Breathing life back into Lough Neagh.

How to control algae blooms in large bodies of water

Executive summary

Lough Neagh is undergoing the biggest natural disaster that Northern Ireland has ever witnessed. This has happened because the health of the lough has taken a back seat to other political, economic and social pressures.

What is needed is a solution that will not only rid the lough of the devastating algae blooms but will do so at a cost that is sustainable.

The nutrient content of the lough needs to be reduced. In reality, this means that there needs to be a change in the way land owners and the farming community use and dispose of fertilisers and slurry. However, even if this was done overnight, it has been estimated that it will take over two decades for the nutrient content to drop to acceptable levels, all the while there is the very real danger that Lough Neagh will suffer even more irreversible ecological damage.

Our objective is to help to return the waters of Lough Neagh to a place that is safe, enjoyable and full of life while the long term objective of reducing the nutrient runoff is achieved. I learned to sail on the lough and I hope any grandchildren I have will be able to do the same.

This can be achieved in a straightforward way, with proven technology, that will not add any burden to the lough.

This proposal is designed to help the lough return to a balanced, sustainable and natural eco-system. Once this has been achieved there would be no further costs and no vacant legacy buildings / treatment plants to need decommissioning.

Any solution that is considered for Lough Neagh has to be economically viable. Returning the lough to a vibrant, clean and safe space full of bio-diversity where people can enjoy being would be pointless if it saddled those people with an unsustainable financial commitment.

Introduction

Hennessy-Ward has been at the forefront of algae control and elimination in for over a decade. One of the directors, David Ward, learned to sail on Lough Neagh and enjoyed boating on the river Blackwater and Coney Island with his three children. This proposal is born out of a respect for the lough and a desire to help it to breath again.

It is well understood that encouraging land owners and farmers to change their methods and practices is essential for the long term health of our water ways, wildlife and Lough Neagh itself. This is the only long term and sustainable way to reduce the nutrient concentration of the water, the underlying cause of the problem. This is a task that will take considerable effort and resources and involve high level government intervention.

Removing leeching from the shoreline is, however, only part of the problem. All of the waterways that flow into the lough carry massive amounts of algae and nutrients with them. Added to that, the existing sediment in the lough holds vast amounts of these nutrients It is estimated that even if no more nutrients entered the lough, it could take several decades for the concentration to drop to acceptable levels.

This is time that Lough Neagh does not have.

Lough Neagh is a national treasure. The potential for the lough is clear for all to see but what would be the point of cleaning the lough if it saddled the public purse with a mounting debt? Any scheme that is considered should have a clearly defined end, where the lough can exist without costly interventions.

This is an affordable, effective and highly visible response that can not only reduce the nutrient content of the water but also demonstrates to the public that the issue is being taken seriously.

Our three pronged approach will:

1. Give a highly visible and effective Rapid Response to emerging algae blooms so they are stopped from becoming environmental disasters.
2. Eliminate the algae flowing into the lough from the rivers and other waterways.
3. Reduce the nutrient content in the waters of Lough Neagh significantly faster than leaving it to nature.

By removing the existing algae and nutrients from the water, we are offering a solution that can happen in the short to medium term. When the effects of reducing the nutrient run-off start to gain traction, the lough will already be well on its way to being clean.

Our goal is that the interventions outlined below can be phased out as the nutrient levels entering the waterways decreases. There should be no long term financial burden incurred to remove algae and nutrients as the lough settles into its own, natural eco-system.

The two technologies.

As a direct consequence of the COVID 19 pandemic, two separate but complimentary technologies have been developed that revolutionise our ability to control algae levels in large bodies of water.

1. Hypochlorous Acid (HOCL)

Discovered in 1834, hypochlorous acid is a well-known disinfectant that, although harsh sounding, is actually produced in the human body as part of our immune system. Sold over-the-counter as a facial spray to kill bacteria, there are no known side effects.

Hypochlorous Acid is used extensively as a disinfectant in swimming pools. It has tested to be 80% more powerful at 50 parts per million than chlorine bleach at 200 parts per million. It is highly effective at killing bacteria such as cyano-bacteria, also known as blue-green algae.

A new system has been developed that produces very pure hypochlorous acid at a fraction of the cost of traditional methods. This innovative production method not only produces hyper pure HOCL but the resulting solution has an extended shelf life. It is a win-win.

HOCL can be produced on site and is totally non-toxic. This makes it an ideal solution to be used in environmentally sensitive areas.

