Aquatic, Ecology, Environmental and Land Management Consultants

Canvey Lake

Water Quality Report

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Author (s): **Edward Rickard, Finley O'Grady BSc (Hons), AIFM**

Reviewed: **Ash Girdler C.Biol, FRSB, C.Env, MIFM, FIFM**

A.G.A Group Consultancy Limited
Telephone +044 (01953) 886824
Email: info@agagroup.co.uk
Website: http://www.agagroup.co.uk/

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1.0 Executive Summary

A water quality assessment and algal survey were undertaken at Canvey Lake on 22nd May 2026 to evaluate current ecological conditions, identify potential risks to public health and wildlife, and inform future management recommendations, sampling points have been identified in *Figure 1*.

The water quality assessment identified significant water quality impairment throughout the lake. Elevated concentrations of total phosphorus, ammonia, total organic carbon (TOC), biological oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids. The presence of which indicate significant organic enrichment, nutrient loading and poor ecological condition. Nitrate concentrations were below the analytical detection limit, suggesting that nitrification processes may be limited (broken) and that nutrient cycling within the lake is impaired.

The algal survey identified a phytoplankton community dominated by cyanobacteria (blue-green algae), including *Microcystis* spp. and *Dolichospermum* spp., together with the green algae *Scenedesmus* spp. The presence of these cyanobacterial genera is consistent with the elevated nutrient concentrations recorded and indicates a high risk of nuisance algal blooms. Blooming blue-green algae were observed during the bathymetric survey, confirming that conditions are currently favourable for cyanobacterial proliferation.

The presence of potentially toxin-producing cyanobacteria (*Microcystis* Spp and *Dolichospermum* Spp) represents a risk to wildlife, fish, domestic animals and members of the public. Cyanobacterial blooms can release toxins that may cause adverse health effects following direct contact or ingestion of contaminated water. Although recreational use of the lake is prohibited, warning signage is recommended to inform visitors of the presence of blue-green algae and the associated health risks.

Overall, the results indicate that Canvey Lake is experiencing ongoing water quality degradation driven by excessive organic sediment accumulation, elevated nutrient concentrations and high suspended solids levels. Recommendations have been provided to reduce organic sediment accumulation, improve nutrient cycling, control bank erosion, limit sediment inputs and reduce the likelihood of future cyanobacterial bloom events.

2.0 Introduction

A.G.A Group Consultancy Limited (AGA) was commissioned by Stuart Jarvis, Assistant Director Environment on behalf of Castle Point Borough Council to undertake water quality monitoring and an algal survey of Canvey Lake, on 22nd May 2026.

This assessment is the first of an ongoing water monitoring programme. Survey and analysis will be completed monthly in March - September and bi-monthly from October – February. The purpose of this assessment is to evaluate current water quality conditions and identify factors that may be contributing to historically poor water quality and algal growth. Water samples were analysed for key water quality parameters including pH, nutrients and suspended solids, whilst microscopic examination was undertaken to identify the algal community present within the lake.

This report presents the results of the water quality analysis, discusses the findings and provides recommendations to support improvements in water quality and ecological condition.

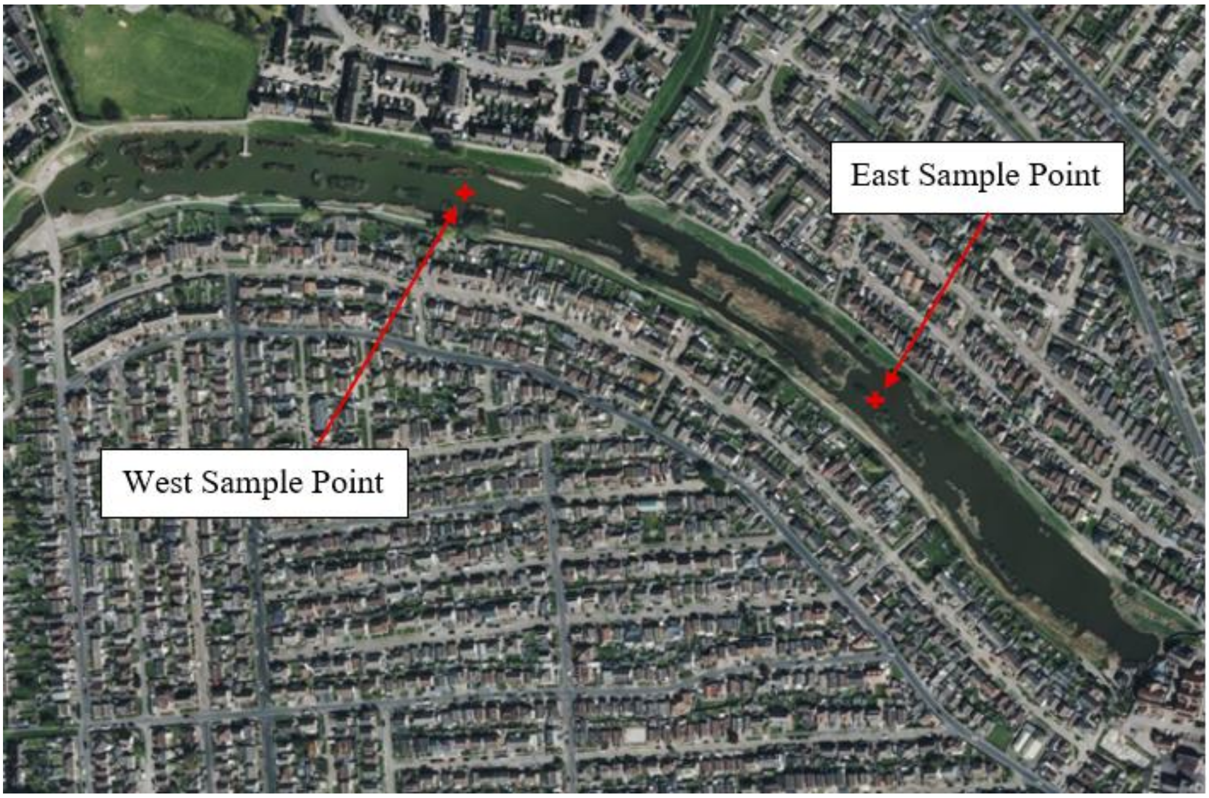


Figure 1 – Canvey Lake with annotated water sampling points.

3.0 Water Quality

A brief overview of the significant parameters is given below. Each of the parameters is explained in terms of its effect on fish that sit at the top of the aquatic food chain as a key indicator. Fish are considered important under the Water Framework Directive (WFD) to assess the ecological standard of a body of water. The significance of each parameter is also considered in relation to the Bathing Water Directive, with particular emphasis on microbiological indicators that are used to assess potential risks to human health during recreational use.

3.1 pH

When analysts measure pH, they are determining the relative concentration of hydrogen ions. In a lake or pond, the water's pH is affected by its age and the chemicals discharged by local communities, agriculture and industries. Most waterbodies are basic (alkaline) when they are first formed and become more acidic with time due to the build-up of organic materials. As organic substances decay, carbon dioxide (CO_2) forms and combines with water to produce a weak acid. This weak acid is called "carbonic" acid. The formation of large amounts of carbonic acid will lower the water's pH.

The effect pH has on fish is slightly complicated by the synergistic effect it may have on other chemicals and compounds. For example, elevated pH increases the toxicity of nitrogen compounds which can cause significant pressure of fish health.

3.2 Phosphates

Phosphorus is important for plant and animal growth. Phosphates are found in nearly all fertilisers which are washed from farm soils into nearby waterways at times of heavy rain. Whilst phosphate is unlikely to ever be at a level that will be toxic to freshwater fish, it does have a large part to play in eutrophication of our freshwaters along with nitrates. The effects of varying levels are shown in *Table 1.*

Amount of total phosphate-phosphorus	**Effects**
0.01-0.03 mg/l	Amount of phosphate-phosphorus in most uncontaminated lakes
0.025 mg/l	Accelerates the eutrophication process in lakes
0.1 mg/l	Recommended maximum for rivers and streams

Table 1. Effects of varying levels of phosphorus/phosphates

3.3 Nitrogen Cycle & the breakdown of Ammonia

Nitrogen makes up about 80% of the air we breathe. As an essential protein component, it is found in the cells of all living things. Inorganic nitrogen may exist in its 'free' state as a gas, or as nitrites, nitrates or ammonia; organic nitrogen is found in proteins and other compounds, it is recycled continually by plants and animals; this natural process is known as the 'Nitrogen Cycle'.

Before specifically considering ammonia, an understanding of this important cycle should be gained. An overview of the nitrogen cycle in soil or aquatic environments is shown in *Figure 2* below.

At any one time a substantial proportion of the total fixed nitrogen will be locked up in the biomass or in the dead remains of organisms (shown collectively as "organic matter").

