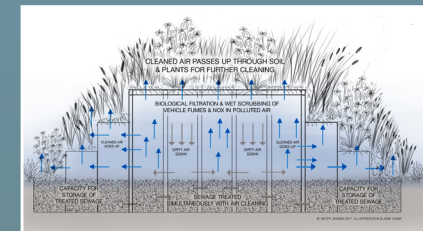
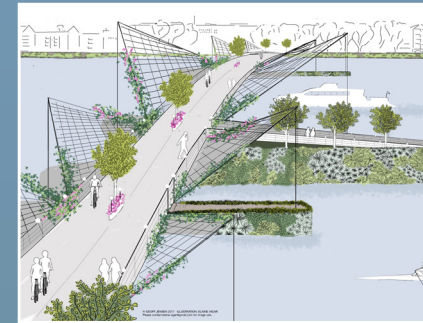


LONDON GREEN ROUTE

THAMES EMBANKMENT BIO-RECYCLE WAY



PURIFYING London's AIR AND WATER whilst providing Londoner's with a CLEANER AND SAFER ENVIRONMENT for CYCLING AND WALKING.

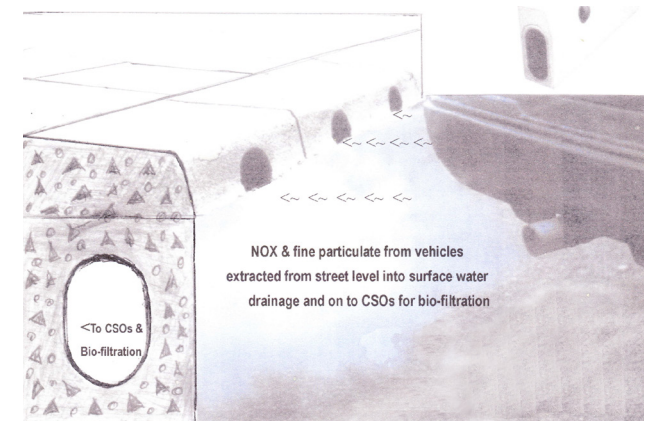


LONDON'S POLLUTION

London suffers from traffic related pollution due to its dense road network and high buildings. Central London tends to be one of the most polluted places in the UK. It is currently the main area failing to comply with the legally binding limits set by the EU.

Pollution can build up in London when it becomes trapped between buildings, or in the local area more generally, especially during the still weather.

In this age of climate change and increased awareness of environmental issues we must act to repair the damage we have done.



NOx & fine particulate is extracted from vehicles at street level into surface water drainage and on to CSOs for bio-filtration.

THE THAMES' WATER PROBLEM

The Thames Tideway flow has suffered for many years from lack of summer flow due to drinking water abstraction upstream and from untreated sewage flows from combined sewer overflows into the Tideway through London during summer storms.

Thames Water were fined £20.3m this year by the Environmental Agency after huge prolonged leaks of untreated sewage led to serious impacts on residents, farmers, and wildlife, killing birds and fish.



CONCEPT © GEOFF JENSEN - ILLUSTRATION © ELAINE VIGAR Please email elaine.vigar@gmail.com for image use

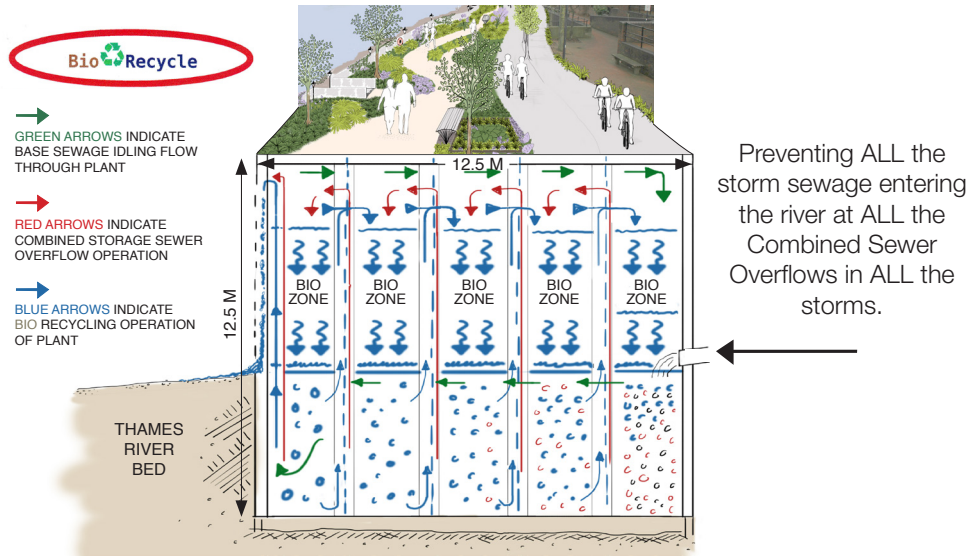
THE PROPOSED SOLUTION

By constructing a linear series of Biomass recycling treatment plants to continuously treat sewage overflows and improve the quality and flow of the river, at the same time providing a dedicated pollution free cycle and pedestrian route along the Thames embankments for commuting and leisure.

