As part of the Windrush Recovery Project



ROAD RUN OFF IN THE UPPER WINDRUSH CATCHMENT



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ROAD RUN OFF IN THE UPPER WINDRUSH CATCHMENT As part of the Windrush Recovery Project

Executive Summary

Road run off poses a widespread and significant challenge across the upper Windrush catchment. Numerous instances of substantial volumes of water flowing directly into the watercourses were documented, leading to the conclusion that other potential pollutants and sediment are also utilising the road network before ultimately reaching the watercourses untreated and undiluted.

This report proposes specific mitigation options and provides a series of recommendations to reduce the risk of pollutants and sediment reaching the watercourses.

Recommendations made by the Windrush Recovery Project include:

- Road run off should be placed higher up on the environmental agenda as a significant contributor to poor water quality and the failure to reach good ecological status across many waterbodies.
- Routine testing of pollutants and sediment in road run off, especially in more rural catchments, should be undertaken to help inform and target future interventions.
- · Addressing the core issues of road run off requires a catchment-wide approach. Interventions should take an integrated approach, with wider benefits identified, costed, incorporated and subsequently shared.
- Where road run off cannot be prevented, in-channel modifications should be proposed to minimise the risks posed by sediment and pollutants.
- Interventions should prioritise long term prevention of road run off rather than simply continually addressing its consequences.
- Public engagement can play a crucial role in addressing road run off issues promptly. Community groups should be supported and educated in identifying issues and reporting them to facilitate quicker resolution and minimise the potential impacts on water quality.
- Local authorities should take a risk-based approached to reducing road run off, tackling high priority areas first.



Introduction

The River Windrush epitomizes many rural lowland UK rivers, where pollution severely disrupts natural processes, significantly diminishing river quality and endangering public health and local ecosystems¹.

Under the Water Environment (Water Framework Directive (WFD)) Regulations 2017, water bodies within the Windrush catchment are classified as 'moderate', 'poor' and 'bad', with only one designated as 'good'. Reasons for not achieving good² (RNAG) status include, but are not limited to, 'agriculture and land management' and the 'water industry'³.

While the chronic damage caused by point source pollution events from sewage treatment works are well-documented⁴, diffuse pollution events are harder to quantify due to their culminative impact across the catchment.

One such diffuse pollution event is road run off, where individual occurrences may not immediately harm river health, but their cumulative effect can be significant. Currently, the majority of the estimated one million outfalls, where water on the road enters the watercourse, do not require permits and are not routinely monitored.

Road run off pollution events happen when pollutants such as oil residue from spills and particles from vehicle tyre and brake wear accumulate on roads during dry weather, subsequently washing into nearby watercourses during rain events. The impermeable nature of tarmac road and pavements, cause rain water and other sources of water to stay above ground, thereby potentially carrying pollutants with them.

Pollutants attributed to road run off are well documented. For example, tyre wear has been found to be a significant contributor to microplastics entering the aquatic environment⁵. In a study conducted in Australia, it was found that approximately 19 out of every 20 microplastics collected from stormwater run off during rain events were tyre wear particles, with the results showing a range from 2 to 59 particles per litre of water⁶.

What is less well documented are the other sources of pollutants that have the ability to utilise the road network as conduits, thereby reaching watercourses untreated and undiluted. Possible pollutants arise from the surrounding land uses of the roads, be it agriculture, urban or industrial.

The ecological status of waterbodies within the Upper Windrush Catchment (UWC) are below par and undesirable, highlighting the need for robust data to support and implement local or catchment-wide interventions aimed at reducing potential pollutants entering the water. This study sets out to report on the levels of road run off across the UWC and begin to collate the quantity and type of pollution that could be found in the run off.

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Overview of the Upper Windrush Catchment

Located in the designated Cotswolds National Landscape, the UWC boasts a quintessentially rural character, characterised by picturesque agricultural landscapes dotted with small settlements.