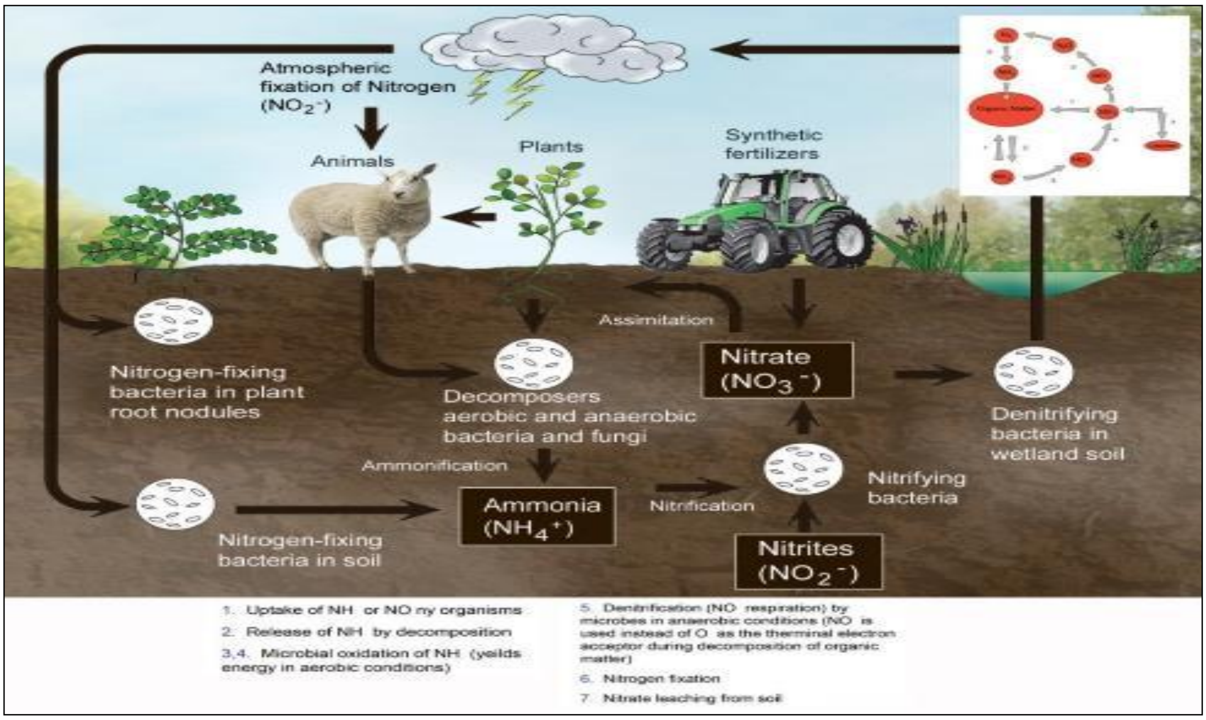


Figure 2. **The Nitrogen Cycle.**

The only nitrogen available to support new growth will be that which is supplied by nitrogen fixation from the atmosphere or by the release of ammonium or simple organic nitrogen compounds through the decomposition of organic matter. Some of other stages in this cycle are mediated by specialised groups of micro-organisms.

3.4 Ammonia

Ammonia is toxic to fish and aquatic organisms, even in very low concentrations. Ammonia levels greater than 0.1mg/l often indicates some degree of organic pollution.

The danger ammonia poses for fish depends on the water's temperature and pH, along with the dissolved oxygen (DO) and carbon dioxide levels (CO_2). The higher the pH and the warmer the temperature, the more toxic the ammonia becomes. It is also much more toxic to fish and aquatic life when water contains very little DO and CO_2. The effects of varying levels of ammonia are described in *Table 2*.

Un-ionised Ammonia – NH3	Effects to Fish
0.06 mg/l	Fish may suffer gill damage
0.2 mg/l	Sensitive fish like trout and salmon begin to die
2.0 mg/l	Ammonia tolerant fish like carp begin to die

Table 2. **Effects of ammonia on fish**

3.5 Nitrite

Nitrite is an intermediate product in the breakdown of ammonia to nitrate (nitrification). High nitrite levels in freshwater cause a serious condition known as brown blood disease in fish. Nitrite levels greater than 0.60 mg/l or 10 times higher than the toxic threshold for un-ionized ammonia is toxic to fish. Nitrite can be toxic to fish at levels above 0.03 mg/l.

The action of nitrifying bacteria uses CO_2 as their source of carbon to synthesise organic compounds. Organisms of this sort are termed chemoautotrophs. They gain their energy by chemical oxidations (chemo-) and they are autotrophs (self-feeders) because they do not depend on preformed organic matter.

Nitrifying bacteria are found in most waters of moderate pH but are not active in highly acidic water.

They are almost always found as mixed-species communities (consortia**)** because some of them are specialised to convert ammonium to nitrite (NO_2^-) (*Nitrosomonas*) while others convert nitrite to nitrate (NO_3^-) (*Nitrobacter*). So, in fact, the accumulation of nitrite inhibits *Nitrosomonas*, so it depends on *Nitrobacter* to convert this to nitrate, whereas *Nitrobacter* depends on *Nitrosomonas* to generate nitrite.

The nitrifying bacteria have some important environmental consequences, for example more plants and micro-organisms absorb either nitrate or ammonium. However, the process of nitrification has some undesirable consequences. The ammonium ion (NH_4^+) has a positive charge and so is readily adsorbed onto the negatively charged clay colloids and organic matter. In contrast, the negatively charged nitrate ion is not held on soil particles and so can be washed down the soil profile (leaching). In this way, valuable nitrogen can be lost from the soil, reducing the soil fertility. The nitrates can then accumulate in groundwater, and other waters adding to their eutrophic nature.

3.6 Nitrate

Nitrate is a major ingredient of farm fertiliser and when it rains, varying amounts of nitrate is washed from the farmland into nearby waterways. However, nitrates may also enter waterways from sources such as leaking septic tanks and cesspools.

Nitrates are also formed naturally by the action of bacteria on ammonia and nitrogen-containing compounds such as nitrite. Nitrate is not likely to be found at levels toxic to fish in natural or semi natural freshwater fishery environments.

3.7 Total Hardness

In the absence of human inputs, the chemical content of substances dissolved in water depends on the nature of rock in which the waterbody is located and the geology of its drainage basin. The main dissolved substances are Calcium and Magnesium carbonates; their concentration determines the hardness of the water.

In general, waterbodies situated in areas of hard rock such as granite, have very soft water, whereas those situated in chalk or limestone areas have hard water.

The chemical content of the water is strongly linked to its ability to support life; soft water waterbodies tend to be less rich in organisms, harder water tends to be richer and support larger biomasses and greater species diversity.

The hardness of the water directly effects its 'buffering capacity', which is its ability to resist the effects of acids or alkaline substances that would change its pH, the harder the water the greater its resistance to pH fluctuations.

In general, Total `Hardness will not, in isolation cause any problems within the aquatic environment however it is considered alongside other parameters, such as pH when analysing water quality data. Classification for the evaluation of water hardness can be found in *Table 3.*

Calcium and Magnesium (mg/l)	Classification
Less than 17.1	Soft
17.1-60	Slightly hard
60-120	Moderately hard
120-180	Hard
Over 180	Very hard

Table 3. Water hardness classification.

3.8 Biochemical Oxygen Demand (BOD)

Biochemical Oxygen demand (BOD) is a measure of the oxygen used by micro-organisms to decompose organic waste. Micro-organisms such as bacteria are responsible for decomposing organic waste. When organic waste such as dead plants, leaf litter or sewage is present in a body of water, bacteria will begin the process of breaking down this waste.

When this happens, much of the available dissolved oxygen (DO) is consumed by aerobic bacteria, restricting other aquatic organisms of the oxygen they need to live. If there is a large quantity of organic waste in the water, there will be many bacteria present working to decompose the waste. A table of expected BOD levels in still-waters with fish populations and some organic waste is shown in *Table 4*.

BOD Level ppm	Water Quality
1 – 4	**Very Good:** There will not be much organic waste present. A balanced system.
5-9	**Good:** Small amount of organic waste present. A reasonably balanced system.
9-15	**Poor:** Usually indicates organic matter is present and bacteria are decomposing this waste.
100 or greater	**Very Poor:** May contain significant amounts of organic waste. An increased risk of contamination or break down of natural systems that provide balance.

Table 4. Possible interpretation of BOD levels in still-waters

The level of BOD is also affected by other factors such as the levels of nitrates, phosphates, and the water temperature. When BOD levels are high, the DO levels decrease because the oxygen that is available in the water is being consumed by the bacteria in the water and the hydro-soil. Since less DO is available in the water; fish and other aquatic life may become stressed and may not survive.

3.9 Chemical Oxygen Demand (COD)

Chemical Oxygen Demand (COD) is commonly used to indirectly measure the number of organic compounds dissolved in water or the hydro-soil of a waterbody. The determination of COD measures the amount of organic and inorganic pollutants found in surface water, for example lakes and rivers, more correctly described as the oxygen consumed by the process. COD is a useful indicator for water quality. It affects the amount of oxygen available for other organisms requiring oxygen and can be interpreted in a similar way as BOD using the interpretation shown in *Table 4*.