With safe walking along garden paths and riverside views this is an environmental proposal, a visionary solution to tackle London's sewage overload and pollution whilst creating an environmental legacy for the city, a new, dedicated green route.

#londongreenroute

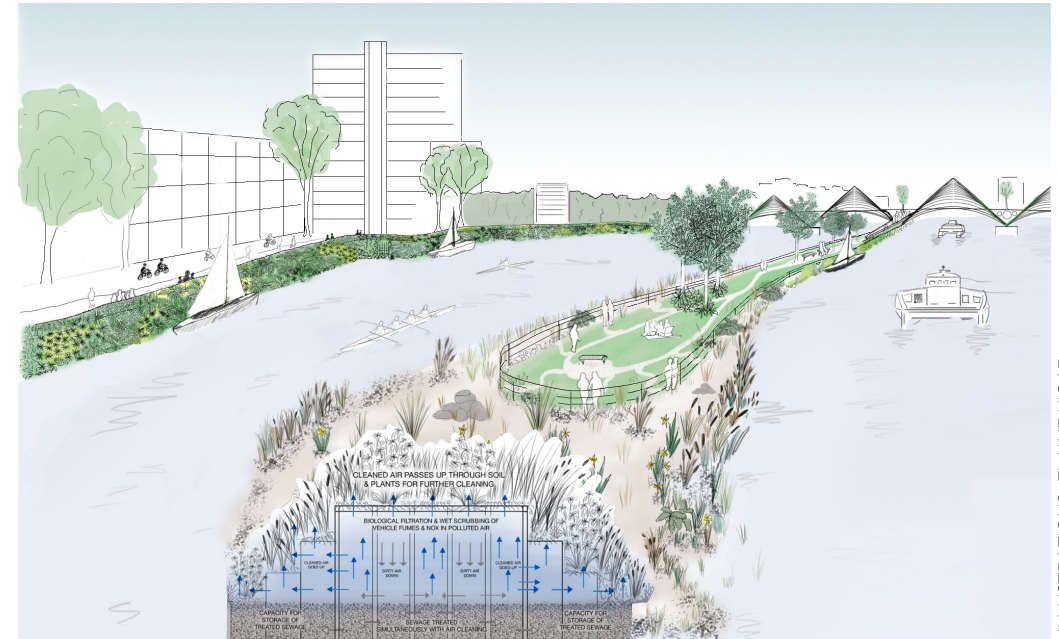
LONDON'S TWO MAJOR WATER AND AIR POLLUTION PROBLEMS SOLVED WITH ONE ECONOMICAL ENVIRONMENTAL SOLUTION



