rd, Cookstown BT80 9LU.
Keystone Lintels Ltd	Ballyreagh Industrial Estate, Cookstown BT80 9DG
Bellicious	12A Sandholes Road, Cookstown BT80 9AR
Trade Mouldings Ltd	Ballyreigh Business Park Sandholes Road, Cookstown BT80 9AR
Emerson	Ballyreagh Industrial Estate, Sandholes Road, Cookstown BT80 9DG
Metro CCTV	1 Ballyreagh Business Park, Cookstown BT80 9AR
Steelweld Fabrications Ltd	3, Ballyreagh Business Park, Sandholes Road, Cookstown BT80 9AR
Health & Safety Services NI	Cookstown BT80 9LU
SKE Solutions Ltd	3 Ballyreagh Business Park, Cookstown BT80 9LU
JF Andrews Engineering	Unit 12 Derryloran Industrial Estate, Sandholes Road, Tyrone, Cookstown BT80 9LU
Enisca	20, Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
Embroiderus	Units 24-29, Cookstown Enterprise Centre, Cookstown BT80 9LU
Cookstown Enterprise Centre	Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
Colloide Engineering Systems	Cookstown Enterprise Centre Co. Tyrone,, Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
Cookstown Panel Centre	Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
CBD Powerwashers	8 Derryloran Industrial Estate, Cookstown BT80 9LU
Panache Packaging	16 Mid Ulster Business Park, Derryloran Industrial Estate, Cookstown BT80 9LU

Sign Works	Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
CFC Interiors Warehouse #2	6 Sandholes Road, Cookstown BT80 9AR
Killymoon Bespoke Living	Derryloran Industrial Estate, Sandholes Road, Tyrone, Cookstown BT80 9LU
Molly and me candles	22 Old Rectory Park, Cookstown BT80 9XR
McGrath Motors	Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
BA Components	Derryloran Industrial Estate, Sandholes Road, Cookstown BT80 9LU
Muldoon Autoparts	1 Riverside Drive, Tyrone, Cookstown BT80 9DH
Keylite Roof Windows Ltd	Derryloan Industrial Estate, Cookstown BT80 9LU
Adventure World	65 Drum Road, Cookstown BT80 8QS
Fyfes Vehicle & Engineering Supplies Ltd Cookstown	65 Drum Road, Cookstown BT80 8RU
Rea Sound (NI Ltd)	57 Drum Road, Cookstown BT80 8QS
Promould	69 Drum Road, Cookstown BT80 8QS
Ka-Toning	The Gatelodge, 53 Drum Road, Cookstown BT80 8QS
Glenavon Beauty,Massage @Holistic Therapy	52 Drum Road, Cookstown BT80 8JQ
Greenvale Hotel & Restaurant	57 Drum Road, Cookstown BT80 8QS

The Cookstown Area Plan 2010 identifies land for future housing, industry and mixed business development. The Regional Development Strategy 2035 estimates that Cookstown District will require an additional 3,300 dwellings by 2015. To meet this requirement, the Cookstown Area Plan has allocated 70.6 hectares of land as Phase 1 housing and a further 77.5 hectares of land as Phase 2 housing. All of these lie within the settlement boundary, the majority being located on the outskirts of the town to the north and west.

Areas designated for future industry and / or mixed-use development are located within the settlement boundary at the southern end of the town and east of the town close to the East Circular Road. Some of these designated areas (as stipulated in the local plan) are dependent on the construction of the Eastern Distributor Route (EDR). Others allow for the potential introduction of the EDR. The local plan stipulates that development reliant on the EDR will not be permitted ahead of the road being built.

Agricultural Land Holdings

Agriculture is the dominant activity to the west of Cookstown and the north east of the Proposed Scheme.

Using the A29 Cookstown Bypass Environmental Web Arc GIS viewer, the predominant Agricultural Land Classification (ALC) across the Proposed Development is Grade 2, consisting of primarily 'Brown Earth Red Trias Sandstone Till'. The land in Cookstown itself and west of the Red Route, including the majority of the Sandholes Link section, is designated as 'Urban'. There are also several sections of ALC Grade 3B, consisting of 'Undifferentiated Alluvium' across the scheme. The largest of these are located close to Ballinderry River (approximately Red Route chainage 150-550), between Golf View and Clare Lane (approximately Red Route chainage 1300-1650) and north of Moneymore Road (Purple B chainage 4000-4350). Small sections of ALC Grade 3B are also located in across the scheme extents. From Red Route chainage 1400-1650 there is also a parcel of ALC Grade 4A, 'Brown Ranker Red Trias Sandstone'. However, as highlighted the majority of the Proposed Development consists of ALC Grade 2.

Walkers, cyclists and horse riders

There are few paths and cycleways within and around the Cookstown. There are no existing equestrian facilities within the Proposed Scheme extents.

There are nine roads to the east of Cookstown town centre with footway facilities extending into the Proposed Scheme extents. They are predominantly the end of footpaths extending to the outermost housing developments, and vary from 1-2m in width. There is light pedestrian use of the footpaths within the Proposed Scheme extents, with a total of 130 journeys recorded along the footpaths within the Proposed Scheme extents surveyed in March 2019 throughout a full day.

A public footpath within Cabin Wood (Woodland Trust Property), known as the Cabin Wood Walk, is a partly circular walk south east of the town, starting south of the roundabout junction of the A29 on Tullywiggan Road running in a northerly direction and circulating around the natural route of the Ballinderry River. It passes through part of the Community Woodland.

Mid Ulster Council Public Rights of Way information[1] highlights PROW 5, along Chapel Road. However, this is over 500m from the proposed route.

The Walking, Cycling and Horse Riding Assessment and Review (WCHAR) Report[2] produced by WSP (October 2019) identifies a PRoW at the rear of Karro Food Group Ltd, however this needs to be investigated further as may have been impacted by the car park constructed here.

The Cookstown Area Plan 2010 includes a proposal for a public footpath and cycleway along the margins of the Ballinderry River.

[1] Mid Ulster Council (2019) Mid Ulster Council Public Rights of Way (Online) Available at: http://data-midulster.opendata.arcgis.com/datasets/mid-ulster-council-public-rights-of-way?geometry=-6.812%2C54.629%2C-6.649%2C54.647 (Accessed 10/09/2019)

[2] WSP (2019) Walking, Cycling And Horse-Riding Assessment, A29 Cookstown Bypass.

The National Cycle Route (Sustrans 95) crosses the study area in a generally west-east direction as it passes from the Sperrins through to Tynan. Following this route in the western corridor and onto A29 James Street in the town centre is the way marked Sperrins Route 5 (The White Hare Cycle Route). The route follows the A29 north through the town centre, then heads north along Coolreaghs Road towards Churchtown before branching off towards either Moneymore or the Sperrins. The Northern Ireland Tourist Board promotes this 58 km route as a discovery of legends and archaeological features. The Sustrans 95 and Sperrins Route bisects the Red Route, Purple A and Purple B proposed route options along Clare Lane. There are no cycle lanes or road markings to indicate this route, with National Cycle Route signs installed at each junction.

A shared use off road cycle route approximately 3 m in width is located on the western side of Sandholes Road, travelling from the junction with Drum Road to the junction with Sandholes East-West road.

In addition to these routes, there is a dismantled railway running parallel to the A29 in a north-east direction. This path, together with a few unmarked tracks in the study area, (in particular to the west of Cookstown), have the potential to be used as pedestrian routes.

Human Health

A baseline health profile for Cookstown is provided below using the most recent, publicly available data. Where possible comparison is made to regional (Mid Ulster) and national (Northern Ireland) figures.

The population of Cookstown, Mid Ulster and Northern Ireland are broken down by age groups and shown below in Table **1-4**. Overall, the age group proportions are similar in Cookstown to the regional and national averages, though Cookstown has a slightly smaller proportion of Older People (Aged 65+) than the average for Northern Ireland. The change in population in Cookstown was slightly lower than that for Mid Ulster, but higher than the average for Northern Ireland as a whole.

Table 1-4 – Population by Age Group

	Cookstown	Mid Ulster	Northern Ireland
Total Resident Population	38,734	147,392	1,881,641
Aged under 16	8,755 (22.60%)	34,248 (23.2%)	393,510 (20.9%)
Aged 16-39	12,332 (31.84%)	46,995 (31.9%)	579,513 (30.8%)
Aged 40-64	11,860 (30.62%)	45,084 (30.6%)	600,421 (31.9%)
Aged 65+	5,787 (14.94%)	21,065 (14.3%)	308,197 (16.4%)
Population Change % (2008-2018)	8.0	10.3	5.8

A summary of indicators compiled by the Department of Health[3] provide an overall picture of the health of the population in Mid Ulster compared to the national average, shown below in Table **1-5**

Table 1-5 – General Health Indicators

	Year	Mid Ulster	Northern Ireland
Life expectancy at birth, Male (years)	2015-17	79.4	78.5
Life expectancy at birth, Female (years)	2015-17	82.7	82.3
Standardised Admission Rate, Circulatory (admissions per 100,000 population)	2015/16-17/18	2,204	2,062
Standardised Death Rate, Circulatory under 75 years (deaths per 100,000)	2013-17	69	74
Standardised Admission Rate, Respiratory (admissions per 100,000 population)	2015/16-17/18	2,008	2,074
Standardised Death rate, Respiratory under 75 (deaths per 100,000 population)	2013-17	32	34

The Department for Health regularly report on health outcomes, such as standard admission rates for different causes, for each Local Government District (LGD) in Northern Ireland. In the 2017 Sub-regional Inequalities Report[4] of the 41 indicators analysed, in Mid Ulster 26 were better than the Northern Ireland average, nine were similar, and six were worse. A total of 26 health outcomes were

[3] Department of Health (2019) The Health Inequalities Annual Report Life, (Online). Available at: https://www.health-ni.gov.uk/publications/health-inequalities-annual-report-2019 (Accessed 10/09/2019)
[4] The Department of Health (2017) Sub-regional inequalities by local government district (LGD) 2017, (Online). Available at:https://www.health-ni.gov.uk/publications/sub-regional-inequalities-by-local-government-district-lgd-2017 (Accessed 10/09/2019)

assessed for each Mid Ulster District Electoral Area (DEA), and in Cookstown. None of the indicators were better than the Mid-Ulster average, with 16 health outcomes reported as similar, and 10 worse. While health outcomes are better in Mid Ulster than the national average, health outcomes in Cookstown are worse than the regional average.

The 2017 Health Inequalities Sub-regional report for Mid-Ulster[5] include deprivation profiles for each of the seven DEA, including Cookstown. Deprivation scores were calculated for each DEA, ranging from -100 (where the entire population falls in the most deprived quintile) to 100 (where the entire population falls in the least deprived quintile). The deprivation score calculated for Cookstown was -41, as 65% of the population live in the two most deprived quintiles. The most deprived DEA in Mid Ulster was Torrent (with a Deprivation Score of -62), and the least deprived was Moyola (with a Deprivation Score of +52).

Cookstown falls within the Northern Health and Social Care (HSC) Trust which provides integrated health and social are services to the local council areas of Coleraine, Moyle, Larne, Antrim, Carrickfergus, Newtownabbey, Ballymoney, Ballymena, Magherafelt and Cookstown. Trusts manage and administer hospitals, health centres, residential homes, day centres and other health and social care facilities, providing a range of health and social care services to their communities. Table **1-6** below provides indicators comparing the Northern HSC Trust with the averages for Northern Ireland, demonstrating that population health in the Northern HSC Trust is similar to the Northern Ireland average.

Table 1-6 – Health and Social Care Trust: General Health Indicators[6]

	year	Northern HSC Trust	Northern Ireland
General Health (% Very Good/Good)	2017/18	71	70
Longstanding illness (%)	2017/18	44	43
Limiting longstanding illness (%)	2017/18	30	32
Prevalence of cigarette smoking (% current cigarette smokers, adults)	2017/18	16	18

[5] The Department of Health (2017) Sub-regional inequalities by local government district (LGD) 2017, (Online). Available at:https://www.health-ni.gov.uk/publications/sub-regional-inequalities-by-local-government-district-lgd-2017 (Accessed 10/09/2019)

[6] Department for Health (2018) Public Health NI fact Sheet Data Tables 2018, (Online) Available at: https://www.health-ni.gov.uk/publications/public-health-ni-fact-sheet-2018 (Accessed 10/09/2019).

Prevalence of drinking alcohol (% adults who are drinkers)	2017/18	76	77
Year 8 Body Mass Index: Overweight or obese (% Overweight or obese)	2016/17	29	29
BMI Classifications (adults): Overweight or obese	2017/18	68	64

FUTURE BASELINE

Between 2008-2018 Cookstown's population change was recorded to increase by 8.0%. This is less than the Mid Ulster rate (10.3%) and greater than Northern Ireland (5.8%), but is still following the shared upward trend.

Population growth is projected for each LGD over the next decade. Ageing of the population is set to continue, with the Northern Ireland population aged 65 and over projected to increase by 25.0% with Mid-Ulster projected to experience a 32.0% increase7. Mid Ulster is set to experience a growth of 48.1% in the category of those aged 85 and over, the highest percentage growth nationally in this age category8. At the Northern Ireland level, the proportion of the population aged 65 and over is projected to overtake that of children by 2028, with this being the case across all LGD's by 2035.

SENSITIVE RECEPTORS

The Land Use and Accessibility study area is based on the construction footprint/project boundary (including compounds and temporary land take) plus a 500 m area surrounding the project boundary. Receptors within this study area include;

- Private property and housing, including land allocated for housing;
- Community land and assets;
- Development land and businesses, including employment sites (excluding agriculture) and land allocated for employment;
- Agricultural land holdings;
- WCH rights of way and other routes used for recreation or commuting.

The Human Health study area is defined based on the following:

[7] Northern Ireland Statistics and Research Agency (2018) 2016-based Population Projections for Areas Within Northern Ireland (Online) Available at: https://www.nisra.gov.uk/news/2016-based-population-projections-areas-within-northern-ireland

[8] Northern Ireland Statistics and Research Agency (2018) 2016-based Population Projections for Areas Within Northern Ireland (Online) Available at: https://www.nisra.gov.uk/news/2016-based-population-projections-areas-within-northern-ireland

1) the extent and characteristics of a project, and

2) the communities/wards directly and indirectly affected by the project.

Receptors within the study area consist of the population of the Cookstown District Electoral Area.

LIMITATIONS AND ASSUMPTIONS

- The Green route option was added subsequent to the site visit conducted on 19 to 20 February 2019 – for the purposes of the Stage 2 options selection this is not considered to be a significant limitation to the robustness of the assessment given its proximity to the other proposed route options.
- The assessment relies on data provided by third parties (e.g. OS Mapping, local authorities, NISRA, etc) which are the most up-to-date, available at the time of the assessment. However, no significant changes or limitations in these datasets have been identified that would affect the robustness of the baseline presented.
- For the purpose of Human Health, vulnerable groups have been assumed to be present throughout the Study Area.
- No information on the temporary land take that may be required for construction activities is available at this stage of the assessment.
- Land parcels where less than 1sqm will be taken for the proposed scheme, and road parcels (where ownership by DfI has been assumed) are not included in the figures for land take.

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APPENDIX B-13:

ROAD DRAINAGE AND THE WATER ENVIRONMENT: WATER QUALITY CALCULATIONS

Department for Infrastructure

STAGE 2 SCHEME ASSESSMENT REPORT: WATER QUALITY CALCULATIONS

A29 Cookstown Bypass

AUGUST 2020

CONFIDENTIAL

Department for Infrastructure

STAGE 2 SCHEME ASSESSMENT REPORT: WATER QUALITY CALCULATIONS

A29 Cookstown Bypass

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 718314

DATE: AUGUST 2020

Department for Infrastructure

STAGE 2 SCHEME ASSESSMENT REPORT: WATER QUALITY CALCULATIONS

A29 Cookstown Bypass

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft			
Date	04/09/2020			
Prepared by	Marta Ibanez			
Signature				
Checked by	Phil Jenn			
Signature				
Authorised by				
Signature				
Project number	718314			
Report number				
File reference	Water Quality Calculations			

CONTENTS

CHAPTER 1

This report provides a technical appendix to the A29 Cookstown Bypass Stage 2 Scheme Assessment Report, Section 6.11 Road Drainage and the Water Environment.

AIMS AND OBJECTIVES

This document provides the calculations and results of water quality assessments for the operational phase of the proposed scheme, discussed in Section 6.11.

This document provides an assessment of:

- Pollution during road operation due to contaminants within routine road runoff. A broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road surface during rainfall events, polluting the receiving surface water bodies and groundwater aquifers.
- Pollution during road operation due to spillage. On all roads there is a risk that accidents or vehicle fires may lead to an acute pollution incident. Where commercial vehicles are involved, potential pollutants that may be spilled could range from hazardous chemicals to milk, alcoholic beverages, organic sludge and detergents. Spilled materials may drain from the road surface, polluting the receiving surface water bodies and groundwater aquifers.

ASSESSMENT APPROACH AND METHODOLOGY

Preliminary drainage network data is detailed in Section 5 Engineering Assessment.

The drainage design, outfall locations and areas draining to several of these outfalls vary between the route options.

The drainage design for each route option includes one level of treatment, in the form of sustainable drainage systems (SuDS), as standard. The proposed treatment consists of filter drains.

The water quality assessments within this report have taken this treatment into account as the proposed SuDS are an intrinsic part of the proposed road design and are not considered to be additional mitigation.

SURFACE WATER ASSESSMENTS

Section 6.11 summarises the procedures for the assessment of pollution impacts from routine runoff on surface water, as provided in DMRB LA 113.

The assessments can be split into two categories; Tier 1 and Tier 2. Tier 1 can be defined as a simple assessment in which an estimated or known river width is used to estimate sediment impacts upon the receiving watercourse. Tier 2 is a more detailed assessment which requires detailed survey data for the receiving watercourse. Assessments at DMRB Stage 2 have been conducted as Tier 1 simple assessments, with Tier 2 assessment to be conducted, where applicable, at Stage 3 as more design and watercourse data becomes available.

A total of 30 individual drainage networks intended to discharge to surface waters have been assessed against this method.

SPILLAGE ASSESSMENT

DMRB LA 113 specifies procedures for the assessment of pollution impacts on both surface and groundwaters from accidental spillage. A summary of this methodology is provided in Section 6.11.

A total of 30 drainage discharges have been assessed against this method.

CUMULATIVE ASSESSMENT

Cumulative assessment of proposed road discharges in close proximity to each other has been undertaken at DMRB Stage 2. However, all drainage networks and treatment measures shall be refined and re-assessed following the selection of the preferred route and additional data collation, with the final design reported at DMRB Stage 3.

LIMITATIONS

Detailed topographic survey data is not currently available for the watercourses where outfalls are proposed, and therefore the routine runoff and spillage assessments have been undertaken using some reasonable assumptions for a number of the input parameters. Additional data to update the assessments will be obtained during Stage 3.

At Stage 2, there is no information available regarding discharge quantities from the existing outfalls for the Sandholes Link Road, nor information available on the permeable area discharging to the outfalls. This information will be confirmed at Stage 3 once a route is confirmed, and assessment then carried out.

RESULTS

The route options involve a total of 30 preliminary drainage networks, which are intended to discharge to surface water.

Sensitive receptors have been identified as part of the Stage 2 assessment. Of the proposed surface water discharges, none discharge directly into or are within 1km upstream of a sensitive receptor. In context for this assessment, sensitive receptors are considered as internationally or nationally designated sites, specifically protected and recognised for hydrological or ecological purposes (e.g. Special Areas of Conservation (SACs) or Areas of Special Scientific Interest (ASSIs)).

The results for each individual drainage network are summarised in Tables 1 to 4 for each route option.

HEWRAT datasheets are provided in Annex A.1 of this report, which includes details on the baseline conditions of the receiving watercourse, proposed mitigation and summary results. Annex A.2 contains spillage parameters and results for all drainage networks within the proposed scheme.

Table 1. Summary of Individual HEWRAT, EQS and Spillage Results for Red Route

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-RR-01	Filter Drains	Ballinderry River	Pass	Pass	0.00	1	Pass	0.00	Pass	0.01	Pass	9,271	Pass
OF-RR-02	Filter Drains	Ballinderry River	Pass	Pass	0.00	4	Pass	0.01	Pass	0.02	Pass	22,673	Pass
OF-RR-03	Filter Drains	Ballinderry River	Pass	Pass	0.00	4	Pass	0.01	Pass	0.02	Pass	13,805	Pass
OF-RR-04	Filter Drains	Fountain Road Stormwater Drain	**Fail**	Pass	0.00	51	Pass	0.92	Pass	1.76	Pass	2,418	Pass
OF-RR-05	Filter Drains	Molesworth Stormwater Drain	Pass	Pass	0.00	6	Pass	0.32	Pass	0.61	Pass	37,627	Pass
OF-RR-06	Filter Drains	Undesignated	Pass	Pass	0.05	64	Pass	0.40	Pass	0.76	Pass	22,649	Pass

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-RR-07	Filter Drains	Undesignated	Pass	Pass	0.05	45	Pass	0.29	Pass	0.56	Pass	31,877	Pass
OF-RR-08	Filter Drains	Undesignated	Pass	Pass	0.01	35	Pass	0.32	Pass	0.61	Pass	5,680	Pass
OF-RR-01, OF-RR-02 and OF-RR-03	Filter Drains	Ballinderry River	Pass	Pass	-	-	-	0.02	Pass	0.07	Pass	4,456	Pass
OF-RR-04 and OF-RR-05	Filter Drains	Fountain Road Stormwater Drain	**Fail**	Pass	-	-	-	1.10	**Fail**	2.11	Pass	2,271	Pass
OF-RR-06 and OF-RR-07	Filter Drains	Unnamed drain	Pass	Pass	-	-	-	0.61	Pass	1.17	Pass	13,240	Pass

Table 2. Summary of Individual HEWRAT, EQS and Spillage Results for Purple A Route

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-PA-01	Filter Drains	Ballinderry River	Pass	Pass	0.01	35	Pass	0.00	Pass	0.61	Pass	13,264	Pass
OF-PA-02	Filter Drains	Ballinderry River	Pass	Pass	0.01	4	Pass	0.01	Pass	0.01	Pass	32,175	Pass
OF-PA-03	Filter Drains	Ballinderry River	Pass	Pass	0.01	6	Pass	0.01	Pass	0.02	Pass	15,819	Pass
OF-PA-04	Filter Drains	Fountain Road Stormwater Drain	Pass	Pass	0.00	32	Pass	0.65	Pass	1.25	Pass	25,490	Pass

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-PA-05	Filter Drains	Molesworth Stormwater Drain	Pass	Pass	0.00	45	Pass	0.36	Pass	0.70	Pass	2,952	Pass
OF-PA-06	Filter Drains	Undesignated	Pass	Pass	0.08	55	Pass	0.50	Pass	0.96	Pass	8,720	Pass
OF-PA-07	Filter Drains	Undesignated	**Fail**	Pass	0.01	161	**Fail**	1.03	**Fail**	1.99	Pass	12,927	Pass
OF-PA-01, OF-PA-02 and OF-PA-03	Filter Drains	Ballinderry River	Pass	Pass	-	-	-	0.02	Pass	0.04	Pass	5,893	Pass
OF-PA-04 and OF-PA-05	Filter Drains	Fountain Road Stormwater Drain	**Fail**	Pass	-	-	-	1.24	**Fail**	2.33	Pass	2,645	Pass

Table 3. Summary of Individual HEWRAT, EQS and Spillage Results for Purple B Route

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-PB-01	Filter Drains	Ballinderry River	Pass	Pass	0.01	2	Pass	0.00	Pass	0.01	Pass	12,248	Pass
OF-PB-02	Filter Drains	Ballinderry River	Pass	Pass	0.01	4	Pass	0.01	Pass	0.01	Pass	28,323	Pass
OF-PB-03	Filter Drains	Ballinderry River	Pass	Pass	0.01	6	Pass	0.01	Pass	0.02	Pass	13,898	Pass
OF-PB-04	Filter Drains	Fountain Road Stormwater Drain	Pass	Pass	0.00	32	Pass	0.65	Pass	1.25	Pass	22,378	Pass
OF-PB-05	Filter Drains	Molesworth Stormwater Drain	Pass	Pass	0.00	45	Pass	0.36	Pass	0.70	Pass	2,997	Pass

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-PB-06	Filter Drains	Undesignated	Pass	Pass	0.00	46	Pass	0.43	Pass	0.83	Pass	13,548	Pass
OF-PB-07	Filter Drains	Undesignated	Pass	Pass	0.13	-	Pass	0.45	Pass	0.88	Pass	5,424	Pass
OF-PB-01, OF-PB-02 and OF-PB-03	Filter Drains	Ballinderry River	Pass	Pass	-	-	-	0.02	Pass	0.04	Pass	5,293	Pass
OF-PB-04 and OF-PB-05	Filter Drains	Fountain Road Stormwater Drain	**Fail**	Pass	-	-	-	1.24	**Fail**	2.39	Pass	2,642	Pass

Table 4. Summary of Individual HEWRAT, EQS and Spillage Results for Green Route

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-GR-01	Filter Drains	Ballinderry River	Pass	Pass	0.01	4	Pass	0.01	Pass	0.01	Pass	2,234	Pass
OF-GR-02	Filter Drains	Ballinderry River	Pass	Pass	0.01	4	Pass	0.03	Pass	0.01	Pass	4,076	Pass
OF-GR-03	Filter Drains	Fountain Road Stormwater Drain (Ballinderry River (Derrygonnigan Catchment))	Pass	Pass	0.00	18	Pass	0.41	Pass	0.78	Pass	27,584	Pass

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-GR-04	Filter Drains	Fountain Road Stormwater Drain (Ballinderry River (Derrygonnigan Catchment))	Pass	Pass	0.00	70	Pass	0.52	Pass	1.01	Pass	1,934	Pass
OF-GR-05	Filter Drains	Undesignated	Pass	Pass	0.00	56	Pass	0.31	Pass	0.61	Pass	9,698	Pass
OF-GR-06	Filter Drains	Undesignated	**Fail**	**Fail**	0.00	267	**Fail**	1.70	**Fail**	3.44	Pass	20,027	Pass
OF-GR-07	Filter Drains	Undesignated	**Fail**	**Fail**	0.00	172	**Fail**	1.69	**Fail**	3.24	Pass	15,244	Pass

Drainage Network ID	Mitigation	Receiving Water body	HEWRAT Acute Impact Assessment		HEWRAT Chronic Impact Assessment			EQS Assessment				Spillage	
					Sediment			Annual Average Dissolved Cooper		Annual Average Dissolved Zinc			
			Soluble Copper	Soluble Zinc	Low Flow Vel. (m/s)	Deposition Index	Pass / Fail	Value (µ g/l)	Pass / Fail	Value (µ g/l)	Pass / Fail	Return Period 1 in "x" (years)	Pass / Fail
OF-GR-08	Filter Drains	Undesignated	Pass	Pass	0.00	48	Pass	0.41	Pass	0.79	Pass	5,673	Pass
OF-GR-01 and OF-GR-02	Filter Drains	Ballinderry River	Pass	Pass	-	-	-	0.04	Pass	0.07	Pass	1,443	Pass
OF-GR-03 and OF-GR-04	Filter Drains	Fountain Road Stormwater Drain (Ballinderry River (Derrygonnigan Catchment))	**Fail**	Pass	-	-	-	1.33	**Fail**	2.54	Pass	1,808	Pass
OF-GR-07 and OF-GR-08	Filter Drains	Undesignated	**Fail**	**Fail**	-	-	-	1.34	**Fail**	3.73	Pass	4,135	Pass

CONCLUSION

There is a total of 30 preliminary road drainage network options. After applying the planned mitigation, 26 networks discharging to surface waters meet acceptable HEWRAT and EQS standards for routine runoff impacts. Of the ten cumulative assessments, five fail to meet the standards for soluble metals.

Spillage calculations and assessments were conducted for each proposed route. All networks pass the higher standard of at least a 1 in 200 year return period (to be applied where sensitive receptors are identified within 1km downstream). The minimum return period has been calculated as 1 in 1,443 years return period.

All drainage networks and treatment measures shall be refined and assessed following the selection of the preferred route and additional data collation during DMRB Stage 3.

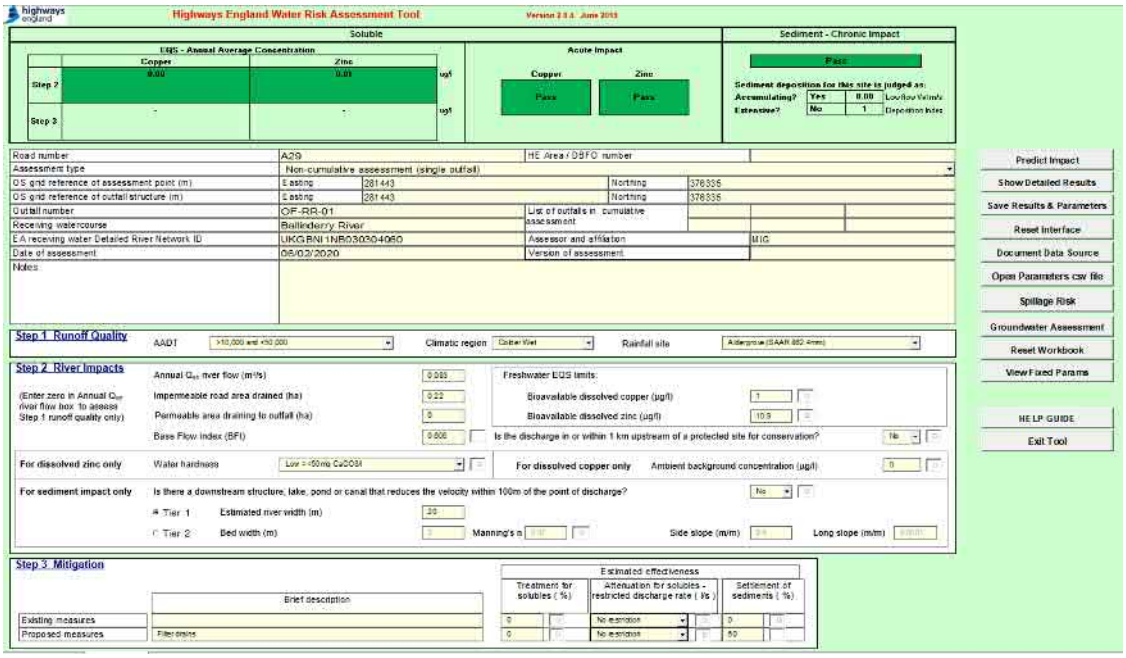
ANNEX A. CALCULATIONS

A.1 HEWRAT CALCULATIONS

RED ROUTE

OF-RR-01

Copper



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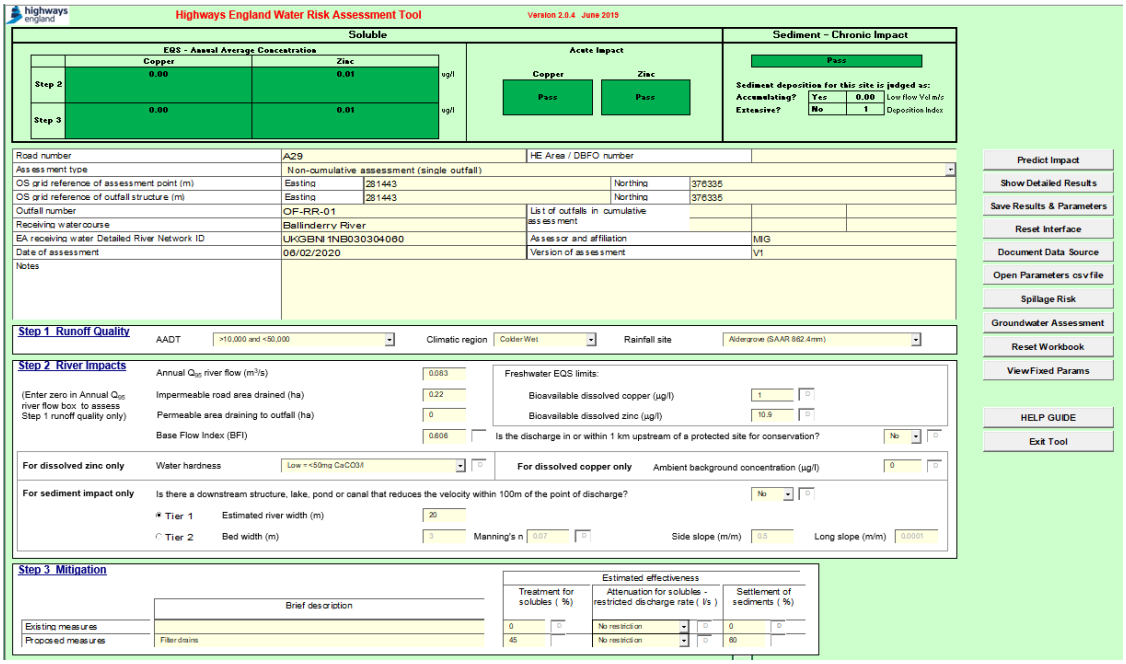
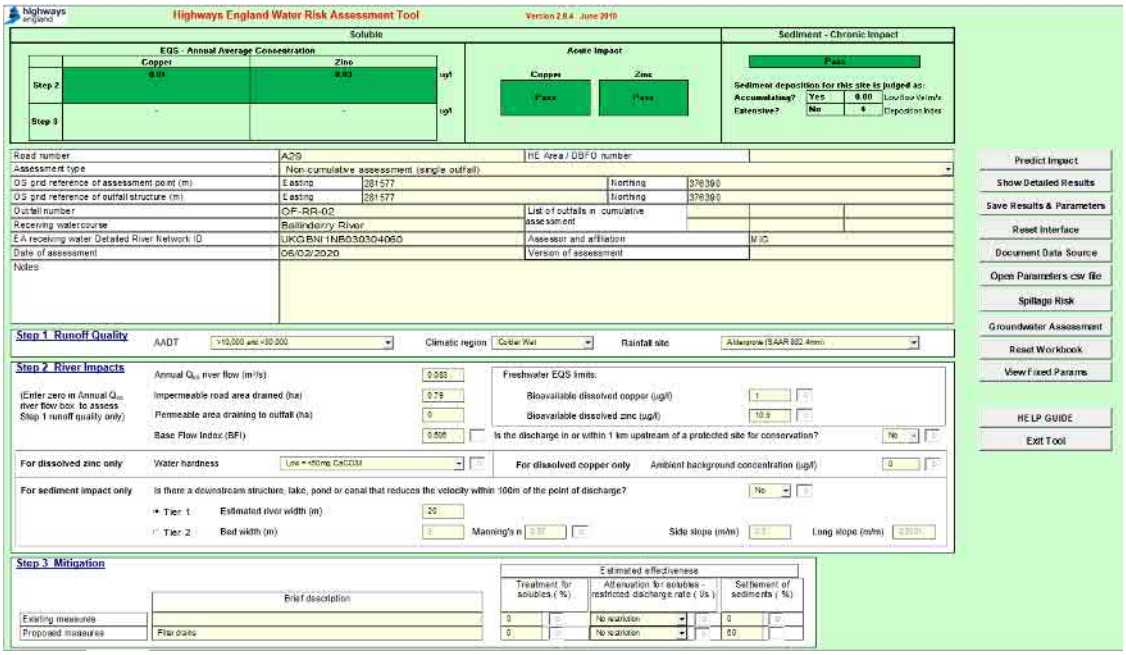