3.10 Suspended Solids

Solids like sand and grit may not have chemical effects on fish but can abrade the body, especially the gills. Damage to the gills can affect gaseous and ionic exchange and cause excess mucus secretion, further affecting gill function. Abrasions can also lead to secondary problems such as bacterial and fungal infections.

The indirect effects of high concentrations of suspended solids can be particularly damaging to fish via effects on habitat quality and other organisms. High turbidity will inhibit photosynthesis and hence plant growth, whilst settling suspended solids can smother plants and prey organisms as well as increase sediment loadings.

3.11 Total Organic Carbon

Total Organic Carbon (TOC) is an important parameter in assessing water quality and its impact on fish health and the aquatic environment generally. TOC measures the amount of carbon found in organic compounds within the water. Elevated TOC levels can significantly impact aquatic ecosystems, as TOC serves as a source of carbon and energy for microorganisms, driving the decomposition of organic matter and influencing nutrient cycling. Organic carbon decomposition releases nutrients such as nitrogen and phosphorus back into the water, affecting nutrient availability and potentially leading to imbalances. High TOC levels are often associated with eutrophication, a process where nutrient over-enrichment stimulates excessive plant and algal growth, depleting oxygen levels and harming aquatic life.

Although there are no strict safety limits for TOC, a euphotic lake, which is characterised by high biological productivity, typically has TOC levels ranging from 3 to 12 mg/l. In contrast, recommended levels of TOC in lakes are around 0.5 mg/l. Elevated TOC levels indicate higher organic matter content, which can lead to increased biological oxygen demand (BOD) and chemical oxygen demand (COD), straining the oxygen available for fish and other aquatic organisms.

TOC also interacts with other water quality parameters, such as pH and alkalinity, influencing their stability and buffering capacity. These interactions are crucial for understanding the overall health of the aquatic ecosystem.

TOC levels can vary seasonally and spatially, influenced by land use, climate, and hydrological conditions. Thus, long-term monitoring is essential to capture these variations and identify trends over time.

3.12 Iron

Measuring iron levels in a lake is crucial for assessing water quality, particularly concerning fish health. Elevated iron concentrations can negatively impact fish by causing respiratory stress and impairing their ability to absorb oxygen through their gills. High iron levels can also promote the growth of certain algae and plants, leading to harmful algal blooms that further deplete oxygen levels in the water, creating hypoxic conditions detrimental to fish survival. Additionally, iron can accumulate in fish tissues, potentially leading to toxicity and affecting their growth, reproduction, and overall health.

Monitoring iron levels helps in identifying pollution sources, such as industrial discharge or runoff, and enables the implementation of management strategies to maintain a balanced and healthy aquatic environment. Hence, regular assessment of iron concentrations is essential for protecting aquatic life and ensuring the lake's overall environmental integrity.

The proposed thresholds for iron concentrations are 0.73 mg/l total iron for the protection of sensitive taxa, and 1.84 mg/l total iron for the protection of the whole community (using community metrics agreed for use in classification under the WFD).

3.13 Magnesium

Measuring magnesium levels in a freshwater body is crucial for assessing water quality, particularly concerning fish health. Magnesium is an essential mineral for aquatic organisms, playing a vital role in various physiological processes such as enzyme activation and muscle function. However, both deficiencies and excesses can have detrimental effects. Insufficient magnesium levels can lead to poor fish growth, weakened immune systems, and increased susceptibility to diseases. Conversely, excessive magnesium concentrations can disrupt osmoregulation in fish, leading to stress and metabolic imbalances

3.14 Total Alkalinity

Total Alkalinity is crucial for fish health as it measures water's ability to neutralize acids, primarily through bicarbonates, carbonates, and hydroxides, thus maintaining pH stability.

A stable pH is essential for fish metabolic functions, including respiration and digestion, and prevents sudden pH shifts that can be stressful or lethal.

Alkalinity also mitigates the toxicity of certain chemicals like ammonia, which becomes more harmful at higher pH levels. Additionally, it supports aquatic plants that provide oxygen and habitat for fish, contributing to a balanced ecosystem. In the UK, the safe range for total alkalinity in freshwater environments is typically between 50 and 200 mg/l as $CaCO_3$, with an optimal level around 100-120 mg/l to ensure sufficient buffering capacity without compromising water quality. Marine environments generally require higher alkalinity, between 125 and 200 mg/l. Maintaining these levels helps prevent common health issues in fish and supports a sustainable aquatic habitat, emphasizing the importance of regular monitoring and adjustments

3.15 Coliforms

Coliform bacteria are a broad group of bacteria that are commonly found in the environment, including soil, plants and water. As indicator organisms comprising of different bacterial species, coliform bacteria are used to evaluate the presence of potentially harmful pathogens. These are typically ‘disease-causing’ bacteria in water. While some coliform bacteria are associated with the intestinal tracts of warm-blooded animals and can indicate faecal contamination, there are also non-faecal coliform bacteria that occur naturally. Because coliforms are not specific to faecal material the World Health Organisation (WHO) deems them useful but not definite as a regulatory parameter of public health.

Therefore, their numbers are not compared to any guideline values in this report (WHO Guidelines for Drinking-water Quality, 4th edition, 2017, WHO's Guidelines for Safe Recreational Water Environment).

3.16 Escherichia coli and Enterococci

Escherichia coli (*E. coli*) and Enterococci are both types of bacteria commonly used as indicators of faecal contamination in water quality assessments. *E. coli* is a bacterium that naturally inhabits the intestines of warm-blooded animals, including humans. Its presence in water suggests recent faecal contamination and the potential presence of harmful pathogens associated with faecal matter. Enterococci, on the other hand, are a group of bacteria found in the intestines of humans and animals. Similar to *E. coli*, their presence in water indicates possible faecal contamination.

Increased concentrations of these bacteria signify an increased possibility of infection. Monitoring levels of *E. coli* and Enterococci provides valuable information about water quality, ensuring the safety of water supplies and protecting public health. Safe parameters for *E. coli* and Intestinal Enterococci are shown in *Table 5* below.

Parameter	**Excellent**	**Good**	**Sufficient**
Intestinal Enterococci (CFU/100ml)	200	400	330
E. coli (CFU/100ml)	500	1,000	900

Table 5. **Standards used by appropriates agencies for classifying inland waters in relation to water quality. The concentration of bacteria is calculated in Colony-Forming Units (CFU*).*** ***References:*** *The Bathing Water Regulations 2013, Schedule 5 Classification.*

The WHO Guidelines for safe recreational water environments (2003) is a universally accepted document highlighting the relationship between the concentration of Enterococci in recreational waters and the associated estimated risk at these concentrations.

The table highlights a proportional relationship between the concentration of Enterococci and risk to human health. The values of intestinal Enterococci and coliforms are measured in either Colony-Forming Units (CFU) or Most Probable Number (MPN), depending on the method of testing involved. The relative values presented above are reflected in *Table 6* below, which provides a quantitative representation of this relationship.

95th percentile value of intestinal enterococci / 100ml	Basis of derivation	Estimated risk per exposure
>40	This count is below the 'no observed adverse effect level' of the studies	**< 1% gastrointestinal illness risk** **< 0.3% acute febrile respiratory illness risk** Less than one case of gastroenteritis in every 100 exposures The risk of acute febrile respiratory illness is negligible
41-200	This count is above the threshold of illness transmission reported in most studies	**1 - 5% Gastrointestinal illness risk** **1. 9 - 3.9% Acute febrile respiratory illness risk** 1 in 20 exposures will result in gastroenteritis Approximately 1 in 50 exposures will result in acute febrile respiratory illness
201-500	This range represents a substantial elevation in the probability of all adverse health outcomes for which dose-response data are available	**5 - 10% Gastrointestinal illness risk** **1.9 - 3.9 % Acute febrile respiratory illness risk** 1 in 10 to 1 in 20 exposures will result in gastroenteritis A risk of 1 in 25 to 1 in 50 exposures resulting in acute febrile respiratory illness
> 500	Above this level, there may be a significant risk of high levels of minor illness transmission	**> 10% gastrointestinal illness risk** **> 3.9 acute febrile respiratory illness risk** There is a greater than 10% chance of gastroenteritis per single exposure The risk of acute febrile respiratory illness would be greater than 1 in 25

Table 6. Guideline values for microbial quality of recreational waters.

References World Health Organisation Geneva (2003) Guidelines for safe recreational water environments: Volume 1, Coastal and Freshwaters. *Chapter 4.4.4; Guideline values for freshwater*, Page 70.

4.0 Results

4.1 Water Quality Results

4.1.1 Table of Results

The water quality results from samples taken 12th May and analysed for the Lake are shown in *Table 7* below.