THE PROPOSED SOLUTION FOR THE THAMES

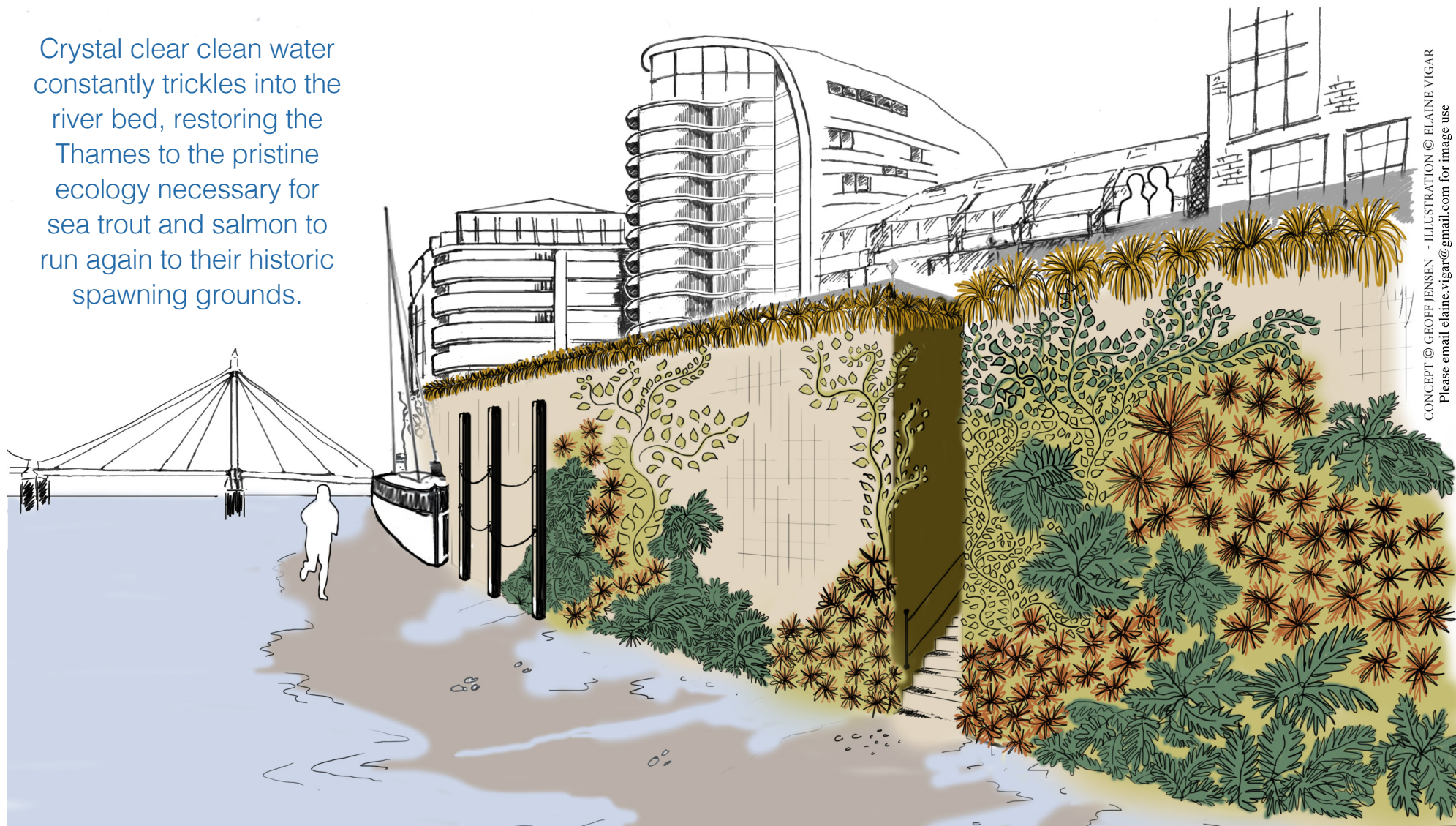
By constructing a linear series of BioRecycle biomass recycling bio-filtration sewage treatment plants, to continuously treat a base of load sewage producing a high quality low or zero ammonia effluent, improving the quality and flow whilst protecting the Tideway from storm overflows. At the same time providing a dedicated cycleway along the Thames' embankments.

The solution of providing high quality treatment by the BioreCycleway, gives the opportunity to provide a dedicated pedestrian and cycle route along Londoner's Thames as a worthy 21st century successor to Bazalgette's 1860 sewers along the Tideway Embankment.