If the concentration of HOCL in Lough Neagh was as little as 1ppm, the problems of algae blooms would be irradicated with no adverse environmental effects.

2. Ozone

Ozone (O_3) is known as the best method for decontaminating water. Produced on site as a gas, ozone will not only kill algae and any other bacteria, but it will also re-oxygenate the water as it goes.

A new method of producing ozone has been developed in the UK. Known as ARCS, this method will use water from the lough to produce the ozone.

ARCS was further developed to target various impurities in waste water streams from the oil industry and the marine shipping industry. The parameters of the process can be adapted to remove all the nitrogen, phosphorus and other nutrients from the waters of Lough Neagh.

It is now possible to completely remove nitrogen, phosphorus and other nutrients from the waters of Lough Neagh.

The only way to control the algae blooms in Lough Neagh in the long term is to reduce the nutrient levels. We all know, if left to nature it will be many years before the nutrient run-off from the land can be brought under control.

Even then the residual nutrient load in the sediment of the lough will take decades to reduce to acceptable levels.

The ARCS Technology gives us a totally safe and environmentally friendly way of not only re-oxygenating the water but also reducing the nutrient levels to a point where algae blooms can no longer cause an environmental disaster.

This technology has the potential to reduce the time taken for the nutrient levels to return to a sustainable level from an estimated 25 years to within 7 years.

The three pronged approach.

1. Rapid Response Units

A Rapid Response Unit would have the ability to deliver a variable but measured concentration of HOCL directly onto algae blooms as they appear. Hypochlorous Acid can now be produced, at a concentration of 2000ppm. In order to kill algae in water, a concentration of 1ppm is more than adequate.

The HOCL will kill the algae and thus, if applied in time, will be able to prevent the thick layers of algae that are seen washing up on the shores of the lough and in the marinas.

This will greatly lower the devastating environmental impact of the algae blooms and ensure that the shoreline of the lough will not become clogged with the thick layers of decaying algae.

Decaying algae is the real danger, as it sucks oxygen from the water. By killing the algae before the thick sludge forms, this danger is greatly reduced.

Each Rapid Response Unit will be able to deliver over 500,000 Liters of HOCL at a concentration of 10ppm. This is more than enough to stop an algae bloom in its tracks.

Land based rapid response units could be as simple as a specially adapted trailer towed behind a suitable vehicle.

Lough based rapid response units would be specially designed RIBs that could access shallow areas of the lough that do not have road access. Fitted with suitable tanks, pumps and spraying equipment they could be brought into service very quickly.

Rapid Response Units could be brought into play quickly, easily and economically. They would give a highly visual signal that the problem is being tackled head on.

2. Treating the rivers

In order to give Lough Neagh the chance to recover, the water flowing into the lough needs to be as free of algae as possible.

Using a network of perforated pipes that are laid on the river bed, the ozone can be delivered across the width of the rivers flowing into the lough, without impeding the use of the river for recreational or commercial purposes. This underwater curtain of ozone bubbling up through the flowing water, will kill the algae flowing into the lough. Excess ozone will also be carried into the lough, creating an algae free area at the mouth of the river.

This algae free, oxygenated water will be clean and healthy. It will sustain life and help the river and the lough breath again.

On smaller rivers, or on sections of the larger rivers, HOCL can be sprayed from the shore over a large area, ensuring maximum effectiveness.

As with the rapid response units, one HOCL generator would be able to produce enough HOCL to produce 3,000,000L of HOCL at 2ppm. If this was introduced into a river over a set period of time, the algae content would be negligible by the time the water entered the lough.

While not "on call" the rapid response units could patrol the rivers and the body of the lough spraying HOCL as they go.

Again this is a highly effective, highly visible and low cost response to the environmental crisis that is occurring in and on Lough Neagh.

3. Treating the waters of Lough Neagh

With the rivers that flow into lough free from algae, treating the vast volume of Lough Neagh becomes much more achievable.

A series of self-navigating small craft – similar in principle to robot lawn mowers – that deliver ozone into the waters of Lough Neagh, would be deployed. The whole lough can be treated in an on-going way.

By using the water of the lough itself to produce the ozone, the nutrient dense and algae filled water would be pumped through a series of treatment chambers to emerge as clean, nutrient free and oxidised water. This could then be returned to the lough where the reactive oxygen species would kill the algae and oxygenate the water.