Parameter	**Unit**	**Canvey Lake West**	**Canvey Lake East**
pH	pH	7.9	8.0
Total Phosphorus	mg/l	0.390	0.940
Ammonia Un-ionised as NH3	mg/l	0.55	1.34
Ammonium as NH4+	mg/l	0.58	1.42
Nitrite (NO2-)	mg/l	0.06	0.04
Nitrate (NO3-)	mg/l	<0.02	<0.02
Total Organic Carbon (TOC)	mg/l	18.0	51.0
Biological Oxygen Demand (BOD)	mg/l	55.0	75
Chemical Oxygen Demand (COD)	mg/l	239	308
Total Hardness as CaCO3	mg/l	806	918
Total Alkalinity	mg/l as CaCO3	338	272
Calcium Carbonate	mg/l as CaCO3	150	180
Suspended Solids	mg/l	303	608
Total Magnesium	mg/l	160	180
Total Iron	mg/l	0.280	0.330
Coliforms	MPN/100ml	>2420	614
E. coli	MPN/100ml	40	35
Enterococci	CFU/100ml	103	113

Table 7. Water quality results for the samples taken 12th May 2026.

4.2 pH

The ideal pH range for water bodies is between 6.5 and 8.5. Over time, water bodies tend to become more acidic due to the accumulation of organic material, which lowers the pH.

The recorded pH for the lake was 7.9 for the West sample point and 8.0 for the East sample point of the lake. This value is within the ideal pH range for water bodies and is of no cause for concern.

4.3 Phosphate

Elevated phosphate concentrations can lead water bodies into a eutrophic state. Eutrophication can severely threaten aquatic ecosystems.

This eutrophication can include oxygen depletion due to the increased decomposition of organic matter, which may result in a loss of fish populations. Phosphorus levels are shown in *Table 7.* The total phosphate concentration for the West sample point 0.39 mg/l and the East sample point was 0.94 mg/l, which is significantly elevated and will be contributing to eutrophication.

4.4 Nitrogen

Total oxidised nitrogen (NO_x-N) is the sum of the concentrations of nitrate, nitrite, and ammoniacal nitrogen.

4.4.1 Nitrate (NO_3)

For many freshwater systems, nitrate levels should be kept below 1 mg/l to protect sensitive species, such as salmonids. Concentrations above 10 mg/l can cause eutrophication in lakes, although nitrate alone is unlikely to harm non-sensitive fish species. The World Health Organization (WHO) recommends a maximum nitrate concentration of 50 mg/l in drinking water. The nitrate levels recorded for both sample points on the lake are <0.02 mg/l, which is initially within acceptable parameters. In conjunction with the elevated un-ionised Ammonia NH_3-N, this is indicates that the Nitrogen Cycle *(Figure 2)* is not cycling efficiently.

4.4.2 Nitrite (NO_2)

Nitrite is toxic to aquatic organisms, even at low concentrations. Ideally, nitrite levels should be kept below 0.1 mg/l for many freshwater species. Acute toxicity can occur at levels as low as 0.2 mg/l, and concentrations above 1 mg/l can be lethal. The recorded nitrite levels in the lake are 0.06mg/l for the West sample point and 0.04 mg/l for the East sample point, this is low and not a cause for concern.

4.4.3 Unionized Ammonia (NH_3-N)

Unionized ammonia should ideally be kept below 0.02 mg/l to protect sensitive aquatic life.

Concentrations above 0.1 mg/l can be harmful or lethal, depending on pH and temperature (see *Table 3*). The NH_3-N levels recorded in the West sample point area are 0.055 mg/l and 1.34 mg/l in the East sample point, this is significantly elevated outside of the safe range for aquatic life.

4.4.4 Ammonium (NH_4^+)

While less toxic than un-ionized ammonia, elevated ammonium levels can still impact aquatic ecosystems by contributing to nutrient loading and promoting eutrophication.

Concentrations below 0.5 mg/l are generally considered acceptable. Higher concentrations, particularly above 1 mg/l, can contribute to nutrient imbalances. The ammonium levels recorded in the West sample point are 0.58mg/l and 1.42 mg/l in the East sample point which is elevated and contributing to eutrophication.

4.5 Total Hardness as $CaCO_3$

Water hardness classifications are shown in *Table 4*. Extremely hard water can be problematic for most fish species, leading to stress, health issues, and respiratory problems due to mineral deposits on the gills. The Total Hardness recorded for the West sample point are 806 mg/l as $CaCO_3$, with calcium carbonate levels at 150 mg/l. The East sample point results are 918mg/l as $CaCO_3$ with calcium carbonate levels at 180 mg/l. Indicating that the water is categorised as very hard and is typical for the area therefore not of concern.

4.6 Total Organic Carbon (TOC)

In a eutrophic lake, characterised by high biological productivity, TOC typically ranges from 3 to 12 mg/l. Recommended TOC levels for lakes are around 0.5 mg/l. The TOC concentration in the West sample point are 18 mg/l and the concentration in the East sample are 51 mg/l. The lake's TOC is significantly elevated, entering the eutrophic range, it indicates significant organic pollution entering the lake.

4.7 Biological Oxygen Demand (BOD)

BOD measures the oxygen demand of organic components in the water system (see *Table 5*). High BOD can cause hypoxic or anoxic conditions, which are detrimental to fish health. The BOD levels in the West sampling point of the lake are 55.0 mg/l and in the East sampling point the levels are 75.0 mg/l which is categorised as poor.

Prolonged, elevated BOD may promote anaerobic (low-oxygen) conditions within the lake sediments, increasing the likelihood of foul-smelling hydro-soil development.

4.8 Chemical Oxygen Demand (COD)

COD measures the amount of oxygen required to chemically oxidise both organic and inorganic compounds in the water. High COD levels can indicate pollution and contribute to eutrophication, oxygen depletion and reduced bathing water amenity. The COD concentration recorded in the lake was 239 mg/l in the West sample point and 308 mg/l in the East sample point, indicating a significant pollution load.

The lake shows elevated levels categorised as “very poor”, indicating elevated concentrations of organic material which can lead to decreased dissolved oxygen during decomposition.

4.9 Iron

The proposed thresholds for iron concentrations are 0.73 mg/l for the protection of sensitive taxa and 1.84 mg/l for the whole community. Levels above this can cause issues depending on the fish species and environmental factors. The recorded iron levels in the West sampling point are 0.28 mg/l and 0.33 mg/l in the East sampling point, this is below the risk threshold for sensitive taxa and not a cause for concern.

4.10 Magnesium

Magnesium is rarely toxic to aquatic life at natural concentrations. Levels below 50 mg/l are generally considered safe for most fish species. Magnesium concentrations in the lake were recorded at 160 mg/l in the West sample point and 180 mg/l in the East sample point on the lake, this is above typical levels but not a cause for concern for aquatic life.

4.11 Total Alkalinity

Freshwater alkalinity should typically be between 20 and 200 mg/l as $CaCO_3$, as levels within this range help buffer water against rapid pH changes and provide a stable environment for aquatic life. The alkalinity levels recorded in the West sample point in the lake are 338 mg/l and 272 mg/l in the East sample point, this is outside the ideal range but not a cause for concern. It should be noted that this will increase the buffering capacity of the waterbody, reducing pH fluctuations.

4.12 Suspended Solids

Suspended solids at elevated concentrations can reduce underwater visibility, detract from the aesthetic quality of the waterbody and may indicate increased organic or sediment inputs.

The suspended solids concentration recorded in the West sampling point are 303 mg/l, and 608 mg/l in the East sampling point, this is significantly elevated and likely to contribute to poor water clarity.

4.13 Coliforms

Coliform concentrations can indicate potentially harmful bacteria or organic pollution entering the water.

Coliform levels in the lake were recorded in the West sample point at >2420 MPN/100ml and 614 MPN/100ml in the East sample point.

4.14 E. Coli

E. Coli is an indicator of organic pollution. The concentrations recorded in the West sample point are 40 MPN/100 ml and 35 MPN/100ml this is low and within the excellent standard for The UK Bathing Regulations (2013).

4.15 Enterococci

Enterococci concentrations indicate potential faecal contamination. The recorded levels in the lake were 103 CFU/100ml in the West sample point and 113 CFU/100ml. The lake's concentration are low, meeting the excellent standard for The UK Bathing Regulations (2013).

4.16 Algal Survey

An algal identification survey was undertaken to assess the composition of the phytoplankton community and identify the presence of nuisance or potentially harmful algal species. Microscopic examination identified the cyanobacteria (blue-green algae) *Microcystis* spp. and *Dolichospermum* spp., together with the green algae *Scenedesmus* spp.

The dominance of *Microcystis* and *Dolichospermum* in the algal community is consistent with the elevated nutrient concentrations recorded within the lake and is indicative of eutrophic conditions. Both genera are capable of forming dense surface blooms under favourable environmental conditions and are recognised for their potential to produce cyanotoxins. These toxins can pose a risk to wildlife, fish, domestic animals and humans through direct contact, accidental ingestion or inhalation of water spray. Exposure may result in skin irritation, gastrointestinal illness and, in severe cases, liver or neurological effects depending on the toxin produced.