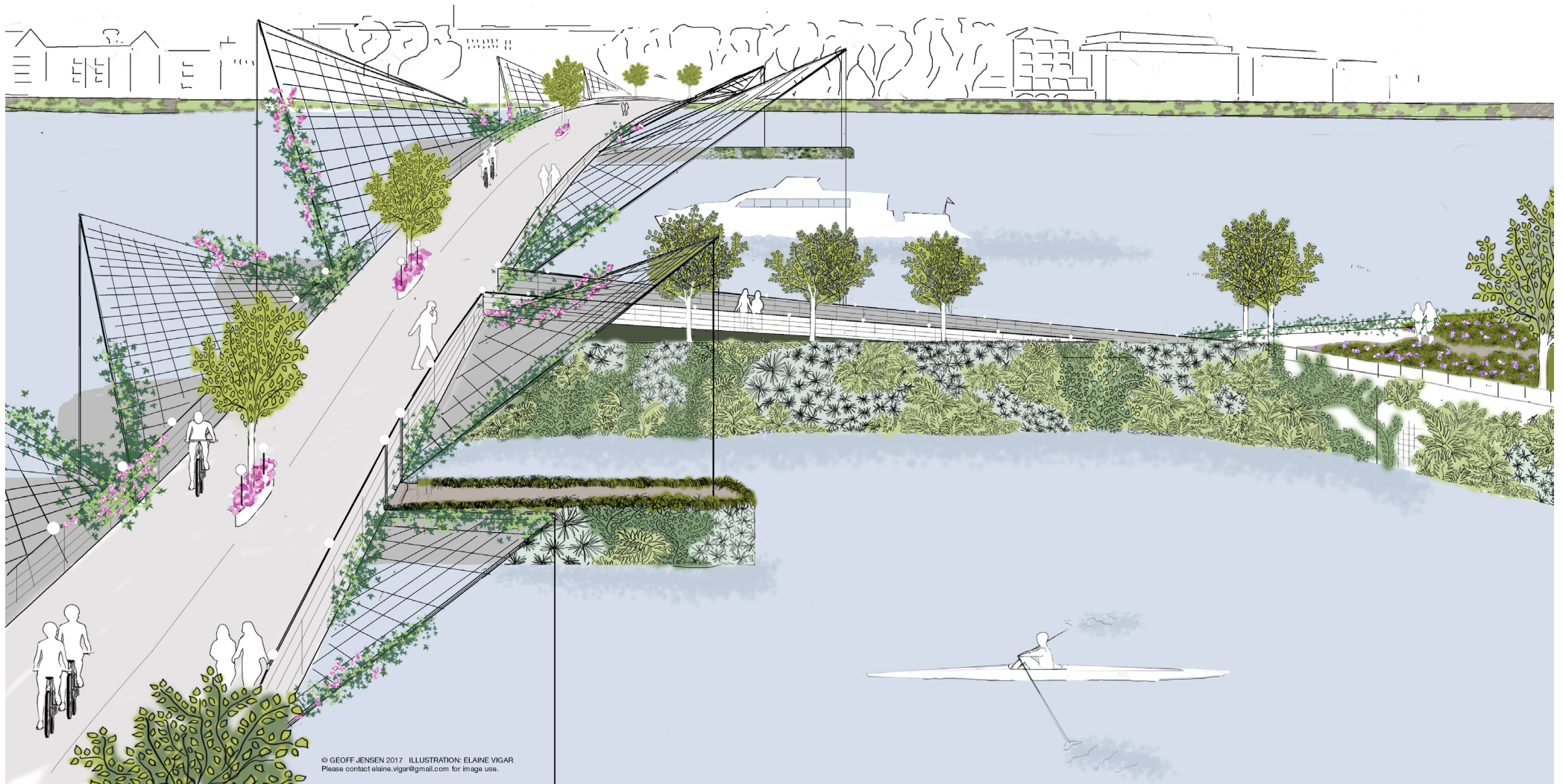
Bio-filtration is also an attractive technique for the elimination of low levels of fine particles and nitrogen oxides and other air pollutants arising from petrol or diesel powered vehicles and heating fuel emissions.

Crystal clear clean water constantly trickles into the river bed, restoring the Thames to the pristine ecology necessary for sea trout and salmon to run again to their historic spawning grounds.



BRINGING NATURE'S ECOLOGY TO CENTRAL LONDON TO PRODUCE CRYSTAL CLEAR PURE WATER FOR GAME FISH

LondonGreenRoute's BioRecycle biomass recirculation plants will continuously produce high quality near zero ammonia effluent from central London's sewage pumping stations. Pumping the treated effluent through a gravel root zone under the gardens and down the outer walls giving a constant flow of crystal clear water to restore the Thames to the pristine ecology necessary for sea trout and salmon to run again to their historic spawning grounds and produce higher organisms and worms to feed birds and fish.



THE THAMES BIORECYCLE BRIDGE & GARDEN ISLAND

Giving Londoners safe dedicated elegant bridges across the Thames for cyclists and pedestrians.

The London green route provides a safe motor vehicle free dedicated pedestrian and cycle route through gardens along the Thames Embankment and over strategically placed elegant light weight bridges crossing the Thames with pedestrian only access to the Garden Islands to create a unique visitors viewing area and a natural wildlife friendly environment encouraging native birds and fish.

#londongreenroute



CLEANING CENTRAL LONDON'S AIR UNDER A GARDEN ISLAND AND NATURE RESERVE IN THE THAMES TIDEWAY.

The Garden Island and Bridge economically provide a solution to traffic related air pollution by transferring air gathered from low level intake points in street kerbs via the drains to CSOs to the BioreCycleway and via ducts within the pedestrian and cycle bridge deck to the Garden island built over BioRecycle biomass recycling bio-filtration sewage treatment plants where the air borne pollutants are adsorbed and treated along with the sewage pollutants.