With a population surge of 9.6% since 2021, reaching 90,800 residents, the catchment exhibits significant growth, ranking second in population expansion among Gloucestershire's six districts.

There are six water bodies as stipulated by the Water Framework Directive situated in the UWC. Their ecological health and reasons for not achieving good (RNAG) status are outlined below:

Windrush (Slade Barn Stream to Dikler)

- Ecological status: Moderate
- Ecological objective/potential: Good by 2027 Low confidence
- chemicals.
- Sector where challenge sits: Agriculture

Windrush (Source to Slade Barn Stream)

- Ecological status: Moderate
- Ecological objective/potential: Good by 2027 Low confidence

- \cap

o Slade Barn Stream (Source to Windrush)

- Ecological status: Moderate
- **Ecological objective/potential**: Good by 2027- Low confidence
- physical modification through land drainage
- Sector where challenge sits: Agriculture (arable).

o Eye (Source to Dikler)

- Ecological status: Good
- Ecological objective/potential: Good

• **Reason**: Disproportionally expensive/burdens of physical modifications to the river through barriers and land drainage, and flow through groundwater abstraction,

Reason: Expense/burdens include physical modification to the river through land use in this case arable farming – although this is only suspected. Sector where challenge sits: Agriculture. Chemical issues as well, sector not known.

• Reason: Expense and burden - Diffuse source through poor soil management and

• Dikler (Source to Wyck Rissington)

- Ecological status: Moderate
- Ecological objective/potential: Good by 2027- Low confidence
- **Reason**: Expense/burdens -hydrological issues related to ground water abstraction
- Sector where challenge sits: Water Industry

o Dikler (Wyck Rissington to Windrush) and Lower Eye

- Ecological status: Moderate
- **Ecological objective/potential**: Good by 2027- Low confidence
- Reason: Physical modification due to land use in this case arable farming although this is only suspected
- o Sector where challenge sits: Agriculture, rural land management

Methodology

A walkover survey of the UWC, defined as the Windrush catchment above Bourton on the Water, was carried out from July 2023 to February 2024, during periods of wet weather.

Locations, potential pollutant sources and impact of run off were recorded, graded, mapped, and photographed.

Cases of road run off were recorded, and interventions to reduce the run off were planned and, where possible, implemented. These were site specific and included a range of measures to stop additional water joining the road and where it was on the road to discharge it to an attenuation area.

Walkovers were planned prior to the visiting locations using OS maps to examine the topology of the area, and points where roads cross the waterways. Public rights of way were also identified. On visits where access to private land was required prior arrangements were made with the landowner.

An overview of existing current data was explored. This included EA Operational catchment data, Windrush Catchment Partnership reports and studies, Catchment Data Explorer. This information was used to provide a baseline for understanding broader water quality issues, current ecological health and challenges in the study area and changes that have occurred over time.

Environmental Information requests and maps of sewage and drainage network were obtained when necessary.

The likely detrimental impact of run off at each site was graded by collating a number of factors including; volume, proximity to the river, the anticipated frequency, the sensitivity of the watercourse, and any obvious impacts such as sedimentation deposition on the riverbed or impact on instream vegetation, with sites graded as high, medium and low priority.

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- 2 https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3539
- 3 https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3539/rnags
- 4 <u>https://www.windrushwasp.org/_files/ugd/cda311_c6239944bded4dfc86348d7aOb72fO44.pdf</u>
- 5 https://www.sciencedirect.com/science/article/pii/S0043135417308400?via%3Dihub
- 6 https://www.sciencedaily.com/releases/2023/09/230905124943.htm#:~:text=Urban%20stormwater%20particles%20from%20 tire.particles%20per%20liter%20of%20water.
- 7 https://www.thames21.org.uk/improving-rivers/road-run-off/

¹ https://committees.parliament.uk/committee/62/environmental-audit-committee/news/160246/chemical-cocktail-of-sewage-slurry-and-plastic-polluting-english-rivers-public-health-and-nature-at-risk/#:~:text=The%20build%2Dup%20of%20high.suffocating%20 fish%2C%20plants%20and%20invertebrates.

