

SECTION 6 | WHY WINDERMERE NEEDS A DIFFERENT SOLUTION



**WHY ‘ONLY
RAINWATER INTO
WINDERMERE’?**

For decades, investment in Windermere has sought to address growing environmental pressures through improvements to wastewater infrastructure.

Building on those lessons, ORiW represents a transformational step forward: a once-in-a-generation opportunity to protect and restore one of England's most iconic lakes. Inspired by internationally recognised success stories such as Lake Annecy and Lake Washington, ORiW takes a bold, catchment-wide approach, redesigning the wastewater system to deliver lasting environmental benefits.

By removing treated and untreated wastewater inputs from Windermere, ORiW addresses the lake's most significant controllable pressure while creating modern, resilient infrastructure capable of adapting to future environmental and regulatory challenges. Unlike the traditional model of successive five-year investment cycles, ORiW has been designed to deliver benefits not just for the next regulatory period, but for the next century.

The choice is clear. Without ORiW, we will continue making incremental upgrades every five years to keep pace with increasing rainfall and flooding, rising lake temperatures and evolving treatment standards – resulting in repeated construction, ongoing disruption and a continual cycle of investment. ORiW breaks that cycle. Through innovative tunnelling techniques and a single, coordinated programme of works, it will deliver meaningful environmental improvements while minimising disruption to local communities and the landscape. Constructable within seven years, it is a genuine 'one and done' solution that will create immediate impact, strengthen resilience and lay the foundations for the ecological restoration of Windermere for generations to come.

Current and planned investment to 2030 represents important progress and will deliver further improvements in wastewater-treatment performance and storm-overflow operation. However, achieving regulatory compliance alone does not equate to achieving ecological recovery. ORiW has therefore been established to identify and deliver the pathway required to eliminate point-source pollution discharges to Windermere and its hydrologically connected waters, creating a step change in freshwater protection.

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Achieving this ambition will require coordinated action across the catchment, including public wastewater infrastructure, privately owned and operated treatment systems, properties not connected to the public sewer network and highways drainage.

ORiW represents a fundamental shift away from managing pressures through incremental improvements towards a coordinated catchment-scale restoration programme that addresses the controllable wastewater drivers of nutrient enrichment and builds long-term ecological resilience.

The opportunity is not simply to slow decline, but to redefine what success looks like for freshwater recovery in England, restoring ecological health, protecting an internationally important landscape and securing Windermere's environmental, economic and cultural value for future generations.

This study demonstrates the engineering pathways available, the investment mechanisms required, and the collective commitment to deliver a nationally and internationally significant approach to freshwater restoration.



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Resilience for the next century

The Windermere catchment experiences some of the highest rainfall levels in the UK, receiving up to 2.5 metres annually. Climate change is expected to bring rising temperatures, more intense rainfall events and increased flood risk, placing further pressure on wastewater infrastructure. These risks are already evident, with wastewater treatment works within the catchment having experienced severe flooding, including the submergence of some facilities.

ORiW presents an opportunity to address these pressures through a long-term, catchment-wide approach to infrastructure planning. Rather than continuing to adapt existing assets incrementally, the project provides an opportunity to consolidate and relocate vulnerable wastewater infrastructure, reducing exposure to future flood risks while accommodating evolving treatment standards, emerging contaminants and future demand.

By designing infrastructure with the next century in mind, ORiW could deliver a more resilient wastewater system, strengthen environmental protection and minimise the need for repeated investment and disruption.

The legacy

Significant investment will be needed in any scenario to respond to environmental decline, ageing infrastructure, population growth and climate change. The choice is not whether to invest. The real choice is whether that investment continues in repeated cycles of partial improvements that cannot restore Windermere to its natural condition, or whether it is brought together behind a single long-term solution, supported by significant new wastewater infrastructure, capable of changing Windermere's future forever and doing so at pace.

The environmental legacy will be a step change in water quality, restoring ecological balance by eliminating the drivers of harmful algal growth from wastewater inputs, strengthening resilience to future climate pressures and restoring Windermere to a pre-industrialised state of no wastewater inputs.