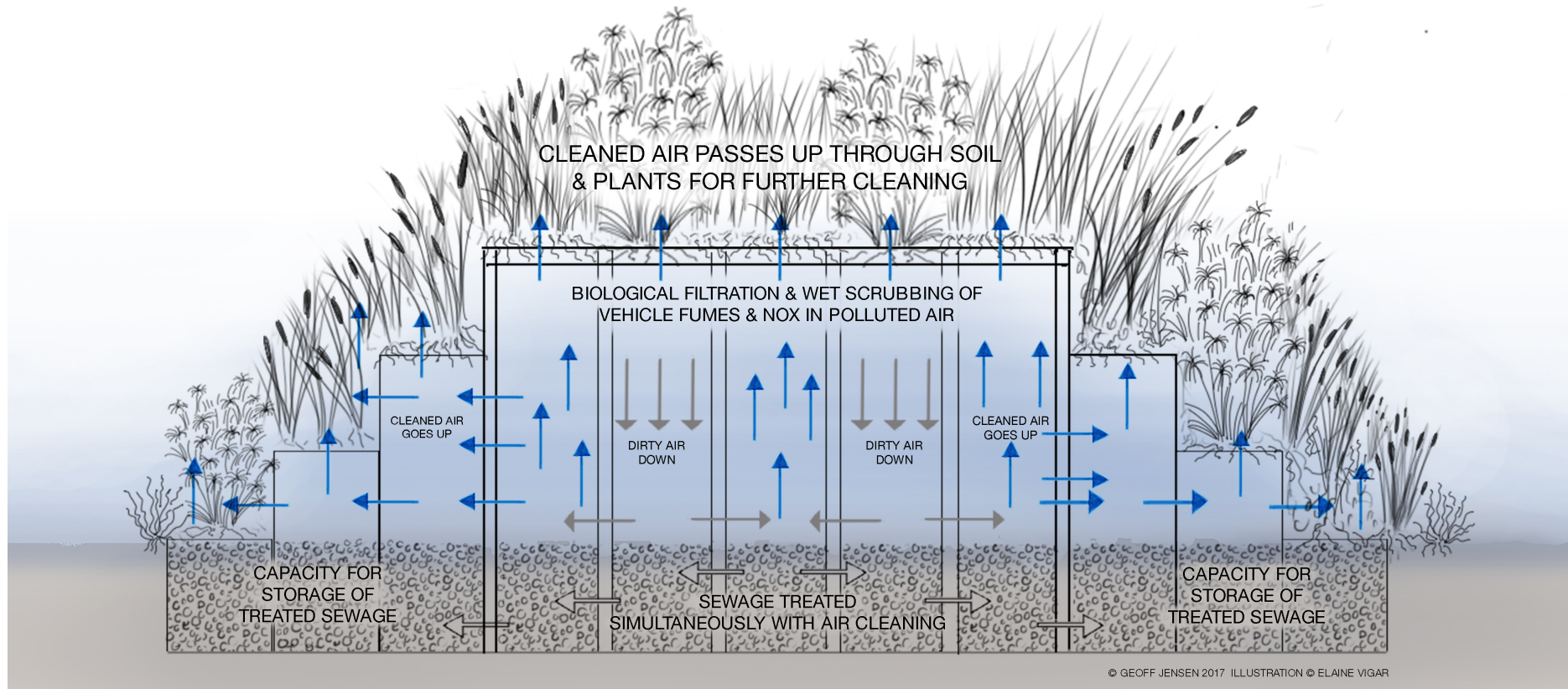
Thames Bio-Recycle Island © Geoff Jensen 2017 Illustration © Elaine Vigar

The Garden Island creates a unique visitors' viewing area and natural wildlife environment encouraging native birds and fish.

#londongreenroute

CROSS SECTION OF GARDEN ISLAND

- PROVIDING CSO TREATMENT AND AIR FILTRATION TO REMOVE NOX AND FINE PARTICULATE FROM VEHICLE FUMES



PURIFYING LONDON'S AIR AND WATER BY BIORECYCLE BIO-FILTRATION

The well tried BioRecycle biomass recycling sewage treatment process where sewage and biomass is continuously recycled over a bio filter, consisting of high surface area media in an enclosed tank with a soil cover has been in wide use in the UK, Ireland and other parts of Europe in packaged plants reducing greenhouse gas emissions from sewage since 1983. Bio-filtration is also an attractive technique for the elimination of low levels of fine particles and nitrogen oxides and other air pollutants arising from petrol or diesel powered vehicles and heating fuel emissions.



THE THAMES BIORECYCLE GREEN ROUTE, BRIDGE & GARDEN ISLAND

Providing Londoners with a cleaner and safer environment for cycling and walking.

The London green route BioreCycleway, Garden Island and Bridge provides by an innovative economical combination of tried and tested BioRecycle bio-filtration methods to simultaneously provide high quality sewage treatment at all storm overflows of sewage from 50 or so CSOs into the Thames through London along with reducing the levels of vehicle pollution in the air Londoners have to breath.

PROTECTING THE COUNTRY'S PREMIER FLY FISHING RIVER FOR 27 YEARS

The BioRecycle sewage treatment process has been ensuring the River Avon at Woodford near Salisbury retains its reputation as the country's premier chalk stream salmon fishery since 1990.



A biomass recycling sewage treatment plant according to Geoff Jensen's 1983 Patent has been purifying the sewage from the Bridge Inn and some neighbouring houses discharging into the River Avon where it passes through the Woodford Valley since 1990.

