Wastewater Biosolids: The Broken Disposal Program.

There are nearly 8 billion people living on the planet Earth. Sixty years ago, there were less than 3.5 billion people. To put it all into perspective, there were about a half a billion people 2,000 years ago. It took 2,000 years to go from a half a billion people to 3.5 billion people but it only took sixty years to go from 3.5 billion people to 8 billion people. By the year 2050, the projected global population will exceed 10 billion people. Pretty scary, right? We all live near and around water. We all flush our toilets several times a day. Connect the dots, and you can see we are in deep shit trouble if we try to continue with the broken disposal program we have today.

In the United States we have over 330 million people and the wastewater from our toilets runs through about 17,000 wastewater treatment plants. Just a few decades ago, the wastewater solids were raw, unprocessed waste that the EPA classified as Class C, commonly known as sewage sludge.

In the 1970's, President Nixon passed legislation that required wastewater solids to be processed and this new EPA classification was Class-B biosolids. Class-B made it possible to reduce the volume by de-watering the solids and to make disposal much easier and more economical. This is where we find ourselves today. Class-B biosolids are landfilled, incinerated and repeatedly land applied on crop land in very high volumes. This is not only a huge water quality issue, but the farm land used as dumping grounds is causing serious health issues. Thousands of acres of farm land is being condemned, and it's just the beginning.

Out of the 17,000 wastewater treatment plants, about 30 plants take the Class-B processing a step further to create Class-A, exceptional quality biosolids (EQ). Class-A biosolids are much less offensive regarding odor, and easier to mix and apply. Out of the 30 or so biosolid plants that produce (EQ) biosolids, about half take it a step further in the processing to create (EQ) biosolids that exceed the EPA 503 REGS for (EQ). These sources are granulated or pelleted into low-cost, easy to handle and easy to apply fertilizer materials that have a great deal of value. They have an optimal particle size for

blending with other fertilizer raw materials, they have less dust and a lower moisture content which makes the material low odor as compared to biosolids that merely just meet the EPA guidelines for (EQ).

Milwaukee Wisconsin was the first biosolid source to process their biosolids into Class-A exceptional quality biosolids. They have been around for over 70 years with their brand, Milorganite.

The demand for these sources that are of the highest quality have skyrocketed in the last 10 years. With very few (EQ) plants coming online anytime soon, the supply is limited. The cost of the processing and the infrastructure to produce (EQ) is very expensive as is the cost to run and maintain these expensive operations. Several (EQ) plant that take the quality to this higher level, have discontinued taking that additional step. When the expensive equipment ages and needs to be replaced, the municipalities do not have the capitol to replace the old equipment. These plants are funded for the most part from tax dollars. Budgets are stretched thin and the profits from the sale of the material are minimal. It is unfortunate that the market has such a low tipping point on cost. This is due in large part, from the public perception that biosolids are harmful and then there is what I call The ICK Factor. The ICK Factor is exactly what it sounds like. People are repulsed by the thought of spreading human waste all over our landscapes and farm fields. There are many environmental watchdog groups, and industry competitors that process animal manures and meals based organic fertilizers that come from animal rendering and other bi-products from corn, coffee, rice, and soy production that spend millions on negative add campaigns, attacking biosolids.

The number one health and environmental complaint about biosolids has been going on for decades. There are heavy metals in all biosolids which presents a real problem when levels reach beyond the acceptable threshold adopted by the EPA. Heavy metals which are inorganic chemical compounds can cause contamination when improperly handled or disposed of. Lead, Nickel, Arsenic, Zinc, Mercury, Copper, Cadmium and Chromium are naturally occurring, heavy metals that are mined and used in the production of a vast array of materials.

Much of the water quality problem is due in large part to industrial waste that is allowed to enter the system. Occasionally, high levels of heavy metals overload the systems because industrial operations that are connected to the wastewater treatment systems either have a breakdown in their own safety protocols through human error or mechanical breakdown, or the contamination can occur on purpose. Regardless, these industrial operations owned by large companies are often hit with penalties and fines.

When this happens, the processed biosolids must be landfilled or incinerated which cost more taxpayer money. The contaminated biosolids should not be used for land applications until the system is cleaned out, which represents a loss in revenue.