The societal legacy will be the protection and enhancement of Windermere as a nationally and internationally significant natural asset, strengthening its role as a world-class venue for national and international sport while improving amenity, wellbeing and cultural value

for communities, visitors and future generations who depend on and cherish the lake.

The economic legacy will be safeguarding and strengthening Windermere's tourism-dependent economy, supporting regional employment and delivering long-term value to society through sustained environmental recovery.

Most importantly, this project would redefine what is possible in freshwater restoration: eliminating harmful inputs into England's largest lake and setting a new benchmark for environmental conservation in England.

Delivering this once-in-a-generation opportunity would require a step change in infrastructure provision across the catchment. By increasing the wastewater network servicing Windermere by up to approximately 75%, this will create a system capable of supporting communities and the environment for the next century. This demands bold leadership, accelerated investment and collective resolve. This is Windermere's opportunity: to move from managing decline to securing lasting restoration.

**Eliminating harmful inputs into
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SOLUTION FOR THE ENVIRONMENT

Due to its long-standing ecological significance, Windermere is one of the most extensively studied lakes in the world, with scientific monitoring records dating back to the 1920s. This unique evidence base tells a clear story: against a backdrop of a changing climate, more needs to be done to protect the lake and its wider catchment from significant environmental pressure.

Long-term monitoring shows declining deep-water oxygen concentrations and increasing algal biomass across large parts of Windermere and neighbouring lakes. Nutrient enrichment is altering ecological conditions within the lake, creating conditions in which harmful algal blooms can develop and leaving the freshwater system with less capacity to withstand further stress. Declines in species abundance, habitat condition and spawning success across parts of the catchment provide further warning that the health of the ecosystem is being eroded.

The pressures come from pollutant inputs compounded by wider environment, such as temperature increase and rainfall, as well as across the catchment. Wastewater infrastructure includes public assets and private wastewater treatment systems serving properties and businesses that are not connected to the public sewerage network. Urban run-off adds further pressure. Agricultural run-off is also recognised as an important catchment pressure. While outside the scope of this study, it will need to be understood and

addressed as part of a catchment-wide approach to improving Windermere's water quality.

The current situation

Across the catchment, United Utilities owns and operates ten WwTWs and six storm overflows. These assets represent the largest regulated wastewater discharges in the catchment and account for the majority of monitored wastewater flows contributing nutrient inputs to Windermere and its connected watercourses. Much of the public wastewater infrastructure was constructed between the 1960s and 1980s, with upgrades continuing over recent decades in response to tighter environment regulation and advances in treatment technology.

The largest wastewater treatment works in the catchment, which discharges directly to Windermere, operates to some of the most stringent phosphorus permit standards in the water sector in England and Wales, including treatment to the current Technically Achievable Limits (TAL) and ultraviolet disinfection, for example.

Alongside the public system, around 1,800 properties are estimated to be outside the public sewer network and there are around 90 permitted privately owned and operated wastewater treatment facilities, often linked to commercial enterprises.



Their discharge pathways and environmental effects vary from site to site, depending on whether effluent is discharged to drainage fields or directly into watercourses. Compared with large public works operating to advanced tertiary treatment standards, private systems are inherently more limited in nutrient removal and ongoing performance monitoring.

Only a 'no sewage' scenario will reduce harmful algal bloom exceedance days to zero.

However, ecological impact is not determined by regulatory compliance and treatment concentration alone. The total volume of wastewater discharged, nutrient load, operational performance under varying flow conditions and the cumulative effect of discharges over time all influence water quality in a lake where pollutants can remain within its system.

Looking to the future

Long-term monitoring and modelling evidence indicates that regulated public wastewater infrastructure remains the most significant and controllable source of nutrient inputs. The relative impact of other sources varies depending on discharge pathways, hydrological connectivity, nutrient loading, and seasonal conditions.