Treating the water as it enters the lough, along with lough based craft traversing the lough, the nutrient content of the lough could be brought down to levels that no longer pose a threat in as little as seven years.

The temptation is to say this means that there is no need to reduce the run-off, but this would be to miss the point. The end goal is to return Lough Neagh and its waterways to a point where they have a sustainable and healthy eco-system.

This cutting edge technology would put Northern Ireland front and centre in the field of algae control in large bodies of water. The system could be fully developed in Northern Ireland which would lead to the creation of jobs in manufacturing and distribution.

Proposed Trial areas

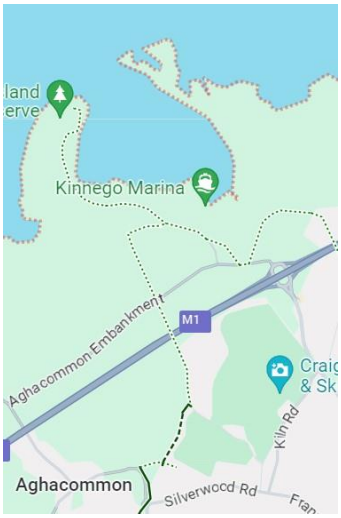
Treating a body of water the size of Lough Neagh is a task that cannot be underestimated. It will be a world first, but it is achievable. In order to fully understand the specific challenges of the task, the cleaning of one or more trial areas would be recommended.

We have selected three different areas, all with their own characteristics, that together effectively mimic the conditions of Lough Neagh.

1. Lough Gullion.
   Also known locally as "The wee Lough" Lough Gullion is a shallow lough with a surface are of approx. 1.3km^2. Located to the South-West of Lough Neagh it drains into the river Bann.

2. Lough Beg.
   Translated as the Little Lough, it a surface area of 5 km^2 and a depth of only 1-2 meters. This can vary greatly depending on recent rainfall. Situated to the North of Lough Neagh, the Lower Bann river flows through Lough Beg at a rate of approx. 90m^3 per second. This is the main river flowing out of Lough Neagh.

3. Kinnego Marina Basin
   An area of Lough Neagh itself and with a surface area of approx. 1km^2 it is located at the Southern end of the lough. Used extensively for water sports and tourism it is home to the Lough Neagh Discovery Centre.



Provisional costings

One HOCL generator that is capable of producing 300L per hour of 2000ppm ultra-pure HOCL would cost £49,590.00 delivered to Northern Ireland. All that is required is a power supply, mains water and salt. It is expected that 8 HOCL generators would supply enough HOCL for the Rapid Response Units and the fixed point units

The running costs are measured in pennies per litre with a power consumption of 6kW and a salt consumption of approx. 6g per litre.

The costs of the rapid response units would vary depending on the application. A mobile land based vehicle could be built for £100,000. A purpose built RIB capable of holding and deploying 2000L of 2000ppm ultra-pure HOCL would cost in the region of £300,000.

It is expected that 4 land based units and 4 water based RIBs would be needed

The ARCS system is very different, but what it is capable of is extra-ordinary. A system that could treat all the water flowing along the River Blackwater or the River Bann with an ozone curtain would cost in the region of £300,000. Three such units are envisaged, one on the Blackwater, one on the Upper Bann and one on the Lower Bann.

The autonomous craft delivering ozone into the lough would cost £350,000 each. It is estimated that 20 such craft would be required.

Again, the running cost of the ARCS Technology is measured in pennies per cubic meter of water treated, with a power consumption of 5kW.

Thus, for a total cost of under £10m not only could the lough be cleaned of algae and the nutrient content reduced but the water would be reoxygenated and totally healthy within 10 years.

Conclusion

The algae blooms in Lough Neagh have happened because the health of the lough has taken a back seat to other political, economic and social pressures.

Last year, images of the thick, decomposing layer of algae along the shores of Lough Neagh have brought the issue into sharp focus.

A highly effective and highly visual response to the issue will not only help turn the tide on the environmental disaster, but also reassure the public that the problem is being taken seriously.

Controlling the algae in Lough Neagh and returning it to a sustainable ecosystem has the potential to turn this natural disaster into a good news story for Northern Ireland.

The jobs created and resulting economic boost could put Northern Ireland on the map as the centre of excellence for the removal of algae and nutrients from large bodies of water.

Contact me directly to learn more about how this proposal can be put into action, including detailed timescales and costs.

David Ward
07541013575
www.hennessy-ward.com