OF-RR-02

Copper



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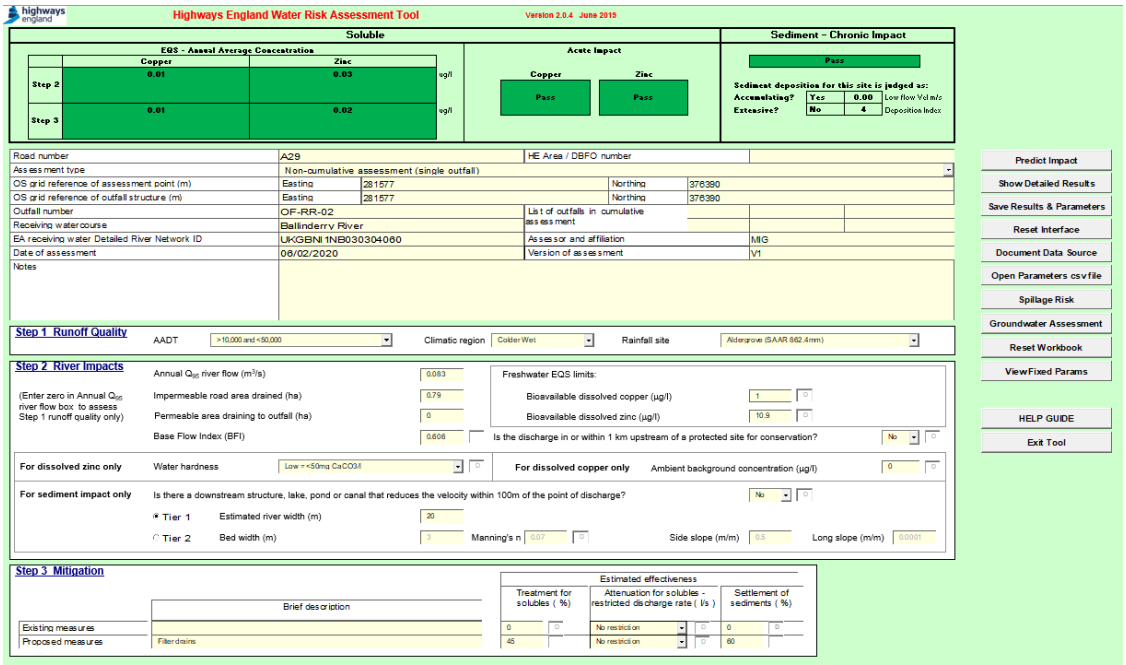
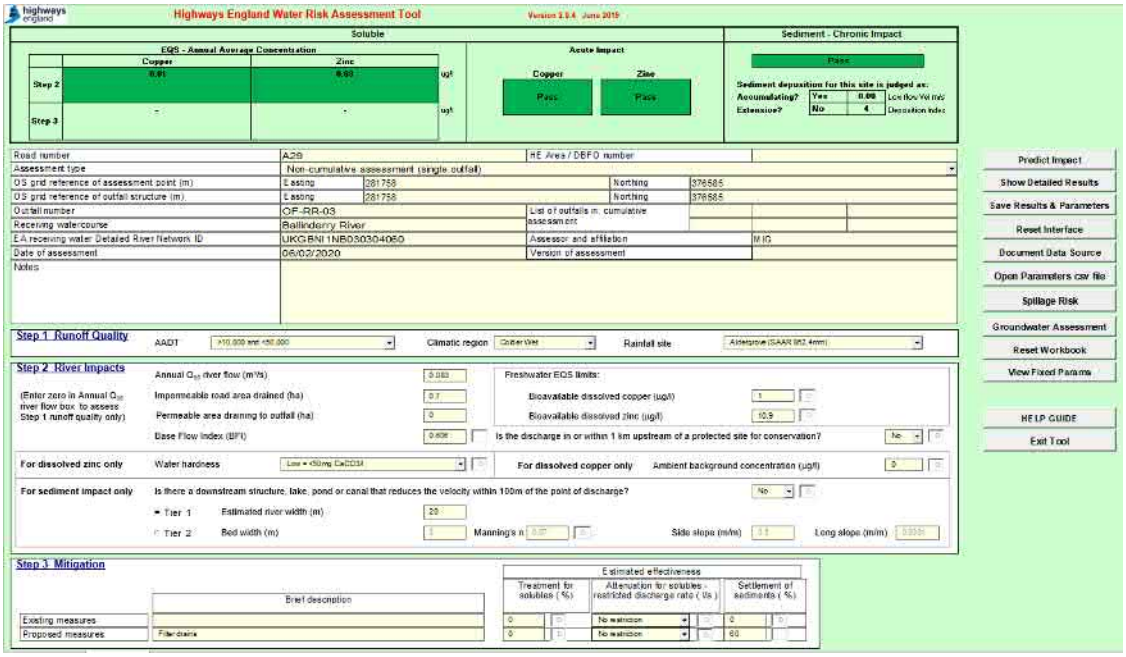


OF-RR-03

Copper



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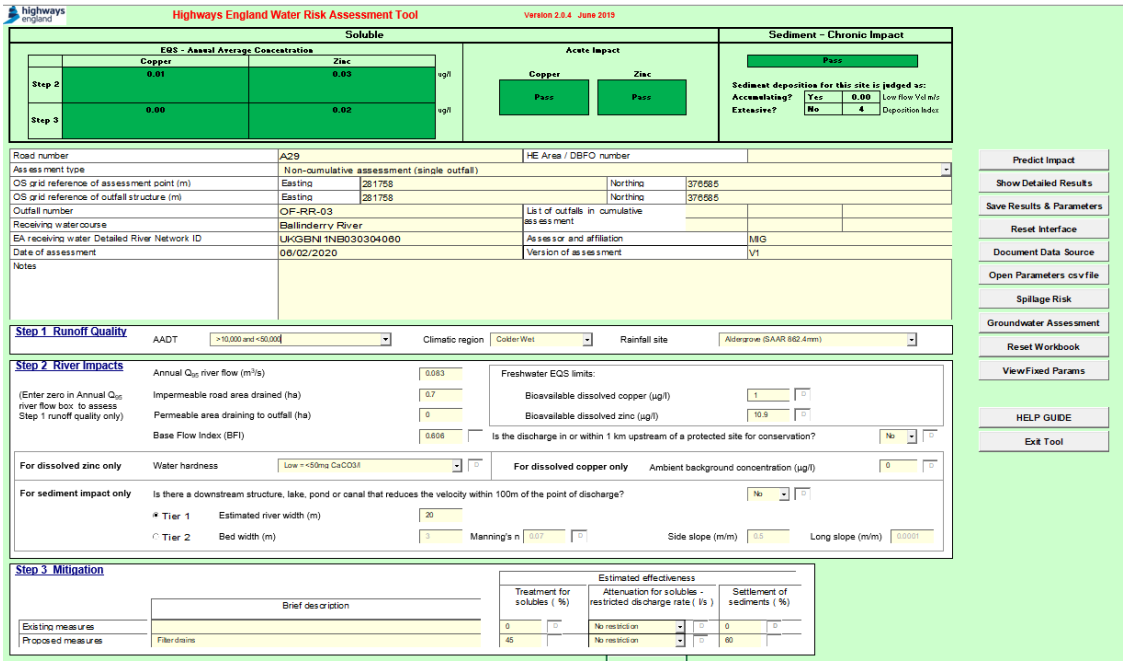
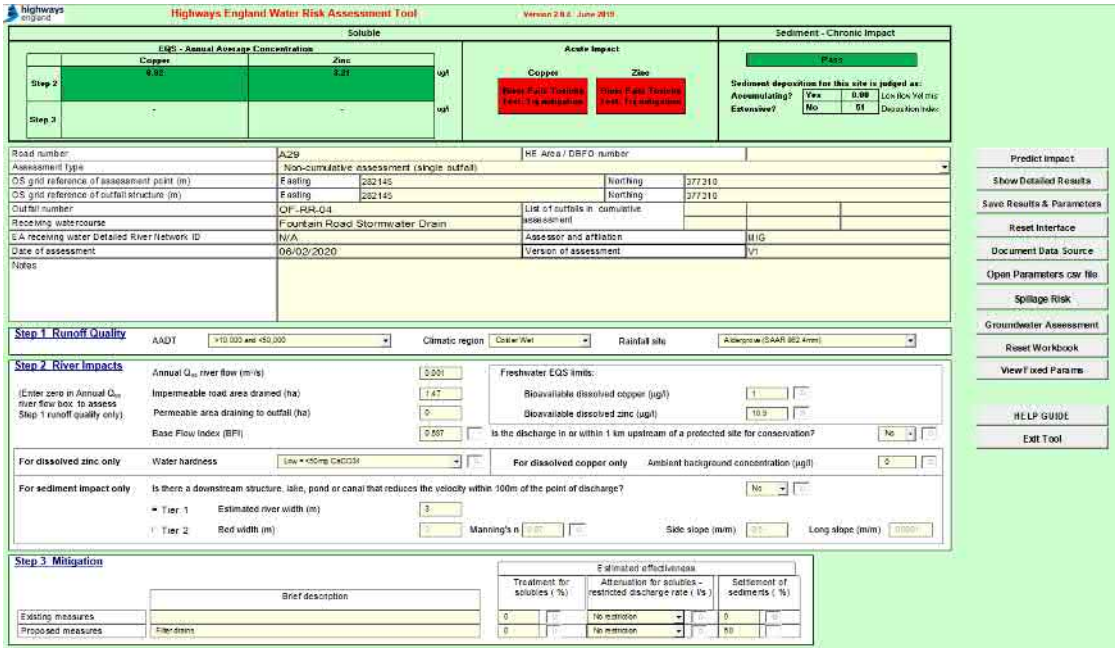


OF-RR-04

Copper



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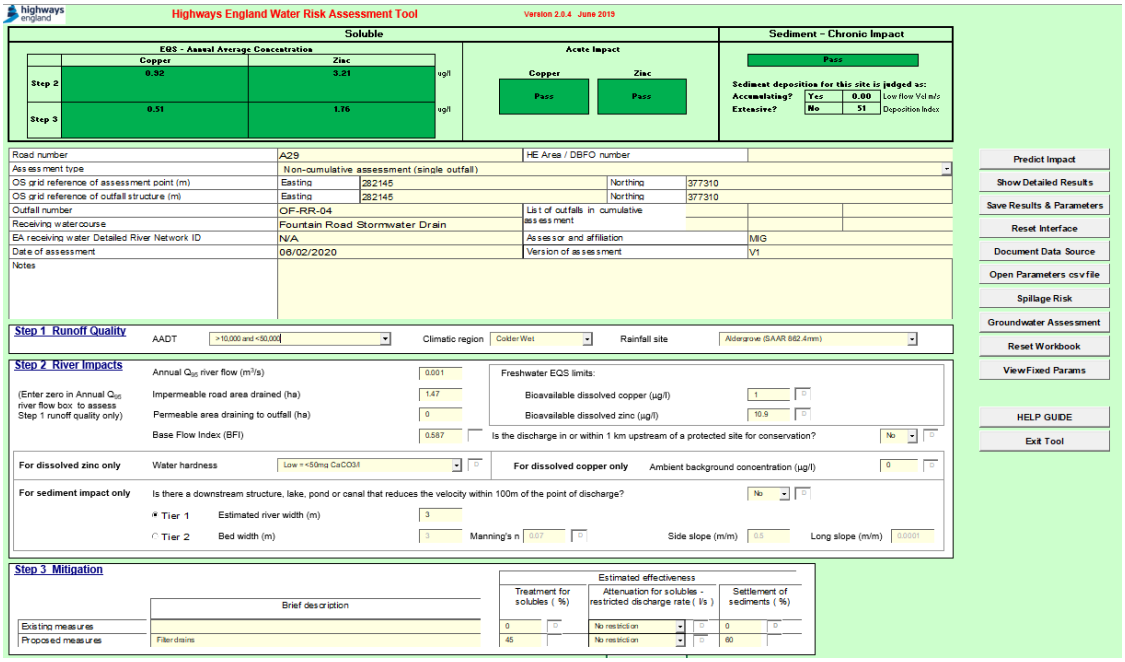

OF-RR-05

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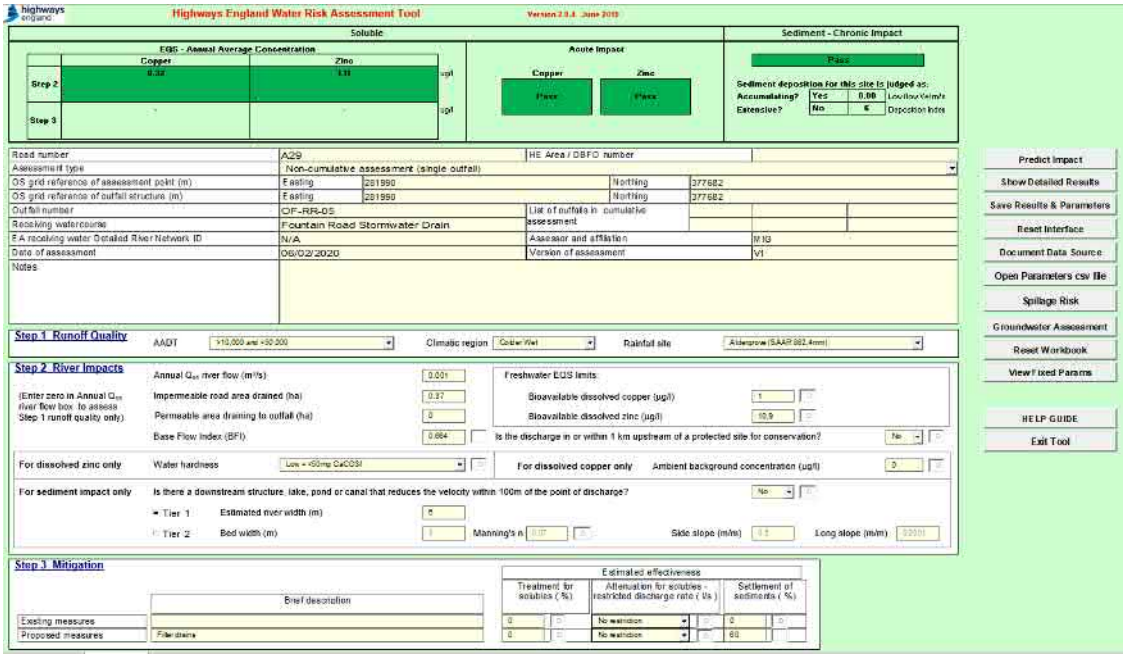

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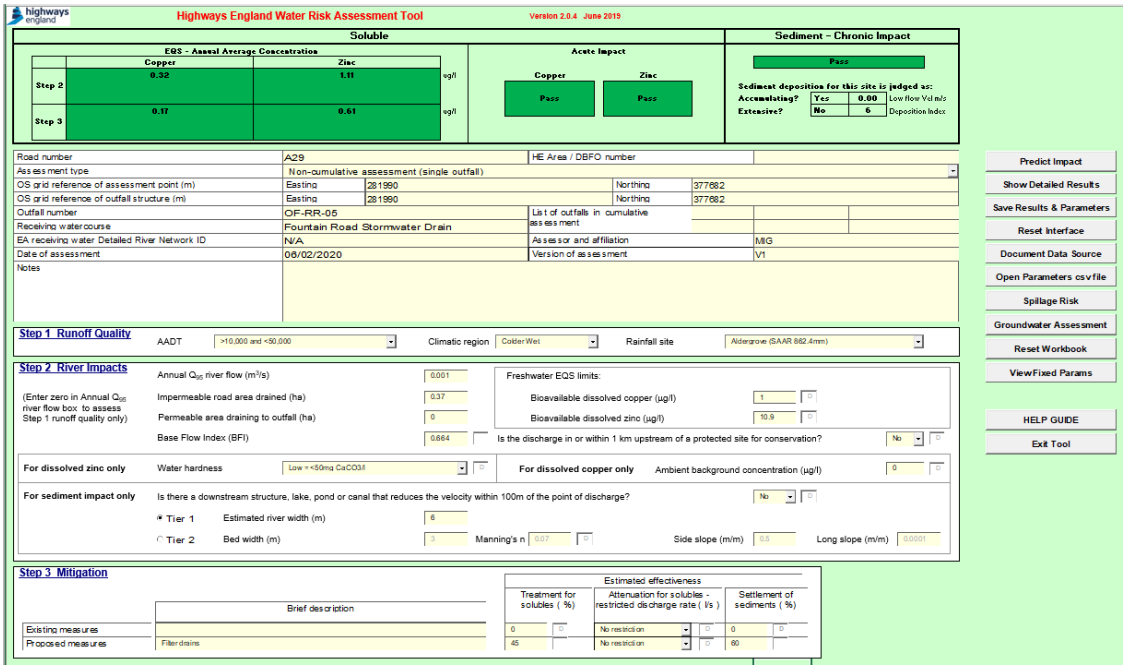

OF-RR-06

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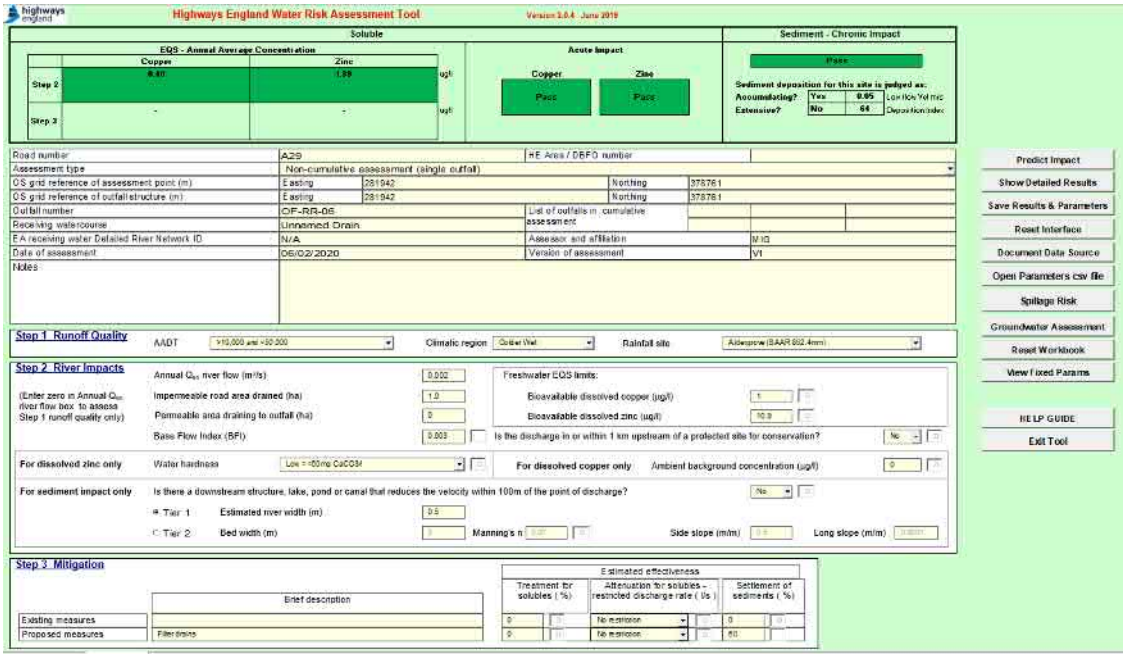

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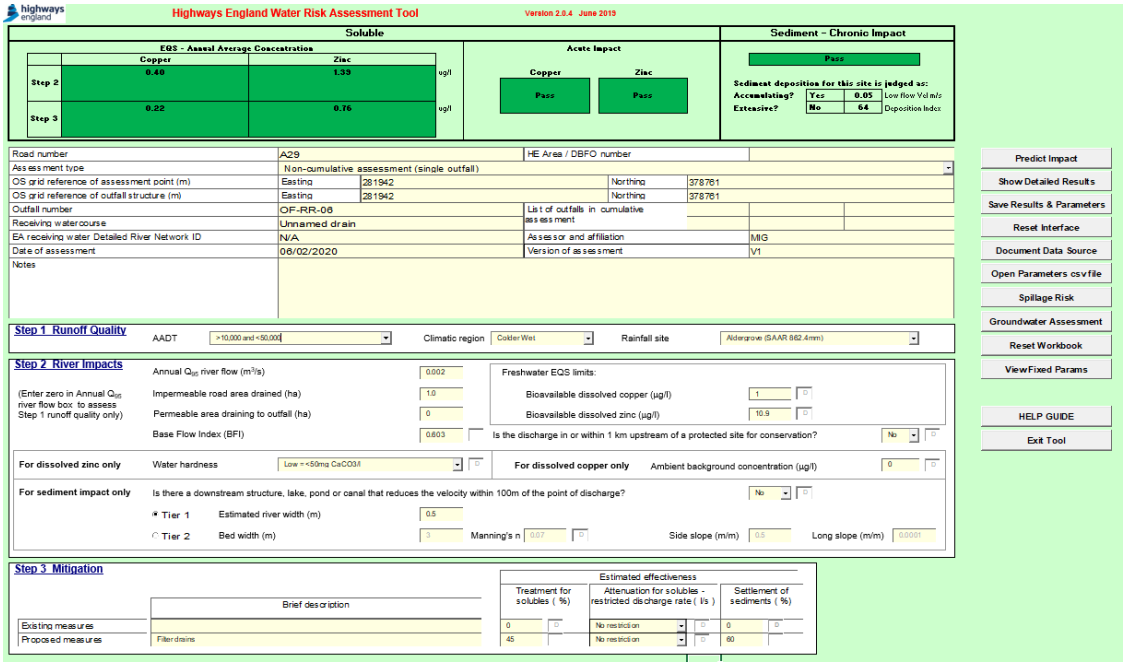

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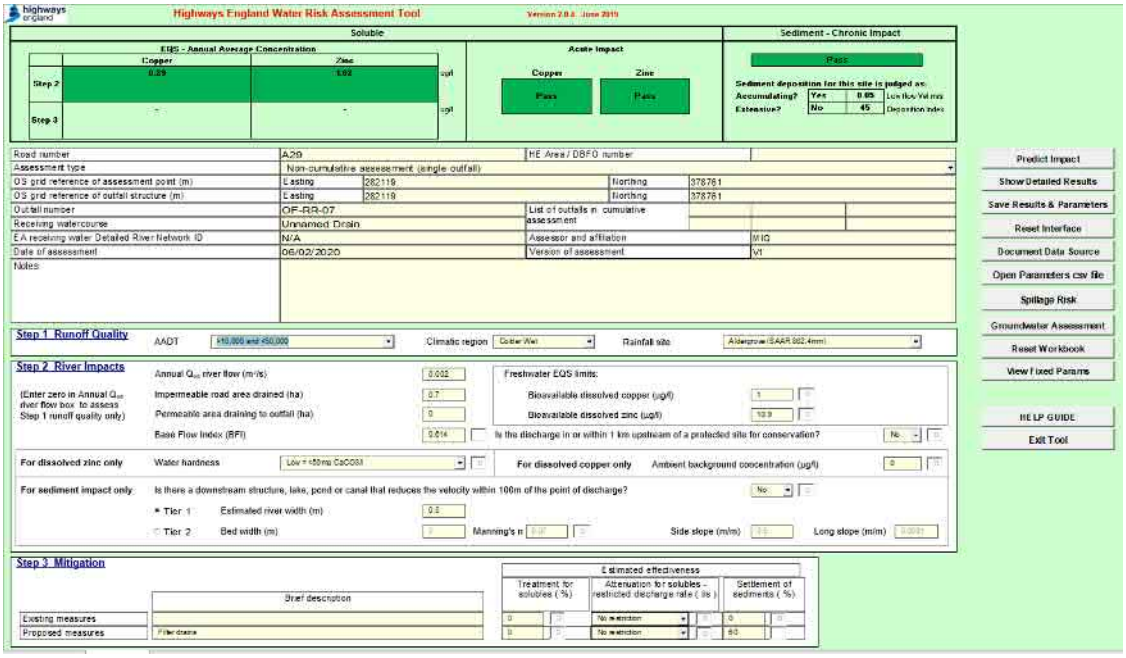

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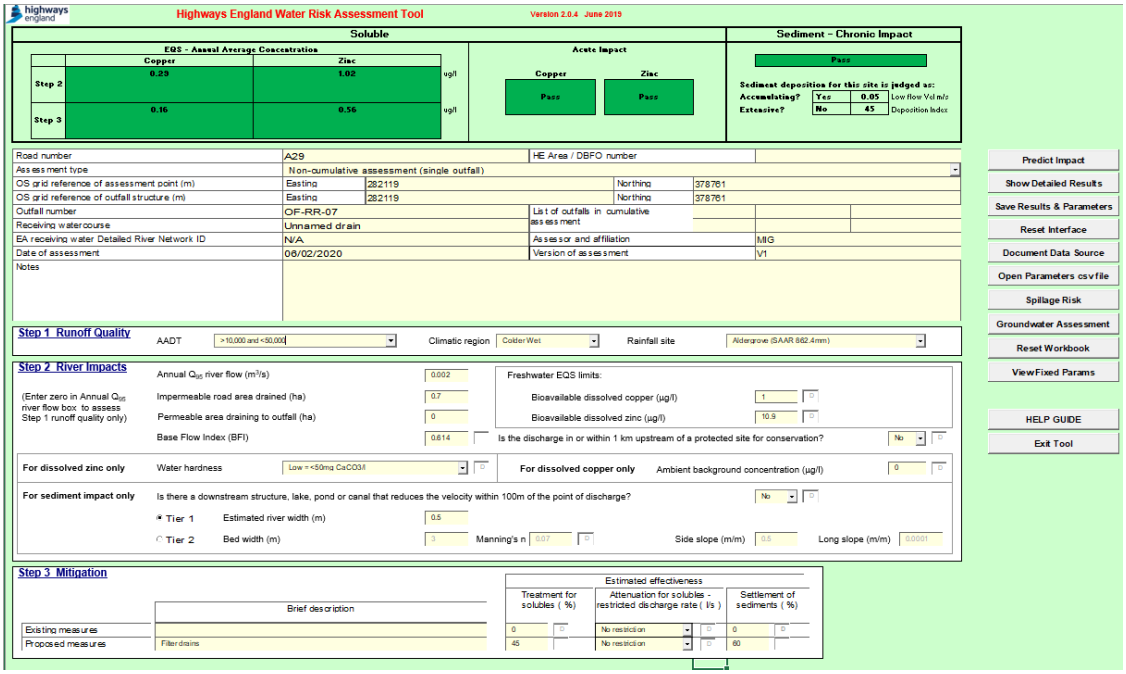

OF-RR-08

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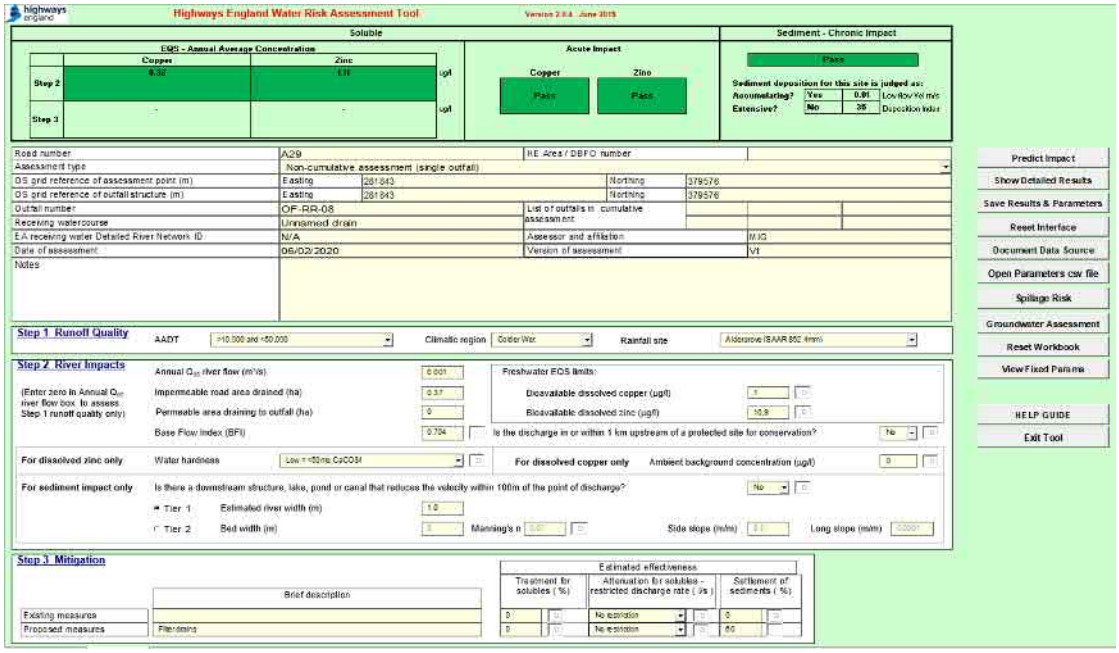

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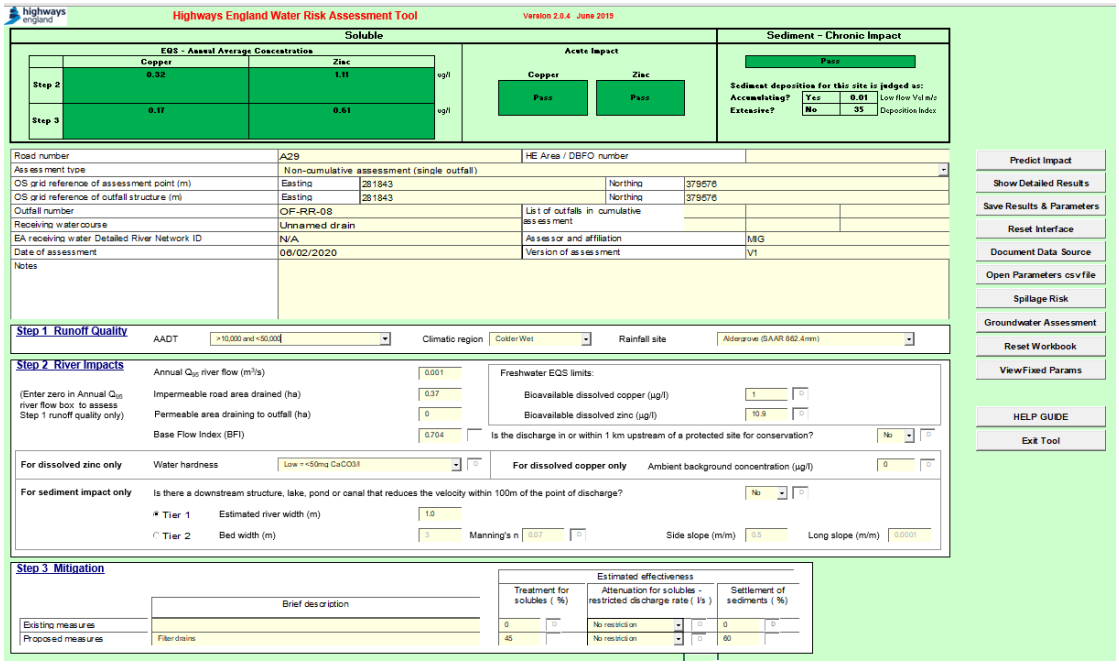
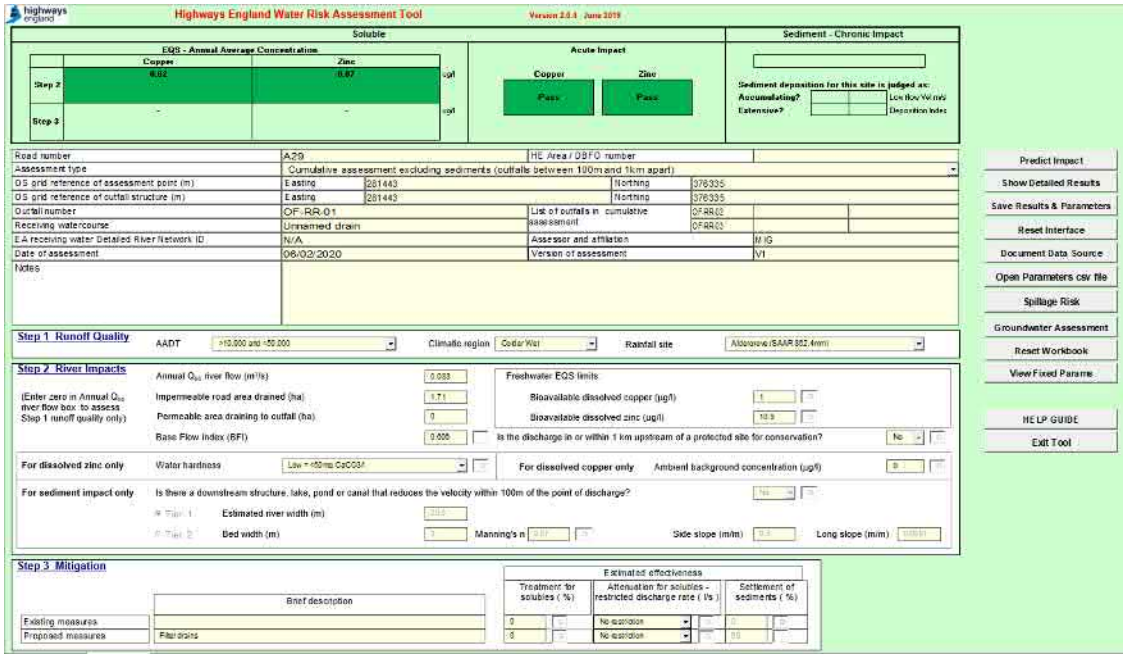


Cumulative (OF-RR-01, OF-RR-02 and OF-RR-03)

Copper



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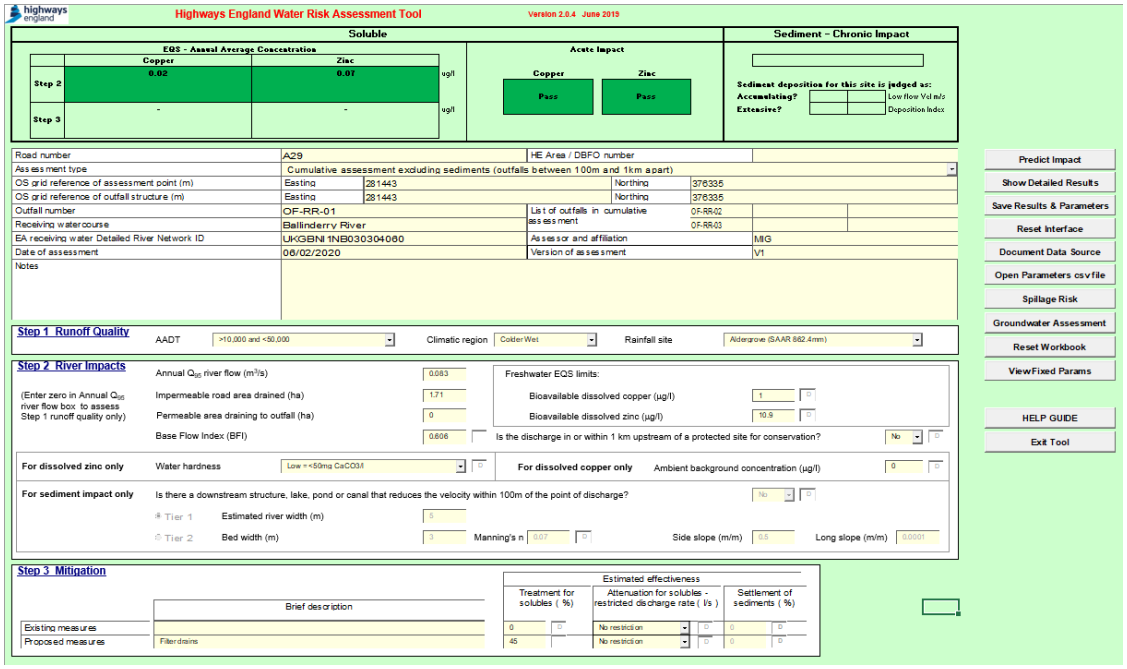

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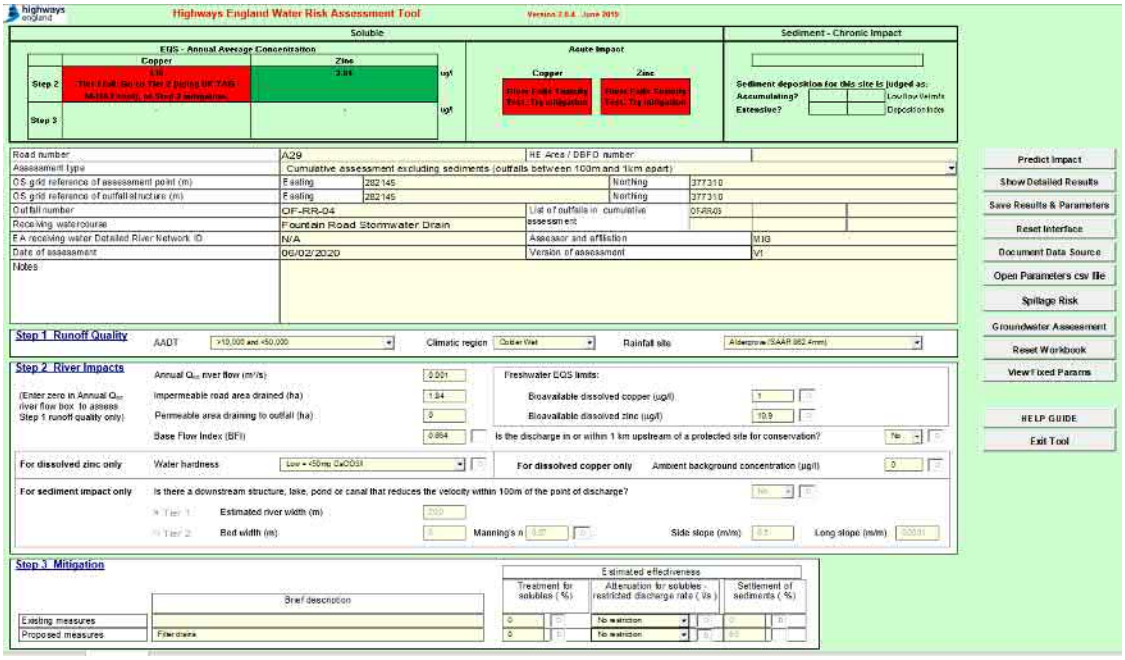