The latest attack on biosolids comes from environmental watch groups and the mainstream media that target polyfluorinated alkyl substances (PFAS) commonly called forever chemicals. There is good reason for these attacks but no viable solutions are identified. There is only blame and criticism of our government, along with demands to implement more regulations and spend more tax dollars on ineffective, unproven strategies that are costly, and fail to work quickly enough to make up for the monumental hole we have dug for ourselves.

These multi-chemical groups that are commonly used in Class-B firefighting foam are found everywhere, and in everything. PFAS chemicals are extremely persistent. They do not breakdown but rather, they accumulate over time. PFAS chemicals are linked to a multitude of adverse health conditions and environmental damage that likely cannot be reversed.

The problem is, there's not enough research yet to determine just how far reaching or how much damage these forever chemicals have caused. There is still a lot of work to do before real solutions can gain enough traction to make a difference and hopefully reverse the effects of PFAS chemicals.

Meanwhile, the negative effects of biosolids containing Forever Chemicals are now materializing. Farmers in Texas, Michigan, Maine, and several other states are filing lawsuits in an effort to recoup staggering losses. After years of over applying biosolids containing PFAS to grow grains for livestock feed, dairy cows are dying in excessive numbers from PFAS that have reached deadly levels in their bodies. First, the milk from the cows becomes contaminated. The farmers must dispose of the tainted milk, or process the milk to make it safe to use. This is expensive, and the cost gets passed along to the consumer.

What happens next is a tragic nightmare. The government has declared the farmland with high levels of PFAS to be unsafe, and the land has been condemned. It will be decades or even longer before the land can be declared safe for crop production. Third and fourth generation farmers are losing everything they have worked for, and everything their ancestors worked for. A century of struggle, hardship, perseverance, and in some cases, bloodshed, are being ripped away from hardworking Americans that have been the backbone of the American economy from the country's inception. Farming is recognized as one of the top most stressful professions.

Depression cases among farmers are at an all-time high. Many depend on Government programs to make ends meet, including mental health support. The DACF has instituted government programs geared specifically toward PFAS recovery. But there are a lot of hoops to jump through. Even if a farmer meets all of the criteria to qualify for The DACF assistance, it doesn't mean they will receive final approval. The assistance programs are subject to change, and any financial assistance received by farmers may be considered reportable income to the IRS, and State Revenue entities.

By the time farmers apply for the DACF assistance and go through the approval process, the losses seem insurmountable. If they are lucky, the farmers will receive assistance, but will it be enough to cover all the costs associated with the losses? When you add it all up, the costs are beyond astronomical. If you review what is on the Maine Department of Agriculture Website for PFAS assistance, you will see the assistance program is segmented into 9

separate sections, ranging from the initial, general application to New Loan Assistance. They use the words financial support, and partialy compensate. A clear indication, the funding will be too little too late. Factor in the income taxes that farmers will pay for the assistance, and you can see how crushing PFAS has become.

Depression and mental health case numbers for farmers is at an all-time high. Some resort to suicide rather than face the reality they lost the farmland that defined their families for generations. Alcohol and drug use factor in and compound the problem by adding a whole other level of problems.

The recent freeze on federal funding has caused confusion in farming communities across the country. Farmers on the edge of bankruptcy are becoming desperate. By the time the dust settles, it could be too late for many farmers.

Micro Plastics in Biosolids Will be the Final Straw.

To make matters worse for biosolids, environmental organizations are spreading the news that biosolids are the largest carrier source of micro plastics in the world.

The truth of the matter is, micro plastics and PFASs are found in everything, including our food, water, air, soils, and of course our waste. Plastics can take up to 500 years to fully decompose but we really do not know for certain because plastics have only been around for a little over one century. The UV light from the sun and specific strains of microbes can expedite the time it takes for plastics to breakdown, but the time it takes for a plastic to breakdown also depends on the type and chemical makeup of the plastic. The longer the carbon chain, the more persistent the material, which means it will take longer to breakdown. UV light and movement will reduce the plastic to microscopic particles over a long period of time. This compounds the problem in that microplastics can work their way into living organisms. To put it all into perspective, most of the plastics produced since the early twentieth century are still present in our environment.

The attacks on the biosolid industry are not the answer. If the hysteria leads to new regulations that ban biosolids, we will end up with far greater problems. The wastewater biosolids industry is nothing more than a disposal program. The solids never stop coming. This disposal program is broken. We cannot continue to landfill and land apply biosolids in massive quantities on the same tracks of land, repeatedly.