During the bathymetric survey, blooming blue-green algae were observed within the lake, confirming that conditions are currently favourable for cyanobacterial proliferation. The occurrence of active blooms, combined with the elevated phosphorus concentrations and high organic loading identified during the water quality assessment, suggests there is an ongoing risk of bloom persistence and expansion during warmer periods.

Given the identification of potentially toxin-producing cyanobacteria and the observation of active blooms, warning signage should be installed at key access points around the lake to inform members of the public of the potential health risks associated with contact with blue-green algae. Signage should advise against entering the water and highlight the risks to pets and wildlife, particularly dogs, which may be vulnerable to cyanotoxin exposure through ingestion of contaminated water or algal material.

The algal community observed during the survey is consistent with the wider water quality assessment, which identified elevated nutrient concentrations, high organic loading and impaired ecological conditions. Management measures aimed at reducing nutrient availability and improving water quality will be essential to minimise the frequency and severity of future cyanobacterial blooms. Microscopy is shown in *Plate 1.*

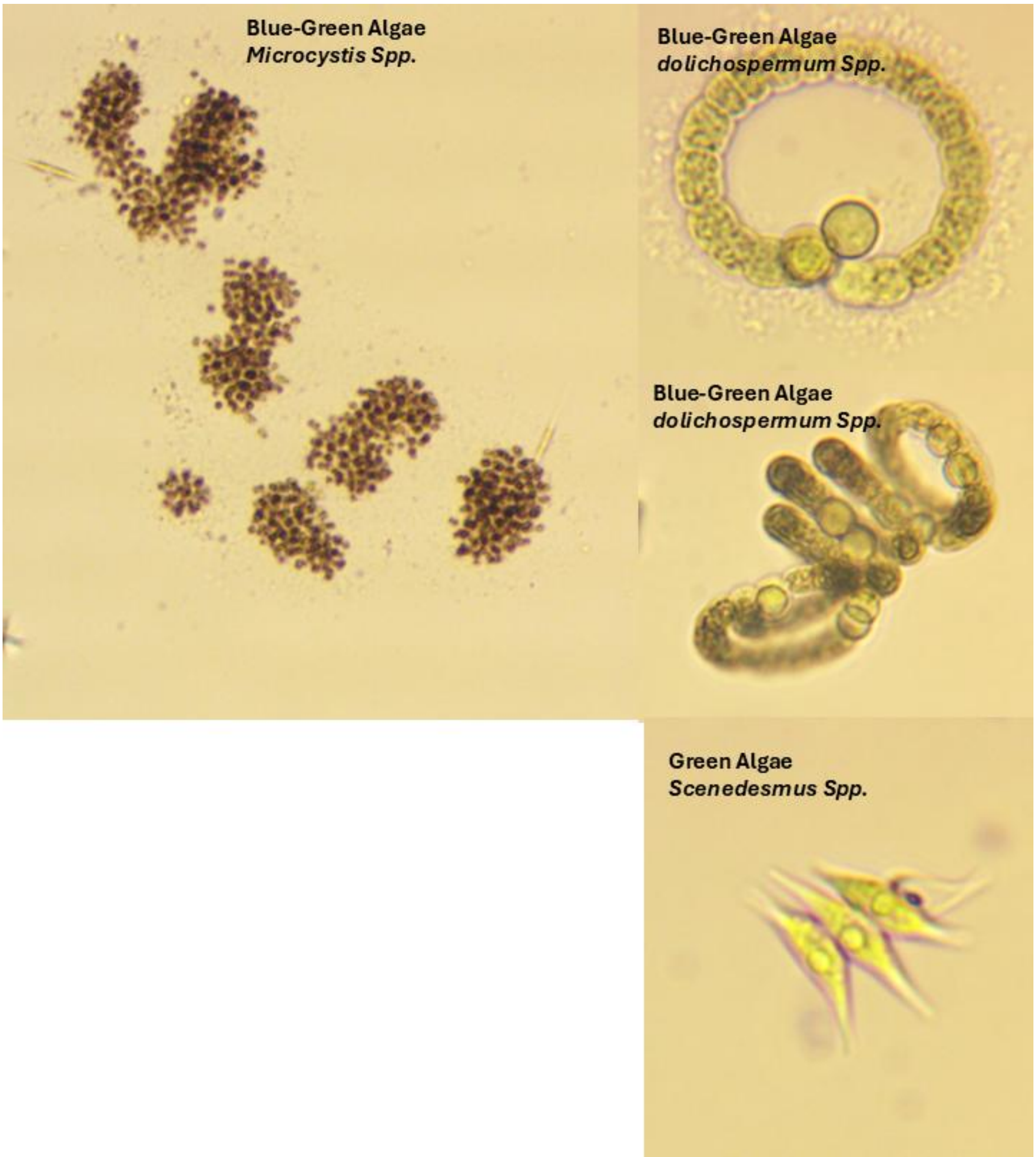


Plate 1. Microscopy of algae community.

5.0 Discussion

5.1 Overview of Water Quality Condition

The results of the current assessment indicate that the lake is in a strongly eutrophic state, driven by excessive nutrient enrichment, high organic loading and significant internal sediment disturbance. This is evidenced by elevated concentrations of phosphorus, ammoniacal nitrogen species, TOC, BOD, COD and suspended solids, alongside the presence of cyanobacterial blooms (*Microcystis* spp. and *Dolichospermum* spp.). Collectively, these parameters confirm a system under considerable ecological stress, with impaired biological and chemical function.

5.2 Nitrogen Cycle Dysfunction

The nitrogen species profile indicates a severely disrupted nitrogen cycle within the lake. Nitrate concentrations were consistently <0.02 mg/l, whilst ammonium (0.58–1.42 mg/l) and unionised ammonia (0.055–1.34 mg/l) were elevated across both sampling locations.

Under normal aerobic conditions, ammonium is oxidised via nitrification to nitrite and subsequently nitrate. The absence of nitrate accumulation, combined with elevated reduced nitrogen species, indicates that nitrification is either highly inefficient or being inhibited. This is strongly indicative of low dissolved oxygen conditions within the water column and sediment interface, which suppress nitrifying bacterial activity.

As a result, toxic ammonia persists within the system, contributing directly to ecological stress whilst also sustaining nutrient availability for primary production. This imbalance is a key driver of ongoing eutrophication and algal proliferation.

5.3 Organic Loading and Oxygen Demand

The elevated TOC (18–51 mg/l), BOD (55–75 mg/l) and COD (239–308 mg/l) demonstrate a substantial organic pollution load within the lake. These values indicate high levels of biodegradable and chemically oxidisable material, which exert significant oxygen demand during decomposition.

The high oxygen demand is likely contributing to hypoxic and anoxic conditions, particularly at the sediment-water interface. This environment restricts aerobic microbial processes, further impairing nitrogen cycling and promoting the accumulation of reduced compounds such as ammonium.

5.4 Sedimentation and Sediment Resuspension

Suspended solids were recorded at elevated concentrations (303–608 mg/l), indicating significant sediment resuspension throughout the lake. This is consistent with a waterbody that contains a high level of accumulated fine sediment.

The lake is understood to have substantial historic sediment deposition, and this material is likely being continually disturbed by wind action, wave energy, bioturbation and marginal erosion. This resuspension has several key impacts:

- Reduced water clarity and light penetration
- Release of sediment-bound nutrients, particularly phosphorus and ammonium
- Continued internal nutrient loading sustaining eutrophic conditions

Instability of benthic habitats and prevention of ecological recovery

The system is therefore operating as both a source and recycler of nutrients, with sediment acting as a major internal loading reservoir.

5.5 Internal Nutrient Cycling and Eutrophication

The combination of elevated sediment disturbance, organic loading and poor oxygen conditions is driving strong internal nutrient cycling within the lake. Nutrients stored within the sediment are repeatedly reintroduced into the water column, particularly under anoxic conditions where phosphorus release is enhanced.

This internal loading mechanism is a primary factor maintaining eutrophic conditions, even in the absence of significant external nutrient inputs. The system therefore exhibits a self-reinforcing feedback loop:

- Organic accumulation → oxygen depletion
- Oxygen depletion → reduced microbial processing
- Reduced processing → nutrient release from sediment
- Nutrient release → algal growth → further organic accumulation

5.6 Algal Response and Ecological Implications

The dominance of *Microcystis* spp. and *Dolichospermum* spp. confirms that nutrient availability and environmental conditions are sufficient to support harmful cyanobacterial blooms. These taxa are well adapted to low nitrogen conditions and high phosphorus environments.

Observed blooms during the survey further indicate that the lake is currently in an active eutrophic state, with a continued risk of toxin production under favourable climatic conditions. This presents ecological risks to fish, wildlife and public exposure.

5.7 Management Recommendations

5.7.1 Sediment and Internal Loading Control

To address the primary issue of sediment-driven internal nutrient release, the following treatments are recommended:

- **LakeAid AquaBio**: to improve sediment redox conditions, reduce anoxia and enhance breakdown of organic sediments.
- **Bacterius® Muck**: to biologically degrade accumulated sediment and reduce long-term silt build-up.