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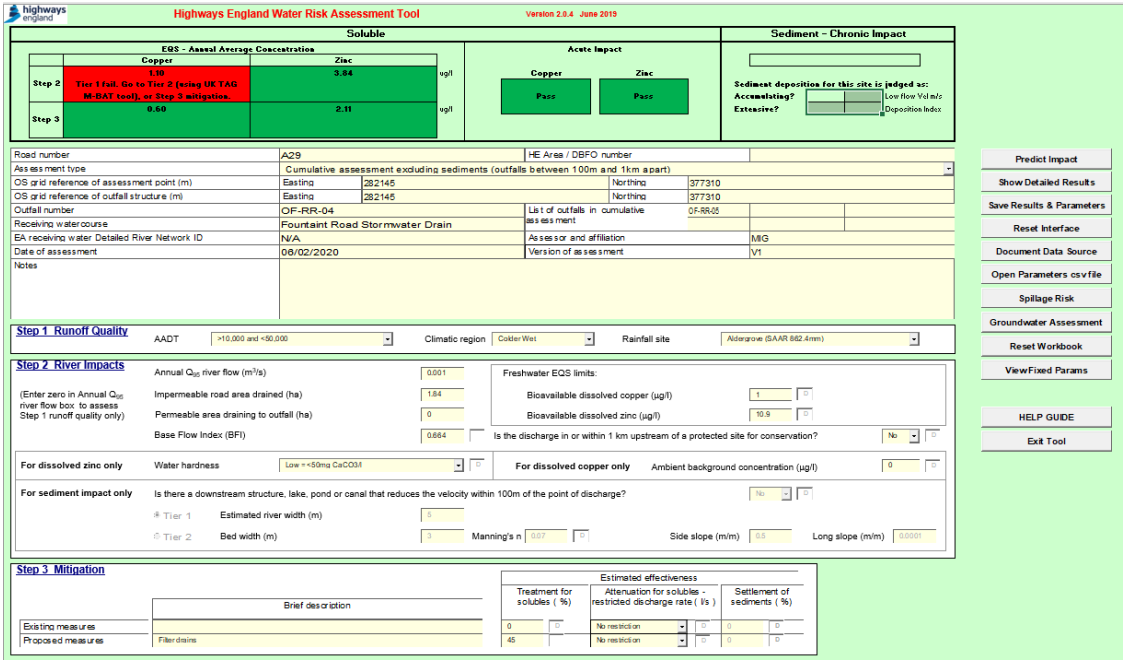

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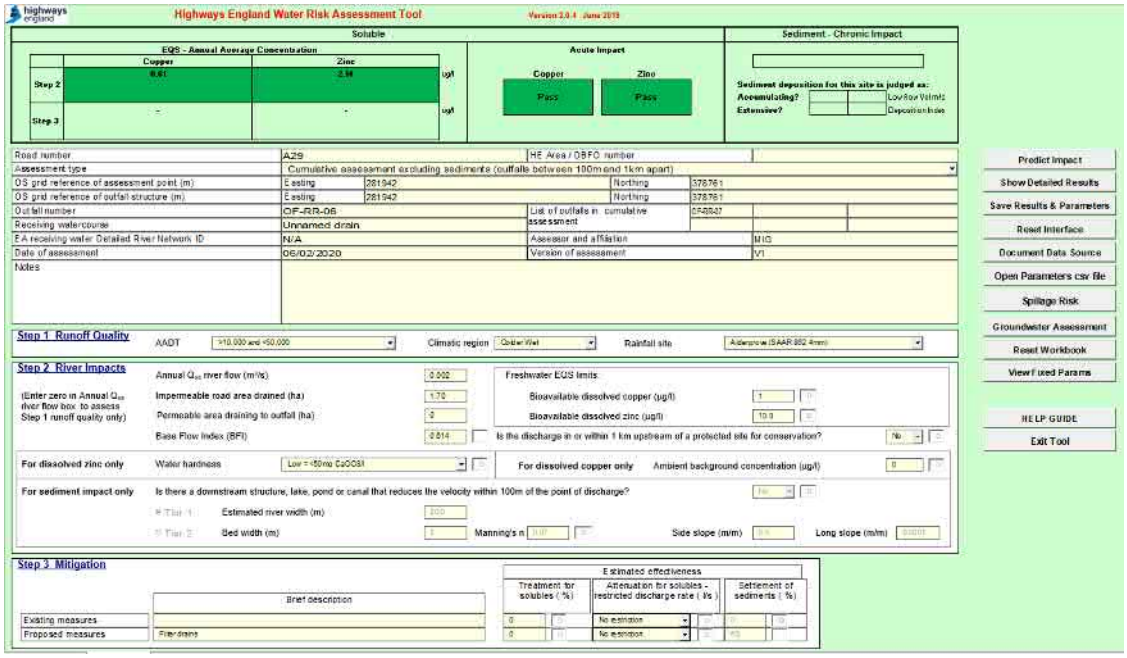

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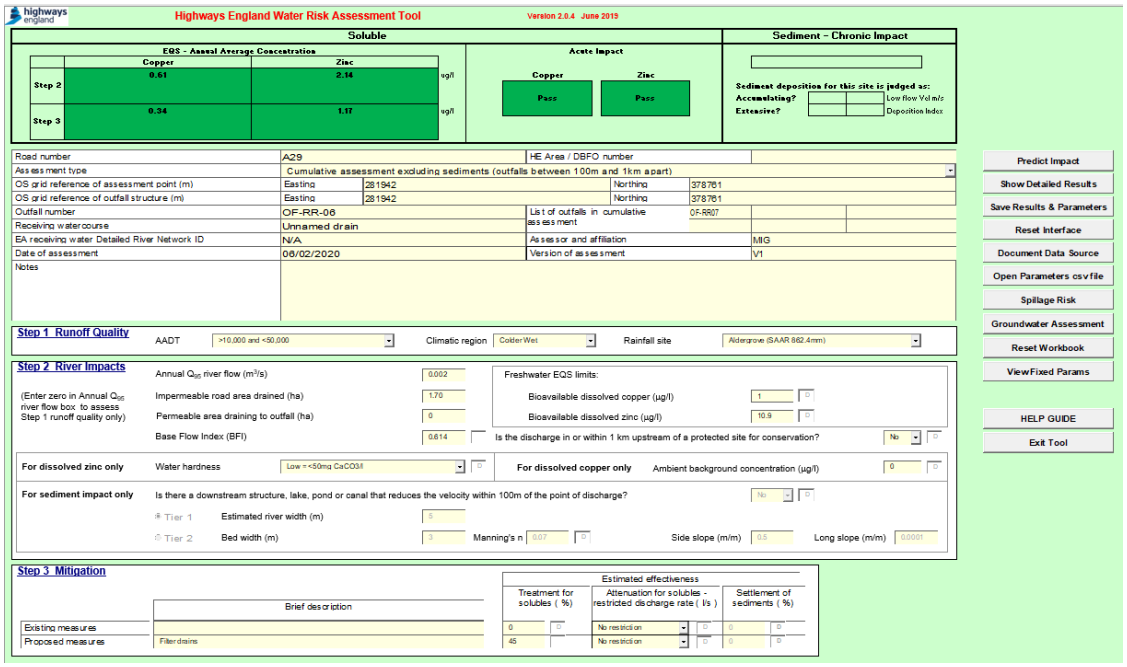
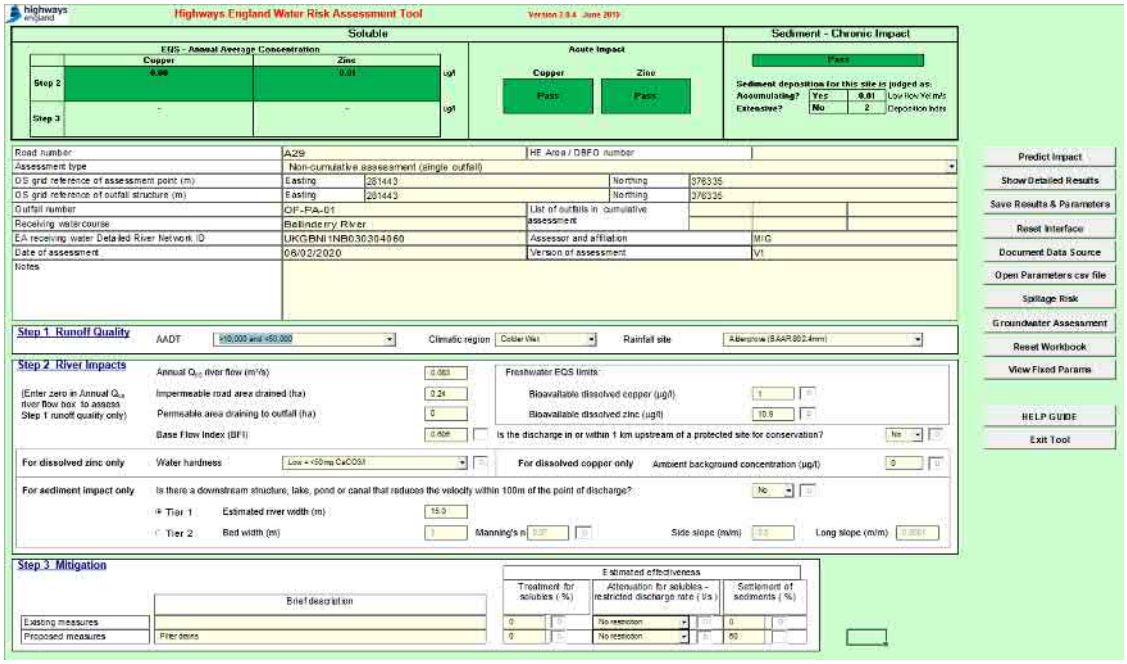


PURPLE A ROUTE

OF-PA-01

Copper



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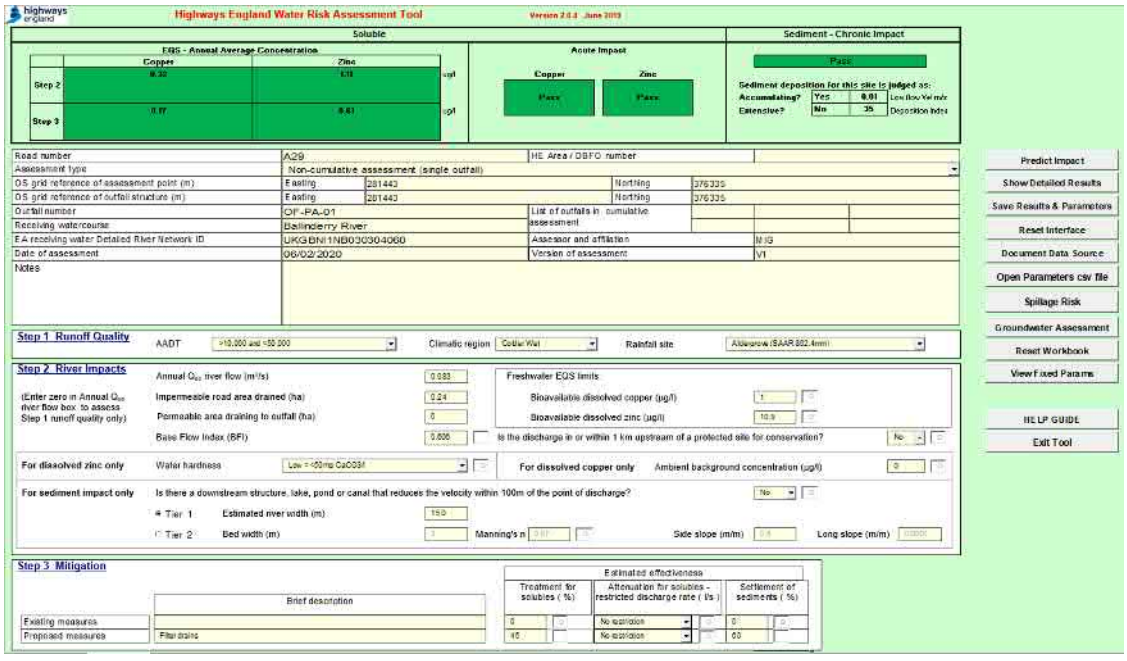
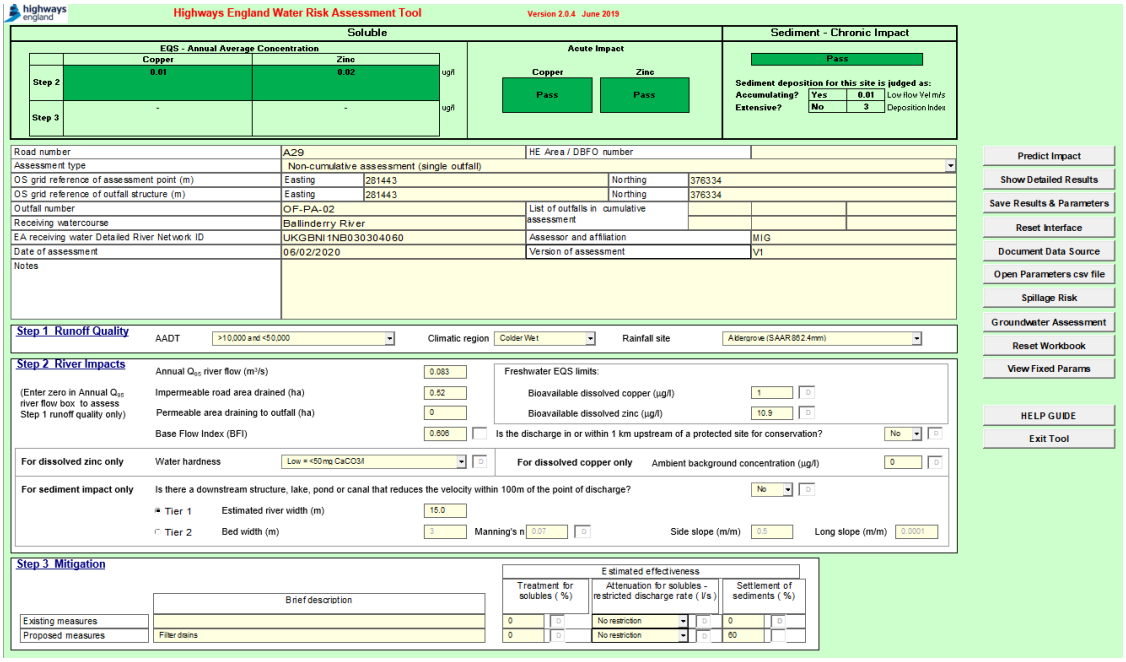
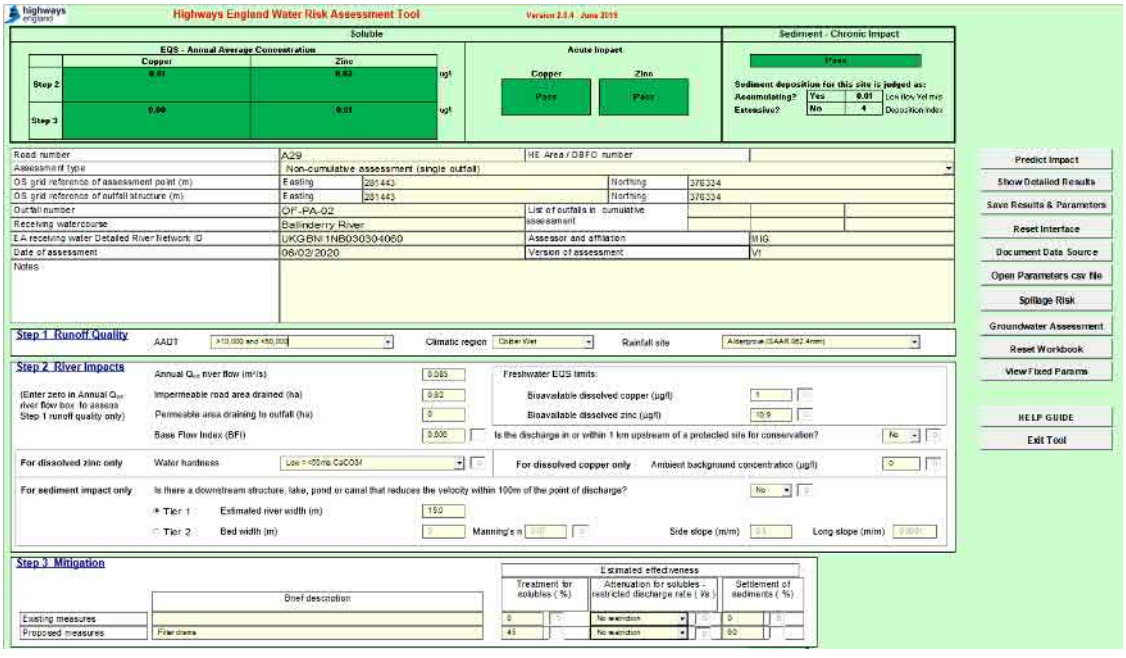


OF-PA-02

Copper

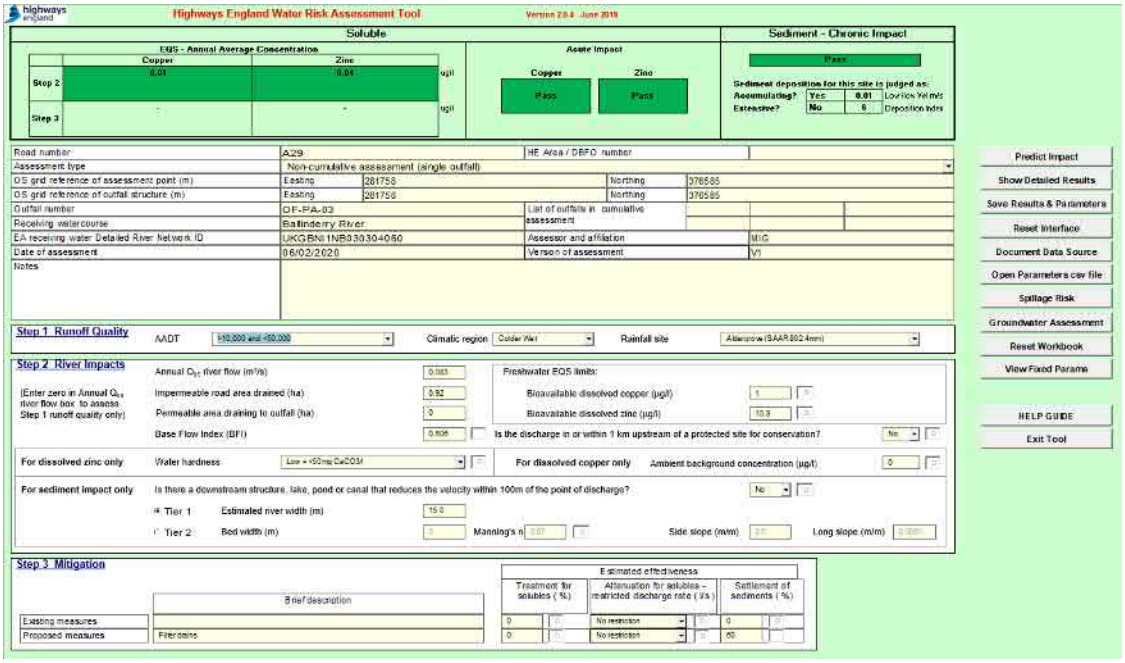


Zinc



OF-PA-03

Copper



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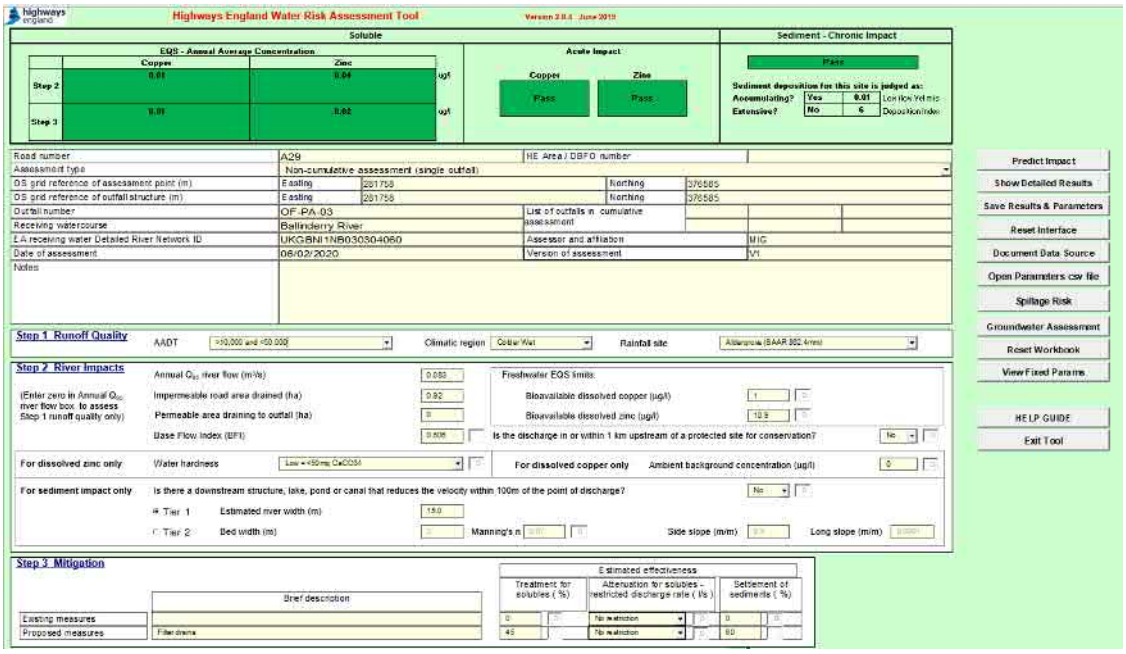

OF-PA-04

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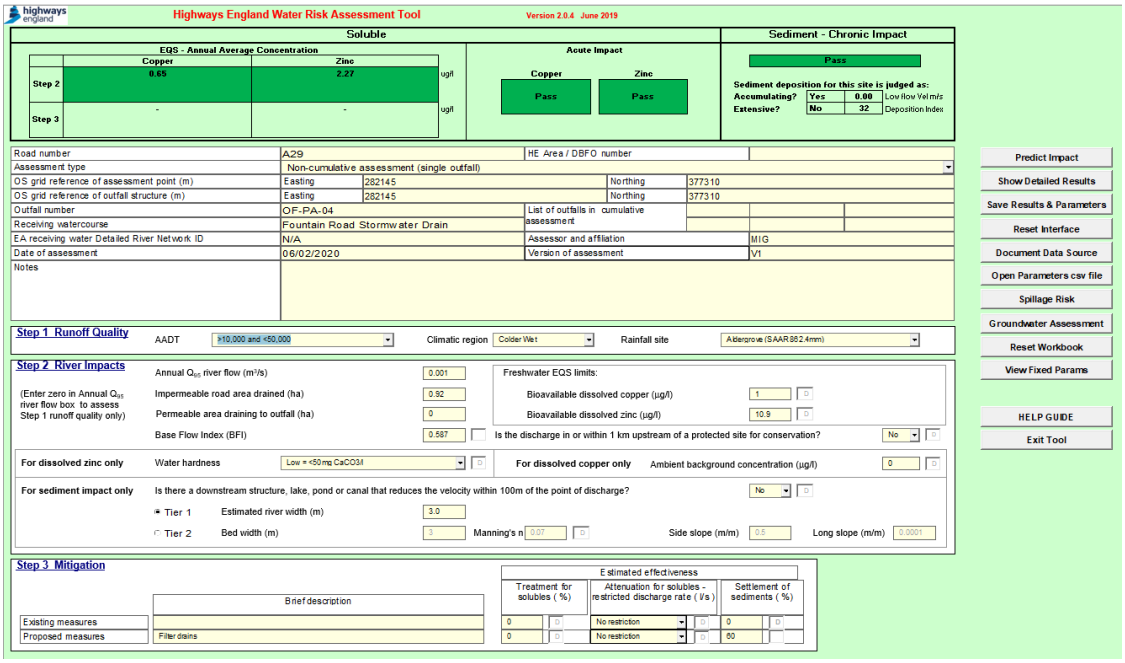

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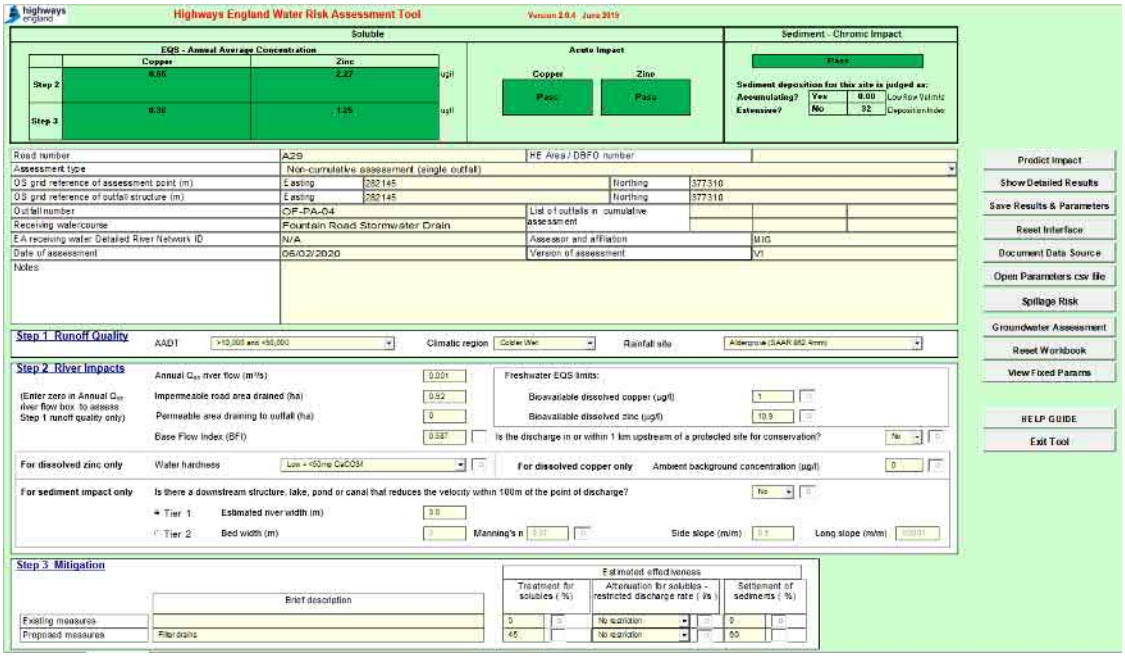

OF-PA-05

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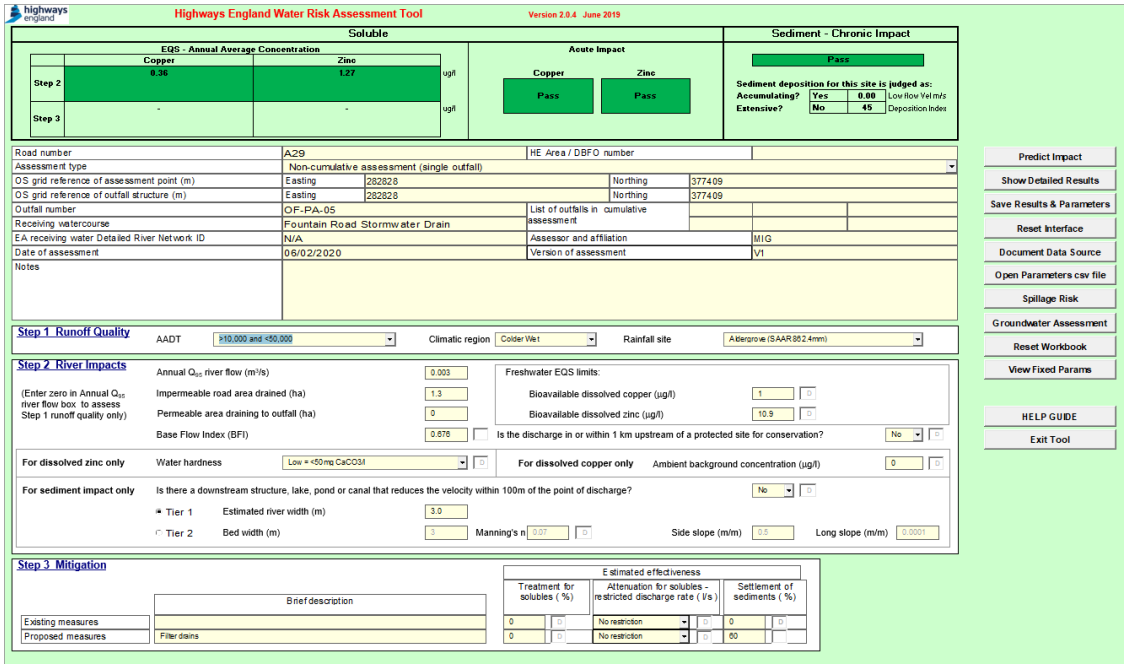

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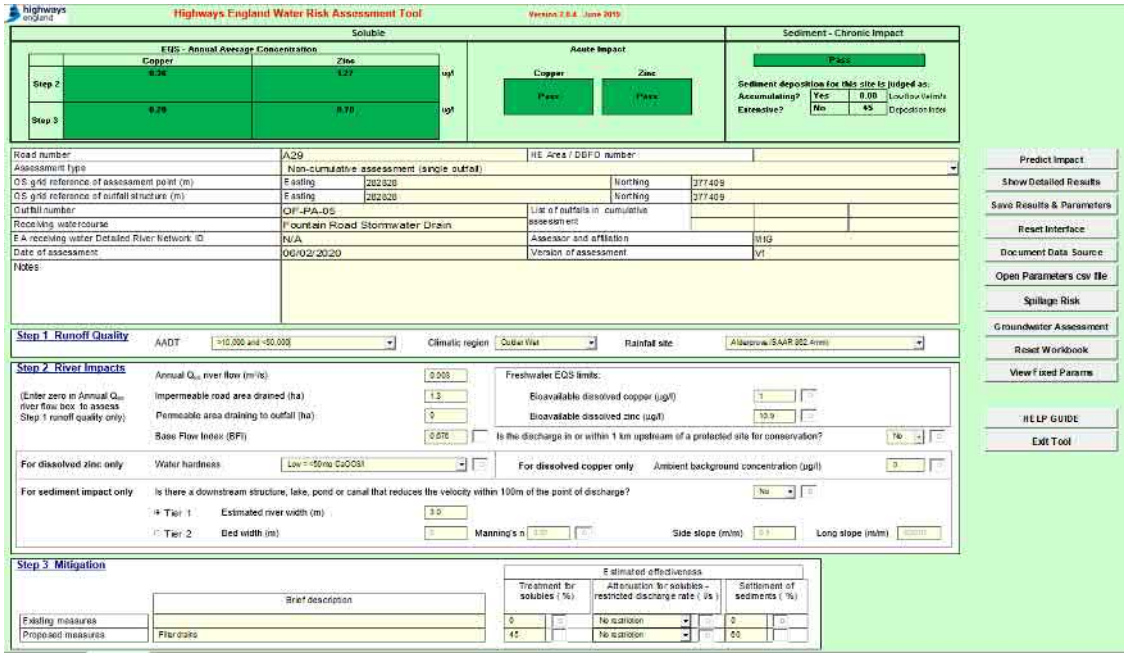

OF-PA-06

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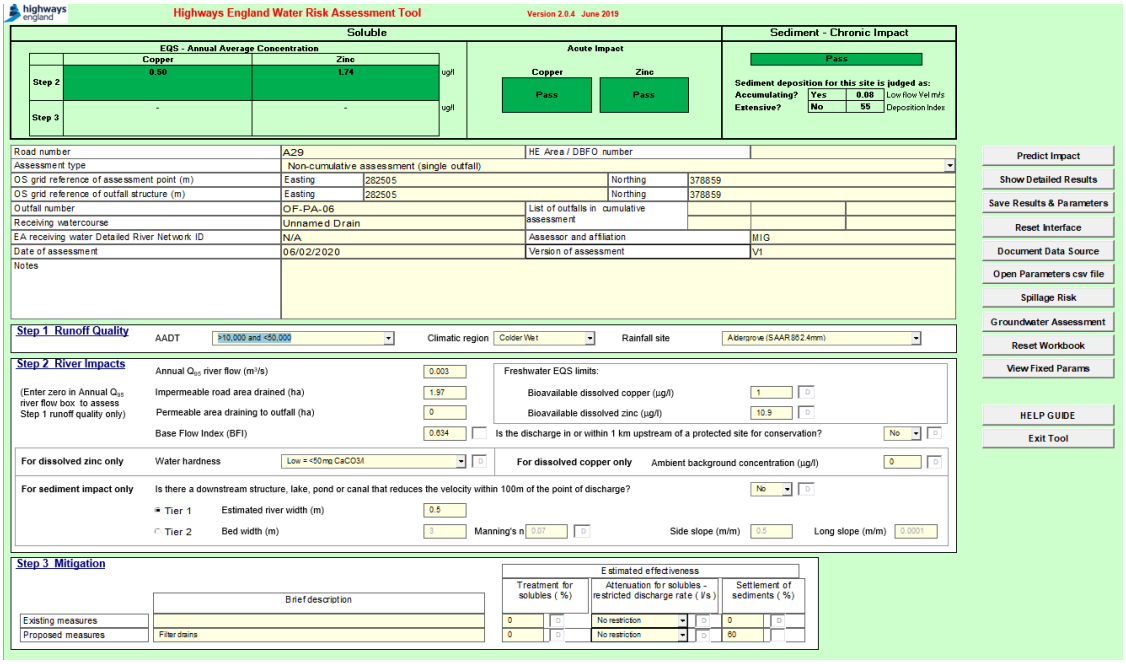

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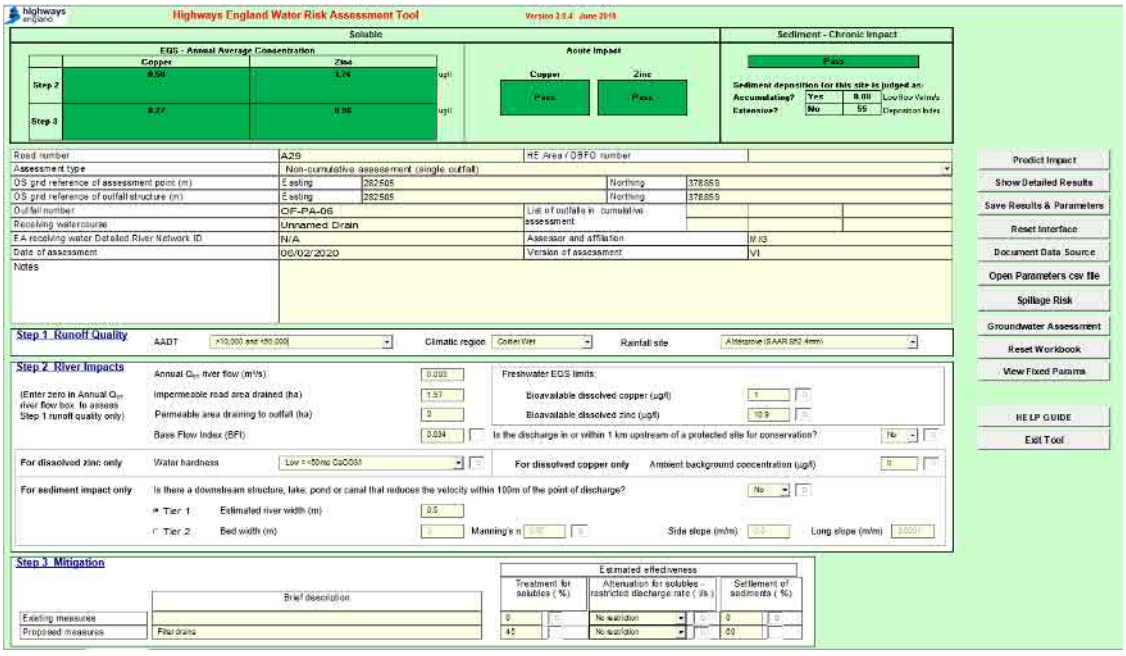
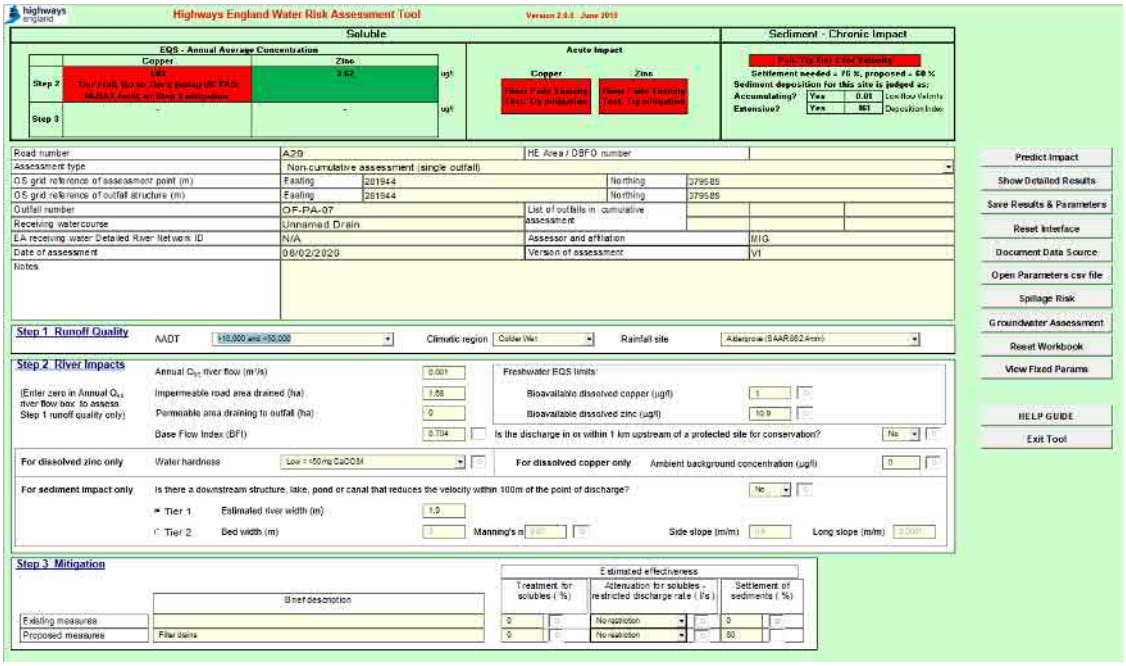