So, what's next?

My prediction is going to sound ridiculous, but based on the history of our government and world leadership as a whole, their answer to this waste disposal problem will not go far enough to be a bonified, long-term solution. Whatever they come up with will ultimately fail because of the expansive divide. This "Great Divide" encompasses politics, economics, environmental organizations, race, and religion. Mostly, the Great Divide is fueled by greed and fear.

Billions of tax dollars will be flushed down the drain, in an effort to put a band aid on an arterial hemorrhage.

It will get interesting from here on. The world could take a turn for the surreal. Before we start dumping our waste in vast desserts or blasting them off into outer space, we should examine natural solutions that are science based, low cost, and easy to replicate.

The solution to pollution is dilution.

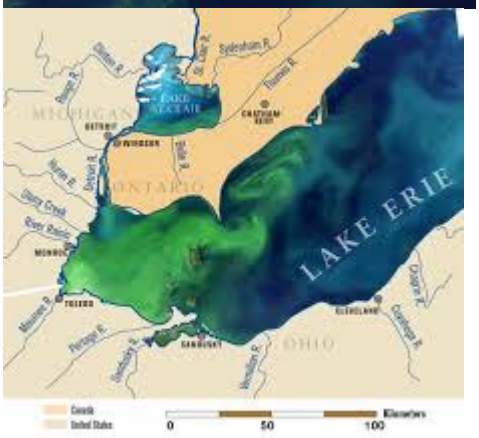
Wastewater biosolids should be processed to achieve a higher quality material that can be blended with other fertilizer materials and soil amendments so they can be applied safely on land expanses that are millions of acres. These diluted biosolid blends will deliver nutrient efficiency and can be shipped outside of the watershed areas that are located near and around the biosolid plants. The current disposal programs are dumping very high volumes of

non-diluted biosolids on large farms and in landfills that are usually located within a 50-mile radius of these wastewater treatment plants.

This broken disposal program is the main contributing factor in the massive buildup of PFAS, microplastics and other chemicals in the environment. The broken disposal programs can be fixed but the infrastructure is costly. In order to affect real change, we would need to restructure how we dispose of wastewater biosolids in conjunction with a global effort to phase out persistent chemicals. Even then, it would take centuries to completely reverse the negative effects on health and the environment.

The biggest threat from biosolids is to water. The number one source of water pollution comes from wastewater treatment plants. They dewater the solids, filter the effluent, and end up with what appears to be clean, clear water that when compared to natural spring water, it looks no different. The problem is, the effluent is full of nitrates and phosphates. The effluent is then pumped into our rivers, lakes, bays, and oceans at alarmingly high volumes. Millions of gallons of wastewater treatment effluent per day get dumped in the water. The nitrates and phosphates trigger massive algae blooms that block out sunlight required by aquatic plants, and deplete the water of oxygen, causing detrimental effects in fish, shellfish, and mollusks. The lack of oxygen causes massive fish kills and the decline of mollusks which filter pollutants and significantly reduces the natural filter system. The algae negatively impact the underwater flora and fauna that feeds the sea life that also acts as a natural filter of pollutants.

The technology to extract the nitrates and phosphates from the wastewater effluent has been around for decades. This technology is a crystallization process that incorporates magnesium to extract the nitrates and phosphates from the effluent. The extracting process of nitrates and phosphates are called struvite. It produces a nutrient rich fertilizer material that is highly plant available. The problem is the exorbitant cost of the infrastructure and the nutrient rich fertilizer material this produces. Most municipalities do not have the budget to undertake such a venture. Meanwhile, we continue to dump astronomical volumes of polluted wastewater effluent into our water.



These satellite photos show the algae blooms near wastewater treatment plants. Notice Lake Erie in the third picture? The main cause of this algae growth is the wastewater treatment plant located in Detroit Michigan. Detroit has one of the largest wastewater treatment plants in the world. This is a signature algae pattern indicative to wastewater effluent being pumped out in the water by the millions of gallons per day.

The reality is biosolids have been used in crop production since the beginning of agronomic society. It's done every day on a grand scale. Not only do we grow livestock feed grain with biosolids, but we grow fruits and vegetables that you buy at the local supermarket. Additionally, biosolids are used to grow crops used in material production such as cotton and hemp.

So, what's the big fuss about? Most wastewater treatment plants have tested low to moderate PFAS, and heavy metals levels. When it comes to non-food crops and turfgrass, it shouldn't be an issue.