Results

Walk over reports highlighted road run off in the UWC being substantial and widespread, with some examples shown to be discharging large volumes of potentially polluted water. In total, 14 case studies (appendices 1-14) presented a snapshot of the different sources of water using the road network as a conduit to reach watercourses.

Case studies were provided, and mitigation methods recommended, where; the source of the water utilising the road network came from; rain water landing directly on the road or verge, springs near to the road, agricultural land and farm tracks leading on to a road, and industrial sites and private properties connecting to the road.

Throughout the walkover many exacerbating factors, those that resulted in more water utilising the road network and therefore increasing the risk of pollutants and, in many cases, sediment reaching the watercourse, were recorded. These included blocked drains (figures 1 and 2) and grips (figures 3 and 4), abraded road edges (figures 5-7) and potholes (figure 8), and vehicles bringing mud on to the roads (figure 9).



Locations of the case studies within the Upper Windrush Catchment (UWC). Waterbodies are highlighted in their Water Framework Directive designation (green = good, yellow = moderate)





Figure 1 – Blocked gully adjacent to the Dikler, Upper Swell





Figure 4 – Saturated drainage grip in Lower Swell





Figure 7 – Gully formed along road side at Ford

Figure 2 - Blocked gully in Naunton



Figure 8 – Potholes potentially caused by standing water, Upper Swell



Figure 3 – Saturated drainage grip in Lower Swell



Figure 6 – Gully formed along road side near to Naunton



Figure 9 – Mud on road near to Naunton

Discussion

Road run off poses a widespread and significant challenge across the UWC. Not only is road run off prevalent, but other potential pollutant sources and sediment are also evident, and utilising the road network before ultimately reaching watercourses untreated and undiluted. Numerous instances of substantial volumes of water flowing directly into the watercourses were documented.

RECOMMENDATION 1

Road run off should be placed higher up on the environmental agenda as a significant contributor to poor water quality and the failure to reach good ecological status across many waterbodies.

To date there has been limited focus and attention of the impact of pollutants and sediment in road run off on the health of our river network. Those studies that have been undertaken have been predominantly focused at urban catchments.

To help raise the issue up the agenda there is a wide scope for further exploration and research to better understand the impact of road run off on river quality.

RECOMMENDATION 2

Routine testing of pollutants and sediments in road run off, especially in more rural catchments, should be undertaken to help inform and target future interventions.

While some instances of road run off may be challenging or impossible to prevent due to the proximity to the watercourse, mitigation measures should be focused on stopping run off at source. All the case studies collated had one or more options available that would have reduced the risk of pollutants reaching the watercourse via the road network.

Mitigation interventions are often beneficial to a number of partners, and implementing them can have additional benefits. This is especially relevant to nature-based solutions that can also capture carbon, enhance habitats and filter the water.

Engagement with landowners throughout the project revealed a willingness to find solutions, especially when highlighting the potential loss of sediment, but there was a lack of urgency and awareness regarding available funding opportunities. Capital grants and take up of Environmental Land Management schemes, along with support from organisations like the Catchment Sensitive Farming, can assist landowners in implementing interventions.

RECOMMENDATION 3

Addressing the core issues of road run off requires a catchment-wide approach. Interventions should take an integrated approach, with wider benefits identified, costed, incorporated and subsequently shared.

RECOMMENDATION 4

Where road run off cannot be prevented, in-channel modifications should be proposed to minimise the risks posed by sediment and pollutants.

Beyond environmental concerns road run off also poses additional issues, including road degradation (figures 5-8) and risks to public safety, such as potholes (figures 4 and 8) and urban flooding. The financial burden of the maintenance of our roads alone underscores the importance of addressing road run off effectively and with a long-term view.

The UWC is an area with a growing population, and increased traffic volume as a consequence verge degradation on smaller roads (figure 6-8) is a growing phenomenon.