OF-PA-07

Copper



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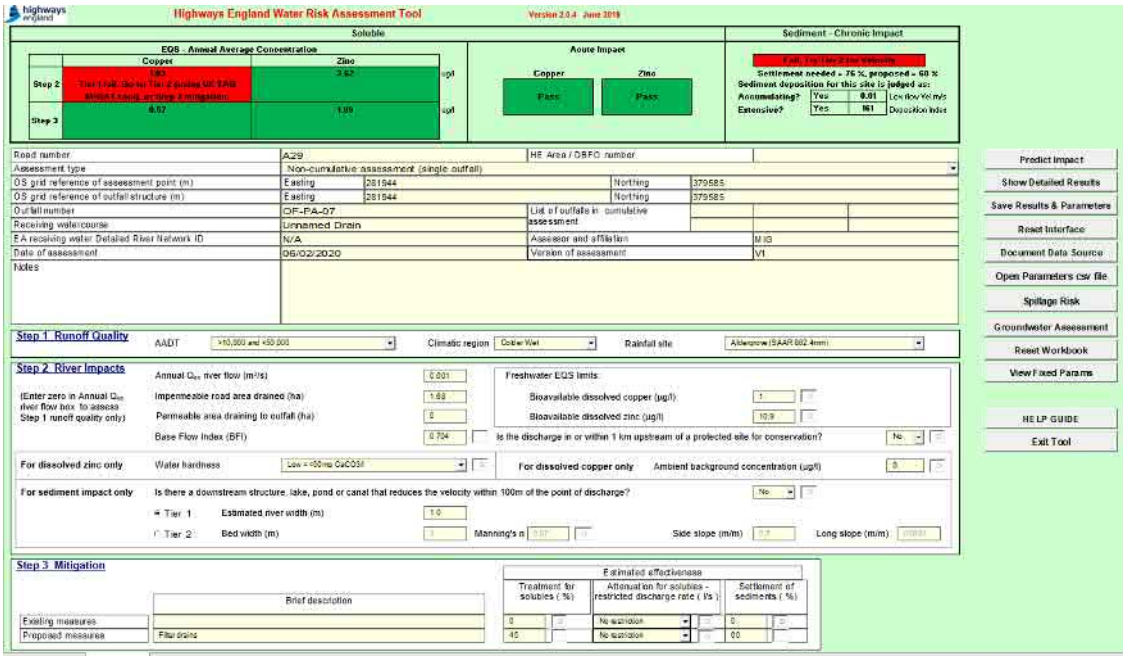
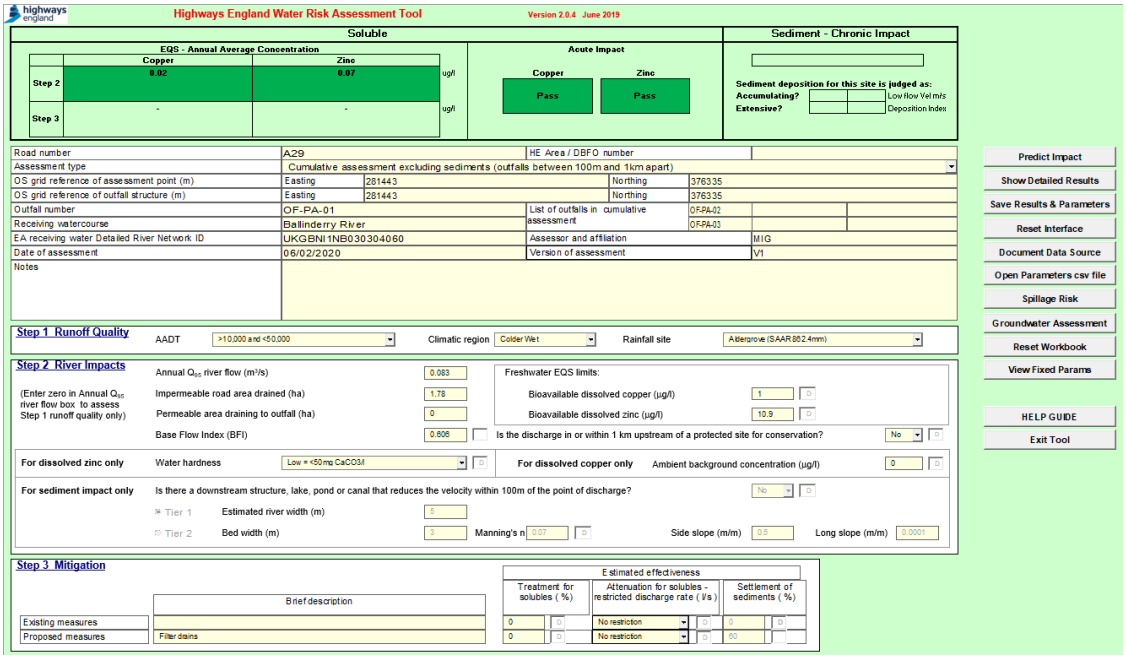


Cumulative (OF-PA-01, OF-PA-02 and OF-PA-03)

Copper



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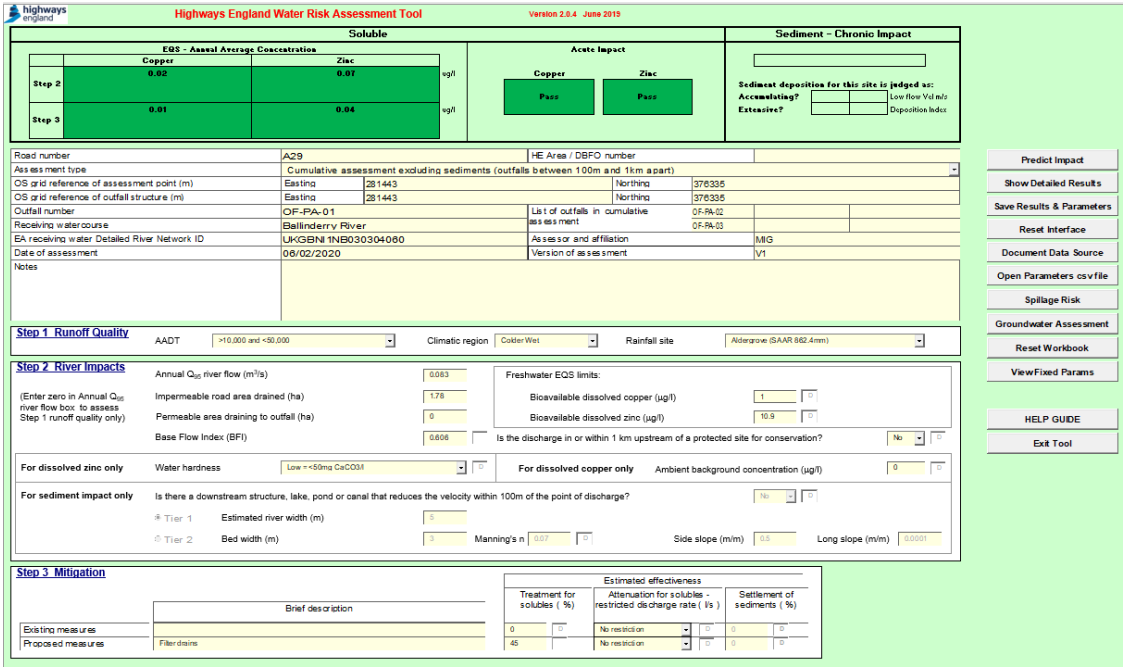
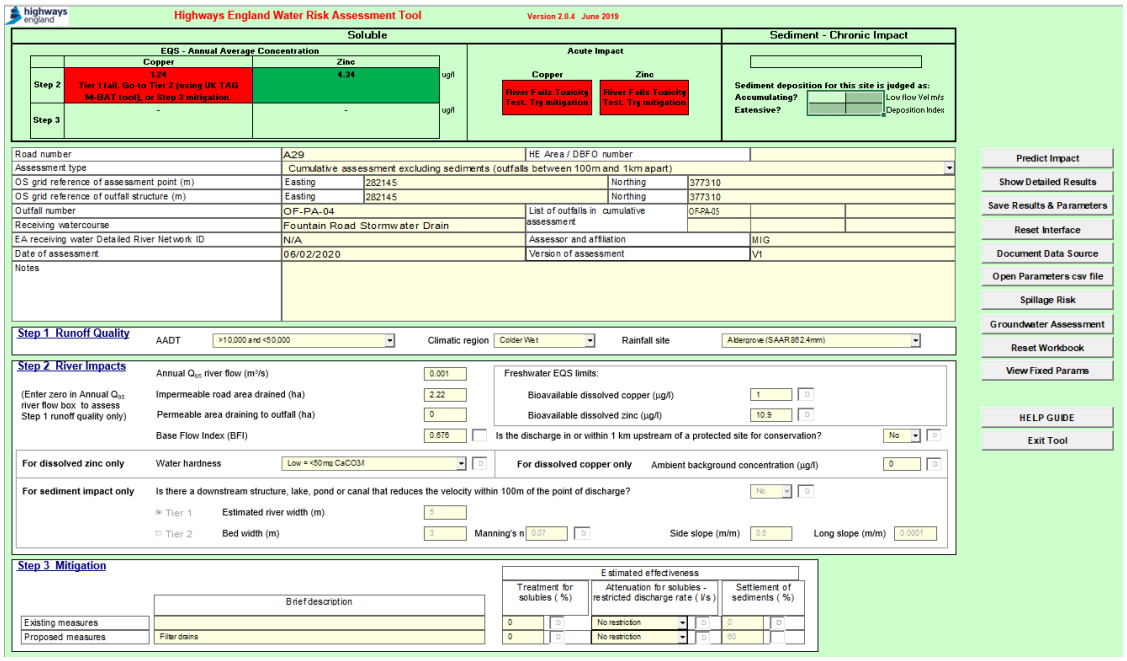


Cumulative (OF-PA-04 and OF-PA-05)

Copper



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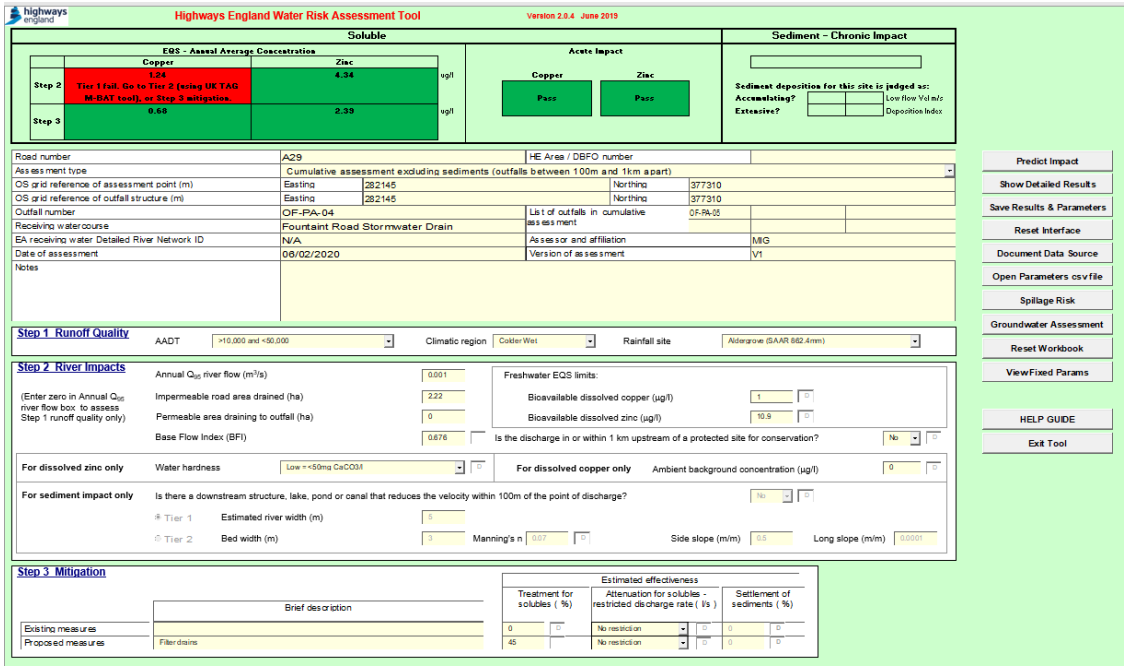
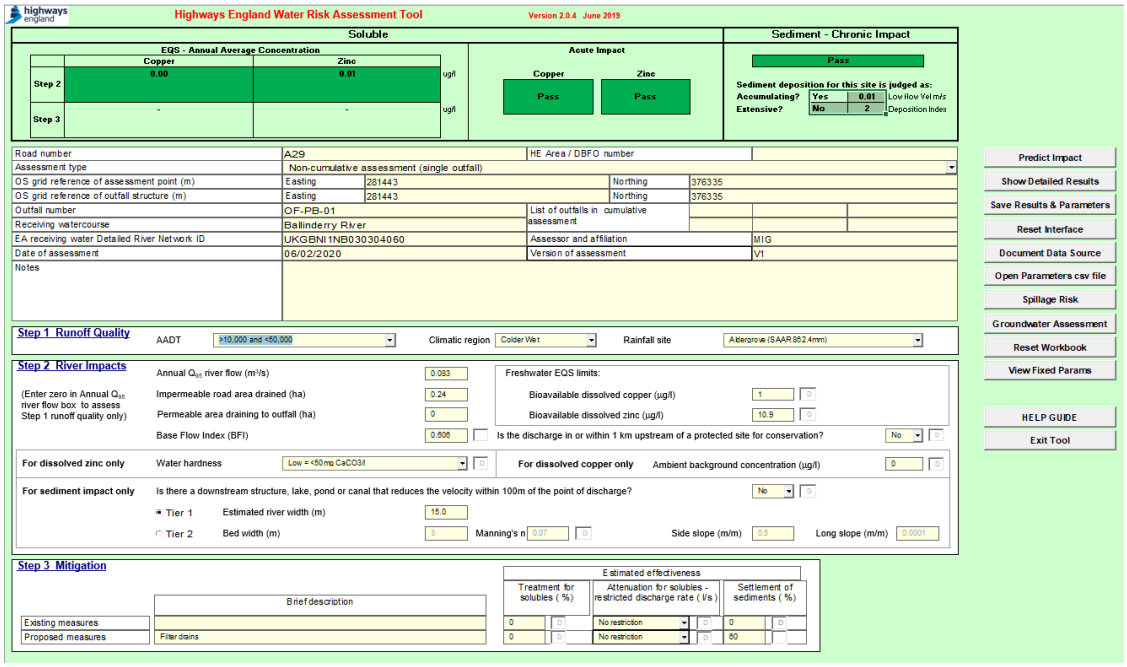


PURPLE B ROUTE

OF-PB-01

Copper



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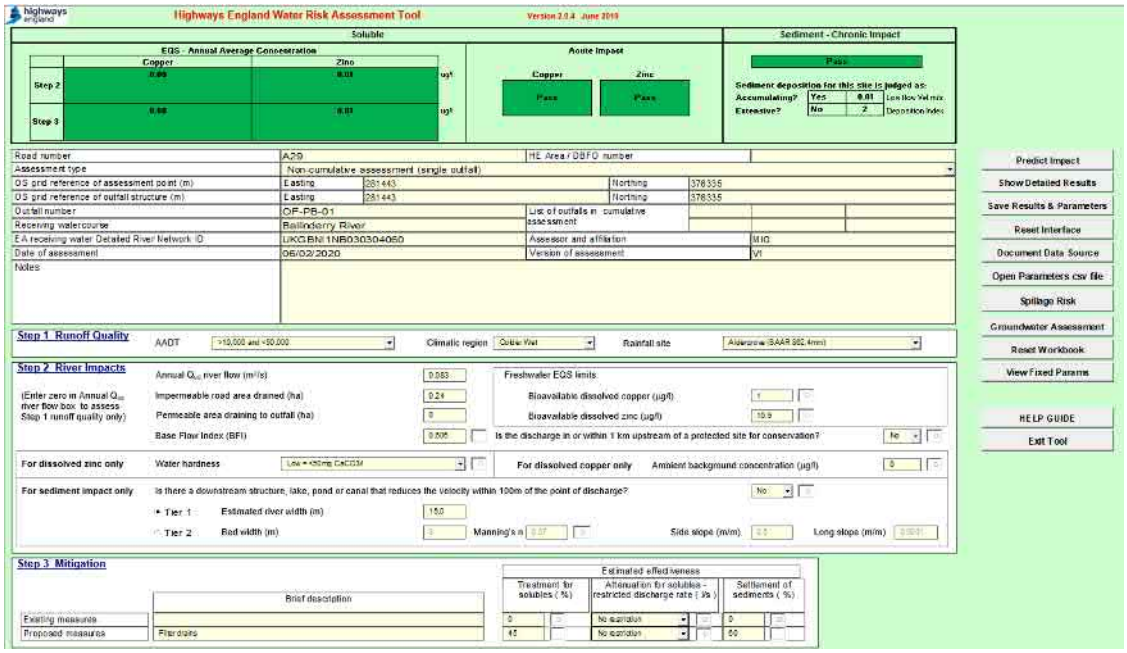
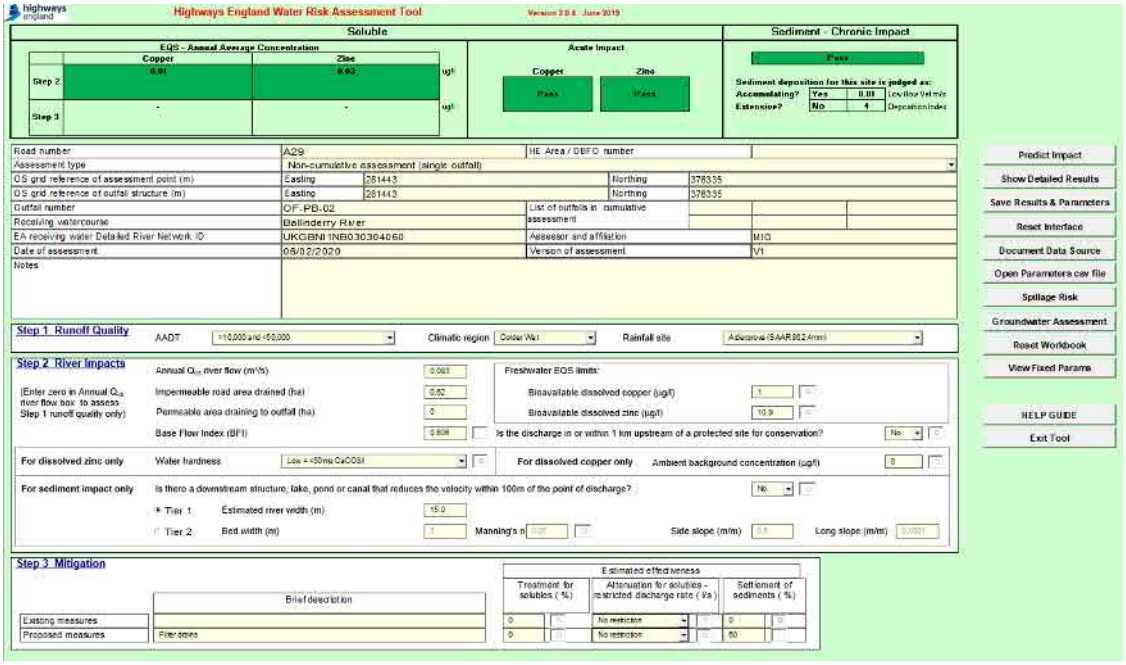


OF-PB-02

Copper



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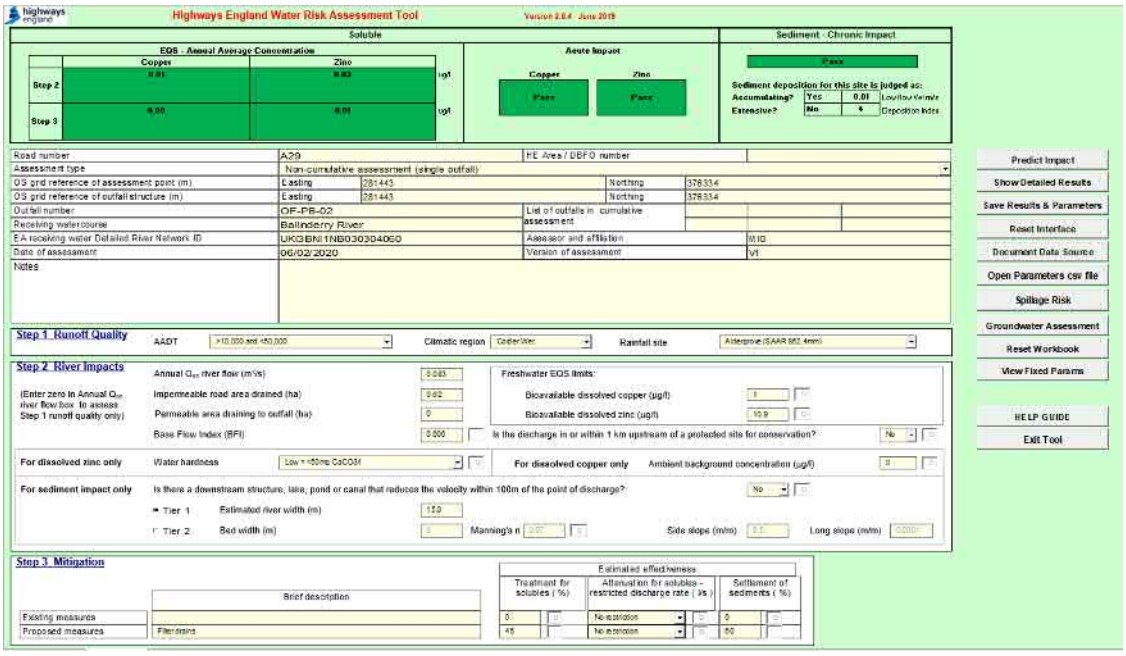
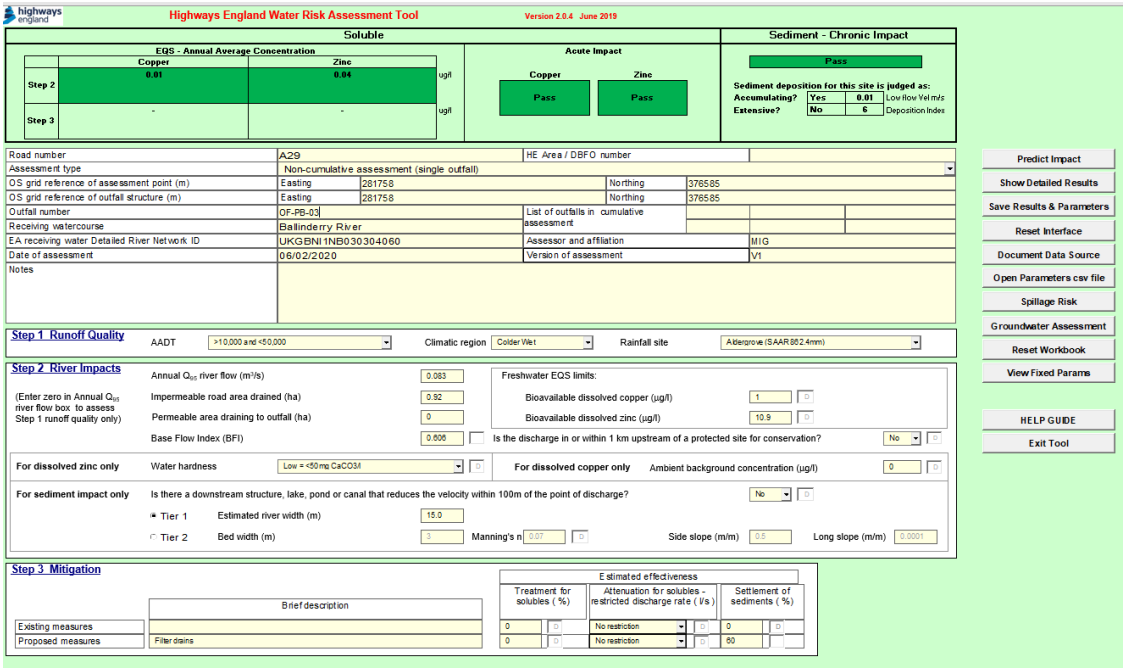


OF-PB-03

Copper



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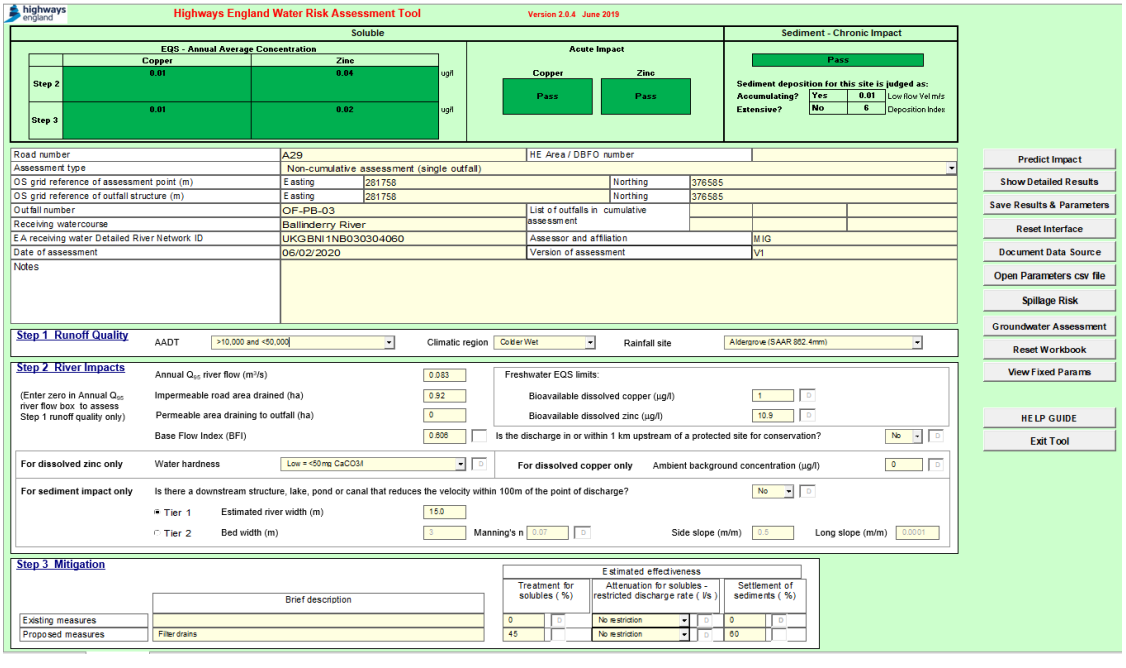
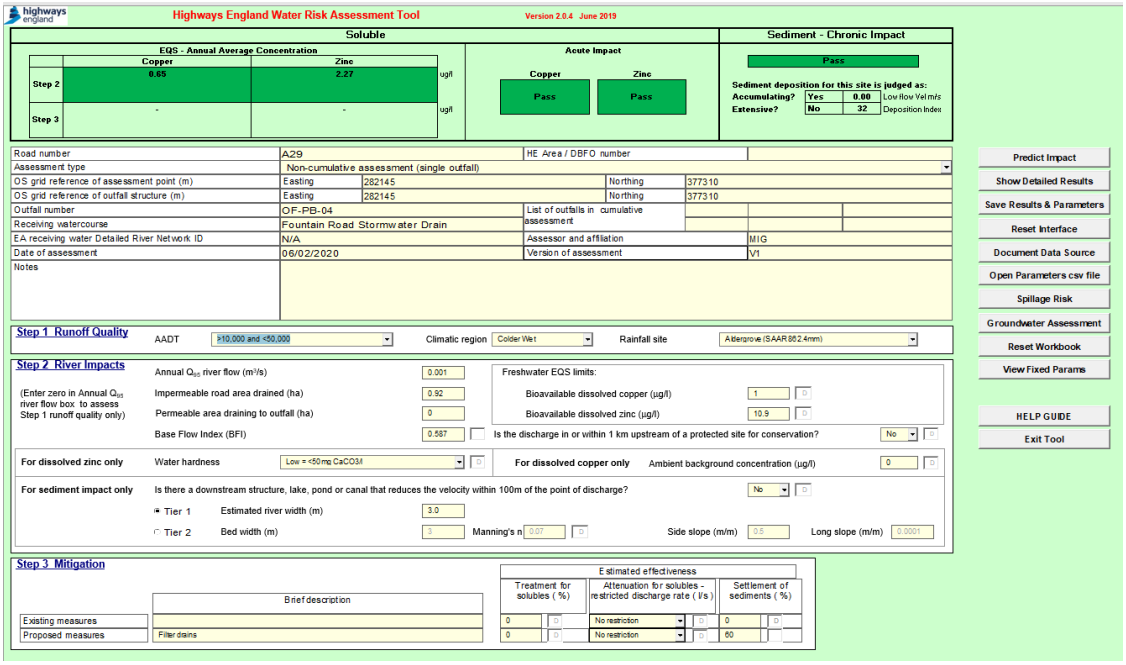


OF-PB-04

Copper



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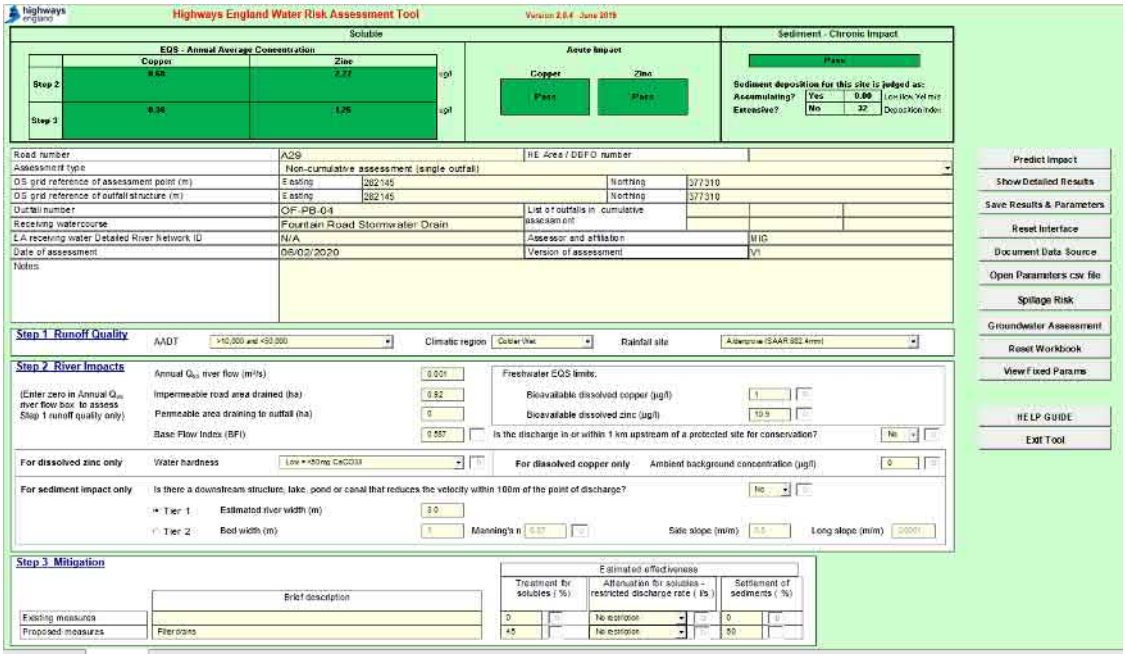
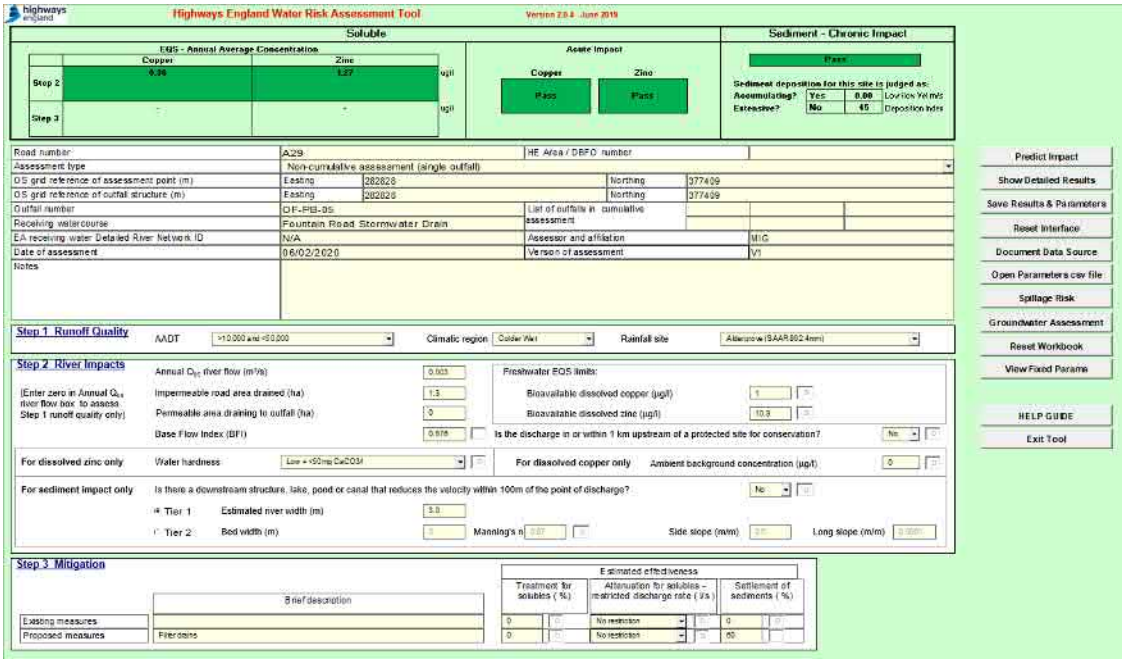


OF-PB-05

Copper



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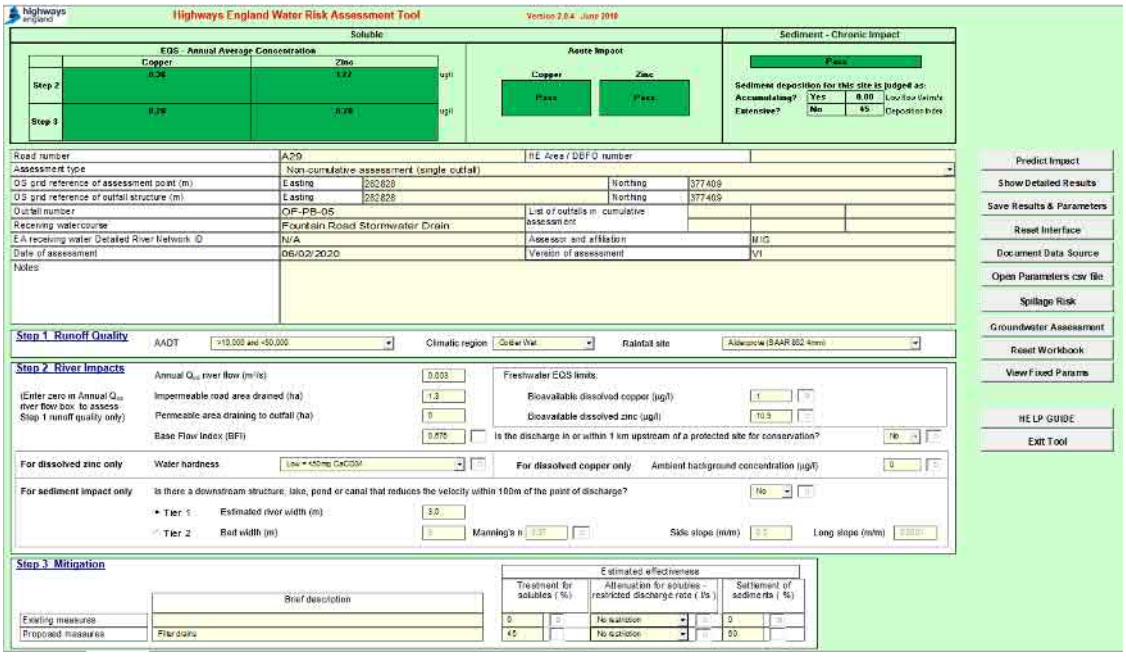
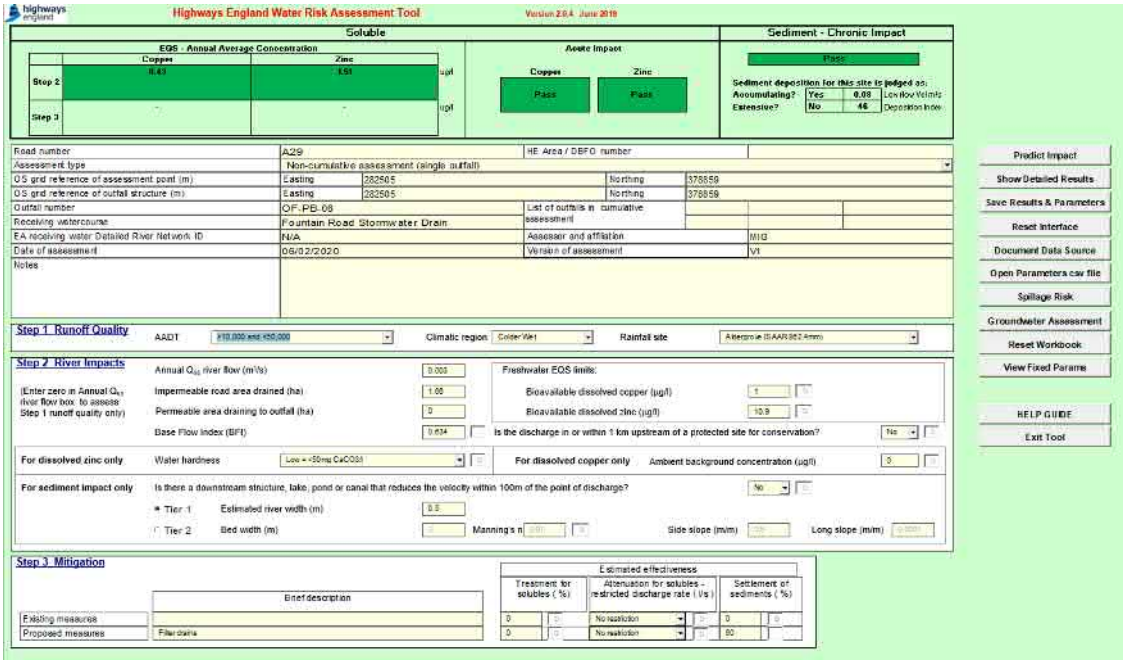