Modelling undertaken for the Environment Agency's Nutrient Futures for Windermere study (2026) indicates that climate change will intensify existing challenges. It highlights that, even though continued investment to 2030 will improve water quality in the short term, residual algal bloom risk remains, with up to 24 cyanobacteria exceedance days per year forecast in

the North Basin by 2079 – whereas a 'no sewage' 2079 scenario reduces exceedance days to zero. Surface water temperatures have risen by approximately 1.7°C over the past 70 years and are expected to continue rising. Future climate scenarios point to higher temperatures, altered rainfall patterns, more intense storms and longer periods of thermal stratification. By the 2070s, climate-driven change could increase nutrient loading to the lake by up to 7%, while mean temperatures could rise by 2.5°C. Without a substantial reduction in controllable nutrient inputs, the lake will become increasingly vulnerable to ecological instability and decline. These changing conditions are expected to increase ecological instability and create conditions in which harmful algal blooms become more frequent and persistent.

Planned investment to 2030 will deliver important improvements to wastewater treatment and reduce storm overflows, driving necessary improvements to water quality, and delivery of this investment has informed the baseline of ORiW solutions. Taking a longer-term view, modelling indicates that it will not provide the long-term climate resilience the lake requires. The risk of harmful algal blooms will remain, particularly in the North Basin, while treated and untreated wastewater will continue to place nutrient pressure on an already stressed lake.

Beyond reducing nutrient inputs from wastewater sources, ORiW also provides an opportunity to reduce other present and emerging contaminants from the lake. This includes, for example, PFAS, bacteria and other emerging inputs. ORiW provides long-term resilience through removing and centrally treating a significant proportion of wastewater inputs.

The value of having wastewater in a central treatment location, with discharge of treated effluent away from Windermere, is also relevant when considering emerging contaminants such as forever chemicals. Not only does ORiW remove this challenge now, as understanding of these contaminants develops so too will treatment requirements and standards. The ORiW approach enables this to evolve at a single treatment site, as opposed to incrementally across multiple disparate wastewater systems.

Windermere is already showing the consequences of cumulative impacts and a changing climate. Nutrient Futures demonstrates that achieving regulatory compliance and continuing repeated cycles of incremental investment are unlikely, on their own, to restore Windermere's ecological health. This approach would leave the lake dependent on sustained treatment performance, future regulatory intervention, and further investment as climate pressures intensify. Removing treated and untreated wastewater inputs will provide the step change needed to address the lake's most significant and controllable source of nutrient enrichment, create the conditions for long-term recovery and build resilience for the next century.



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SOLUTION FOR THE ECONOMY

Windermere underpins the Lake District National Park's visitor appeal, which generates around £2.4 billion in annual tourism revenue and attracts approximately 17.7 million visitors annually.

Over 60% of employment in the Lake District National Park is linked to tourism. Windermere's environmental condition and reputation are therefore directly connected to regional prosperity, employment and community resilience.

Research across 14 European countries has demonstrated that perceptions of declining water quality at recreational blue spaces can significantly influence visitor

behaviour, with reduced perceived quality associated with fewer visits and improved perceptions associated with increased visitation. Continued water quality concerns therefore represent a long-term risk to Windermere's visitor economy, with modelling indicating that deterioration could result in annual economic losses of up to £122.5 million.

£2.4 billion

annual revenue generated from tourism in the Lake District National Park

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Over 60%

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SOLUTION FOR THE PUBLIC

Strong public engagement and sustained local and national campaigning has raised awareness of the challenges facing Windermere and its catchment.

This collective action has amplified public scrutiny and expectation, helping to shape the narrative around the ambition for Windermere's future and contributing to increased recognition of the need for enhanced protection measures.

Alongside this, citizen science initiatives demonstrate the scale of public engagement and societal demand for action. The Big Windermere Survey formed one of the country's largest citizen science endeavours. This growing awareness reflects a clear public

demand for a step change in how Windermere is protected and restored. Protecting and restoring the lake, and the wider network of connected water bodies, will safeguard not only economic outcomes, but a nationally significant natural asset with long-term social and cultural value.

A clear public demand for a step change in how Windermere is protected and restored back to its natural state.