RECOMMENDATION 5

Interventions should prioritise long term prevention of road run off rather than simply continually addressing its consequences.

On two occasions interventions were undertaken following the issue being raised with the relevant body (appendix 9 and 11). This highlighted the value of community action in tackling issues quickly.

RECOMMENDATION 6

Public engagement can play a crucial role in addressing road run off issues promptly. Community groups should be supported and educated in identifying issues and reporting them to facilitate quicker resolution and minimise the potential impacts on water quality.

Efforts should be focused on areas presenting high risks, considering factors such as proximity to the watercourse, road gradient, water volume and land use. Implementing model systems tailored to rural catchments would help prioritise actions effectively.

RECOMMENDATION 7

Local authorities should take a risk based approached to reducing road run off, tackling high priority areas first.

APPENDICES

APPENDIX 1 Road run off Barton

Location	SP 10041 25444	Date		30/12/23	
River/tributary	Windrush (Source to Slade Barn Stream)	Waterway/desigr	nation	Main	
EA classification	Ecological Moderate	Waterbody		GB106039037460	
Pollution type	Sediment	Priority		Medium	
Source category	Conduit	Source type		Road and Farm Track	
Land use	LH Orchard		RH Garde	en	
Vegetation	LH Unimproved grassland	RH Garden	RH Garde	en	

Synopsis

Water was seen running down the steep road which enters Barton and discharging into a gully that flows straight into the Windrush. The water contained significant quantities of sediment which derived from the saturated and cut up verges adjacent to the road.

Additionally, water carrying sediment was also noted to be running along a muddy farm track opposite the bridge for approximately 100m before entering the road gully.





Mitigation

Road run off – Tackling the road run off would require grips to be dug across the verge to allow the water to drain from the road. Feasibility – There is unlikely to be space to create an attenuation area for the road run off because the river runs directly below the road on one side and there is an incised verge on the other.

Damaged verged – Cleaning up the mud verge and extending the length of the existing kerb would reduce the saturation of the verge and reduce the amount of sediment washed down stream by the any road run off. It might be of benefit to install a kerb on the opposite side of the road. Feasibility – Further investigation of the quantity of run off is recommended and liason with the local authority should be undertaken.

Track run off – The water running down the track was carrying a large volume of sediment. Resurfacing the track and installing culverts and cross drains to direct the run off into the adjacent pasture would reduce the water and sediment discharging into the river.

Feasibility – Further investigation of the quantity of run off, modelling of interventions, and communication with the landowner as part of the Catchment Sensitive Farming programme should be undertaken.

APPENDIX 2 Road run off Bourton on the Water

Location	SP 16129 21017	Date	15/03/2023
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/designation	Main
EA classification	Ecological Moderate	Waterbody	GB106039037460
Pollution type	Pollutants from vehicles	Priority	High
Source category	Conduit	Source type	Road
Land use	LH Agriculture, pasture	RH W	podland
Vegetation	LH Grass	RH Tre	ees

Synopsis

Water was seen running along the side of the Fosse Way which slopes downhill to the river intersection at the road bridge. The water collected on the roadside forming a large puddle before it flowed across a vegetated area and discharged into the river .

Additionally, water was seen running down Buckle Street which joins the water running along the Fosse Way about 30 metres prior to where it discharges into the Windrush.

The Fosse Way is the busiest road in the UWC, meaning the possibility of vehicle pollution in the road run off is high risk.



Mitigation

Road run off - To reduce run off from both the Fosse Way and Buckle Street grips need to be dug and maintained across the verge to ensure water and pollutants can drain from the road before hitting the Windrush.

Feasibility - The woodland on the corner of the Fosse Way and Buckle Street is well-sited for the creation of an attenuation area. Further investigation of the quantity of run off and holding capacity of the woodland would be required, additionally dialogue with the landowner and the local authority would be required.