OF-PB-06

Copper



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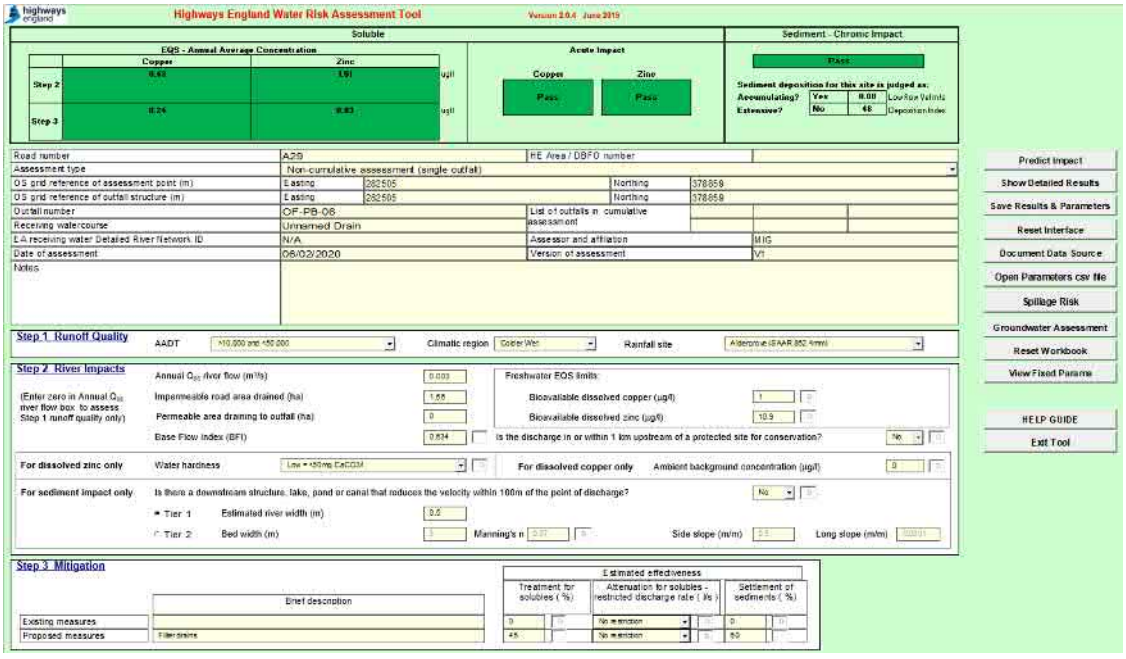
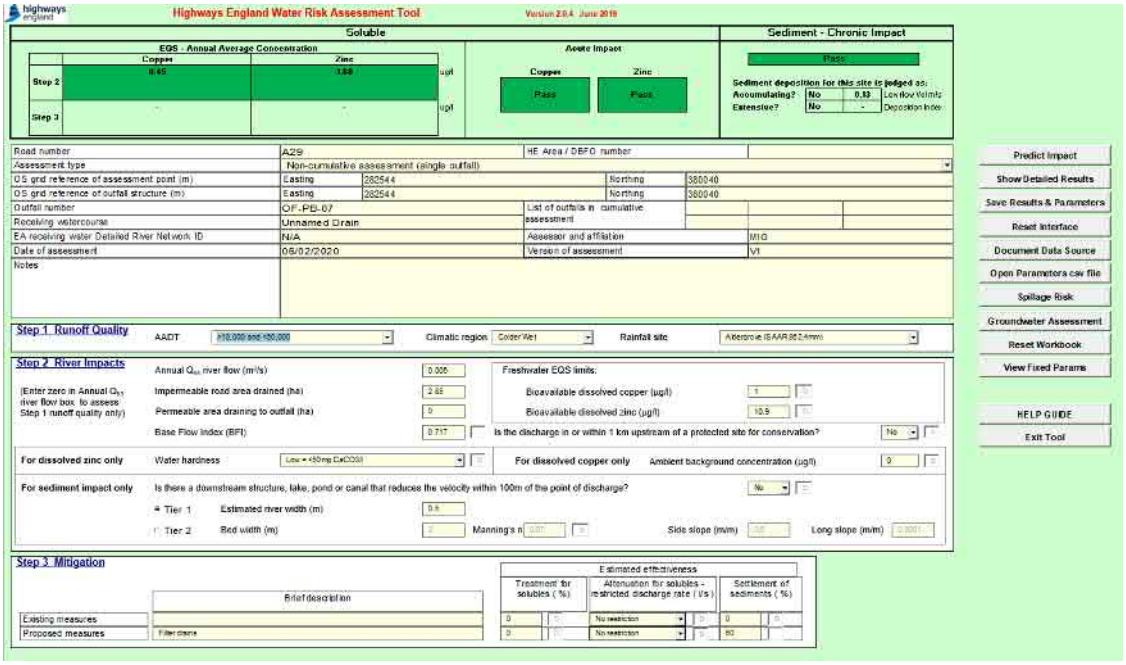


OF-PB-07

Copper



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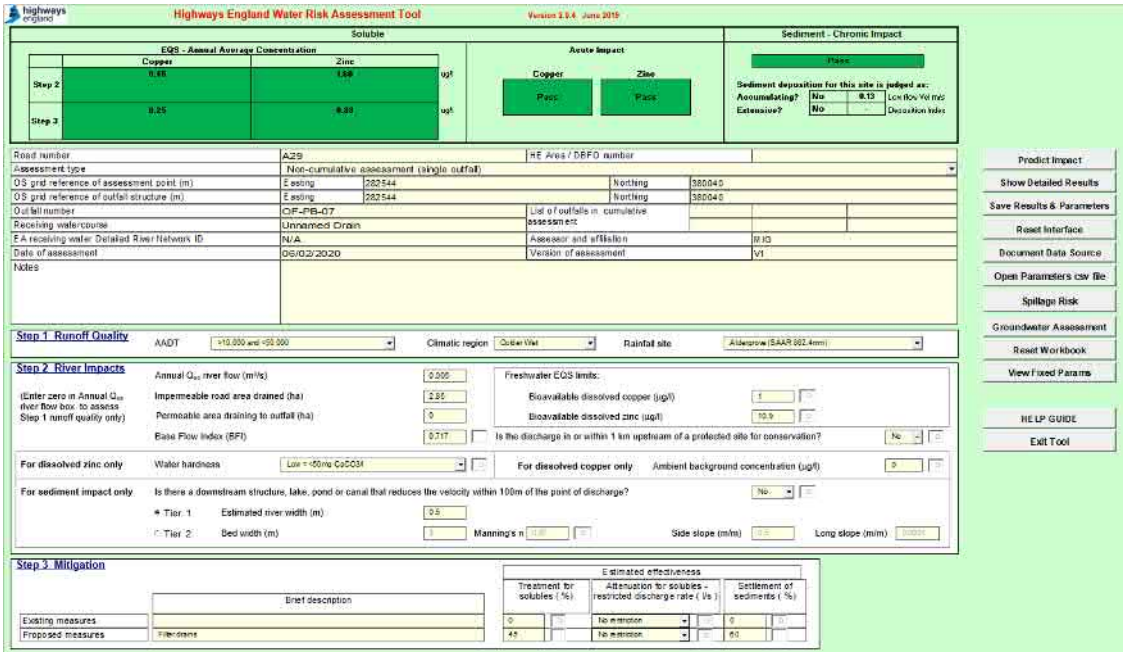
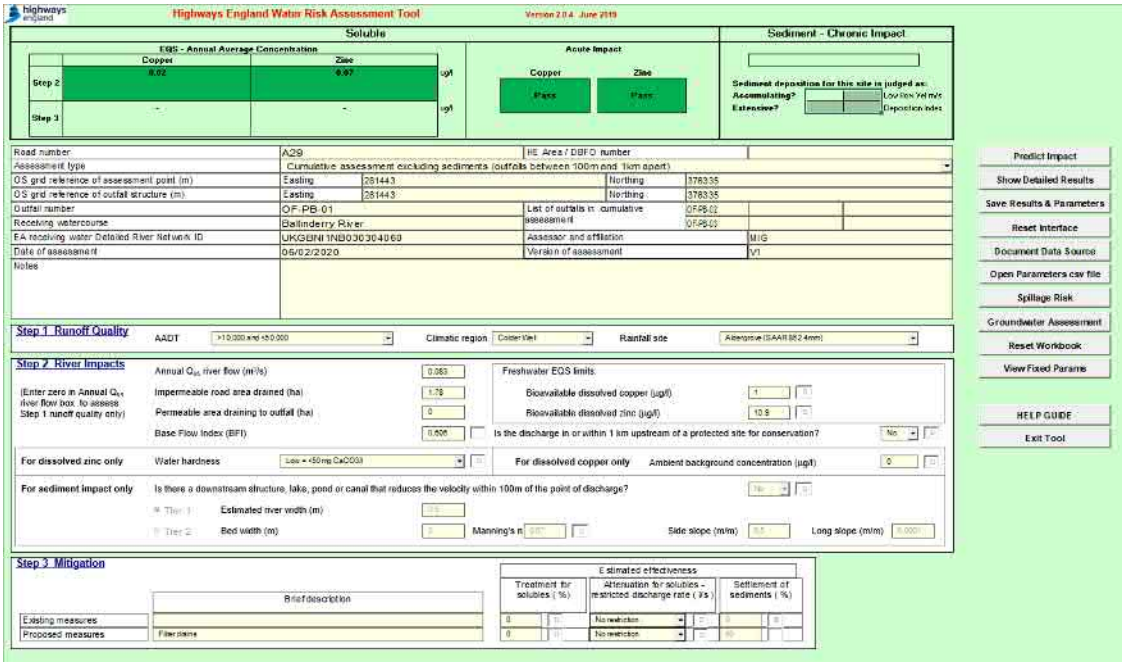


Cumulative (OF-PB-01, OF-PB, 02 and OF-PB-03)

Copper



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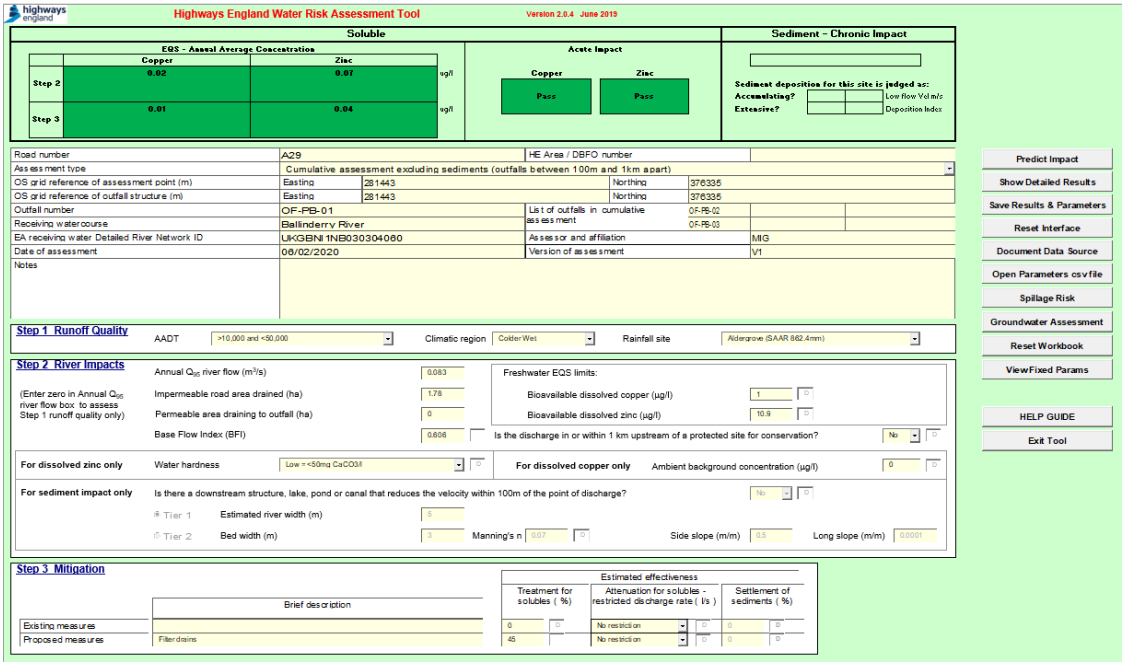
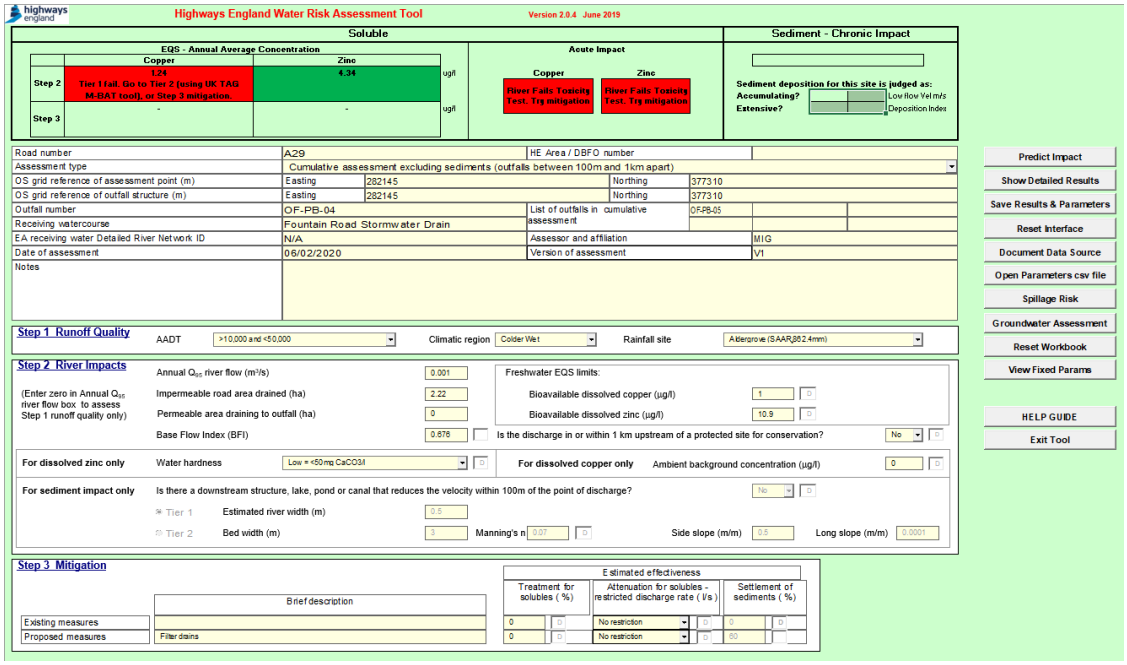


Cumulative (OF-PB-04 and OF-PB-05)

Copper



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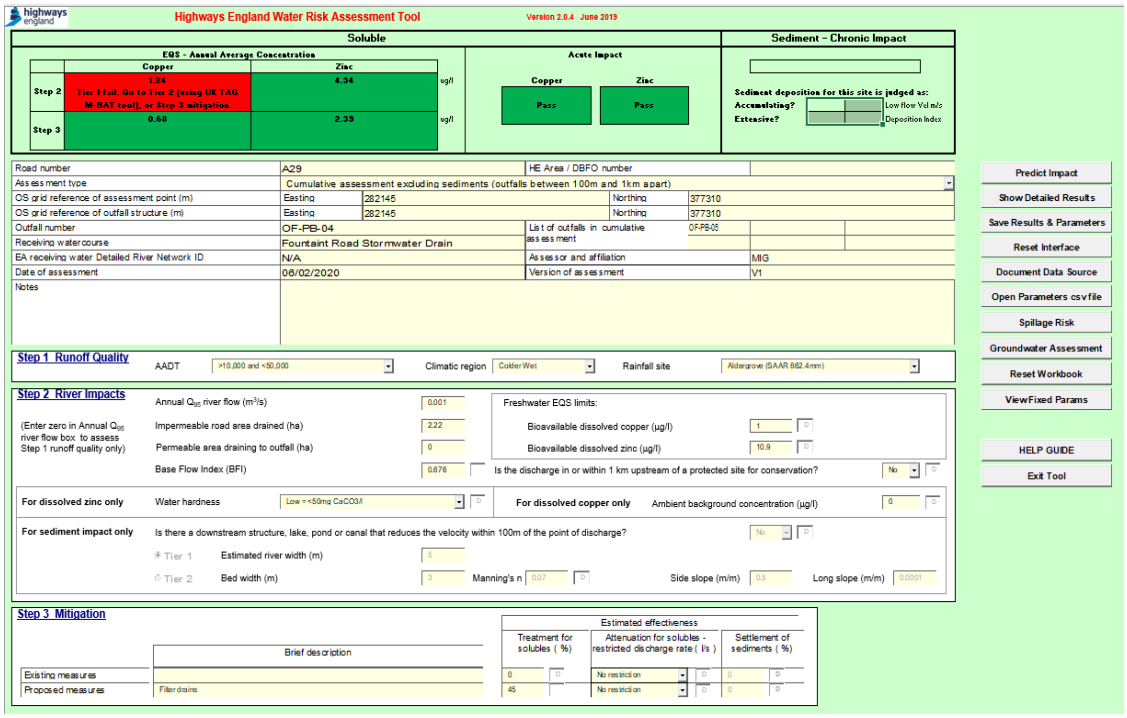
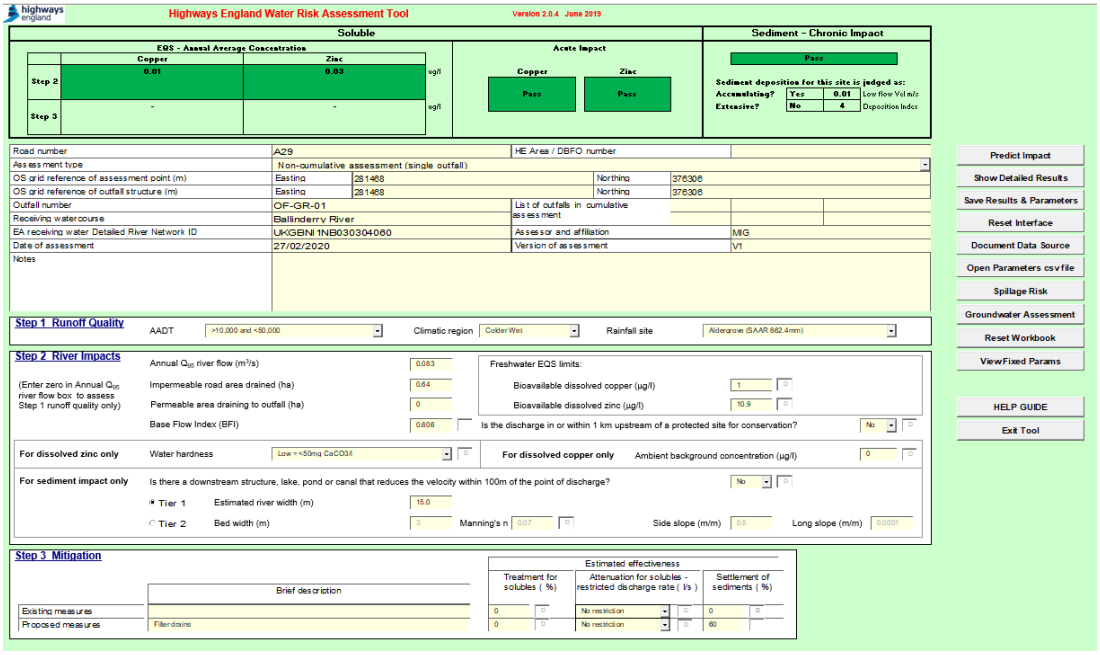


GREEN ROUTE

OF-GR-01

Copper



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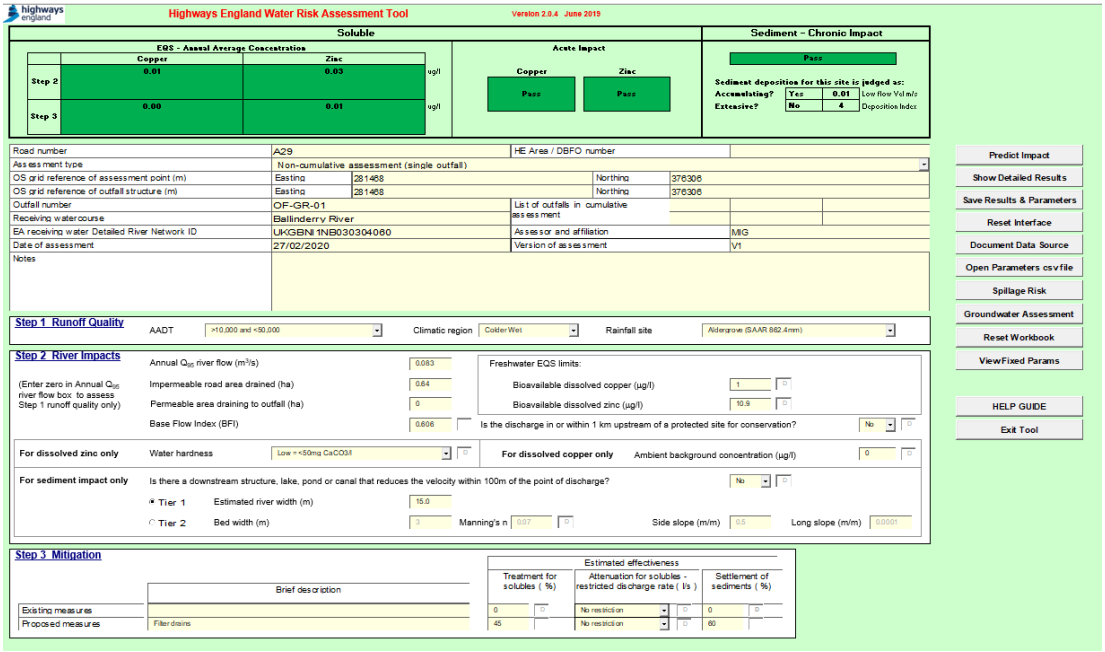
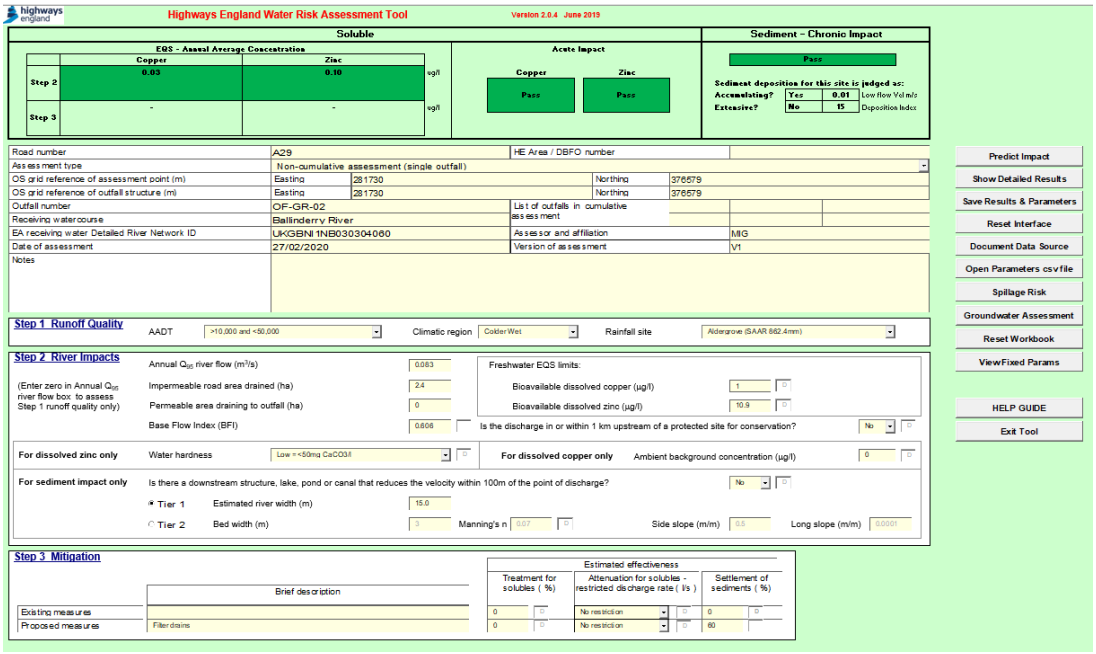


OF-GR-02

Copper



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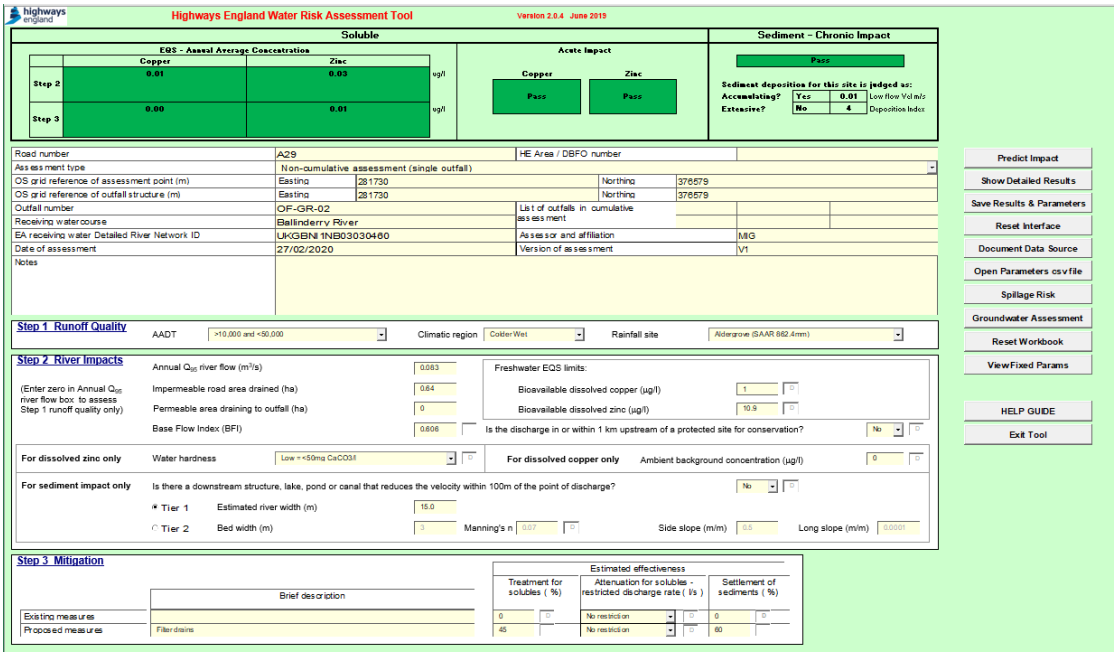
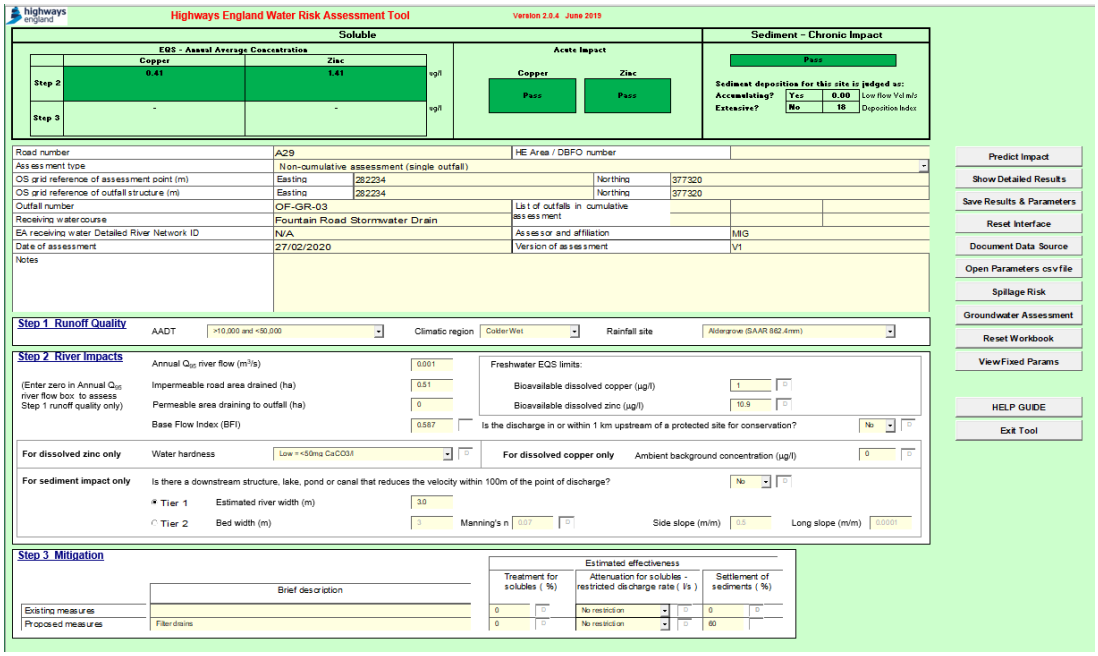


OF-GR-03

Copper



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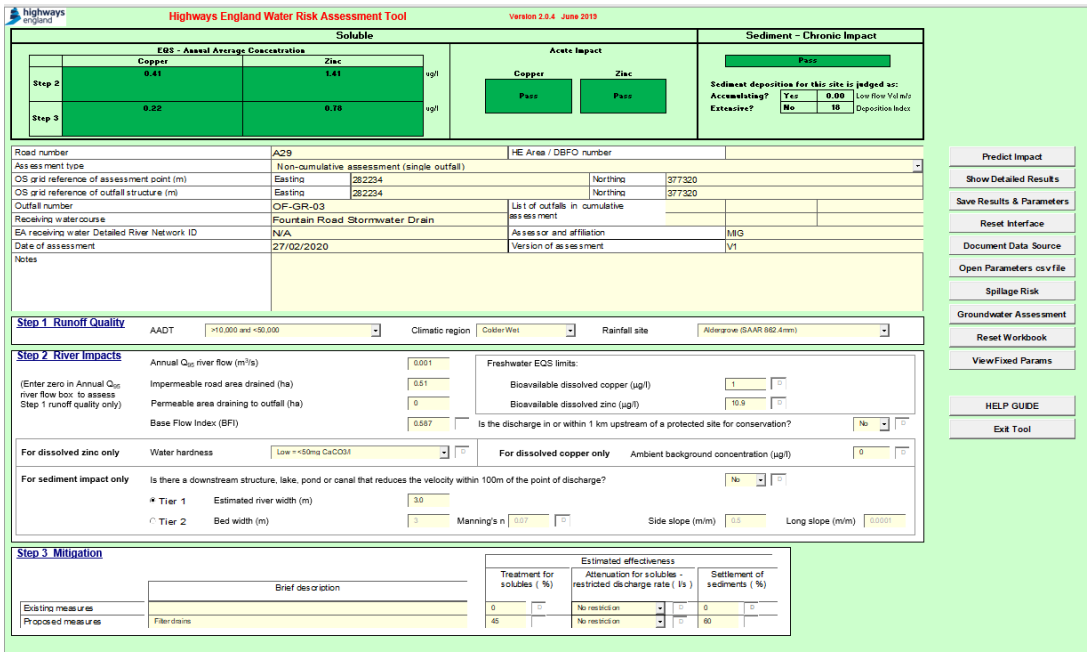
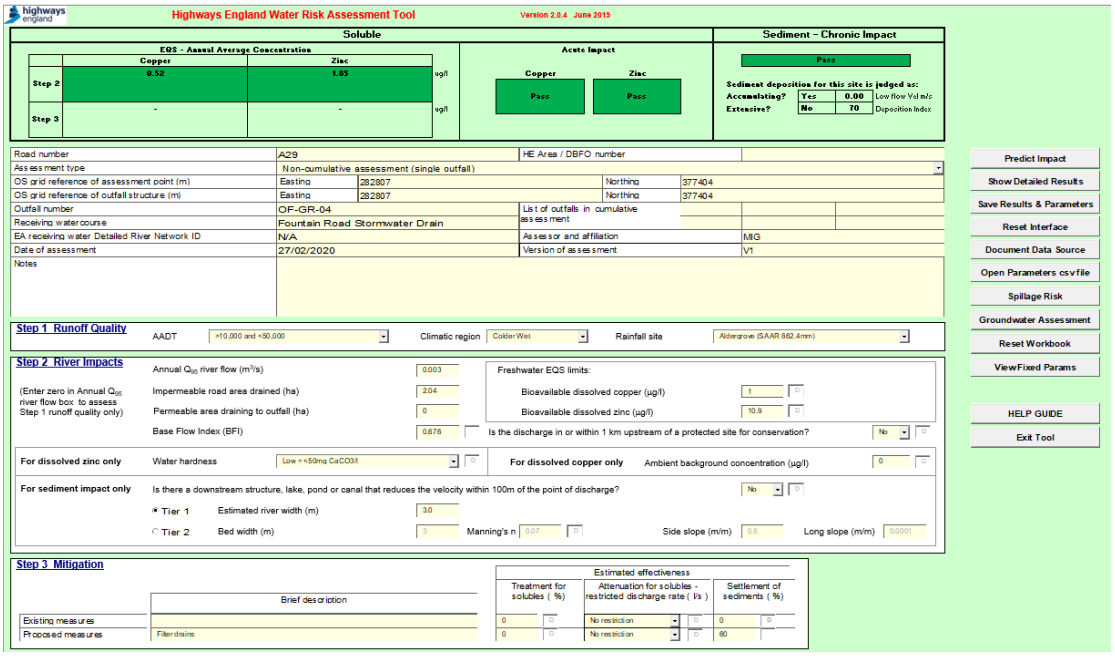


OF-GR-04

Copper



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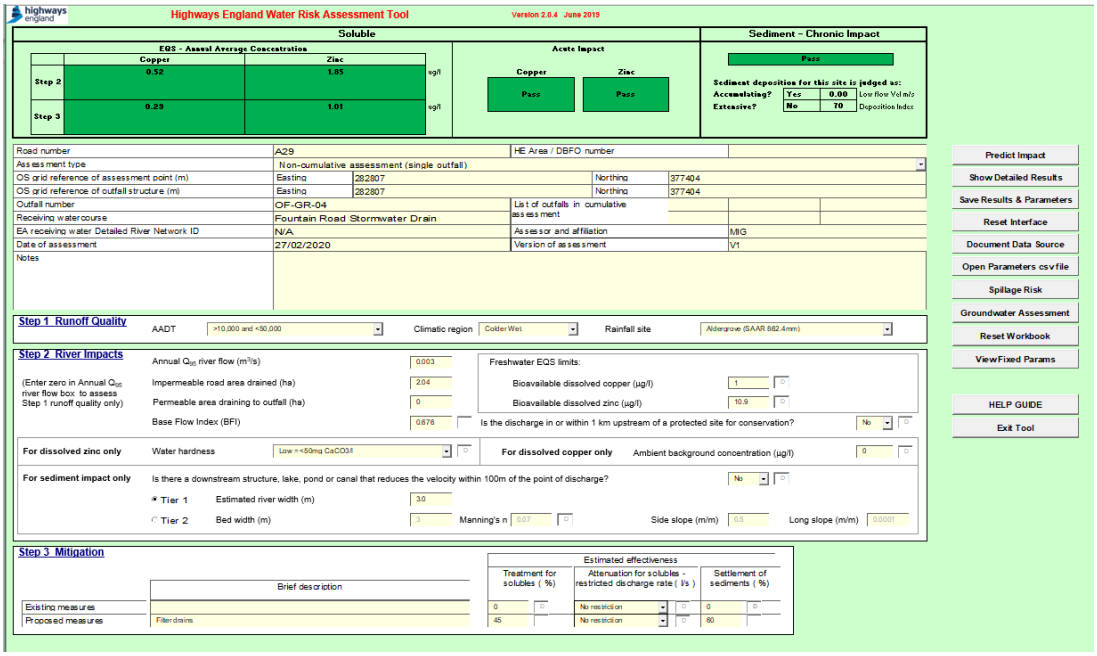