These interventions aim to restore more aerobic sediment conditions and reduce internal nutrient release. In the long-term, de-silting of lake sediment will be the most effective option for sediment management, further analysis and comment on de-silting works will be available following silt analysis.

5.7.2 Nitrogen Cycle Restoration

To improve nitrification efficiency and stabilise nitrogen dynamics:

- **Bacterius N**: supports nitrifying bacterial populations and ammonia reduction.
- **Bacterius 5B**: enhances nitrogen cycling efficiency and contributes to improved water clarity

These treatments target the restoration of functional microbial nitrogen pathways, reducing toxic ammonia accumulation.

5.7.3 Algal Growth Suppression

To assist in short-term control of cyanobacterial proliferation:

- Lake Aid BioX (barley straw extract): provides algistatic effects, helping to reduce bloom intensity while longer-term nutrient management strategies take effect

5.7.4 Bank Stabilisation

To reduce ongoing sediment and nutrient input:

- Installation of **vegetated coir rolls** along vulnerable margins
- Establishment of emergent vegetation (e.g. *Phragmites*, sedges, *Iris pseudacorus*)
- These measures will stabilise banks, reduce erosion, intercept nutrient runoff and provide long-term ecological benefits.

5.8 Summary

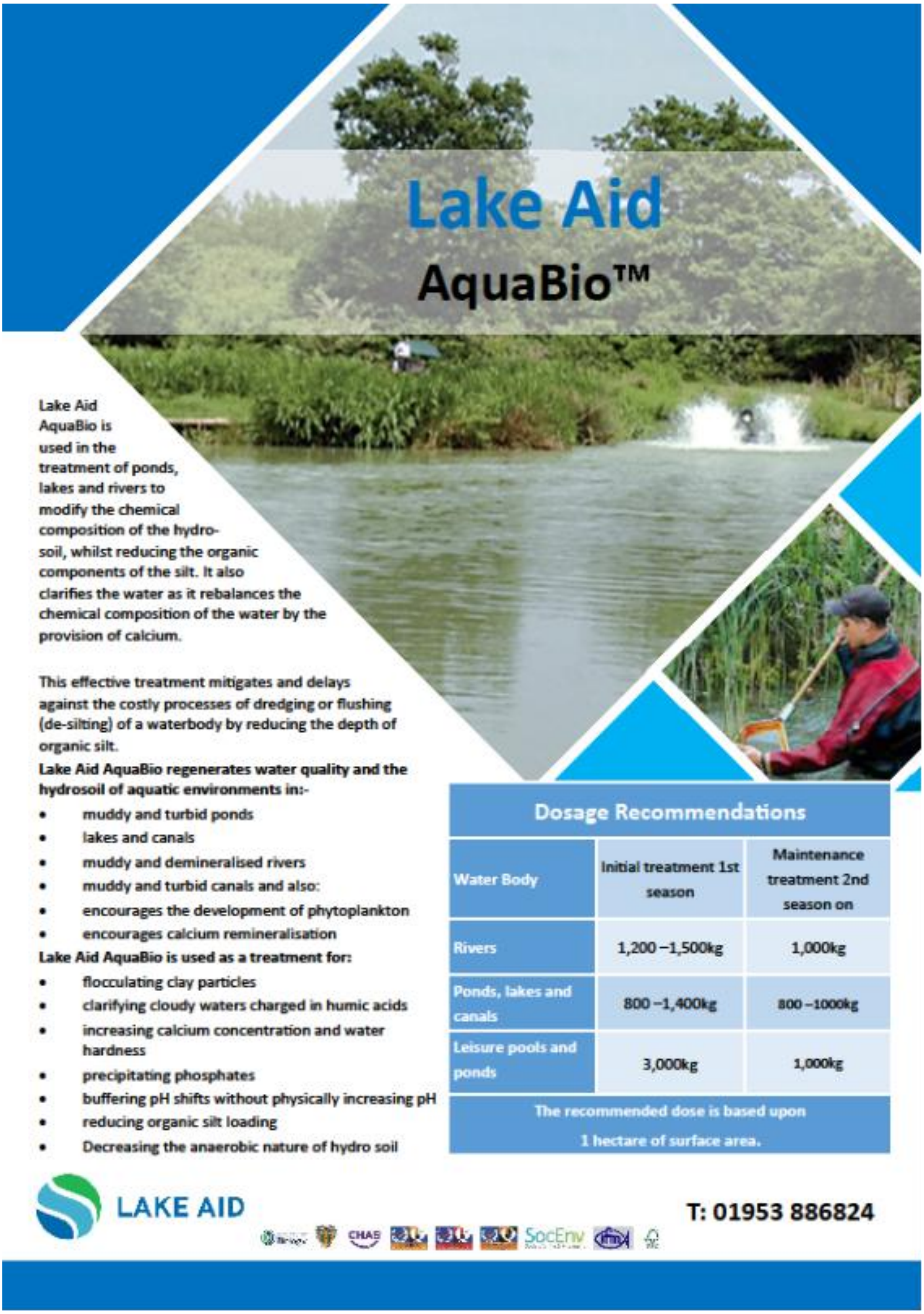
Overall, the lake is functioning as a highly nutrient-enriched, sediment-loaded system with impaired nitrogen cycling and significant internal loading. The dominant constraints on water quality are associated with sediment anoxia, organic accumulation and continuous resuspension of fine material.

Effective restoration will therefore require a combined approach targeting sediment quality, microbial nitrogen cycling, internal nutrient release and marginal erosion control. Over time, these measures should improve water clarity, reduce ammonia toxicity, suppress cyanobacterial dominance and promote a more stable ecological equilibrium.

6.0 Recommendations

Recommendation	Rationale
Winter Lake Aid AquaBio treatment programme. *Appendix A*	AquaBio treatment applications. A hydro-soil conditioner is recommended to promote oxidation of organic sediments and improve redox conditions. The treatment programme is expected to reduce internal nutrient availability and lower phosphorus concentrations within the lake.
Apply Bacterius 5B and Bacterius N. *Appendix C*	Un-ionised ammonia, nitrite and nitrate concentrations indicate that the nitrogen cycle is not functioning effectively. Application of Bacterius 5B and Bacterius N will support beneficial bacterial populations responsible for nutrient cycling and improve the biological processing of nitrogen compounds.
Apply Bacterius Muck *Appendix C*	Bacterius Muck is recommended to accelerate the biological breakdown of accumulated organic sediments within the lake. Reducing organic sediment deposits will help lower oxygen demand, improve nutrient cycling, reduce internal nutrient loading and improve overall water quality conditions.
Lake Aid BioX treatment programme. *Appendix B*	BioX should be used to limit algal growth and proliferation by reducing the competitive advantage of nuisance algae and cyanobacteria. This will assist in controlling bloom development and improving water clarity.
Continue monthly water quality monitoring and algal identification surveys.	Ongoing monitoring will allow treatment effectiveness to be assessed and provide early warning of deteriorating water quality or bloom development.
Coir roll installation	Planted coir rolls are recommended to stabilise eroding banks and reduce sediment inputs to the lake. This will help improve water clarity, enhance marginal habitat and support healthy zooplankton populations, which are an important component of the aquatic ecosystem.
Vegetated floating eco-islands	Vegetated eco-islands are recommended to provide nutrient uptake from the waterbody, provide substrate for nitrifying bacteria within the suspended root system and for improved habitat for aquatic wildlife required for a robust ecosystem.
De-silting works	De-silting of Canvey Lake is recommended to manage sediment within the lake. This would provide significant benefits by increasing water depth of the lake and remove the high volume of nutrient rich sediment from the lakebed.

7.0 Appendix A: Lake Aid AquaBio



Lake Aid

AquaBio™

Lake Aid AquaBio is used in the treatment of ponds, lakes and rivers to modify the chemical composition of the hydro-soil, whilst reducing the organic components of the silt. It also clarifies the water as it rebalances the chemical composition of the water by the provision of calcium.

This effective treatment mitigates and delays against the costly processes of dredging or flushing (de-silting) of a waterbody by reducing the depth of organic silt.

Lake Aid AquaBio regenerates water quality and the hydrosoil of aquatic environments in:-

- muddy and turbid ponds
- lakes and canals
- muddy and demineralised rivers
- muddy and turbid canals and also:
- encourages the development of phytoplankton
- encourages calcium remineralisation

Lake Aid AquaBio is used as a treatment for:

- flocculating clay particles
- clarifying cloudy waters charged in humic acids
- increasing calcium concentration and water hardness
- precipitating phosphates
- buffering pH shifts without physically increasing pH
- reducing organic silt loading
- Decreasing the anaerobic nature of hydro soil

Dosage Recommendations

Water Body	Initial treatment 1st season	Maintenance treatment 2nd season on
Rivers	1,200 –1,500kg	1,000kg
Ponds, lakes and canals	800 –1,400kg	800 –1000kg
Leisure pools and ponds	3,000kg	1,000kg
The recommended dose is based upon 1 hectare of surface area.		