The plant remains as it was built 27 years ago and operates unattended except for two service visits a year.

Latest sampled results from the treated sewage effluent from the Bridge Inn show the plant produced an ammonia level at 0.09 parts per million which is 1% of the permitted level and shows both the long term reliability of the process and why it ensures this part of the Hampshire Avon continues to be considered to be one of the finest chalk stream trout (*Salmo trutta*) fisheries in the country according to the Wild Trout Trust.



The BioRecycle plant modules for the proposed London Green Route will be of similar plan dimensions but slightly deeper to accommodate extra storm overflow capacity as required and installed as a linear series.

Photographs of the Bridge Inn at Upper Woodford taken with the kind permission of Sue and Mike Emberley.



#LONDONgreenroute

BioreCycleway, Garden Island and Bridge

Cleaning traffic air pollution, cutting greenhouse gas emissions, restoring the purity and flow of the Thames with a cycling and walking route for Londoners through riverside gardens.

Combined Sewer storm Overflows (CSOs) into the Thames and traffic pollution on its streets are London's two major pollution problems. Both can be solved with BioRecycle biomass recycling bio-filtration preventing water pollution from CSOs into the Tideway and cleaning traffic pollution under a safe "green" walking and cycling route along and across the Thames through central London.

The history of the ongoing problems of air pollution in London's streets and the problems of sewage pollution in the Thames Tideway are both not new. As London was built up legislation attempting to control air pollution was enacted as early as 1306 whilst Richard II in 1388 and Henry VIII in 1531 both tried to prevent water pollution from cesspool discharges.

THE PROBLEM OF LOW SUMMER THAMES' WATER FLOW AND CSO DISCHARGES INTO THE TIDEWAY.

There are about twenty rivers, often fed by springs that feed into the Thames throughout London. They were used to drain rainwater and so became surface water sewers when covered over. It was expressly forbidden to discharge domestic waste into them until a law was passed in 1847 to enforce the discharge of cesspool wastes to surface water sewers that drained into the Thames with disastrous consequences.

It had lethal results for some 10,000 Londoners due to the transmission of cholera through the water drawn from Soho's Broad Street pump in 1854. It also resulted in the Thames becoming so polluted that it became a stinking septic open sewer were it passed the Houses of Parliament.

To overcome the problem Bazellgette designed the large collecting sewers, also building the Thames Embankments,

carrying the tributary rivers' flows plus increasing amounts of domestic sewage to Beckton and Crossness for discharge on the ebb tide from 1860. This also had disastrous consequences locally grossly polluting the Tideway.

Because of the diversion of the tributary rivers during the summer the reduced flow, now about half a kilometre per day in the main Tideway, the discharged sewage remained in the Thames estuary without sufficient dilution or uptake from oxygenating marine plants. This meant that ammonia and its compounds derived from urine killing all marine life. It should be noted that the main detriment to fish life from sewage pollution is ammonia. Derived from urine. Ammonia has a lethal dose to kill 50% of the fish (LD50) of 2.5ppm (parts per million).

The Romans were aware of detrimental effect of discharging micturate into the Tiber 20 centuries ago. They separated micturate or urine to provide ammonia for use

The solution to the problem should follow a similar concept to Bazellgette's 1860 design and at the same time improve public health and access to the Thames

in cleaning and for other uses. Thus ensuring the Tiber remained unpolluted by ammonia and was able to support fish life despite the Roman toilets discharging into the Tiber.

Most of the Thames Tideway's tributary streams and rivers' flows now goes down to Beckton and Crossness depriving the Thames of its natural flow of clean well oxygenated fresh water which encouraged the migration of game fish such salmon and sea trout up river to their ancient spawning grounds in the upper tributaries to the Thames. This no longer happens despite (unsuccessful) attempts by the Environment Agency and Thames Water to place salmon fry in the Kennet and the Lambourne.

In the middle ages salmon was so common in the tidal Thames it was a common source of cheap food for the working class poor. The removal of water from the aquifers by Thames Water and by other water abstraction in the upper reaches of the Thames has also resulted in much lower summer flow in the Thames which means any pollution remains in the Tideway for long periods.

The solution to the problem of untreated sewage from combined sewer storm overflows (CSOs) discharging to the Thames during summer storms should follow a similar concept to Bazellgette's 1860 design of a collecting sewer built each side of the river, at the same time improving the public access to the Thames. ▶

BIO-FILTRATION - AN ORGANIC SOLUTION.

Bazelgette's 1860 solution was before sewage treatment by bio-filtration been invented. To prevent sewer flooding during rainstorms Combined Sewers storm Overflows (CSOs) discharged untreated sewage directly to the Thames. The modern solution Bazelgette would probably have chosen would be connecting the CSOs directly into BioRecycle recirculating biomass bio-filtration sewage treatment plants under a new commuting and leisure cycleway and garden path running along the Thames Embankment.