OF-GR-05

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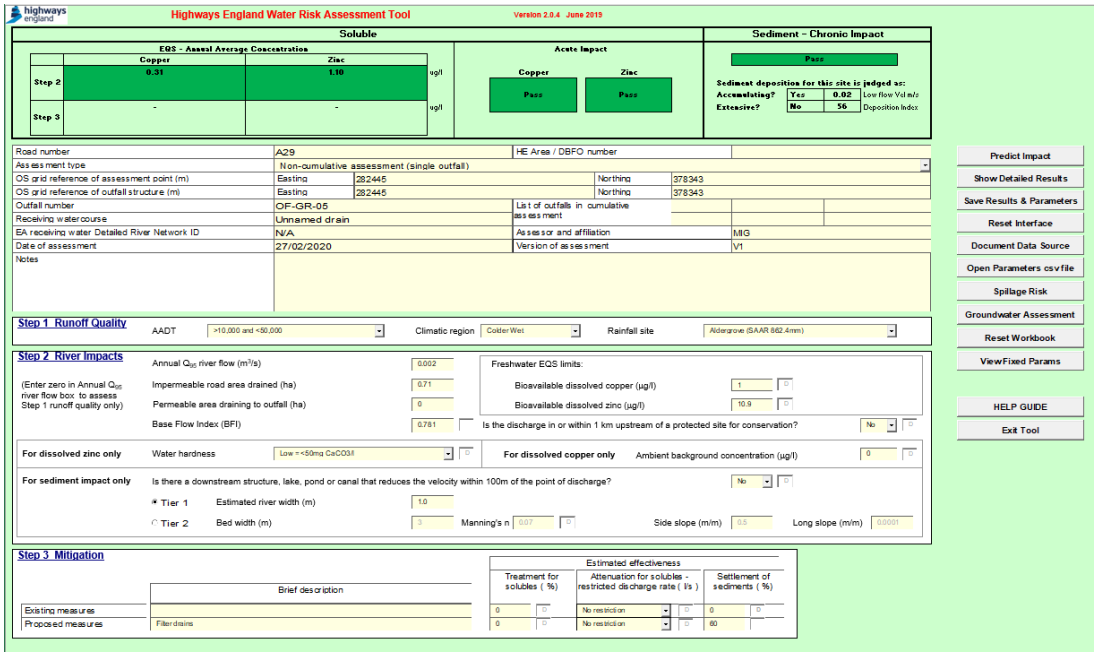

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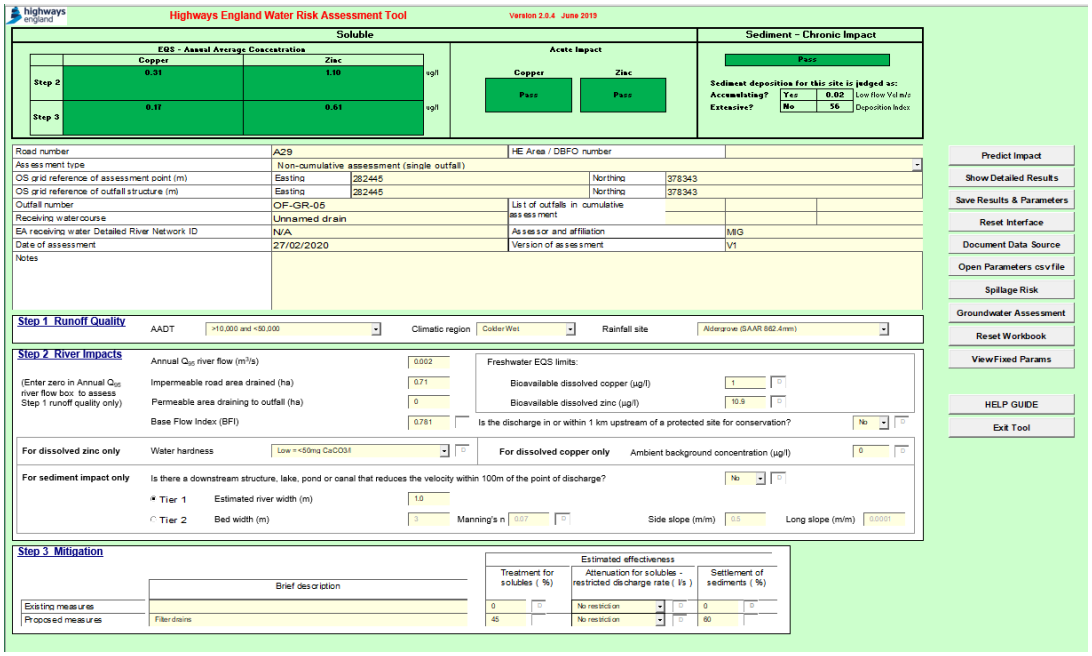
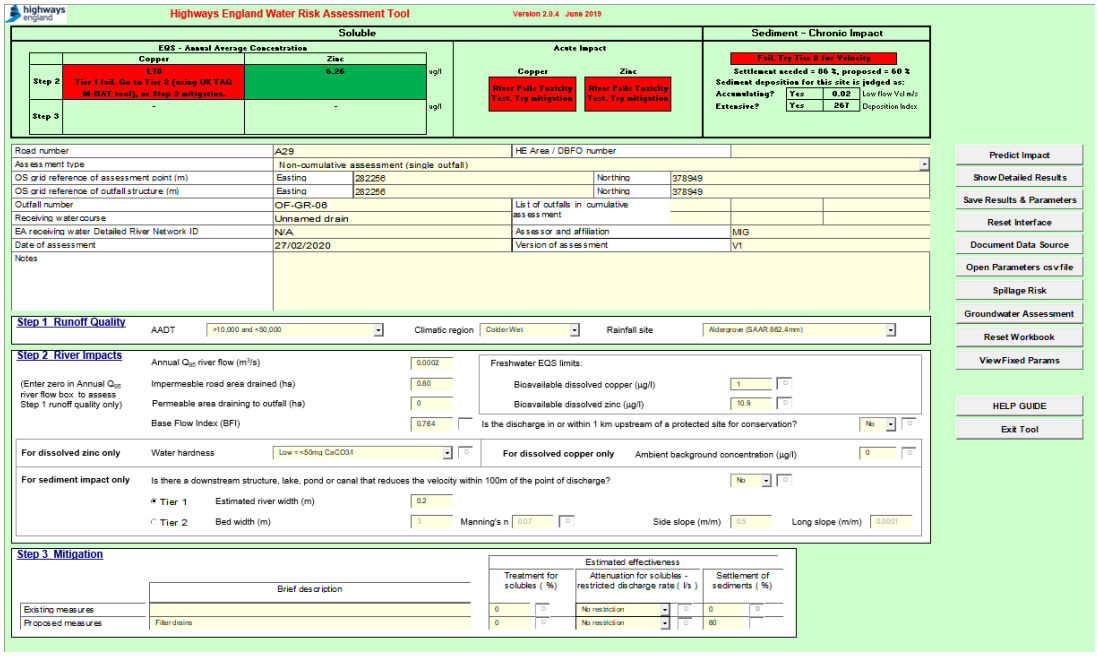


OF-GR-06

Copper



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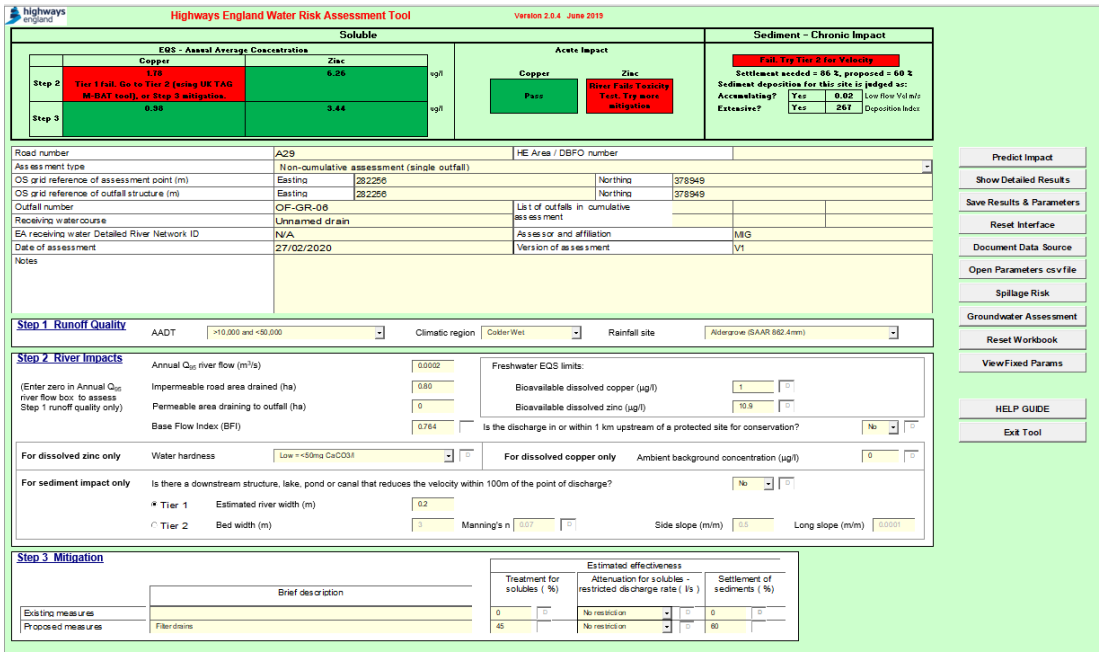

OF-GR-07

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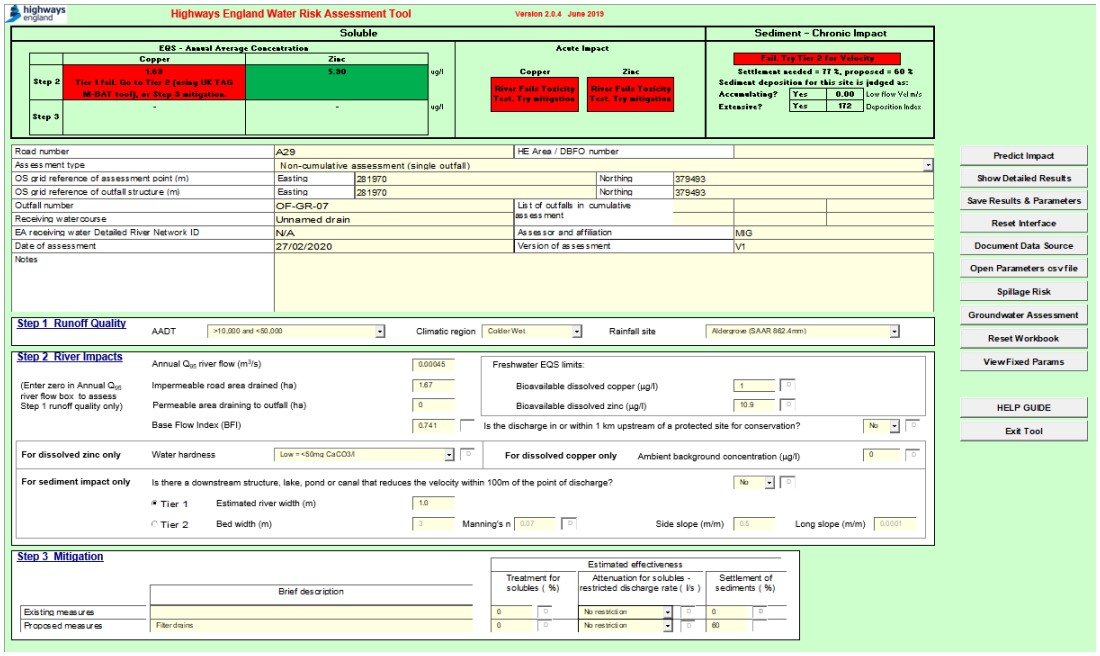

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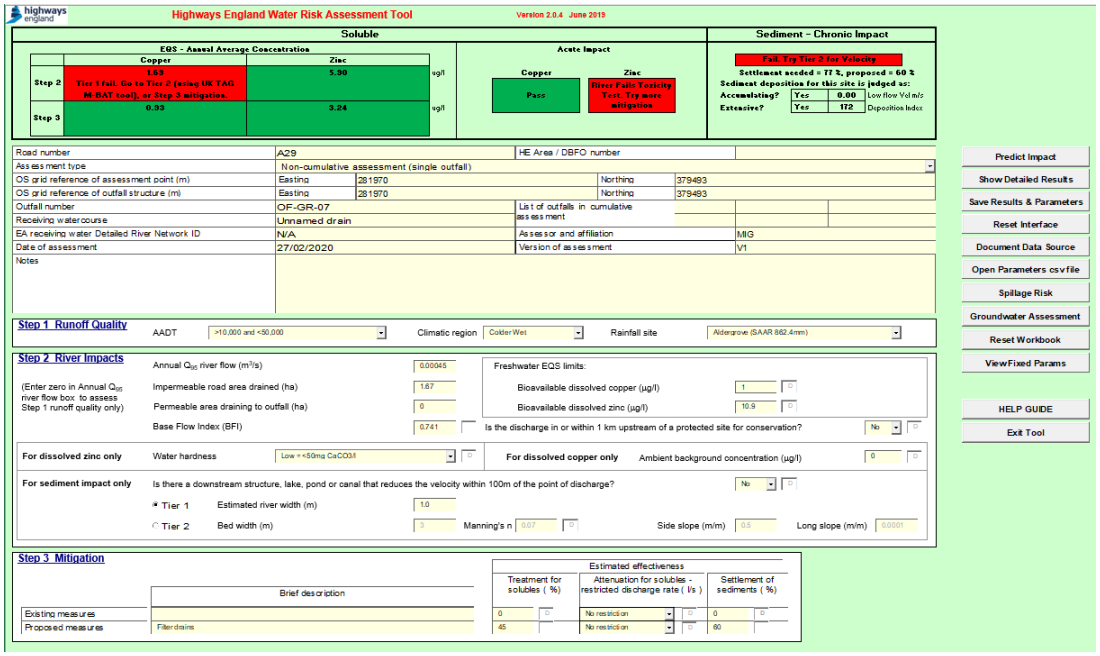

OF-GR-08

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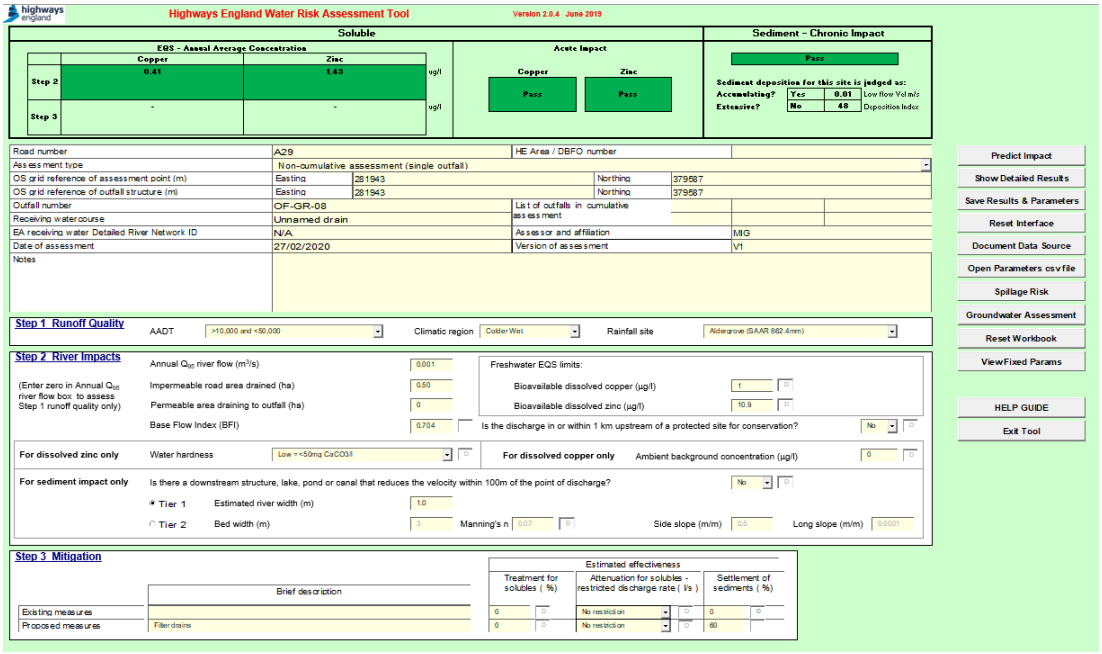

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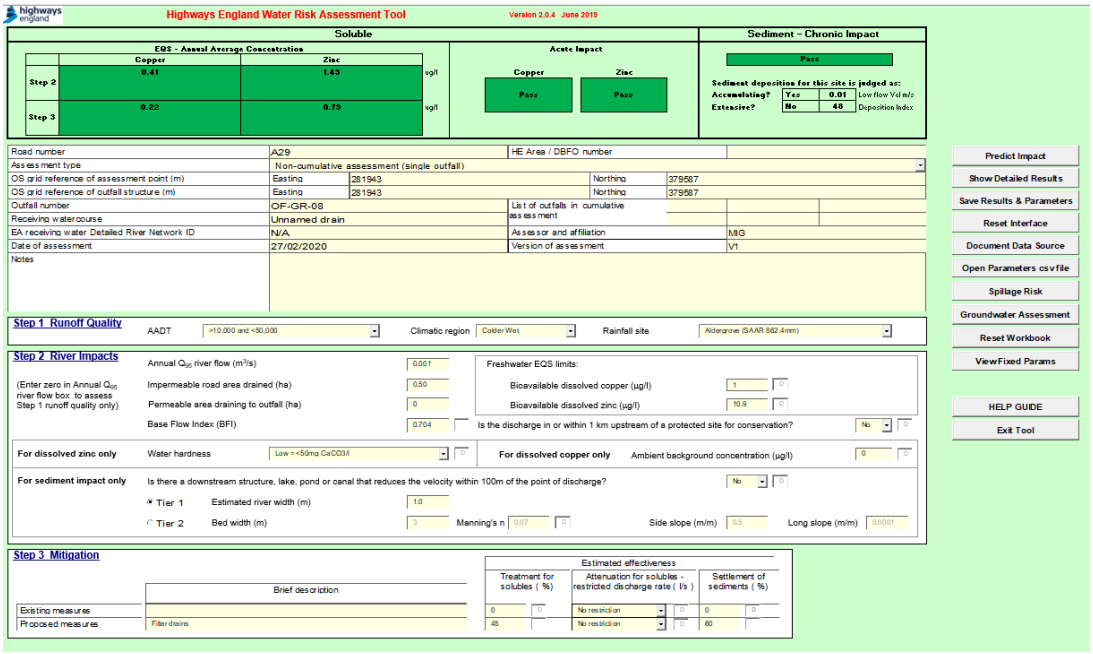
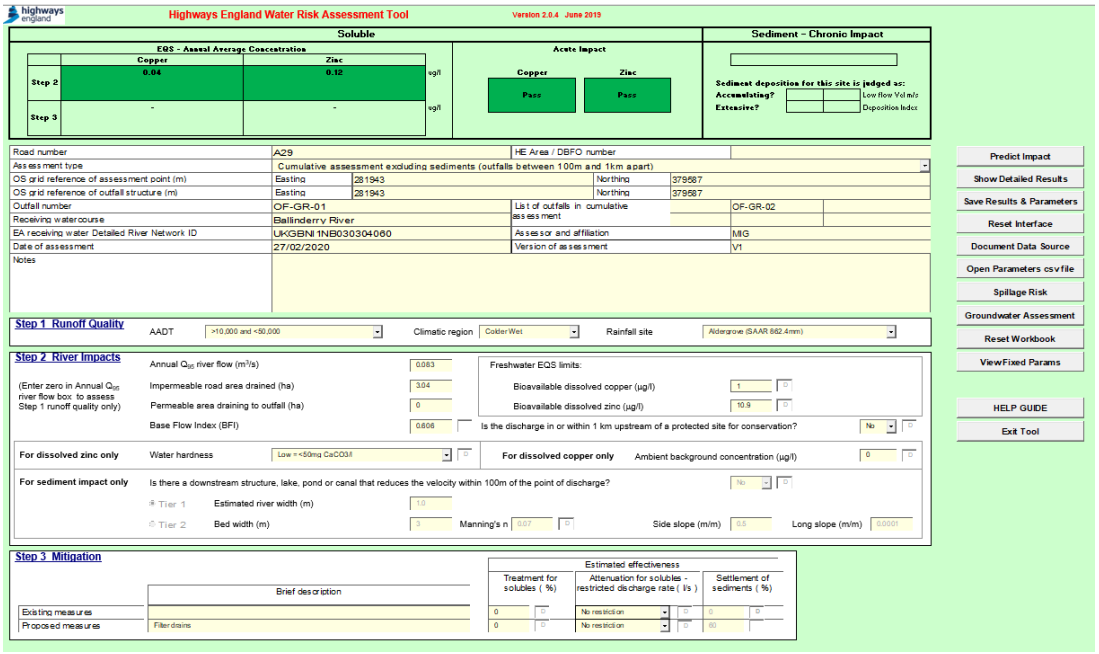


Cumulative (OF-GR-01 and OF-GR-02)

Copper



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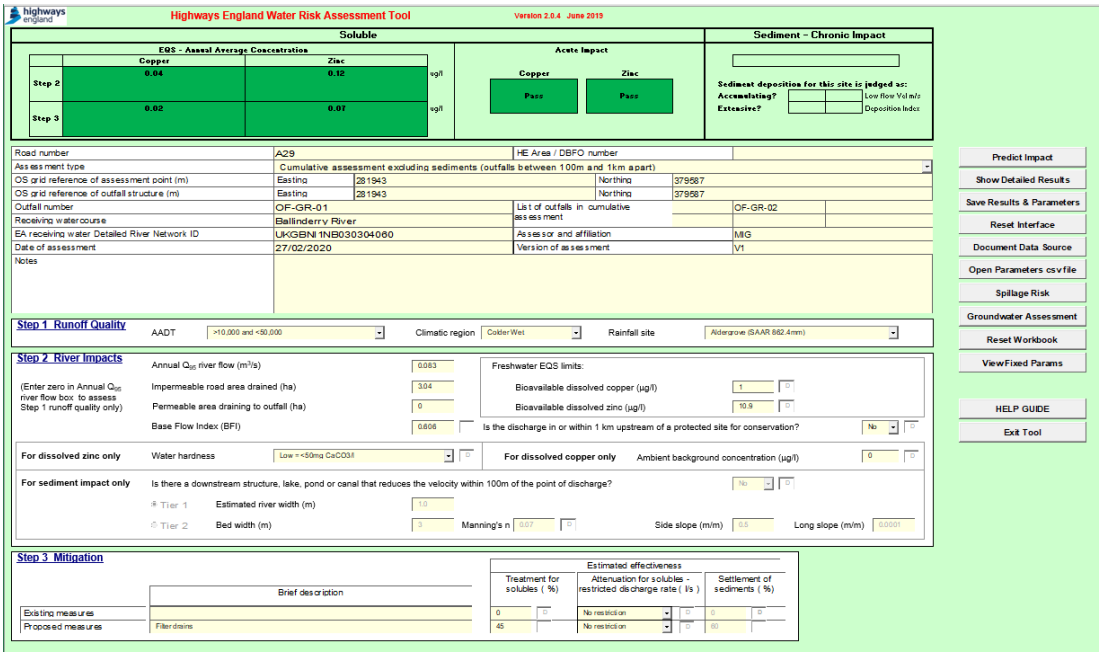
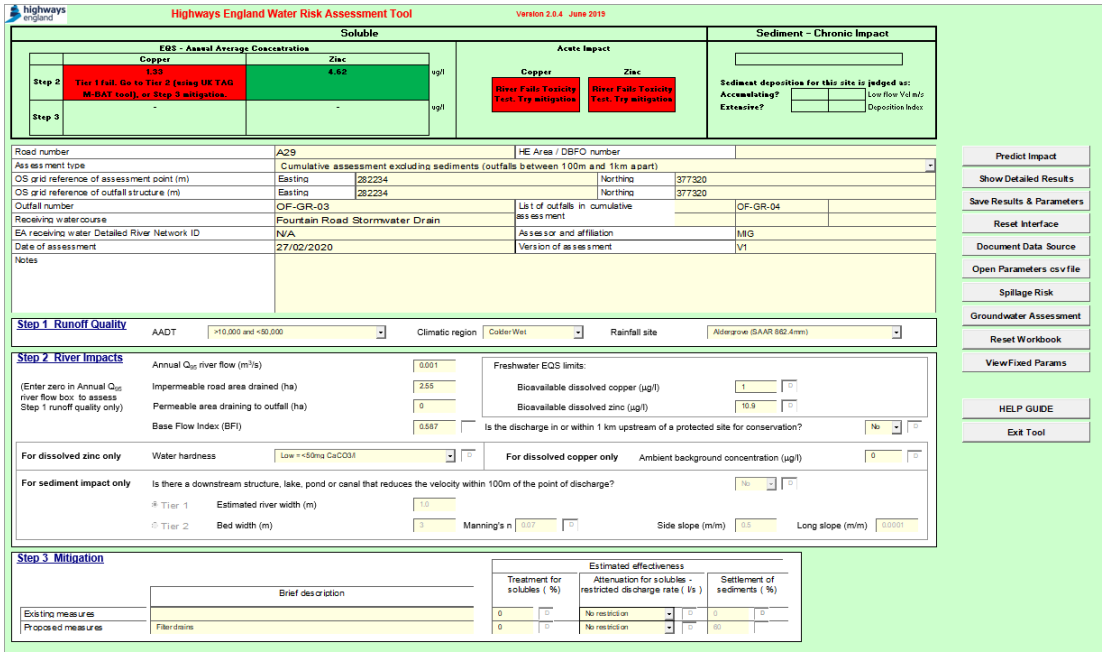


Cumulative (OF-GR-03 and OF-GR-04)

Copper



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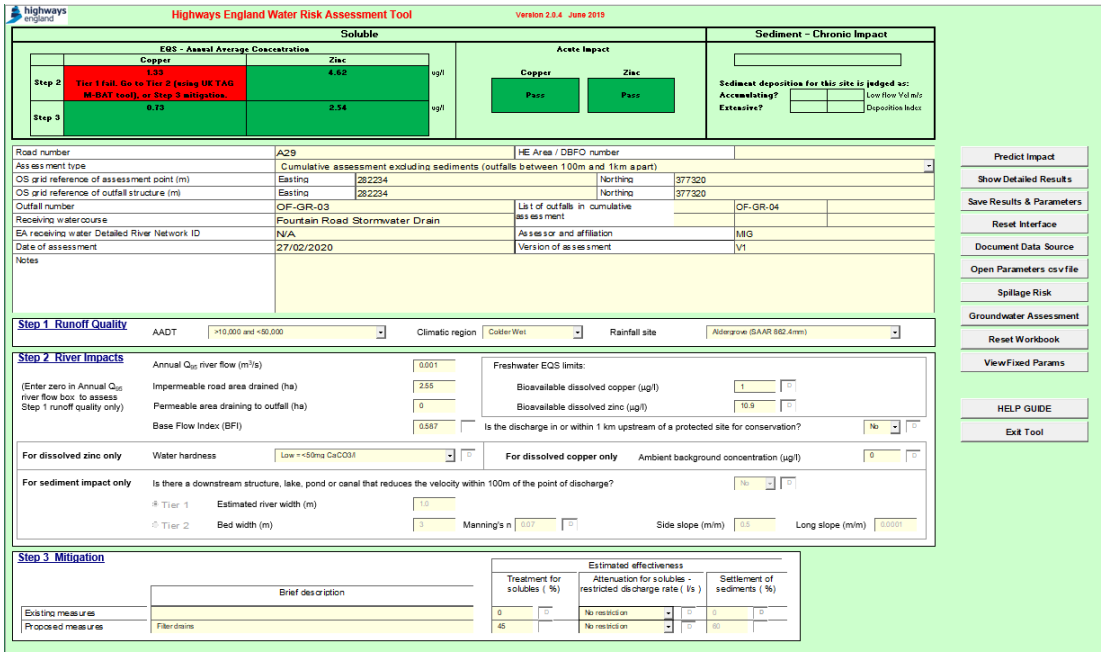
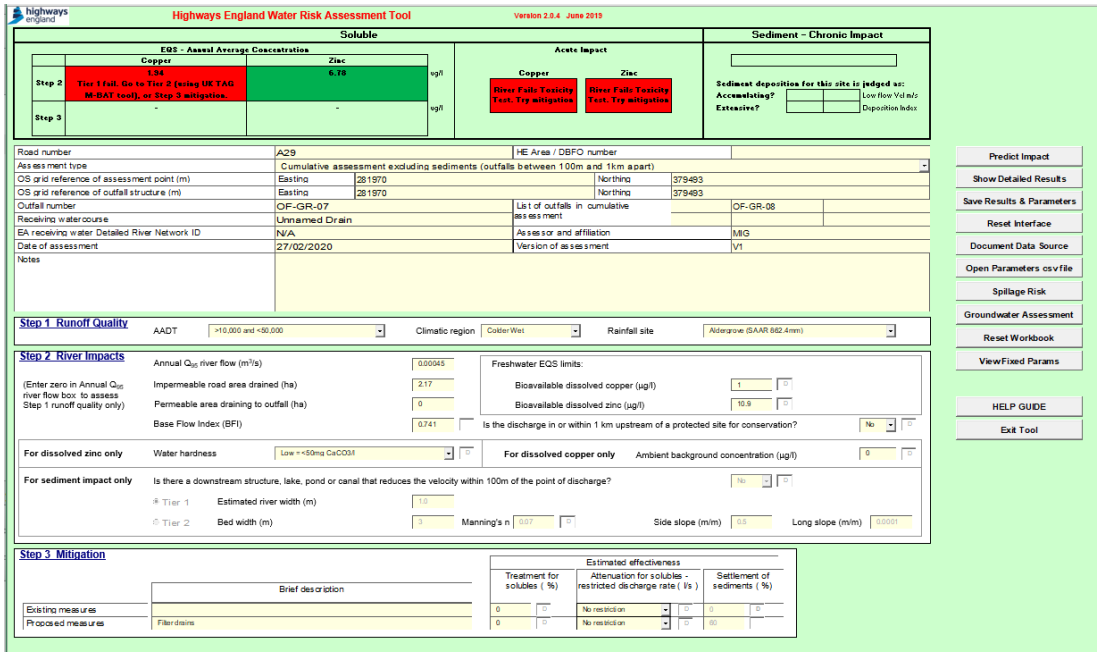


Cumulative (OF-GR-07 and OF-GR-08)

Copper



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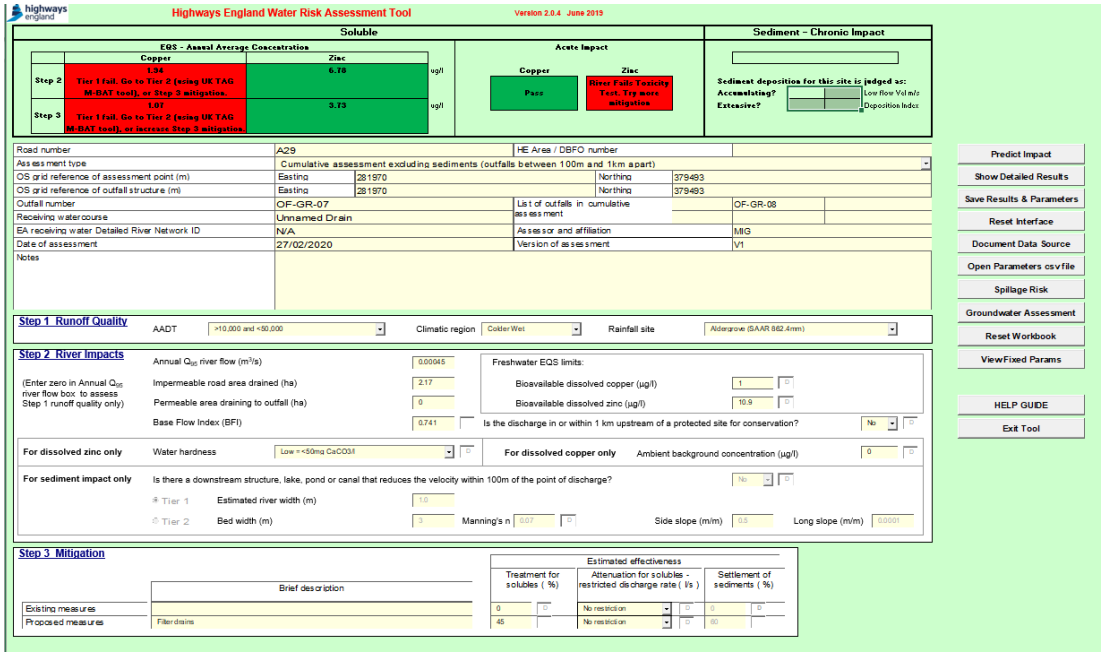

A.2 SPILLAGE CALCULATION RESULTS

RED ROUTE

Spillage Calculations Formula RL x SS x (AADT x 365 x 10^{-9}) x (%HGV /100)																			
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HGV	P^{spl}	P^{pol}	P^{inc}	Outfall Risk	Overall Prob.	Designated Area <1km	Annual Probability 1 in x	RANK	Annual Probability 1 in x		Cumulatives	
																	Overall Prob.	Annual Probability 1 in x
OF-RR-01	0.1013976	Rural	Roundabout	3.09	10110	12	0.000138743	0.75	0.000104057	0.00010405733154728	0.000104057	No	9610	4	9271			
OF-RR-01	0.0394799	Rural	No Junction	0.29	10110	12	5.0699E-06	0.75	3.80242E-06	0.00000380242425291	0.000003802	No	262990	26		OF-RR-01, OF-RR-02 and OF-RR-03	0.000224404	4456.25
OF-RR-02	0.2118212	Rural	No Junction	0.29	10110	12	2.72015E-05	0.75	2.04011E-05	0.00002040111723080	0.000020401	No	49017	15	22673	OF-RR-04 and OF-RR-05	0.000440212	2271.63
OF-RR-02	0.2461239	Rural	No Junction	0.29	10110	12	3.16065E-05	0.75	2.37049E-05	0.00002370491026017	0.000023705	No	42185	13		OF-RR-06 and OF-RR-07	0.000075523	13240.96
OF-RR-03	0.0486602	Rural	Side Road	0.93	10162	12	2.01424E-05	0.75	1.51068E-05	0.00001510676253830	0.000015107	No	66196	20	13805			
OF-RR-03	0.0487315	Rural	Side Road	0.93	10110	12	2.00686E-05	0.75	1.50515E-05	0.00001505148179348	0.000015051	No	66439	21				
OF-RR-03	0.0938029	Rural	No Junction	0.29	10110	12	1.20459E-05	0.75	9.03443E-06	0.00000903443073445	0.000009034	No	110688	25				
OF-RR-03	0.2064032	Rural	No Junction	0.29	10162	12	2.66421E-05	0.75	1.99815E-05	0.00001998154146174	0.000019982	No	50046	16				
OF-RR-03	0.1847739	Rural	Side Road	0.93	178	0	0	0.75	0	0.00000000000000000	0.000000000	No	0	1.5				
OF-RR-03	0.0427238	Rural	Side Road	0.93	10162	12	1.7685E-05	0.75	1.32638E-05	0.00001326378233821	0.000013264	No	75393	23				
OF-RR-04	0.057593	Rural	Side Road	0.93	10162	12	2.384E-05	0.75	1.788E-05	0.00001787998764633	0.000017880	No	55928	18	2418			
OF-RR-04	0.1094804	Rural	Side Road	0.93	10073	12	4.49213E-05	0.75	3.3691E-05	0.00003369097131209	0.000033691	No	29682	10				
OF-RR-04	0.0978188	Rural	Roundabout	3.09	10073	12	0.000133356	0.75	0.000100017	0.00010001727503562	0.000100017	No	9998	5				
OF-RR-04	0.1024623	Rural	Roundabout	3.09	7404	12	0.000102675	0.75	7.7006E-05	0.00007700596432445	0.000077006	No	12986	7				
OF-RR-04	0.2769242	Rural	No Junction	0.29	10073	12	3.54317E-05	0.75	2.65738E-05	0.00002657376655556	0.000026574	No	37631	12				
OF-RR-04	0.272111	Rural	No Junction	0.29	7404	12	2.55908E-05	0.75	1.91931E-05	0.00001919313332887	0.000019193	No	52102	17				
OF-RR-04	0.1488303	Rural	Roundabout	3.09	10537	9	0.000159185	0.75	0.000119389	0.00011938876340873	0.000119389	No	8376	3				
OF-RR-04	0.1021259	Rural	Roundabout	3.09	2463	8	2.26956E-05	0.75	1.70217E-05	0.00001702169886143	0.000017022	No	58749	19				
OF-RR-04	0.0570856	Rural	Side Road	0.93	2463	8	3.81818E-06	0.75	2.86364E-06	0.00000286363752864	0.000002864	No	349206	27				
OF-RR-04	0.095746	Rural	Side Road	0.93	77	0	0	0.75	0	0.00000000000000000	0.000000000	No	0	1.5				
OF-RR-05	0.0851159	Rural	Roundabout	3.09	5497	3	1.5831E-05	0.75	1.18733E-05	0.00001187326865428	0.000011873	No	84223	24	37627			
OF-RR-05	0.3152463	Rural	Side Road	0.93	3664	5	1.96043E-05	0.75	1.47032E-05	0.00001470322298791	0.000014703	No	68012	22				
OF-RR-06	0.6259774	Rural	No Junction	0.29	7404	12	5.88704E-05	0.75	4.41528E-05	0.00004415281888294	0.000044153	Yes	22649	9	22649			
OF-RR-07	0.4447545	Rural	No Junction	0.29	7404	12	4.18272E-05	0.75	3.13704E-05	0.00003137040552243	0.000031370	No	31877	11	31877			
OF-RR-08	0.0990736	Rural	Roundabout	3.09	7404	12	9.92789E-05	0.75	7.44592E-05	0.00007445917285767	0.000074459	No	13430	8	5680			
OF-RR-08	0.3322274	Rural	No Junction	0.29	7404	12	3.12445E-05	0.75	2.34334E-05	0.00002343339587044	0.000023433	No	42674	14				
OF-RR-08	0.1204487	Rural	Roundabout	3.09	7671	10	0.000104209	0.75	7.81568E-05	0.00007815678874117	0.000078157	Yes	12795	6				