APPENDIX 3 Road run off Critchford Lane, Kineton

Location	SP 08698 25947	Date	30/12/23
River/tributary	Slade Barn Stream (Source to Slade Barn)	Waterway/designation	Not designated
EA classification	Ecological Moderate	Waterbody	GB10603903744
Pollution type	Pollutants from vehicles and sediment	Priority	Medium
Source category	Conduit	Source type	Road and Farm Track
Land use	LH Agriculture, pasture	RH A	griculture, pasture
Vegetation	LH Grass, hedgerow	RH G	rass/Hedgerow

Synopsis

Water was seen running down the steeply sloping rural single-track road that transects the Slade Barn Stream at a ford.

Two separate sources of run off were identified at this location. Firstly, run off from rainfall falling directly onto the road and secondly field run off from a gateway located 20m above ford. The run off collects sediment from the damaged verge edges and discharges directly into the stream.

Both sides of the road are badly eroded by run off suggesting this is a long-term issue. A concrete gully has been installed to one side of the road to divert water into a ditch adjacent to the ford. The ditch does not have adequate capacity to contain the runoff during periods of heavier rainfall.



Mitigation

Road run off - Diverting the water that reaches the road will be critical to reducing the run off that discharges into the ford. This could be undertaken by enhancing the gully or digging grips. Feasibility – The road is heavily incised meaning that it could be a challenge to create new grips to divert the run off. Further investigation should focus on determining the specific source of the run off.



APPENDIX 4 Road run off Cutsdean

Location	SP 086665 30172	Date	02/01/2024
River/tributary	Windrush (Source to Slade Barn)	Waterway/designation	Main
EA classification	Ecological Moderate	Waterbody	GB10603903746
Pollution type	Pollutants from vehicles and sediment	Priority	High
Source category	Conduit and diffuse	Source type	Agriculture, road and spring
Land use	LH Woodland	RH Agr	iculture, pasture
Vegetation	LH Trees	RH Gra	ss

Synopsis

Water was seen running down the steeply sloping single-track road before it diverts into a a ditch which discharges into the watercourse. The run off has eroded the road edge to create a gully.

The volume of the road run off at this location is increased by water discharging from a spring 50 m above the discharge point and water running onto the road from adjacent fields.

The sediment in the road run off caused strong cplouration and highnturbidity of the water discharging into the river.



Mitigation

Road run off – Slowing down the water running off the road and reducing the volume could be achieved by digging additional grips higher up the road and diverting it into the ditch. Routine maintenance and clearance of the existing grips is essential to prevent them blocking.

Feasibility – Liaise with local authority for further investigation

Field run off – The planting of field margins and creation of attenuation areas could slow the flow and leave sediment in the field.

Feasibility - Further investigation of the quantity of run off and modelling of interventions, and communication with the landowner, as part of the Catchment Sensitive Farming programme, should be undertaken.

APPENDIX 5 Road run off Ford

Location	OS 08668 29334	Date		27/12/23	
River/tributary	Windrush	Waterway/des	signation	Main	
EA classification	Ecological Moderate	Waterbody		GB106039037460	
Pollution type	Pollutants from vehicles and sediment	Priority		Medium	
Source category	Conduit	Source type		Road	
Landura		liantial	DUDesia	la matia l	
Land use	LH Driveway, garden, resciential		RH Resid	iential	
Vegetation	LH Grass, trees		RH Grass, treess		

Synopsis

Road run off was seen tracking down steep hill until it reaches the bridge crossing over Windrush where it discharges into the river via a series of three gullies. The road was reported by local residents to be frequently flooded when the gullies and drains block up with sediment and organic matter.

The frequent flooding will be damaging the road surface and the location of the pooling water on a bend at the bottom of a steep hill creates a risk to road users.



Mitigation

Drain maintenance – Regular and ongoing clearing of the drains will reduce flooding issues on road **Feasibility** – The matter was raised with the local authority and it is hoped a new regime of regular maintenance will be undertaken.