LAKE AID

T: 01953 886824

LAKE AID AQUABIO.

To enhance fishery conditions Lake Aid AquaBio facilitates the breakdown of previously partially decomposed organic material and boosts aerobic digestion. Untreated the hydro-soil becomes anaerobic producing the undesirable gases methane and hydrogen sulphide. Because of their inbuilt instincts fish will always avoid these poor water areas.

TREATMENT PERIOD.

Any time of the year but most effective between March to November in Temperate regions (water temp 10C).

Two or three treatments spread over a season will be more effective than one application.

This is particularly true for lake bed hydro-soil where there is a significant proportion of partially digested sediment or anaerobic conditions forming the noxious gasses associated with the anaerobic substrate.

PRODUCT DESCRIPTION.

Lake Aid AquaBio is completely harmless to all aquatic organisms including fish and amphibians.

Lake Aid AquaBio is a micronised powder produced from the processing of high purity mineral ($CaSO_4.2H_2O$ - Calcium Sulphate Di-hydrate).

Lake aid AquaBio is completely harmless to all aquatic organisms including fish and amphibians.

TECHNICAL DATA.

For a comprehensive technical data sheet please contact A.G.A. direct.

HEALTH AND SAFETY.

These products are not classified as dangerous/hazardous chemicals. Health and Safety information sheets are always available on request.

SUPPLY DETAILS.

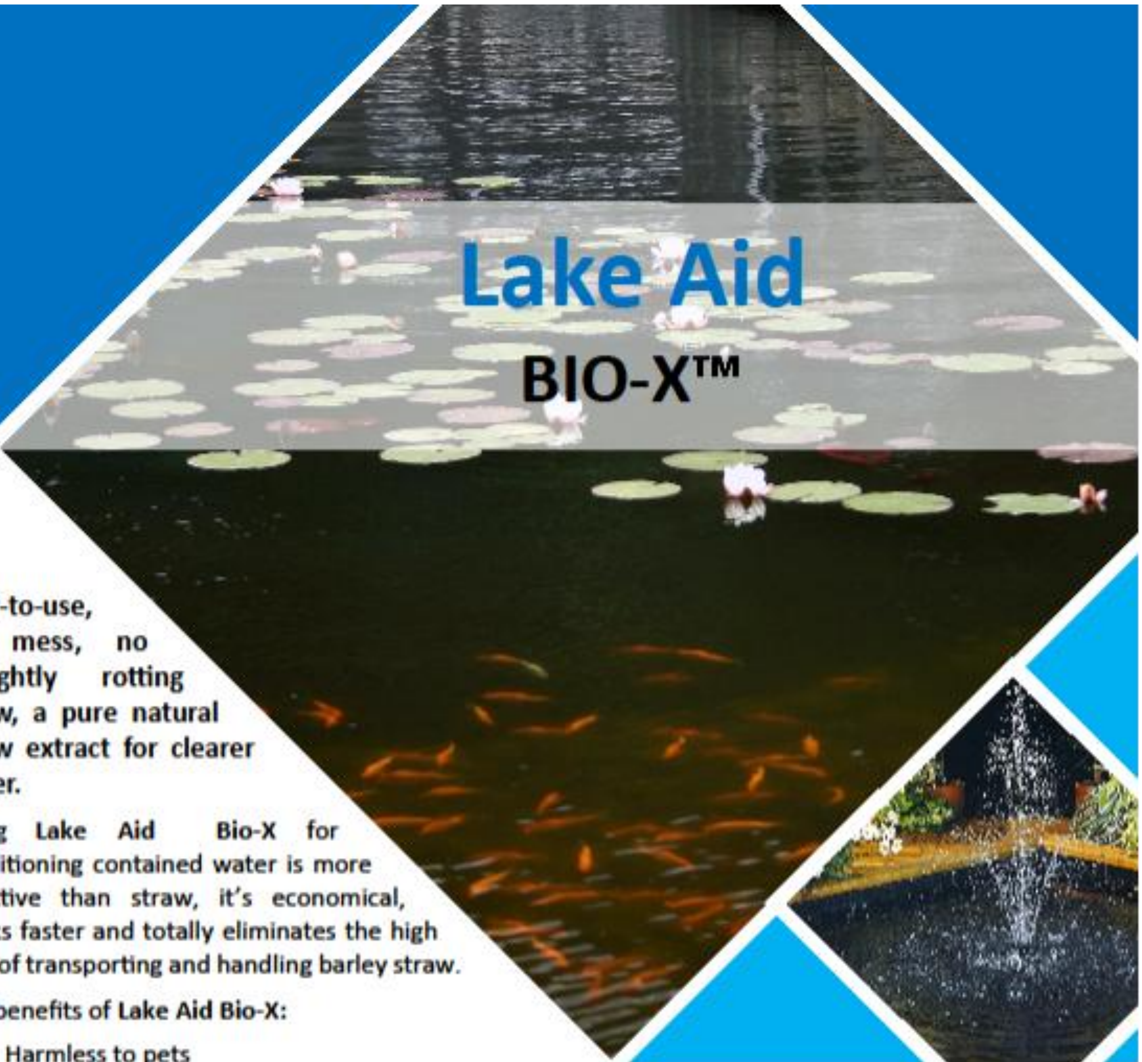
Lake Aid AquaBio is supplied in handy 25Kg plastic sacks.

STORAGE.

When stored under normal dry conditions, this product will not deteriorate chemically, however it is susceptible to compaction lumps. Each bag is stamped with a date of manufacture and a batch reference. Stocks should be rotated so that the oldest material is used first.

A.G.A. Group
Merton Hall Ponds, Merton
Thetford, Norfolk. IP25 6QH
England
Telephone: 01953 886824
Email: info@agagroup.co.uk
Web: www.agagroup.co.uk

8.0 Appendix A: Lake Aid BioX



Easy-to-use, no mess, no unsightly rotting straw, a pure natural straw extract for clearer water.

Using **Lake Aid Bio-X** for conditioning contained water is more effective than straw, it's economical, works faster and totally eliminates the high cost of transporting and handling barley straw.

The benefits of **Lake Aid Bio-X:**

- Harmless to pets
- Harmless to fish and wildlife in ponds
- Controls algae and filamentous algae (blanket weed)
- Accelerates the clearing of the green water
- Contains no synthetic chemicals or artificial pesticides
- Becomes effective weeks earlier than barley straw
- Can safely be used in ponds with filters and water features
- Excellent value
- Environmentally friendly

The A.G.A. Group's Biologists have concentrated the inhibiting chemical compounds produced by barley straw into a practical easy to apply extract.

The application of **Lake Aid Bio-X** barley straw concentrate has the same inhibiting effect on the growth of algae without the often arduous and untidy process of introducing and removing large quantities of barley straw.

LAKE AID

T: 01953 886824

ALGAE CONTROL.

Lake Aid Bio-X is a concentrate of barley straw which conditions the water to inhibit and control algae growth. For years' environmentalist and pond keepers alike have been using barley straw treatment as a control against the nuisance of algae. This laborious and expensive control is no longer the ideal answer.

Lake Aid Bio-X should be applied initially at a dose rate of 5 litres per acre before dilution.

The concentrate should be added to the water body by mixing at least 1 part concentrate to 5 parts water, this is done, not directly to dilute the product, but simply to create volume thus ensuring a good initial spread across the entire area of the waterbody

Further weekly treatment should then be carried out at 1-5 litres per acre dosage, still diluting the product for ease of application across the water surface.

Ideally the dilute concentrate should be applied from a boat preferably by spraying out through a knapsack sprayer which should be kept clean of any other chemicals.

Alternatively it can be drizzled gradually into a running inlet which will then naturally distribute it with the flows and currents.

Lake Aid BioX contains: Aqueous barley straw extract as a natural source of plant lignin. Lake Aid Bio-X is triple distilled to ensure 'full strength' delivery of the active ingredient

DOSAGE.

Lake Aid Bio-X is available in handy 25 litre drums.