PURPLE A ROUTE

Spillage Calculations
Formula
RL x SS x (AADT x 365 x 10^{-9}) x (%HGV /100)

Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HGV	P^{spl}	P^{pol}	P^{inc}	Outfall Risk	Overall Prob.	Designated Area <1km	Annual Probability 1 in x	RANK	Annual Probability 1 in x		Cumulatives	
																	Overall Prob.	Annual Probability 1 in x
OF-PA-01	0.1002804	Rural	Roundabout	3.09	8756	10	9.90315E-05	0.75	7.42736E-05	0.000074273590310 24	0.000074274	No	13464	8	13264			
OF-PA-01	0.0160749	Rural	No Junction	0.29	8756	10	1.48986E-06	0.75	1.11739E-06	0.000001117393545 96	0.000001117	No	894940	20		OF-PA-01, OF-PA-02 and OF-PA-03	0.000169688	5893.16
OF-PA-02	0.4471232	Rural	No Junction	0.29	8756	10	4.14404E-05	0.75	3.10803E-05	0.000031080291505 82	0.000031080	No	32175	11	32175	OF-PA-04 and OF-PA-05	0.000377987	2645.60
OF-PA-03	0.1452327	Rural	Side Road	0.93	178	0	0	0.75	0	0.000000000000000 00	0.000000000	No	0	2				
OF-PA-03	0.1025486	Rural	Side Road	0.93	8756	10	3.04797E-05	0.75	2.28598E-05	0.000022859807294 71	0.000022860	No	43745	13				
OF-PA-03	0.0730228	Rural	No Junction	0.29	8756	10	6.76792E-06	0.75	5.07594E-06	0.000005075938601 65	0.000005076	No	197008	18	15819			
OF-PA-03	0.1038266	Rural	Side Road	0.93	8756	10	3.08596E-05	0.75	2.31447E-05	0.000023144694984 28	0.000023145	No	43206	12				
OF-PA-03	0.1745971	Rural	No Junction	0.29	8756	10	1.61821E-05	0.75	1.21365E-05	0.000012136540363 08	0.000012137	No	82396	16				
OF-PA-04	0.5643715	Rural	No Junction	0.29	8756	10	5.23072E-05	0.75	3.92304E-05	0.000039230419574 69	0.000039230	No	25490	10	25490			
OF-PA-05	0.0999138	Rural	Roundabout	3.09	8756	10	9.86694E-05	0.75	7.40021E-05	0.000074002064686 01	0.000074002	No	13513	9				
OF-PA-05	0.1311146	Rural	No Junction	0.29	8756	10	1.2152E-05	0.75	9.114E-06	0.000009113998085 25	0.000009114	No	109721	17				
OF-PA-05	0.1830824	Rural	Roundabout	3.09	9138	10	0.00018869	0.75	0.000141518	0.000141511756843 509	0.000141518	No	7066	4				
OF-PA-05	0.1006113	Rural	Roundabout	3.09	3007	7	2.38852E-05	0.75	1.79139E-05	0.000017913928478 14	0.000017914	No	55822	14				
OF-PA-05	0.1001469	Rural	Roundabout	3.09	4098	0	0	0.75	0	0.000000000000000 00	0.000000000	No	0	2	2952			
OF-PA-05	0.0454865	Rural	Side Road	0.93	4098	0	0	0.75	0	0.000000000000000 00	0.000000000	No	0	2				
OF-PA-05	0.1034177	Rural	Roundabout	3.09	7015	13	0.00010637	0.75	7.97771E-05	0.000079777148627 39	0.000079777	No	12535	6				
OF-PA-05	0.2260248	Rural	No Junction	0.29	7005	11	1.84352E-05	0.75	1.38264E-05	0.000013826397682 80	0.000013826	No	72325	15				
OF-PA-05	0.0486133	Rural	Side Road	0.93	3007	7	3.47346E-06	0.75	2.6051E-06	0.000002605095493 76	0.000002605	No	383863	19				
OF-PA-06	1.5839577	Rural	No Junction	0.29	7015	13	0.000152899	0.75	0.000114674	0.000114674467691 69	0.000114674	No	8720	5	8720			
OF-PA-07	0.1002818	Rural	Roundabout	3.09	7015	13	0.000103144	0.75	7.73581E-05	0.000077358093084 87	0.000077358	No	12927	7	12927			

PURPLE B ROUTE

Spillage Calculations Formula RL x SS x (AADT x 365 x 10^{-9}) x (%HGV /100)																		
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HGV	P^{spl}	P^{pol}	P^{inc}	Outfall Risk	Overall Prob.	Designated Area <1km	Annual Probability 1 in x	RANK	Annual Probability 1 in x		Cumulatives	
																	Overall Prob.	Annual Probability 1 in x
OF-PB-01	0.1012332	Rural	Roundabout	3.09	8547	11	0.000107345	0.75	8.05085E-05	0.00008050854197984	0.000080509	No	12421	4	12248			
OF-PB-01	0.0152047	Rural	No Junction	0.29	8547	11	1.51313E-06	0.75	1.13484E-06	0.00000113484453471	0.000001135	No	881178	26		OF-PB-01, OF-PB, 02 and OF-PB-03	0.000188902	5293.76
OF-PB-02	0.4492829	Rural	No Junction	0.29	8999	11	4.70758E-05	0.75	3.53068E-05	0.00003530684834243	0.000035307	No	28323	10	28323	OF-PB-04 and OF-PB-05	0.000378373	2642.90
OF-PB-03	0.0704353	Rural	No Junction	0.29	8999	11	7.3802E-06	0.75	5.53515E-06	0.00000553515046990	0.000005535	No	180664	21				
OF-PB-03	0.1046079	Rural	Side Road	0.93	8999	11	3.51502E-05	0.75	2.63626E-05	0.00002636261559883	0.000026363	No	37933	13				
OF-PB-03	0.1471014	Rural	Side Road	0.93	178	0	0	0.75	0	0.00000000000000000	0.000000000	No	0	1	13898			
OF-PB-03	0.104805	Rural	Side Road	0.93	9051	11	3.54199E-05	0.75	2.65649E-05	0.00002656490876900	0.000026565	No	37644	11				
OF-PB-03	0.170658	Rural	No Junction	0.29	9051	11	1.79848E-05	0.75	1.34886E-05	0.00001348863576343	0.000013489	No	74136	17				
OF-PB-04	0.5653779	Rural	No Junction	0.29	9051	11	5.95825E-05	0.75	4.46869E-05	0.00004468689754827	0.000044687	No	22378	9	22378			
OF-PB-05	0.1296428	Rural	No Junction	0.29	9051	11	1.36624E-05	0.75	1.02468E-05	0.00001024683582692	0.000010247	No	97591	19				
OF-PB-05	0.0985239	Rural	Roundabout	3.09	9051	11	0.000110632	0.75	8.29743E-05	0.00008297427226658	0.000082974	No	12052	3				
OF-PB-05	0.1806706	Rural	Roundabout	3.09	9090	9	0.000166704	0.75	0.000125028	0.00012502777046505	0.000125028	No	7998	2				
OF-PB-05	0.0999991	Rural	Roundabout	3.09	5098	2	1.14995E-05	0.75	8.62459E-06	0.00000862459132798	0.000008625	No	115948	20				
OF-PB-05	0.0453638	Rural	Side Road	0.93	5146	1	7.92419E-07	0.75	5.94314E-07	0.00000059431444402	0.000000594	No	1682611	27	2997			
OF-PB-05	0.1002986	Rural	Roundabout	3.09	2797	7	2.21481E-05	0.75	1.66111E-05	0.00001661108439375	0.000016611	No	60201	14				
OF-PB-05	0.0497622	Rural	Side Road	0.93	2797	7	3.30724E-06	0.75	2.48043E-06	0.00000248043102697	0.000002480	No	403156	25				
OF-PB-05	0.1062292	Rural	Roundabout	3.09	5784	14	9.70178E-05	0.75	7.27634E-05	0.00007276337554757	0.000072763	No	13743	6				
OF-PB-05	0.2234272	Rural	No Junction	0.29	5784	14	1.91506E-05	0.75	1.4363E-05	0.00001436297778196	0.000014363	No	69623	16				
OF-PB-06	1.1481828	Rural	No Junction	0.29	5784	14	9.84143E-05	0.75	7.38107E-05	0.00007381072692146	0.000073811	No	13548	5	13548			
OF-PB-07	0.0984717	Rural	Roundabout	3.09	5784	14	8.9933E-05	0.75	6.74498E-05	0.00006744975287311	0.000067450	No	14826	7				
OF-PB-07	0.7916376	Rural	No Junction	0.29	5784	14	6.78537E-05	0.75	5.08903E-05	0.00005089028220451	0.000050890	No	19650	8				
OF-PB-07	0.0996106	Rural	Roundabout	3.09	915	14	1.43915E-05	0.75	1.07936E-05	0.00001079362419630	0.000010794	No	92647	18				
OF-PB-07	0.0994837	Rural	Roundabout	3.09	4857	4	2.17987E-05	0.75	1.63491E-05	0.00001634905411217	0.000016349	No	61166	15	5424			
OF-PB-07	0.5355162	Rural	Side Road	0.93	4857	4	3.53164E-05	0.75	2.64873E-05	0.00002648730573465	0.000026487	No	37754	12				
OF-PB-07	0.062455	Rural	Roundabout	3.09	4217	2	5.9409E-06	0.75	4.45567E-06	0.00000445567408755	0.000004456	No	224433	23				
OF-PB-07	0.0482484	Rural	Roundabout	3.09	915	14	6.97081E-06	0.75	5.22811E-06	0.00000522810923409	0.000005228	No	191274	22				
OF-PB-07	0.0832079	Rural	Side Road	0.93	915	14	3.61817E-06	0.75	2.71363E-06	0.00000271363084800	0.000002714	No	368510	24				

GREEN ROUTE

Spillage Calculations Formula RL x SS x (AADT x 365 x 10^{-9}) x (%HGV /100)																		
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HGV	P^{spl}	P^{pol}	P^{inc}	Outfall Risk	Overall Prob.	Designated Area <1km	Annual Probability 1 in x	RANK	Annual Probability 1 in x		Cumulatives	
																	Overall Prob.	Annual Probability 1 in x
OF-GR-01	0.10204	Rural	Roundabout	3.09	19080	10	0.000219584	0.75	0.000164688	0.00016468779983400	0.000164688	No	6072	2				
OF-GR-01	0.02335	Rural	No Junction	0.29	19080	10	4.71581E-06	0.75	3.53686E-06	0.00000353685602250	0.000003537	No	282737	20	2,234			
OF-GR-01	0.2527	Rural	Roundabout	3.09	14527	9	0.000372628	0.75	0.000279471	0.00027947070800539	0.000279471	No	3578	1		OF-GR_01 and OF-GR-02	0.000693050	1442.90
OF-GR-02	0.10001	Rural	Side Road	0.93	19080	10	6.47735E-05	0.75	4.85802E-05	0.00004858015252950	0.000048580	No	20585	13		OF-GR_03 and OF-GR-04	0.000553246	1807.51
OF-GR-02	0.09964	Rural	Side Road	0.93	19080	10	6.45339E-05	0.75	4.84004E-05	0.00004840042393800	0.000048400	No	20661	14	4,076	OF-GR_07 and OF-GR-08	0.000241863	4134.58
OF-GR-02	0.48086	Rural	No Junction	0.29	19080	10	9.71154E-05	0.75	7.28365E-05	0.00007283651336100	0.000072837	No	13729	9				
OF-GR-02	0.49869	Rural	No Junction	0.29	19080	10	0.000100716	0.75	7.55372E-05	0.00007553724753150	0.000075537	No	13239	8				
OF-GR-03	0.23934	Rural	No Junction	0.29	19080	10	4.83375E-05	0.75	3.62532E-05	0.00003625315290900	0.000036253	No	27584	15	27,584			
OF-GR-04	0.09956	Rural	Roundabout	3.09	19080	10	0.000214247	0.75	0.000160685	0.00016068519552600	0.000160685	No	6223	3				
OF-GR-04	0.10032	Rural	Roundabout	3.09	8564	1	9.68982E-06	0.75	7.26736E-06	0.00000726736192776	0.000007267	No	137602	19				
OF-GR-04	0.17219	Rural	Roundabout	3.09	9739	9	0.000170222	0.75	0.000127667	0.00012766663413350	0.000127667	No	7833	6	1,934			
OF-GR-04	0.09737	Rural	Roundabout	3.09	4887	5	2.68342E-05	0.75	2.01257E-05	0.00002012565949656	0.000020126	No	49688	16				
OF-GR-04	0.09625	Rural	Roundabout	3.09	14995	11	0.000179057	0.75	0.000134293	0.00013429272942422	0.000134293	No	7446	5				
OF-GR-04	0.51132	Rural	No Junction	0.29	14995	11	8.92735E-05	0.75	6.69552E-05	0.00006695516139593	0.000066955	No	14935	10				
OF-GR-05	0.78745	Rural	No Junction	0.29	14995	11	0.000137484	0.75	0.000103113	0.00010311320081597	0.000103113	No	9698	7	9,698			
OF-GR-06	0.38133	Rural	No Junction	0.29	14995	11	6.6578E-05	0.75	4.99335E-05	0.00004993352830929	0.000049934	No	20027	12	20,027			
OF-GR-07	0.50098	Rural	No Junction	0.29	14995	11	8.74682E-05	0.75	6.56012E-05	0.00006560118273514	0.000065601	No	15244	11	15,244			
OF-GR-08	0.1014	Rural	Roundabout	3.09	14995	11	0.000188638	0.75	0.000141478	0.00014147826247913	0.000141478	No	7068	4				
OF-GR-08	0.17197	Rural	Roundabout	3.09	806	16	2.50126E-05	0.75	1.87595E-05	0.00001875945957444	0.000018759	No	53306	17	5,673			
OF-GR-08	0.0704	Rural	Roundabout	3.09	13454	2	2.13651E-05	0.75	1.60238E-05	0.00001602384315840	0.000016024	No	62407	18				

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APPENDIX B-14:

ROAD DRAINAGE AND THE WATER ENVIRONMENT: WATER FRAMEWORK DIRECTIVE SCREENING ASSESSMENT

Client Name

WFD SCREENING ASSESSMENT

A29 Cookstown Bypass

MARCH 2021

CONFIDENTIAL

WFD SCREENING ASSESSMENT

A29 Cookstown Bypass

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 718314

DATE: MARCH 2021

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WFD SCREENING ASSESSMENT

A29 Cookstown Bypass

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	September 2019	15/03/2021		
Prepared by	Neil Burrows; and Marta Garcia Ibenez	Neil Burrows; and Marta Garcia Ibenez		
Signature				
Checked by	Helena Parsons	Helena Parsons		
Signature				
Authorised by				
Signature				
Report number				
File reference				

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FIGURES

APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

1.1.1. The Northern Ireland Environment Agency (NIEA) requires an assessment of the impact of any works/modifications to water bodies in the UK under the European Union's Water Framework Directive (WFD) (2000/60/EC). The WFD was transposed into law in Northern Ireland under the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017.

1.1.2. The primary aim of the Water Framework Directive (WFD) is to improve/maintain the Ecological Status/Potential of all water bodies and to prevent deterioration in status of the water bodies and their associated WFD quality elements. Ecological Status/Potential is determined by a suite of biological, physico-chemical and hydromorphological quality elements. This WFD assessment aims to establish the baseline conditions, evaluate potential impacts of the Proposed Scheme and assess compliance of the Proposed Scheme against WFD objectives.

1.1.3. The overarching objective of the WFD is for surface water bodies in Europe to attain overall 'Good Ecological Status (GES) or 'Good Ecological Potential' (GEP). GES refers to situations where the ecological characteristics show only a slight deviation from natural/near natural conditions. In such a situation, the biological, chemical, physico-chemical and hydromorphological conditions are associated with limited or no human pressure. Artificial and heavily modified water bodies have a target to achieve GEP, which recognises their important uses, whilst ensuring the quality elements are protected as far as possible.

1.1.4. The WFD sets a number of objectives including:

- Prevent deterioration in status for water bodies;
- Aim to achieve good biological and good surface water chemical status in water bodies. Those water bodies that did not achieve GES by 2015 need to achieve compliance by 2021 or 2027;
- For water bodies that are designated as artificial or heavily modified (A/HMWB), the objective is to achieve GEP. Those A/HMWB that did not achieve GEP by 2015 need to achieve compliance by 2021 or 2027;
- Comply with objectives and standards for protected areas where relevant; and,
- Reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

1.1.5. The introduction of a new modification, change in activity or change to structure on a water body needs to be considered in relation to whether it could cause deterioration in the Ecological Status or Potential of any water body. New modifications or changes to activities or structures may also result in any proposed mitigation measures or actions to achieve GES/GEP being ineffective. This could result in the water body failing to meet GES/GEP. Where a Scheme is considered to cause deterioration or where it may contribute to the failure of the water body to meet GES/GEP, then an Article 4.7 assessment would be required which makes provision for deterioration of status provided that certain conditions are met.

1.1.6. The purpose of this WFD screening assessment is to identify the extent to which the Proposed Scheme would likely affect relevant WFD water bodies: Lissan Water, the Ballinderry River

(Cookstown), the Ballinderry River (Derrygonnigan) and the Cookstown and Moneymore groundwater bodies.

1.2 THE PROPOSED SCHEME

1.2.1. The proposed scheme would involve a 4km single carriageway with no private accesses, extending from the A29 Dungannon Road roundabout to the south of the town to a proposed roundabout on the A29 Moneymore Road to the north, in the vicinity of the termination of the Moneymore Road dual carriageway. The proposed scheme also includes improvements to the carriageway connecting the A29 Dungannon Road roundabout to the A505 Omagh Road via the Sandholes Road.

1.2.2. This new carriageway aims to greatly improve journey times and journey time reliability for road users travelling within and through Cookstown, significantly improve road safety and traffic congestion, enhance connectivity and unlock the economic potential of the region.

1.2.3. All the proposed route options cross a number of watercourses which will require culverting and/or watercourse diversions/realignments. It is also noted that a bridge structure will be required across any major watercourse.

1.2.4. The watercourses which may potentially be affected by each of the route options include the Lissan Water, Ballinderry River (Cookstown), Ballindery River (Derrygonningan), Fairy Burn, Molesworth Road Stormwater Drain, Fountain Road Stormwater Drain and undesignated watercourses.

1.2.5. Consequently, it might be necessary to alter the alignment of specific watercourses in order to avoid excessive culverting. As such, this provides an opportunity to not only mitigate the impacts of the Proposed Scheme but enhance the aquatic and riparian environment of the affected watercourses.

1.2.6. The Proposed Scheme comprises the following elements:

- New bypass linking the A29 Dungannon Road to the A29 Moneymore Road to remove the traffic through Cookstown;
- Retaining walls on both sides of the route to the Ballinderry River (Cookstown) and the Waste Water Treatment Works (WwTw);
- Cuttings required at Ballinderry River;
- Construction of embankments to accommodate the new bypass and enable the provision of culverts; and,
- Upgrade to the existing Sandholes Link road.

1.2.7. An overview of the proposed routes is provided in

1.2.8. Figure 1-1. The interaction points within each water body are provided in Figure 1-2, Figure 1-3 and Figure 1-4.

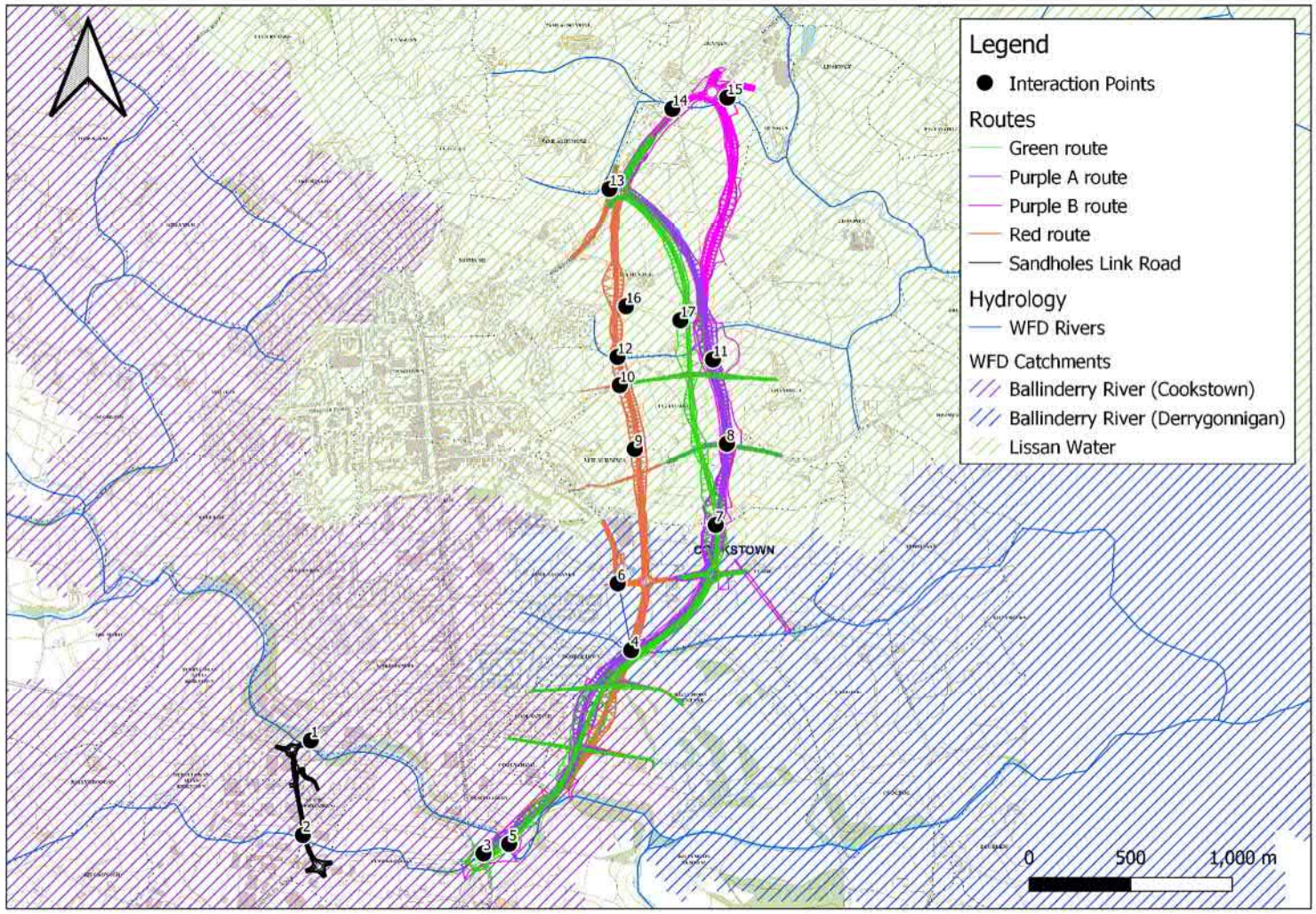

Figure 1-1 – The proposed scheme, WFD Rivers and Catchments, and watercourse interaction points.

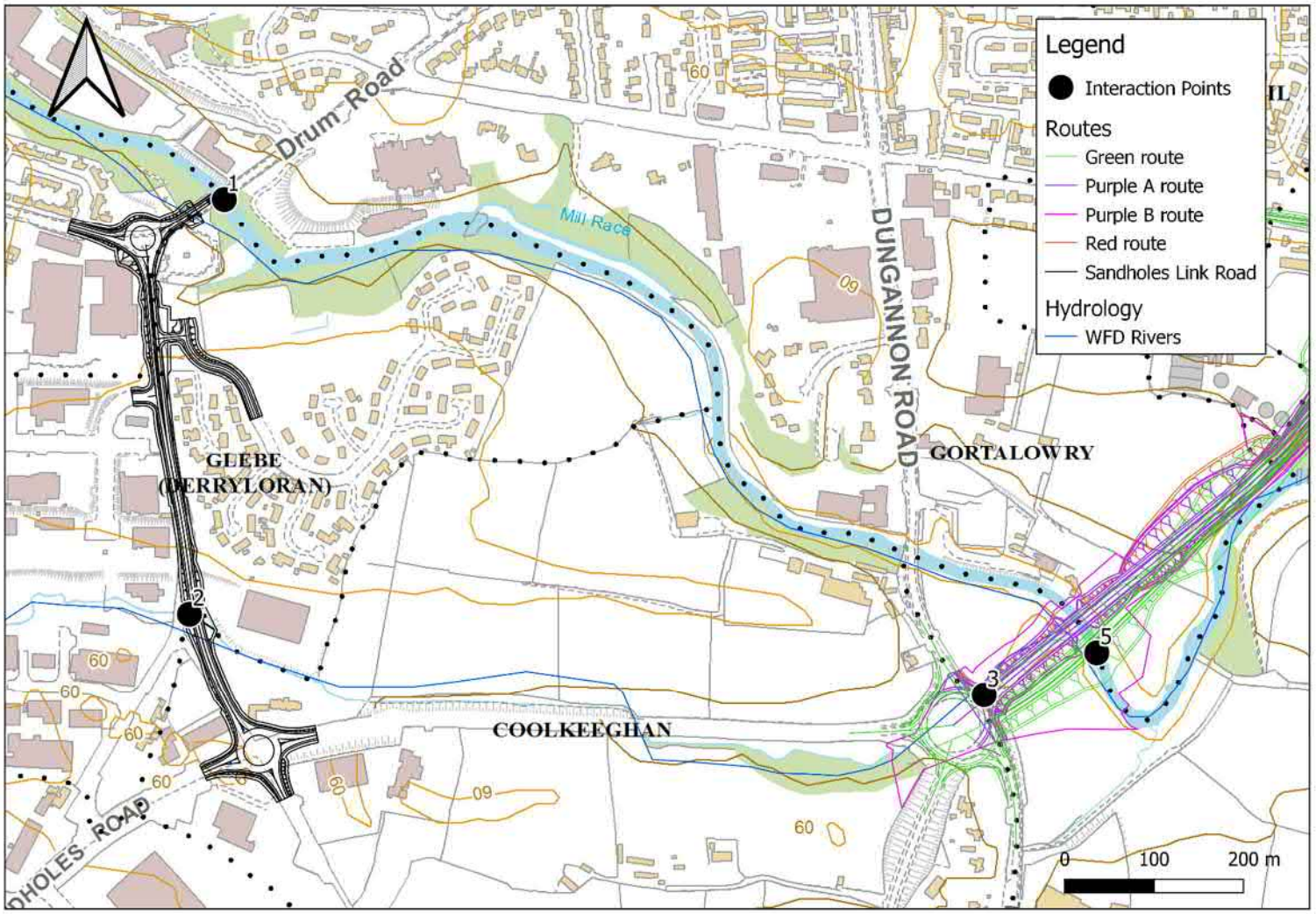

Figure 1-2 – Interaction points within the Ballinderry (Cookstown) water body catchment.

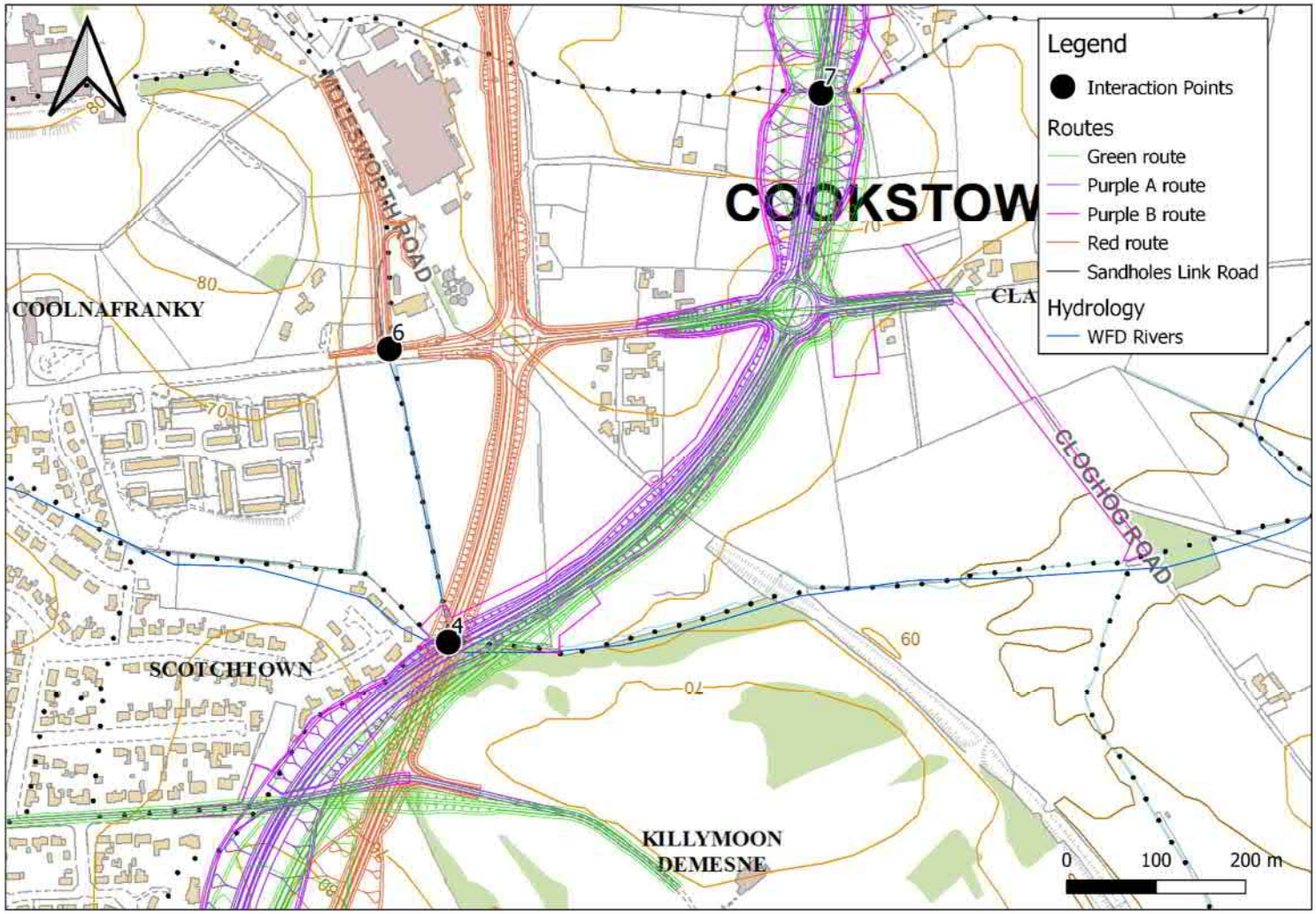

Figure 1-3 – Interaction points within the Ballinderry (Derrygonigan) water body catchment.

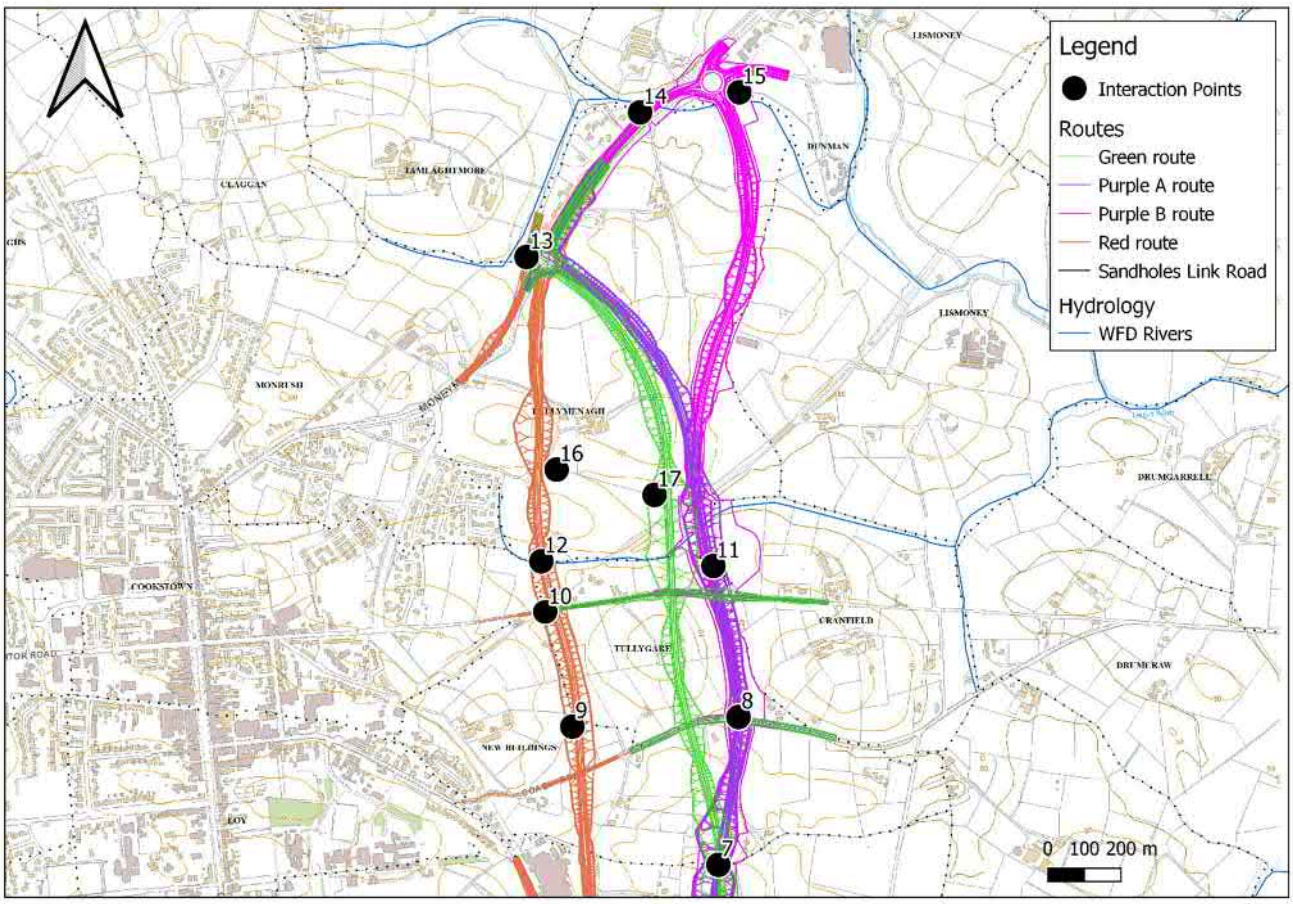

Figure 1-4 – Interaction points within the Lissan Water water body catchment.

1.3 SCREENING METHODOLOGY

1.3.1. Each potential watercourse crossing was identified during a desk study using a range of information including contemporary and historical mapping data, open source data (specifically, WFD catchment and river segment data), and literature available online. Following this, a walkover survey was conducted from 1st July to 4th July that specifically targeted the crossing points identified at the desk study phase. Each watercourse was assessed based predominantly on their hydromorphological characteristics; however, aquatic and riparian habitats were also taken into consideration, in addition to physico-quality elements.