Road run off – Drain maintenance will stop the flooding in the village, but it will not stop the water and potential pollutants and sediment flowing straight into the watercourse. Opportunities to slow and reduce the run off before it reaches the drains would alleviate the pollution and flooding risk. **Feasibility** – Further investigation and liaison with the local authority is required.

APPENDIX 6 Road run off Hollow Bottom Guiting

Location	OS 10281 23923	Date	23/01/23	
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/designation	Main	
EA classification	Ecological Moderate	Waterbody	GB106039030480	
Pollution type	Pollutants from vehicles, sediment and agriculture	Priority	Low	
Source category	Conduit	Source type	Road and field gateway	
Land use	LH Agriculture, pasture	RH Agri	culture, pasture	
Vegetation	LH Grass	RH Gras	s, trees	

Synopsis

Water was seen running down a long stretch of steep road before draining through a series of roadside grips which directs the water into an area of pasture.

The water was carrying significant volumes of sediment derived from damaged roadside verges and field run off washed onto the road from a gateway located 200m uphill of the discharge point.



Mitigation

Field entrance – Reducing the sediment and gravel derived from the field entrance further up the hill could be achieved through the installation of hard standing and a cross drain at the field entrance and possibly digging more grips to drain water off the road.

Feasibility - Further investigation of the quantity of run off and modelling of interventions, and communication with the landowner, as part of the Catchment Sensitive Farming programme, should be undertaken.

APPENDIX 7 Road run off Kineton 1

Location	SP 09812 26722	Date	27/12/2023
River/tributary	Windrush (Source to Slade Barn Stream)	Waterway/designat	ion Main
EA classification	Ecological Moderate	Waterbody	GB106039037460
Pollution type	Sediment and agricultural run off	Priority	High
Source category	Conduit	Source type	Road and farm track
Land use	LH Agriculture, arable	RF	H Woodland
Vegetation	LH Wheat	RH	l Trees

Synopsis

Water was seen running along a farm track for about 500m before discharging onto the road. The source of the water is run off from the fields adjacent to the track. The run off contained large quantities of sediment,. Once on the road the water flows downhill for another 600m before discharging into the Windrush at a ford located below the village

The run off was causing significant discolouration to the water in the river channel.



Mitigation

A Farm track run off – Planting a hedgerow and establishing a rough grass margin along the edge of the track will help slow the run off of water and sediment from the fields. The installations of cross drains along the track and new ditches would reduce the amount of water that is able to reach the road.

Feasibility – Further investigation of the quantity of run off and modelling of interventions should be done. Communication with the landowner, as part of the Catchment Sensitive Farming programme, should be undertaken.



APPENDIX 8 Road run off Kineton 2

Location	SP 09906 26433	Date	27/12/2023
River/tributary	Windrush (Source to Slade Barn)	Waterway/designation	on Main
EA classification	Ecological Moderate	Waterbody	GB106039037460
Pollution type	Sediment	Priority	Medium
Source category	Conduit	Source type	Farm track and road
Land use	LH Agriculture, pasture	Agr	iculture, pasture
Vegetation	LH Grass	RH	Grass

Synopsis

Water was seen to run off along an unmade track which transects the Windrush at a ford crossing. The track allows access for vehicles and is also used by horse riders and cyclists. An area of tarmac had been laid to divert the water into an attenuation area to the side of the track, but this was heavily eroded and broken down.



Mitigation

Farm track run off – Repair to the surface of the track, particularly where it crosses the river at the Ford should be undertaken. Cross drains could help to reduce the amount of run off and sediment that is washed directly into the river. Feasibility - Further investigation of the quantity of run off and modelling of interventions, and communication with the landowner as part of the Catchment Sensitive Farming programme, should be undertaken.