The effluent being discharged locally, with low Ammonia and high Dissolved Oxygen effluent, will restore to the Tideway water from the upper Thames basin being drawn off for drinking water supplies. So it is capable of biologically treating surge flows during rainstorms, a continuous amount of sewage about 1/5 of Dry Weather Flow should be drawn off and treated to high quality to keep the biomass recirculation bio-filtration plants ticking over.

The biomass recycling treatment process utilises and removes nitrate from the effluent and by discharging through a root zone will reduce eutrophication of the Tideway. By increasing the summer flow in the Thames Tideway it will improve the ecology increasing the amount of ammonia free oxygenated water to the benefit of higher organisms. This will increase fish stocks and varieties, improving the Thames and its tributaries for recreational fishing and possibly bring back salmon and sea trout to traditional breeding grounds like the Kennet and the Wandle.

By reducing the load on the sewage plants at Mogden, Beckton and Crossness it will improve the quality of the effluent discharged there giving more chance for migratory fish to pass upriver through the Thames barrier to their spawning grounds.

SOLVING LONDON'S AIR POLLUTION FROM TRAFFIC.

Central London is currently failing to comply with the legally binding limits set by the EU. This is due to a dense road network where pollution can build up when it becomes trapped between buildings, especially during still weather. The sheer number of motor vehicles on the streets of London

is producing considerable amounts of Nitrogen dioxide and small particles. There is mounting evidence of health effects from everyday exposure to air pollution, small particles <10microns and especially <2.5microns along with nitrogen dioxide is a major cause for concern.

Bio-filtration is a known technique for the elimination of low levels of fine particles and nitrogen oxides and other air pollutants

In London, pollution concentrations within a few metres of busy roads are normally 2 or 3 times those at background locations 50-100m away from busy roads. The most extreme conditions are found in narrow streets lined with tall buildings.

Diesel cars, trucks and buses emit particularly high concentrations of fine soot. Large numbers of very toxic substances coat these particles. Included with carbon emissions from engines are small bits of metal and rubber from engine wear and braking as well as dust from road surfaces. The majority of particles that can penetrate the airway are too small to see and thus can be present in air that seems clean. Particles smaller than about 10 microns can settle in the airways deep in the lungs and cause health problems.

Road transport is estimated to be responsible for about 50% of total emissions of nitrogen oxides. Nitrogen dioxide (NO₂), one of the group of nitrogen oxide gasses, levels are highest close to busy roads. There is good evidence that nitrogen dioxide is harmful to health. The most common outcomes are respiratory symptoms with Nitrogen dioxide inflaming the lining of the lung and reducing immunity to lung infections such as bronchitis. The result of diesel cars creating more nitrogen dioxide than was anticipated means the average level within London has not fallen as quickly as predicted.

Both the river pollution from sewage overflows and air pollution from traffic can be cleaned using the BioRecycle biomass recycling bio-filtration process under

the Londongreenroute BioreCycleway or transferred by pedestrian and cyclist only Bridges to Garden Islands.

The purification of body waste is a natural process that occurs in aerated free draining soil by the action of microbes and worms turning it into plant nutrients and food for birds, small mammals and amphibians. Top soil has about 20% to 40% air space. A cubic metre of air contains 280gm of Oxygen. A cubic metre of water dissolves 10gm of Oxygen maximum at 10Celsius

The Bio-filtration sewage treatment process invented in 1893 is where settled sewage is trickled onto an open bed of stone, or more often now high surface area plastic filter

A Bio-filter functions, whether for water or air borne pollutants, by bring micro-organisms into contact with pollutants.

media 1.5m to 2m deep. The contact time is only 20 to 30 seconds yet the quality of the settled will meet the 30mg/l Suspended solids - 20mg/l Biochemical Oxygen Demand - 10mg/l Ammonia as N, warmth in the bio-filter encourages nitrification.

Bio-filtration is a known technique for the elimination of low levels of fine particles and nitrogen oxides and other air pollutants arising from petrol or diesel powered vehicles.

A Bio-filter functions, whether for water or air borne pollutants, by bring micro-organisms into contact with pollutants. Pollutants contained in an air stream are picked up or dissolve, along with the pollutants arising from sewage, in water.

A Bio-filter is a means of providing the breeding ground for micro-organisms that live in a thin layer of moisture, the "biofilm", which surrounds the surfaces that make up the filter media. Polluted air or water is slowly pumped over the bio filter and the contaminants are adsorbed into the biofilm where they are oxidised.