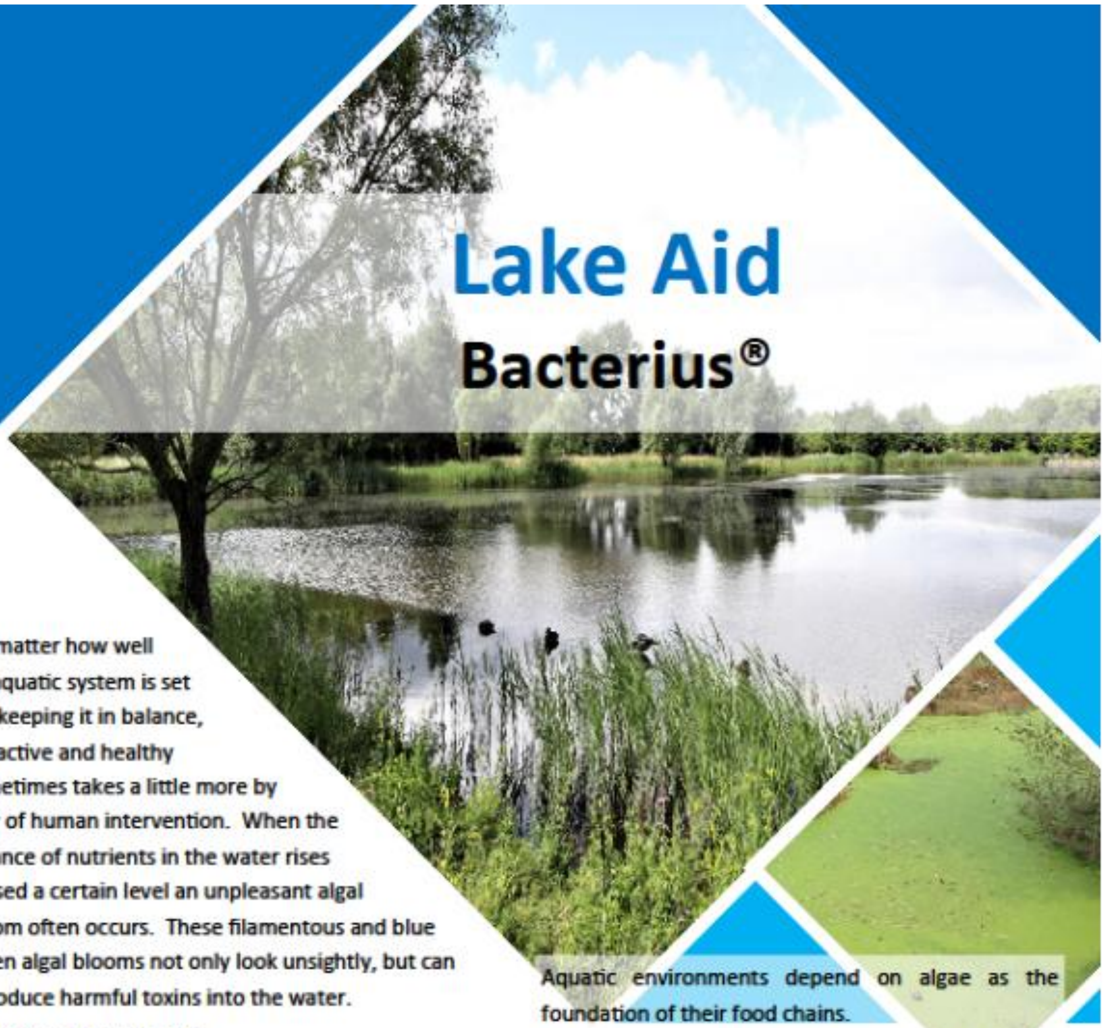
Other pack options such as IBC 1000 litre containers available

Initial application rates 5 litre per acre. Subsequent regular applications 1.5 litre per acre should be carried out at weekly intervals.

The treatment should be carried out through the algae season. We therefore recommended that the critical application of **Lake Aid Bio-X** is commenced in early spring and used throughout the spring and summer to prove most effective in the control of algae.

A.G.A. Group
Merton Hall Ponds, Merton
Thetford, Norfolk. IP25 6QH
England
Telephone: 01953 886824
Email: info@agagroup.co.uk
Web: www.agagroup.co.uk

9.0 Appendix C: Bacterius



Lake Aid

Bacterius®

No matter how well an aquatic system is set up, keeping it in balance, attractive and healthy sometimes takes a little more by way of human intervention. When the balance of nutrients in the water rises passed a certain level an unpleasant algal bloom often occurs. These filamentous and blue green algal blooms not only look unsightly, but can introduce harmful toxins into the water.

Bacterius® products will:

- Reduce the levels of nutrients
- Reduce the phosphorus loading
- Reduce the nitrogen loading
- Breakdown dead algae
- Reduce algal blooms
- Reduce toxicity
- Reduce Sludge build up

Bacterius® is safe for fish and plants and will help support fish health and clear water.

Aquatic environments depend on algae as the foundation of their food chains.

In a healthy, stable setting, the amount of algae is regulated by various factors such as light, temperature, available gases, other nutrients, and the organisms that consume it.

Most aquatic systems achieve a balanced state where these factors stabilise. However, this balance may not always be ideal from our perspective. When phosphorus levels increase, it typically encourages the growth of filamentous and blue-green algal blooms.

LAKE AID

Bacterius.

BACTERIUS®

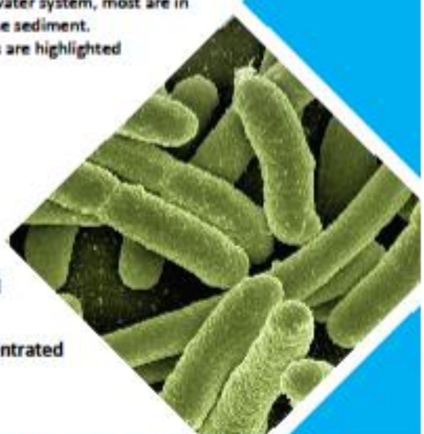
Bacterius®: Natural Water Treatment Solutions
Bacterius® is a brand of water treatment products designed to improve water quality as naturally as possible. Supplied by Canadianpond, a company renowned for its expertise in bioaugmentation and water treatments, Bacterius® products leverage the power of beneficial microorganisms to transform water parameters. In the UK, A.G.A Group is the exclusive supplier of this innovative technology and has successfully used it to treat ponds and lakes across the country.

How Does It Work?
Bioaugmentation involves introducing cultured beneficial microorganisms into an existing microbial community. These microorganisms reduce nutrient levels and break down unwanted compounds, thereby enhancing water quality. Specifically, the microorganisms in Bacterius® products produce enzymes that biodegrade or transform excess ammonia, nitrites, phosphorus, and hydrocarbon-based contaminants. This enzymatic activity is crucial in maintaining a healthy aquatic environment.
The enzymes released by the microbes in Bacterius® products break down various compounds that may contaminate aquatic environments. Bioaugmentation with Bacterius® offers many benefits:

- **Reducing Odours:** The breakdown of organic matter by beneficial microorganisms helps eliminate unpleasant odours commonly associated with stagnant or polluted water bodies.
- **Natural Clarification of Pond Water:** The enzymatic activity helps clear suspended particles and organic matter, increasing water clarity and enhancing the aesthetic appeal of ponds and lakes.
- **Reducing the Risk of Sickness and Death Among Fish:** By maintaining balanced nutrient levels and reducing harmful compounds, bioaugmentation promotes a healthier environment for fish, decreasing disease and mortality rates.
- **Clearing Lake or Pond Bottoms and Reducing Silt:** The microorganisms break down organic matter that accumulates on the bottoms of ponds and lakes, reducing silt and sediment buildup and maintaining the natural depth and health of these water bodies.
- **Controlling Algal Growth, Including Blue-Green Algae:** By breaking down excess nutrients, the beneficial microbes help control and prevent excessive algal growth, maintaining a balanced and healthy aquatic ecosystem.
- **Controlling Ammonia Levels:** Denitrifying bacteria break down harmful ammonia, converting it into nitrogen gas (N_2), which is harmlessly released into the atmosphere.

PRODUCTS WE OFFER

Bacterius® products come in various different product types, each specialised to the needs of the water system, most are in liquid form and are applied to the surface while some are in solid forms designed to dig deep into the sediment.
All Bacterius® products are non-toxic and safe for the environment, the products A.G.A Group offers are highlighted below .



Bacterius® C – Organic matter and waste controller

Bacterius® N – Nitrogen controller to reduce ammonia and nitrites (water nitrification)

Bacterius® EQUINOX – Cold Water Beneficial Bacteria Treatment

Bacterius® MUCK – Concentrated bacterial pellets for treating shoreline muck and sediment rich areas

Bacterius® 5B – High concentration bacteria with barley straw for sediment reduction and water clarity

Bacterius® 1B – Natural bacteria with barley straw, same formulation as 5B but less concentrated

Bacterius® POND – Nitrification and control of organic sediment

This information is subject to change arising from new developments and findings. If you are unable to find the item you are looking for, please do not hesitate to contact us immediately.
The A.G.A. Group installation teams operate solely within the field of aquatic and bioengineering. We operate a policy of 'Best Practice' and are bound by the Code of Conduct of both the Institute of Fisheries Management and the Society of Biology. The A.G.A. Group will quote for the supply of materials, their installation or for 'turnkey' projects.
A.G.A. is Quality assured to: ISO45001 : 2018, ISO9001 : 2015 & ISO 14001 : 2015
A.G.A. Group, MMG and MHP and AGACES are trading styles of A.G.A. Group Enviro-Fix Limited

A.G.A. Group
Merton Hall Ponds, Merton
Thetford, Norfolk. IP25 6QH
England
Telephone: 01953 886824
Email: info@agagroup.co.uk
Web: www.agagroup.co.uk