APPENDIX 9 Road run off Lower Swell

Location	SP1784825695	Date	23/04/23	
River/tributary	River Dikler (Source to Wyck Rissington)	Waterway/desigr	Main	
EA classification	Ecological Moderate	Waterbody	GB106039037470	
Pollution type	Pollutants from vehicles and sediment	Priority	High	
Source category	Conduit	Source type	Spring onto road	
Land use	LH Residential		RH Road verge	
Vegetation	LH Shrubs/Trees		RH Grass	

Synopsis

Significant volumes of water was seen flowing down the edge of the road. Water derived from rainfall on the road is increased in volume as a result of springs adjacent to the road discharging water when ground water levels are high. The water was carrying sediment from damaged verges and road grit which discahrges directkly into the Dikler.

The road run off flows over the bridge which crosses the Dikler before being diverted into a field via a culvert. On visiting the culvert was overgrown and not at full functionality so water was pooling on the road and there was water entering the Dikler directly causing the river to become extremely turbid.

The water pooling on a sharp bend at the bottom of the hill creates a risk to road users.



Mitigation

Road run off – Reconnect the culvert to the attenuation area and ensure it is kept free from sediment and organic litter that can block it.

Feasibility - **COMPLETE** – Following the project officers and local community raising their concerns work has been undertaken to ensure the culvert works and water cannot flow directly into the watercourse.



APPENDIX 10 Road run off Naunton 1

Location	OS SP11372 23865	Date	30/12/2023
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/designation	Main
EA classification	Ecological Moderate	Waterbody	GB106039030480
Pollution type	Sediment	Priority	High
Source category	Conduit	Source type	Field and gateway
Land use	LH Agricultural	RH We	oodland
Vegetation	LH Stubble	RH Tre	es

Synopsis

Water was seen running down the edge of a badly degraded single track road which slopes downhill into the village of Naunton. The water came from rainfall and run off from an agricultural track. The run off contained sediment from the verge, road grit from the damaged road surface and sediment from the adjacent fields and tracks.

The water runs along the road for another 500m before entering a series of three drains which discharge directly into the Windrush.



Mitigation

Road run off – There is an opportunity to divert the water away from the road by draining it into the adjacent woodland or agricultural field. Planting a hedgerow adjacent to the road and establishing a rough grass margin would help slow and divert water decreasing the amount or run off discharging into the Windrush at the bottom of the hill. Feasibility - Discussion between local highways and farming interests could see the landowner take up an Environmental Land Management schemes such as margins and hedgerow creation to create attenuation areas to relieve road run off.



Field entrance – Installation of hard standing and a cross drain at the entrance to the arable field would help minimise the erosion and associated sediment and gravel run off.
Feasibility - Further investigation of the quantity of run off and modelling of interventions would be beneficial to identify the most suitable interventions. Communication with the landowner as part of the Catchment Sensitive Farming programme should be undertaken.

Drains – The drains at the bottom of the road were completely blocked with sediment and debris causing localised flooding in the village. Feasibility - Work completed at the top of the hill and the increased maintenance of the drains would reduce the occurence of flooding and damage to the road from standing water.

APPENDIX 11 Road run off Naunton 2

Location	SP11335 24419	Date	5/12/2023
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/desigr	nation Main
EA classification	Ecological Poor	Waterbody	GB106039030480
Pollution type	Sediment	Priority	High
Source category	Conduit	Source type	Quarry track
Land use	LH Woodland		RH Woodland, grass
Vegetation	LH Trees		Trees, grass

Synopsis

Large volumes of water and sediment were seen running from the entrance track to a local stone quarry. The water flowed downhill along the road for about 1km before entering drains that discharge directly into the Windrush.



Mitigation

Road run off - Diverting the water before it reaches the quarry entrance and road is a priority. There is an opportunity to have the water enter into the woodland on the edge of the quarry and to create an attenuation area which would act as a natural filter. Feasibility – COMPLETE – The issue was resolved within a month following it being raised with Highways Gloucestershire County Council and the Environment Agency who subsequently liaised with the quarry operators. When returning to the site, the entrance to the quarry had been cleaned and tarmacked. Water and sediment were still able to run off the hard standing but was now being diverted into the woodland via additional culverts which had been dug and enlarged.