2 BASELINE CONDITIONS

2.1 WFD STATUS

2.1.1. The WFD water bodies potentially impacted by the proposed scheme are:

- Lissan Water;
- Ballinderry River (Cookstown);
- Ballinderry River (Derrygonnigan);
- Cookstown (groundwater); and,
- Moneymore (groundwater).

2.1.2. The WFD status for the Lissan Water water body is provided in Table 2-1. The WFD status for the Ballinderry River (Cookstown) water body is provided in Table 2-2. The WFD status for the Ballinderry River (Derrygonnigan) water body is provided in Table 2-3. The WFD status for the Cookstown groundwater body is provided in Table 2-4. The WFD status for the Moneymore groundwater body is provided in Table 2-5.

Table 2-1 – WFD Status of the Lissan Water potentially impacted by the proposed scheme (DAERA, 2015[1]).

	Current WFD Baseline Status
Water Body ID	UKGBNI1NB030308231
Water Body Name	Lissan Water
Water Body Type	River
Water Body area (Km^2)	44.7
Hydromorphological Designation	Not Heavily Modified
Reason for Designation	N/A
Overall Ecological Status/Potential	Good
Current Overall Status/Potential	Moderate
Status Objective (overall)	Good by 2021
Justification for not Achieving Good Status by 2015 (from 2009) Neagh Bann RBMP	Soluble Reactive Phosphorus
Protected Area Designation	

[1] https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=7e234827aa7a405d990359aa92c7c287

	Current WFD Baseline Status
Biological Quality Elements	
Overall Biological Quality Element Status	Good
Fish	
Invertebrates	Good
Macrophytes	High
Phytobenthos	Good
Physico-chemical Quality Elements	
Overall Physico-Chemical Quality Element Status	Moderate
Ammonia	Good/High
Temperature	High
Dissolved Oxygen	High
pH	High
Soluble Reactive Phosphorus	Moderate
Specific pollutants	
Specific pollutants Quality Element Status	Good/High
Ammonia	Good/High
Arsenic (dissolved)	Good/High
Chromium (dissolved)	Good/High
Iron (dissolved)	Good/High
Chemical	
Overall Chemical Quality Element Status	Moderate
Overall Chemical Quality Element Status Objective	Good
Cadmium (dissolved)	Good
Lead (dissolved)	Good
Priority substances	Good
Nickel (dissolved)	Good
Priority hazardous substances	Good

	Current WFD Baseline Status
Dissolved inorganic Nitrogen	
Hydromorphological Quality Elements	
Hydromorphology Supporting Elements Status	Good
Hydrological regime	Good
Mitigation Measures Assessment	
Current	

Table 2-2 – WFD Status of the Ballinderry River (Cookstown) potentially impacted by the proposed scheme (DAERA, 2015).

	Current WFD Baseline Status
Water Body ID	UKGBNI1NB030308230
Water Body Name	Ballinderry River (Cookstown)
Water Body Type	River
Water Body area (Km^2)	26.2
Hydromorphological Designation	Not Heavily Modified
Reason for Designation	N/A
Overall Ecological Status/Potential	Good
Current Overall Status/Potential	Moderate
Status Objective (overall)	Moderate by 2021
Justification for not Achieving Good Status by 2015 (from 2009) Neagh Bann RBMP	Soluble Reactive Phosphorus
Protected Area Designation	
Biological Quality Elements	
Overall Biological Quality Element Status	Good
Fish	
Invertebrates	Good
Macrophytes	High
Phytobenthos	Moderate

	Current WFD Baseline Status
Physico-chemical Quality Elements	
Overall Physico-Chemical Quality Element Status	Good
Ammonia	Good/High
Temperature	High
Dissolved Oxygen	High
pH	High
Soluble Reactive Phosphorus	Moderate
Specific pollutants	
Specific pollutants Quality Element Status	Good/High
Ammonia	Good/High
Arsenic (dissolved)	Good/High
Chromium (dissolved)	Good/High
Iron (dissolved)	Good/High
Chemical	
Overall Chemical Quality Element Status	Moderate
Overall Chemical Quality Element Status Objective	Good
Cadmium (dissolved)	Good
Lead (dissolved)	Good
Priority substances	Good
Nickel (dissolved)	Good
Priority hazardous substances	Good
Dissolved inorganic Nitrogen	
Hydromorphological Quality Elements	
Hydromorphology Supporting Elements Status	Good
Hydrological regime	Good
Mitigation Measures Assessment	
Current	

Table 2-3 – WFD Status of the Ballinderry River (Derrygonnigan) potentially impacted by the proposed scheme (DAERA, 2015).

	Current WFD Baseline Status
Water Body ID	UKGBNI1NB030304063
Water Body Name	Ballinderry River (Derrygonnigan)
Water Body Type	River
Water Body area (Km^2)	13.7
Hydromorphological Designation	Not heavily modified
Reason for Designation	N/A
Overall Ecological Status/Potential	Moderate
Current Overall Status/Potential	Moderate
Status Objective (overall)	Good
Justification for not Achieving Good Status by 2015 (from 2009) Neagh Bann RBMP	Benthic invertebrates, Macrophytes, BOD and Soluble Reactive Phosphorus
Protected Area Designation	
Biological Quality Elements	
Overall Biological Quality Element Status	Moderate
Fish	N/A
Invertebrates	Moderate
Macrophytes	Moderate
Phytobenthos	Good
Physico-chemical Quality Elements	
Overall Physico-Chemical Quality Element Status	Moderate
Ammonia	Good/High
Temperature	High
Dissolved Oxygen	High
pH	High
Soluble Reactive Phosphorus	Moderate
Specific pollutants	

	Current WFD Baseline Status
Specific pollutants Quality Element Status	Good/High
Ammonia	Good/High
Arsenic (dissolved)	Good/High
Chromium (dissolved)	Good/High
Iron (dissolved)	Good/High
Chemical	
Overall Chemical Quality Element Status	Good
Overall Chemical Quality Element Status Objective	
Cadmium (dissolved)	Good
Lead (dissolved)	Good
Priority substances	Good
Nickel (dissolved)	Good
Priority hazardous substances	Good
Dissolved inorganic Nitrogen	N/A
Hydromorphological Quality Elements	
Hydromorphology Supporting Elements Status	Good
Hydrological regime	Good
Mitigation Measures Assessment	
Current	

2.2 BASELINE CHARACTERISTICS AGAINST WFD SURFACE WATER QUALITY ELEMENTS

BALLINDERRY RIVER (COOKSTOWN)

Main Ballinderry River (Crossings 1 and 5 – Sandholes (crossing 1 only), Purple route A, Purple route B, Red route, Green route)

Biological Quality Elements

Fish

2.2.1. The Ballinderry River (Cookstown) WFD water body is not assessed for fish under the WFD. However, the river provides good habitat for a variety of species despite a number of in-channel structures that are situated both upstream and downstream of the proposed crossing locations. The structures that were observed during the site visit were noted to have fish-pass structures installed to mitigate their impacts of fish migration. The channel is largely well-shaded offering multiple benefits to fish, such as cover, habitat and feeding opportunities. Spawning habitat appears to be restricted by the disruption to riffle-pool sequencing as a result of the local weir structures. Nevertheless, numerous fish, presumed to be brown trout, were observed feeding during the walkover survey.

Invertebrates

2.2.2. Invertebrates are classed as Good for the Ballinderry River (Cookstown) WFD water body. This is in part due to the favourable water quality conditions (see the Psychochemical Quality Elements section below) within the watercourse in addition to a prevalence of suitable habitat for a range of benthic invertebrates.

Phytobenthos and Macrophytes combined

2.2.3. The Ballinderry River (Cookstown) WFD water body is currently classed as Moderate for Phythobenthos. This may be due to significant channel shading that is present along much of the watercourse as a result of dense tree cover. In addition, the ponding effect created by numerous weirs along the watercourse may give rise to water depths that are beyond the tolerances of the flora that would be expected to be present.

Physicochemical Quality Elements

Thermal Conditions

2.2.4. Thermal conditions within the Ballinderry River (Cookstown) WFD water body is currently classed as High. Whilst the abundant tree growth along the riparian zone is of detriment to Phythobenthos, the shading effect may contribute to the favourable temperature conditions within the watercourse.

Oxygenation Conditions

2.2.5. Dissolved Oxygen is similarly classed as High for the Ballinderry River (Cookstown) WFD water body. This, too, is likely linked to the extensive channel shading along the watercourse and its tributaries.

Salinity

2.2.6. No baseline salinity information is available for the Ballinderry River (Cookstown) WFD water body.

Acidification

2.2.7. No baseline acidification information is available for the Ballinderry River (Cookstown) WFD water body.

Nutrient Conditions

2.2.8. No baseline acidification information is available for the Ballinderry River (Cookstown) WFD water body. The High status for Ammonia suggests that nutrient loading to channel is not a considerable issue.

Hydromorphological Quality Elements

Quantity and Dynamics of flow

2.2.9. Flow within the Ballinderry River was noted to be modified by a succession of both significant concrete weirs and smaller, informal rock weirs. These features, particularly the former, create an upstream ponding effect and regulate flow to create a homogenous flow structure. However, this homogeneity is disrupted by the smaller rock weirs, which create broken water at their downstream side. Flow at the downstream end of the larger weirs is similarly turbulent and shallow, with bed scour evident as result of obstruction of sediment delivery.

Connection to Groundwater Bodies

2.2.10. Connection to the underlying groundwater body – Cookstown (UKGBNI4NB003) – does not appear to be significantly inhibited, notwithstanding the localised impact of the major in-channel structures.

River Continuity

2.2.11. The succession of weirs, previously discussed, exert significant disruption to the longitudinal connectivity within the Ballinderry River. The result of these structures in an artificially modified flow structure, leading to storage of gravel upstream, and bed scour downstream, of each structure. Lateral connectivity is similarly poor. The channel has, at some point in history (pre-mid-1800s), been straightened and canalised, leading to an over-deep channel. However, there are discrete reaches that are characterised by bedrock geology and are thus naturally confined.

River Width and Depth Variation

2.2.12. River width and depth is also somewhat homogenous throughout the surveyed reach. This is primarily due to the Ballinderry River flowing through the urban centre of Cookstown, where it is constrained by artificial banks and bank revetments. However, the width is naturally controlled by bedrock in places; and in other, discrete reaches, active bank erosion is evident.

Structure and Substrate of River Bed

2.2.13. The Ballinderry River substrate is comprised primarily of gravel, with smaller proportions of fines and, conversely, cobble and boulder, with discrete regions of bedrock dominated substrate. The succession of in-channel structures influence the transport and, therefore, distribution of sediments.

Structure of Riparian Zone

2.2.14. The riparian zone along the surveyed reach of the Ballinderry River is comprised of native deciduous trees and shrubs; however, there is a significant, wide-reaching giant hogweed issue, which was noted along the entire reach of the Ballinderry River riparian corridor.

Fairy Burn (Crossings 2 and 3 – Sandholes (crossing 2 only), Purple route A, Purple route B, Red route)

Biological Quality Elements

Fish

2.2.15. The Ballinderry River (Cookstown) WFD water body is not assessed for fish under the WFD. However, the Fairy Burn, a tributary to the main Ballinderry River, currently supports good quality habitat, providing spawning and nursery habitat to a range of lithophilic fish species. The channel is characterised by a succession of riffles and pools, with cover provided from riparian vegetation.

Invertebrates

2.2.16. Invertebrates are classed as Good for the Ballinderry River (Cookstown) WFD water body. This is in part due to the favourable water quality conditions (see the Psychochemical Quality Elements section below) within the watercourse in addition to a prevalence of suitable habitat for a range of benthic invertebrates.

Phytobenthos and Macrophytes combined

2.2.17. The Ballinderry River (Cookstown) WFD water body is currently classed as Moderate for Phythobenthos. No in-channel vegetation was noted in The Fairy Burn watercourse during the walkover survey; however, the channel is moderately shaded and channel form and function is such that the physical habitat for phytobenthos is present.

Physicochemical Quality Elements

Thermal Conditions

2.2.18. Thermal conditions within the Ballinderry River (Cookstown) WFD water body is currently classed as High. The Fairy Burn is moderately shaded both by a densely vegetated riparian zone and, at the lower reaches, a deeply incised channel, which contribute to regulating water temperature.

Oxygenation Conditions

2.2.19. Dissolved Oxygen is similarly classed as High for the Ballinderry River (Cookstown) WFD water body. This, too, is likely linked to moderate channel shading along the watercourse. In addition, the sequence of riffle features is likely to promote gaseous exchange and maintain the dissolved oxygen content.

Salinity

2.2.20. No baseline salinity information is available for the Ballinderry River (Cookstown) WFD water body.
Acidification

2.2.21. No baseline acidification information is available for the Ballinderry River (Cookstown) WFD water body.

Nutrient Conditions

2.2.22. No baseline acidification information is available for the Ballinderry River (Cookstown) WFD water body. The High status for Ammonia suggests that nutrient loading to channel is not a considerable issue.

Hydromorphological Quality Elements

Quantity and Dynamics of flow

2.2.23. Flow structure within the Fairy Burn watercourse is generally illustrative of a riffle-pool system. Towards the downstream reaches (near crossing point 3), leading to the confluence with the main Ballinderry River, the channel is moderately sinuous, which creates additional flow heterogeneity; however, the channel has been realigned at some point prior to the mid-19th Century. The upstream reaches (near crossing point 2) are considerably more constrained by local infrastructure. The flow at this location is heavily modified by artificial bank revetments, culverts and canalisation.

Connection to Groundwater Bodies

2.2.24. Connection to the underlying groundwater body – Cookstown (UKGBNI4NB003) – does not appear to be significantly inhibited.

River Continuity

2.2.25. Longitudinal connectivity within the watercourse is disrupted by a number of culverts – particularly a one-hundred-metre-long pipe that conveys flow under the A29 at Sandholes roundabout. However, this does not appear to significantly influence sediment delivery to the downstream reaches of the watercourse. Lateral connectivity is similarly disrupted as a consequence of channel straightening – the channel is over-deep for the most part, and thus disconnected from its floodplain. However, the channel is connected to its left floodplain towards the lowermost reach of the watercourse.

River Width and Depth Variation

2.2.26. Width variation throughout the Fairy Burn watercourse is relatively homogenous as a result of historic channel modifications. Depth is more varied due to the undulating bed topography that gives rise to the riffle-pool features along the watercourse.

Structure and Substrate of River Bed

2.2.27. The substrate of the Fairy Burn watercourse is comprised primarily of fine to medium gravels with smaller proportions of coarse gravel and small cobble. The coarser material is arranged into intermittent riffles whilst the pools are comprised of a finer substrate.

Structure of Riparian Zone

2.2.28. The riparian zone of the Fairy Burn watercourse is in poor condition. There is a significant number of giant hogweed plants along the watercourse and, due to the over-deep nature of the channel, the riparian zone has limited functionality as a result of being disconnected from the watercourse.

BALLINDERRY RIVER (DERRYGONNIGAN)

Unnamed Tributary of Main Ballinderry River (Crossings 4 and 6 – Purple route A, Purple route B, Red route)

Biological Quality Elements

Fish

2.2.29. The Ballinderry River (Derrygonnigan) WFD water body is not assessed for fish under the WFD. The unnamed watercourse, on which crossings 4 and 6 sit, offers some fish habitat; however, the watercourse is functionally cut off to fish due to very poor habitat downstream and a culvert structure upstream. Therefore, it is unlikely fish are present.

Invertebrates

2.2.30. Invertebrates are classed as Moderate for the Ballinderry River (Derrygonnigan) WFD water body. The unnamed tributary to the Ballinderry River was noted to have invertebrate habitat of varying quality: the reach between crossing points 4 and 6 is relatively good, with clean gravels and sufficient cover for a plethora of invertebrates. Downstream of crossing point 6, however, the channel is extremely clogged with fine silt material that is wholly unsuitable for a wide range of benthic macroinvertebrates.

Phytobenthos and Macrophytes combined

2.2.31. The Ballinderry River (Derrygonnigan) WFD water body is currently classed as Good for Phythobenthos. The unnamed watercourse between crossing points 4 and 6 is deeply incised and therefore heavily shaded. This probably limits phytobenthos growth within the channel and therefore does not reflect the favourable status for the wider water body.

Physicochemical Quality Elements

Thermal Conditions

2.2.32. Thermal conditions within the Ballinderry River (Derrygonnigan) WFD water body is currently classed as High. Channel shading due to both the incised channel character and, in places, dense tree cover, are likely to regulate water temperature within the watercourse.

Oxygenation Conditions

2.2.33. Dissolved Oxygen is classed as High for the Ballinderry River (Derrygonnigan) WFD water body. The presence of intermittent areas of broken water in the reach between crossing points 6 and 4 probably aid water oxygenation; however, the reach downstream of crossing point 4 is has a significant quantity of silt in the channel, which may inhibit oxygenation processes.

Salinity

2.2.34. No baseline salinity information is available for the Ballinderry River (Derrygonnigan) WFD water body.

Acidification

2.2.35. No baseline acidification information is available for the Ballinderry River (Derrygonnigan) WFD water body.

Nutrient Conditions

2.2.36. No baseline acidification information is available for the Ballinderry River (Derrygonnigan) WFD water body. The High status for Ammonia suggests that nutrient loading to channel is not a considerable issue however locally, downstream of crossing point 6, the channel is clogged with silt which probably has a high nutrient content.

Hydromorphological Quality Elements

Quantity and Dynamics of flow

2.2.37. Flow patterns within the unnamed watercourse were noted to vary significantly between the segments upstream and downstream of crossing points 4 and 6. The segment of watercourse between the two crossing points exhibits a riffle-pool morphology within a grossly over-deep, straightened channel. the watercourse was not safely accessible upstream of crossing point 6; however, it is believed to comprise of a modified channel with homogenous flow. Downstream of crossing point 4, the channel character is extremely homogenous, with a stagnant, ponded flow character and no perceptible variability in terms of flow dynamics.

Connection to Groundwater Bodies

2.2.38. Connection to the underlying groundwater body – Cookstown (UKGBNI4NB003) – does not appear to be significantly inhibited.

River Width and Depth Variation

2.2.39. Width variation throughout the watercourse is relatively homogenous as a result of historic channel modifications. Depth is more heterogamous due to the undulating bed topography that gives rise to the riffle-pool features along the watercourse.

Structure and Substrate of River Bed

2.2.40. Between crossing points 6 and 4, the substrate is comprised of small to medium gravels with the riffle features encompassing the coarser size fraction of gravels found through the reach. Downstream of crossing point 4 the substrate character is dominated by a thick layer of silt.

Structure of Riparian Zone

2.2.41. The grossly over-deep character of the watercourse means that there is very little functioning riparian zone adjacent to the watercourse. There is an occasional berm feature that supports some riparian functionality, however these are sat within a deep (approximately 3-metre) channel.

LISSAN WATER

Southern Unnamed Tributary of Lissan Water (Crossings 11 and 12 – Purple route A, Purple route B, Red route)

Biological Quality Elements

Fish

2.2.43. Crossing point 11 was not fully safely accessible on the day of survey, however a small segment of the unnamed tributary was accessed nearby; therefore, the screening assessment for crossing point 11 is based on that segment. The Lissan Water WFD water body is not assessed for fish under the WFD. However, based on visual observations, the unnamed watercourse appeared to support fish habitat for a range of species and age groups. The substrate was noted to be free from excessive fines and the sequencing of riffles and pools would support spawning and refuge habitat respectively.

Invertebrates

2.2.44. The Lissan Water WFD water body is presently classed as Good under the WFD. The unnamed watercourse similarly appears to support good invertebrate habitat for a range of species. This is based both on the favourable physical habitat that was noted during the walkover survey, but also the Good/High status for specific pollutants, Biochemical Oxygen Demand (BOD), Temperature, and Dissolved Oxygen (DO).

Phytobenthos and Macrophytes combined

2.2.45. The Lissan Water WFD water body is currently classed as Good and High for Phytobenthos and Macrophytes respectively. The watercourse was noted to support a wide range of native plant species that contribute to the favourable fish and invertebrate habitat noted within the watercourse.

Physicochemical Quality Elements

Thermal Conditions

2.2.46. Thermal conditions within the Lissan Water WFD water body is currently classed as High. Channel shading due to both the incised channel character and, in places, dense tree cover, are likely to regulate water temperature within the watercourse.

Oxygenation Conditions

2.2.47. Dissolved Oxygen is classed as High for the Lissan Water WFD water body. The presence of intermittent areas of broken water in the reach probably aid water oxygenation.

Salinity

2.2.48. No baseline salinity information is available for the Lissan Water WFD water body. Local infrastructure is located at some distance away from the watercourse, so influx of, for example, road salts is unlikely to be an existing issue.

Acidification

2.2.49. There is no baseline acidification information is available for the Lissan Water WFD water body.

Nutrient Conditions

2.2.50. No baseline Nutrient information is available for the Lissan Water WFD water body. The Good/High status for ammonia and Good status for BOD suggest that excessive nutrient loading is not an issue for the water body. The landcover local to crossing points 11 and 12 was noted to consist of rough pasture and meadow, which similarly suggests that intensive agriculture does not impact the reach.

Hydromorphological Quality Elements

Quantity and Dynamics of flow

2.2.51. The general morphology of the unnamed watercourse is characteristic of a riffle-pool system. However, towards the upper reaches, in the vicinity of crossing point 12, this is less evident where the channel is strongly influenced by significant plant growth. Further downstream, however, flow patterns become more varied with pool-riffle sequences observed throughout the reach.

Connection to Groundwater Bodies

2.2.52. Connection to the underlying groundwater body – Moneymore (UKGBNI4NB004) – does not appear to be inhibited.

River Continuity

2.2.53. Longitudinal connectivity within the unnamed watercourse is encumbered by a number of culvert structures that were noted during the survey. These likely limit the transfer of sediment to lower reaches of the watercourse. Lateral connectivity is relatively poor in the upper reaches of the watercourse which have an over-deep channel character. However, this improves towards crossing location 11 where features such as low sediment berms promote hydraulic connectivity and plant growth.

River Width and Depth Variation

2.2.54. River width and depth variation is similarly limited in the upper reaches near crossing location 12 where the over-deep, straightened channel restricts width and depth variation. This improves towards crossing location 11 where the aforementioned sediment berms and pool-riffle sequences create a diversity of widths and depths.

Structure and Substrate of River Bed

2.2.55. The substrate of the bed is comprised predominantly of small to medium gravels. The substrate was noted to be clean and free from excessive fine material, including within the gravel matrix. The structure of the stream bed is consistent with a riffle-pool morphology in that coarser gravels are arranged in riffles, while pools have a fine material substrate.

Structure of Riparian Zone

2.2.56. The structure of the riparian zone is comprised of native plant species, including various trees, marginal vegetation and rough pasture. The riparian zone represents a functioning buffer zone between the channel and the surround land, however, as discussed previously, no intensive agriculture was noted in the immediate vicinity of the watercourse.

Northern Unnamed Tributary of Main Lissan Water (Crossings 13, 14 and 15 – Purple route A, Purple route B, Red route, Green route)

Biological Quality Elements

Fish

2.2.57. The unnamed watercourse may provide spawning and nursey habitat to a range of fish species. However, there are a number of culverts on the watercourse that are likely to present a significant barrier to fish migration.

Invertebrates

2.2.58. The Lissan Water WFD water body is presently classed as Good under the WFD. The unnamed watercourse similarly appears to support good invertebrate habitat for a range of species. This is based both on the favourable physical habitat that was noted during the walkover survey, but also the Good/High status for specific pollutants, BOD, Temperature, and DO.

Phytobenthos and Macrophytes combined

2.2.59. The Lissan Water WFD water body is currently classed as Good and High for Phytobenthos and Macrophytes respectively. The watercourse was noted to support a wide range of native plant species that contribute to the favourable fish and invertebrate habitat noted within the watercourse.

Physicochemical Quality Elements

Thermal Conditions

2.2.60. Thermal conditions within the Lissan Water WFD water body is currently classed as High. Channel shading due to both the incised channel character and, in places, dense tree cover, are likely to regulate water temperature within the watercourse.

Oxygenation Conditions

2.2.61. Dissolved Oxygen is classed as High for the Lissan Water WFD water body. The presence of intermittent areas of broken water in the reach probably promote water oxygenation.

Salinity

2.2.62. No baseline salinity information is available for the Lissan Water WFD water body. Minor local infrastructure is located adjacent to crossing point 13 so influx of, for example, road salts is unlikely to be an existing issue at this location. However, crossing points 14 and 15 are situated close to the existing A29 road, and therefore may be impacted by road washings.

Acidification

2.2.63. There is no baseline acidification information is available for the Lissan Water WFD water body.

Hydromorphological Quality Elements

Quantity and Dynamics of flow

2.2.64. The unnamed watercourse in its upper reaches is representative of a straightened, modified channel. Flow was very slow on the day of survey and little variability of flow patterns was observed. Towards interaction points 14 and 15, however, development of a pool-riffle and a generally more complex flow structure was noted.

Connection to Groundwater Bodies

2.2.65. Connection to the underlying groundwater body – Moneymore (UKGBNI4NB004) – does not appear to be inhibited.

River Continuity

2.2.66. Longitudinal connectivity within the watercourse is disrupted by a number of culvert structures that probably limit sediment transport processes. Lateral connectivity is also poor throughout the surveyed reaches, with the channel exhibiting an over-deep character.

River Width and Depth Variation

2.2.67. The unnamed watercourse in its upper reaches exhibits very little width and depth variation. Further downstream, towards interaction points 14 and 15, however, the riffle-pool sequences create topographic high and low points in the channel which promote depth variability. The channel widens gradually towards crossing point 15.

Structure and Substrate of River Bed

2.2.68. The substrate of the bed is comprised predominantly of small to medium gravels. The substrate was noted to be clean and free from excessive fine material, including within the gravel matrix. The structure of the stream bed is consistent with a riffle-pool morphology in that coarser gravels are arranged in riffles, while pools have a fine material substrate.

Structure of Riparian Zone

2.2.69. The structure of the riparian zone is comprised of native plant species, including various trees, marginal vegetation and, in the vicinity of interaction point 13, rough pasture. The riparian zone here represents a functioning buffer zone between the channel and the surround land. Towards interaction points 14 and 15, however, the riparian zone is somewhat absent and poorly functioning due to major local infrastructure and agricultural fields respectively.

Other Potential Watercourses (Crossings 7, 8, 9 and 10)

2.2.70. A number of potential watercourse crossings were identified on a pre-site visit desk study and assigned an interaction point number. Points 7, 8, 9 and 10 were found to be either minor agricultural drains or cut ditches. Whilst these are hydrologically linked to the local surface water network, they offer little functional habitat, are not designated as WFD watercourses, and are thus scoped out for further WFD assessment (see Section 3, Table 3-1).

3 SCREENING

Table 3-1 – Screening assessment of each interaction point between watercourses and the proposed scheme route alignments.

Watercourse Crossing ID	Watercourse General Description	Screened in/out	Reasons
1	Interaction point 1 crosses the Ballinderry river. The proposed scheme does not interact with the watercourse.	Out	The proposed road alignment does not interact with the watercourse.
2	The proposed scheme crosses interaction point 2 over Fairy Burn. The channel is situated within an incised valley and exhibits an artificially straight character with limited natural functioning. Access was not safe on the day of survey; however, little evidence of hydraulic variability (pools, riffles etc.) could be seen: flow structure was homogenous, and the water was noted to be murky and discoloured. The natural character of Fairy Burn is an actively meandering system; however, the historical mapping record reveals that the channel has been significantly modified from its highly sinuous form to what is essentially a straightened ditch.	In	The proposed scheme crosses Fairy Burn – a WFD river. Extensive mitigation would be required to offset the impacts of the proposed scheme.
3	The potentially impacted reach begins at the outlet of a culvert that underpasses Loughry roundabout on the A29. A large corrugated steel cylindrical structure is located at the culvert outlet, close to right bank. It is unclear what the purpose of structure is, however the stream appears to have taken a preferential flow route to the left of the cylinder. Beyond the immediate vicinity of the culvert outlet, the channel narrows to approximately 1.5m and exhibits an incised, over-deep character in places. The substrate of the channel is comprised of medium to coarse gravels intermixed with fine material (probably sourced from road drain outfalls). The channel exhibits a pool-riffle morphology with riffles spaced every 8-10m. Right bank is generally significantly higher than left bank. This is probably a consequence of channel straightening that has taken place at some point in the 20th Century. The historical mapping reveals that, originally, the stream exhibited a considerably more sinuous character and flowed slightly to the north of its current location.	In	The proposed scheme currently overlays the course of Fairy Burn – a WFD river. This would result in culverting and loss of habitat and impact a range of WFD quality elements.

Watercourse Crossing ID	Watercourse General Description	Screened in/out	Reasons
4	Interaction point 4 lies on an unnamed watercourse that follows the boundary of Killymoon Golf Course. The channel was noted to be very heavily silted with no apparent flow on the day of survey. It is unlikely the watercourse supports varied fish, invertebrate and macrophyte populations given the poor condition of the channel, both in terms of habitat quality and, most likely, water quality. In addition, the watercourse is fragmented by culverts and urban areas meaning longitudinal connectivity is poor. The channel also exhibits a straight planform; however, the historical mapping record reveals that likely modifications predate formal mapping. The stream was probably once had a sinuous form with a pool-riffle morphology.	In	The proposed scheme crosses a WFD river.
5	Interaction point 5 falls on the same stretch of carriageway as point 3; however, this point is situated at the intersection between the main Ballinderry river and the proposed scheme. The channel appears to be suffering from considerable fine sediment issues at this location; probably in part due to the urban centre of Cookstown providing a source of urban runoff; but also, there is a significant degree of active erosion on the left bank that provides a source of clay and other fines. Furthermore, a succession of flow control structures (informal boulder weirs) appear to create ponded sections of channel that further exacerbate deposition. The natural character of the channel is generally an actively meandering, pool-riffle system; however, approximately 250m downstream of the crossing point, the channel becomes defined by bedrock with limited lateral erosion. In addition, there is a large, formal weir structure approximately 400m downstream of the interaction point that is controlling the water level for some distance upstream, thereby disrupting the natural pool-riffle sequencing in the river (though its impacts are probably superseded by the informal structures). Nevertheless, a number fish, probably trout, we seen readily feeding indicating reasonable habitat and water quality throughout the reach. However, a significant number of giant hogweed plants were noted on site (and elsewhere along the Ballinderry river). In addition to the crossing point, the proposed road alignment runs immediately adjacent to the Ballinderry river for approximately 100m. Under the WFD requirements, this section would also need to be mitigated.	In	The proposed scheme currently crosses the Ballinderry river – a WFD River. This would result in loss or fragmentation of habitat. A range of WFD quality elements would potentially be affected. In addition, the section adjacent to the river would also potentially impact upon WFD quality elements and therefore require mitigation.

Watercourse Crossing ID	Watercourse General Description	Screened in/out	Reasons
6	The proposed scheme crosses interaction point 6 over an unnamed watercourse. The channel is deeply incised and therefore exhibits a grossly over-deep form: the bankfull height of both banks is approximately three metres, while the wetted width on the day of survey was noted to be approximately 1m. The channel substrate is comprised predominantly of medium gravels arranged into a subtle pool-riffle arrangement. In addition, the channel has been modified and straightened at some point in the mid-19th Century. The historic mapping record reveals that the channel was once sinuous with good longitudinal connectivity; however, today the channel passes through a number of culverts and is therefore significantly fragmented and disconnected.	In	The proposed scheme crosses a WFD river.
7	Interaction point 7 sits within an artificial farmland drainage ditch, which was dry on the day of survey.	Out	The crossing is over an artificial drainage ditch.
8	Interaction point 8 sits within an artificial farmland drainage ditch, which was dry on the day of survey.	Out	The crossing is over an artificial drainage ditch.
9	Interaction point 9 sits within an artificial farmland drainage ditch, which was dry on the day of survey.	Out	The crossing is over an artificial drainage ditch.
10	No watercourse could be located during the survey.	Out	The crossing is over an artificial drainage ditch.
11	Interaction point 11 lies on a small unnamed watercourse. The morphology the channel is representative of a pool-riffle system with a relatively varied flow structure compared to its upstream reaches (at site 12).	In	The proposed crossing is over a WFD River. The channel would respond well to mitigation measures such as, but not limited to: channel reprofiling to promote lateral connectivity; riparian enhancements; and

Watercourse Crossing ID	Watercourse General Description	Screened in/out	Reasons
			re-meandering to enhance sinuosity.
12	Interaction point 12 is located on a small, unnamed watercourse. The channel was noted to be heavily vegetated on the day of survey; however, the plant species assemblage present was varied and comprised of aquatic, marginal and riparian varieties. Flow within the channel was difficult to view owing to the dense vegetation. The substrate was noted to comprise of fine to medium gravels. A small culvert presently crosses the watercourse at the approximate road crossing location creating habitat fragmentation.	In	The proposed crossing is over a WFD River. Mitigation could include incorporation of a bridge over the channel as opposed to a culvert (and removal of the existing culvert); mitigation could also include wetland creation to offset any lost habitat if a culvert is required, particularly as it is unlikely fish are present at this location.
13	Interaction point 13 lies on a minor, unnamed watercourse that flows adjacent to an unnamed back lane off the A29. The channel itself appears to have been straightened and modified; however, these alterations predate formal mapping activity. Flow structure was noted to be homogenous, possibly as a result of a slightly over-deep channel form. However, the adjacent left hand riparian environment and wider left floodplain presently supports quite a varied mix of wetland and meadow plant species.	In	The proposed interaction is close (<8m) to a WFD River. Mitigation could include enhancement of the existing adjacent rough pasture/ meadow land.
14	The proposed scheme does not interact with the watercourse at this location.	Out	No interaction.
15	Interaction point 15 lies on a stretch of relatively good quality watercourse. There is a strong pool-riffle morphology through the local reach, with clean gravels throughout.	In	The channel would respond well to mitigation measures

Watercourse Crossing ID	Watercourse General Description	Screened in/out	Reasons
	However, the channel has been straightened and thus lacks the sinuosity that would be expected on a channel of this nature. Moreover, the riparian environment is essentially non-existent, with agricultural land dominating both floodplains.		such as, but not limited to: channel reprofiling to promote lateral connectivity; riparian enhancements; and re-meandering to enhance sinuosity.
16	Interaction point 16 sits within an artificial farmland drainage ditch, which did not have apparent flow on the day of survey.	Out	The crossing is over an artificial drainage ditch.
17	Interaction point 17 sits within an artificial farmland drainage ditch, which did not have apparent flow on the day of survey.	Out	The crossing is over an artificial drainage ditch.

4 ROUTE OPTION APPRAISAL

INTRODUCTION

4.1.1. Of all the routes considered in this assessment, the Sandholes bypass is at the design fix phase; therefore, its location cannot be influenced, but mitigation may still be required. All other routes are assessed based on their potential interactions with watercourses, which will be used as measure to reveal a preferred option.

POTENTIAL ROAD ALIGNMENTS

Red Route

4.1.2. The proposed Red route has nine watercourse interaction points, of which six are suggested to be put forward to the WFD scoping phase. The route also runs close to the main Ballinderry river; therefore, this area, too, would require further assessment. In addition, the proposed cut earth sections of the route would be assessed based on their potential impacts upon groundwater.

Purple Route A

4.1.3. The proposed Purple route A has seven watercourse interaction points, of which five are suggested to be put forward to the WFD scoping phase. The route also passes within eight metres of the main Ballinderry river; therefore, this area, too, would require further assessment. In addition, the proposed cut earth sections of the route would be assessed based on their potential impacts upon groundwater.

Purple Route B

4.1.4. The proposed Purple route B has eight watercourse interaction points, of which five are suggested to be put forward to the WFD scoping phase. The route also passes within eight metres of the main Ballinderry river; therefore, this area, too, would require further assessment.

Green Route

4.1.5. The Green route has six watercourse interaction points, of which four are suggested to be put forward to the WFD scoping phase. The route also passes within eight metres of the main Ballinderry river; therefore, this area, too, would require further assessment. In addition, the proposed cut earth sections of the route would be assessed based on their potential impacts upon groundwater.

PREFERRED ROUTE

4.1.6. The preferred route, from a WFD perspective, would be the Green route. This is due to the route having the fewest watercourse crossings.

5 CONCLUSION

5.1.1. This WFD screening assessment has presented a high-level appraisal of potential watercourse interaction points along each route option for the proposed scheme. The appraisal has revealed that, out of the 17 potential watercourse interaction points identified at the desk study phase, nine are screened in for further scoping assessment in Stage 3. Accordingly, based on the outcome of the screening assessment, the preferred route option for the proposed scheme would be the Green route.

Appendix A

SITE PHOTOGRAPHS

Interaction point 1	
	
	
	

Interaction point 2	
	
	

Interaction point 3	
	
	
	

Interaction point 4	
	
	

Interaction point 5	
	
	
	

Interaction point 6	
	
	

Interaction point 7	
	
	
	

Interaction point 8


Interaction point 9	
	
	

Interaction point 10	
	
	

Interaction point 11	
	
	

Interaction point 12	
	
	

Interaction point 13	
	

Interaction point 14	
	
	

Interaction point 15	
	
	
	

Interaction point 16	
	
	

Interaction point 17	
	

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