The basic principles bio-filtration for removing the two main pollutants from sewage treatment and air are similar. ►

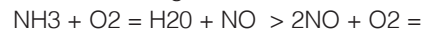
The BioRecycle biomass recycling process was invented as a hybrid processes where the settled biomass, which has adsorbed the pollutants from screened sewage, is airlift recirculated over a biological filter which oxidises the pollutants, removing up to 99% of the ammonia and reduces the volume of biomass sludge produced.

Both the main air and water pollutants are carbon and nitrogen based.

Organic Carbon oxidised to Carbon Dioxide



Nitrogen in Ammonia is oxidised through cell matter to Oxides of Nitrogen to Nitrates



The biomass recycling sewage treatment process (BioRecycle) invented in 1983, uses a high surface area media in an enclosed tank with a soil cover and has been

in wide use in the UK, Ireland and other parts of Europe in packaged plants reducing greenhouse gas emissions from sewage for 30 years. The BioRecycle biomass recycling process was invented as a hybrid processes where the settled biomass, which has adsorbed the pollutants from screened sewage, is airlift recirculated over a biological filter which oxidises the pollutants, removing up to 99% of the ammonia and reduces the volume of biomass sludge produced. The process balances the daily variation in flow by storing fully treated effluent which dilutes the inflow as it is treated displacing the effluent through the outlet.

The BioRecycleway and Garden Island provide the ideal provision with minimal additional capital and running costs for air bio-filtration to reduce vehicle pollution at street level in London's air. The additional costs would be for installing a simple addition or replacement to the kerbs invented in the 1980s by Civil Engineer Neil Beanland and the fans or air movers to draw the air through the drains and sewers via the CSOs to the BioRecycle process.

The #Londongreenroute BioreCycleway and Garden Islands along and across the Thames can remove both air and water pollution by Biomass recirculated bio-filtration.

Because of the method of construction using prefabricated modular components the method can be applied to almost any of Britain's 31,000 CSOs improving beaches, estuaries and rivers around Great Britain.

The purification of vehicle fumes and storm overflows of sewage through BioRecycle treatment plants and the Garden

Islands soil/media provides a timely and economical solution to two of London's major pollution problems that have to be urgently addressed improving both water and air quality through central London along the Thames.

By continuously treating a base load of sewage and treating all rain storm overflows charging Thames Water, or their customers if de-regulation of water and sewerage

The #Londongreenroute BioreCycleway and Garden Islands along and across the Thames can remove both air and water pollution by Biomass recirculated bio-filtration.

charges occurs, at circa 50pence a cubic metre would get a return on the investment in the BioRecycle CSO treatment plants under the #Londongreenroute and Garden Island and Bridge in less than 7 years. For example treating the sewage flow from 4million Londoners along with 40million cubic metres of storm sewage from CSOs will gross £166million per year which should recover an estimated building cost of under £1billion in that time and thereafter give an income that the GLA could use to maintain the BioreCycleway, Garden Islands and Bridges and leave a surplus for environmental investment beneficial to London's whole population. ■

At an estimated building cost of under £1billion the #Londongreenroute BioreCycleway and Garden Islands would get a return on the investment in less than 7 years and thereafter generate an income for maintenance AND leave a surplus for environmental investment.





GEOFF JENSEN

Inventor and Environmental Engineer

A graduate Civil Engineer with long experience of working in drainage and sewage treatment and has been granted from 1983 UK, European, US and many international patents for 3 different variations of his sewage sewage treatment process.

Inventor of the odour free below ground sewage treatment by the Biomass recycling process, cutting greenhouse gasses for 30 years. Now manufactured by The Klargestor Biotec. Certified to British and European Standard BS EN-12566.

The Biotec is described by Klargestor as one of the products that pioneered packaged sewage treatment plant technology and remains the UK and Ireland's most popular packaged treatment plant.



Geoff improved the fixed film sewage treatment process to reduce ammonia and sludge production to such an extent fish could live in the final settlement tank.

Geoff has also been granted patents for glass fibre reinforced composites and produced engineering design in GRP composite to obtain European Norm12566 for manufacturer of packaged sewage treatment plant. He has sat on BS and ISO committees on reinforced plastic pipes.



In his early career Geoff worked on the River Thames from Maidenhead to Staines on bank erosion protection and on the tidal Thames from Teddington to Chelsea on bank raising, prior to the building of the Thames Barrier.

He has been working on sewage treatment for sea outfalls and combined storm overflows since 1987 supplying information to the Commons Environment Committee chaired by Sir Hugh Rossi in 1989.

REPRODUCTION & PUBLICATION

The Intellectual property in the Biomass Recycling Sewage Treatment process as covered in European Patent Application Published 26.09.84 in Bulletin 84/39 and UK Patent GB 2 136 791 granted solely to Geoffrey Harold Jensen 24th September 1987 remains, under EU law, the legal property of Geoff Jensen t/a BioRecycle.

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