APPENDIX 12 Road run off Naunton 3

Location	SP 12875 22873	Date		02/01/2024		
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/designation		Main		
EA classification	Ecological Poor	Waterbody		GB106039030480		
Pollution type	Pollutants from vehicles and sediment	Priority		Medium		
Source category	Conduit	Source type		Road		
Land use	LH Agriculture, pasture		RH Scru	Scrub		
Vegetation	LH Grass		RH Scrub			

Synopsis

Water was seen running alongside a 3km stretch of road from the east and the west of the Windrush. The water diverts into a ditch adjacent to ta road bridge and is discharged directly into the Windrush. Litter was being transported by the water in the direction of the river.



Mitigation

Road run off - The creation of grips and regular clearance of the gullies further up the road would divert the water away from the road and limit the volume of road run off entering the watercourse. **Feasibility** - Further investigation and communication with the Local Authority and landowner is required.

Litter Picking – Regular litter picking from the road verges would reduce the impact of litter reaching the watercourse.

Feasibility – Local authority should be approached to understand the current policy and management.

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APPENDIX 13 Road run off Temple Guiting

Location	SP 09109 27981	Date		27/12/2023	
River/tributary	Windrush (Slade Barn Stream to Dikler)	Waterway/designation		Main	
EA classification	Ecological Moderate	Waterbody		GB106039037460	
Pollution type	Sediment	Priority		High	
Source category	Conduit	Source type		Residential driveway and road	
Land use	LH Residential garden		Residential garden		
Vegetation	Pond, scrub, trees		RH Trees		

Synopsis

The driveway is constructed of hardcore which has broken down and results in large quantities of sediment in the water.

The significant road flooding on the road bridge was the result of the culvert becoming blocked with debris and organic matter. The large puddle on a bend presents a significant hazard for vehicles and other road users.



Mitigation

Private Driveway – Interventions should be focused on preventing the water ands ediment flowing onto the road. The incised nature of the road leading down to the bridge leaves few opportunities to divert the water off the road before the road crossing. The driveway could be resurfaced to reduce sediment run off, and cross drains could be implemented to drain the water away.
 Feasibility – Further investigation would be required to see who owns the driveway and what options are open to reducing the run off on to the road.

Grip Maintenance – Ensuring the drain to the bridge is kept clear at regular intervals would reduce the risk to drivers **Feasibility** – Discussions would be required with the local authority to secure further maintenance.



APPENDIX 14 Road run off Upper Swell

Location	SP 17882 26753	Date		22/6/2023	
River/tributary	River Dikler (Source to Wyck Rissington)	Waterway/designation		Main	
EA classification	Ecological Poor	Waterbody		GB106039030840	
Pollution type	Pollutants from vehicles and sediment	Priority		Low	
Source category	Diffuse	Source type		Spring onto road	
Land use	LH Agriculture, pasture		RH Agriculture, pasture		
Vegetation	LH Grass	RH	Gras	s	

Synopsis

Spring fed field run off was seen emerging onto the road from a farm gateway. The water was picking up sediment before running across the road and discharging into theDikler via a culvert 100 metres downhill.



Mitigation

Field Entrance – The volume of spring water and sediment reaching the road and discharging directly into the waterway could be reduced if the gateway was repositioned ten metres up the field to move it away from the spring. Further monitoring would be required to ensure the spring water does not continue to flow onto the road. Feasibility - Further investigation of the quantity of run off and modelling of interventions, and communication with

Feasibility - Further investigation of the quantity of run off and modelling of interventions, and communication with the landowner as part of the Catchment Sensitive Farming programme should be undertaken.





Report undertaken and compiled by Annie Jenkin

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ROAD RUN OFF IN THE UPPER WINDRUSH CATCHMENT

As part of the Windrush Recovery Project