You can find just about anything in biosolids. Anything that goes into the human body can potentially come out in the solids. Antibiotics, pharmaceuticals, heavy metals, and other chemicals used in the production of materials that we come in contact with every day are found in biosolids. The air we breathe, the water we drink, the foods we eat and the clothes on our back are teaming with chemical substances that make their way into our solids.

Let's talk about the positive aspects of biosolids. Biosolids stimulate and feed the biomass. The biomass or living soil is made up of trillions of organisms that work to break down and convert nutrients into a form that plants can take up and use.

Biosolids contain most of the 16 essential elements for plant health. They are high in nitrogen, most of which is slowly available. (Remember the highly valued, expensive slow-release nitrogen technologies I talked about?) Biosolids are 90% water insoluble nitrogen so they do not leach, runoff or volatilize which makes them super-efficient and environmentally friendly.

Biosolids are inexpensive. The cost per nutrient unit is very low compared to conventional fertilizers. Also, the nutrients are highly plant available and they are packed with plant available, non-staining iron which delivers an intense green color without forcing surge growth.

Biosolids contain naturally occurring simple organic compounds, humic and fulvic acids, amino acids and fresh proteins and carbohydrates that feed the biomass and enhance the plant's ability to create its own plant growth hormones. They build thicker cell walls for a more disease resistant and heat and drought tolerant plant which significantly reduces the need for chemical fungicides and irrigation. They stimulate beneficial micro-organisms that work to create oxygen and provide disease suppression. Biosolids have a low salt content which reduces burning and creates a friendly environment for the biomass. You can significantly reduce your nutrient inputs and the need for chemicals when you incorporate biosolids into you fertilization regimen.

The level of negative compounds in biosolids is miniscule in the whole scheme of things. You will get more exposure to detrimental substances from drinking tap water and eating the food you buy at the grocery store than you will from handling, applying, and using biosolids on your lawn and landscape.

Biosolids, when processed into Class-A, exceptional quality, are a safe, cost effective, super-efficient and a sustainable source of fertilizer for the entire planet.

Simple, low-cost, science-based solutions.

How can we solve the problems related to biosolids, while creating jobs, preventing higher taxes, and contributing to a positive effect on the American economy?

Before you solve the environmental problems through technology, you must first establish regulations and incentives that are synergistic to the technology and free market enterprise.

Broad reaching federal and state government regulations fall short of providing sustainable solutions. Laws and regulations are often not enforced, the inspectors and regulators are paid to look the other way, and penalties are not robust enough to deter the massive corporations that profit from illegal practices. The focus needs to be finite, with State government, regional and, local entities coming together to coordinate viable solutions that achieve the greatest results. Every region has specific issues with waste management that we need to drill down on by including the citizens of those specific regions that have keen insight into the problems, and ability to mobilize business leaders to play an important role in executing the agreed upon strategy.

Regulations can be effective, but it should begin at the source. Wastewater treatment plants are playing catchup with testing the processed material. Each plant has its own specific elements in the wastewater solids and effluent. The

regulation should mandate a much broader spectrum of testing. Many plants do not test for PFASs (forever chemicals) and micro-plastics. This needs to be instituted at the federal level with state oversite to determine the sequential processes required to meet the testing regulation thresholds, by region. This directly relates to free market enterprise in that the end-product can be sold at a profit because it is now safe to use. The profits will play a huge role in funding the infrastructure required. The technology already exists but the costs are astronomical. This is true for the wastewater solids and the effluent that is full of nitrates and phosphates.

How can the hefty price tag of this modern technology infrastructure be circumvented?

The answers are simple. Low cost, natural solutions have existed in Earth's environment since the very beginning of life. I am talking about the foundation of life itself. It was perfect over a billion years ago, and its perfect today. Without it, nothing that is a living organism could survive.

The solution is microorganisms and algae. All life depends upon them. Something so miniscule and seemingly insignificant has the power to create, and destroy life.

Forever Chemicals (PFAS)

The key component that makes PFASs so hard to breakdown are fluorine atoms. They form tight bonds with carbon making them extremely difficult to breakdown.

Microbes are always adapting to substances in the environment. Specific strains of bacteria and fungi are materializing that have the ability to breakdown polyfluoroalkyl substances, thus significantly reducing the levels of PFASs in liquid and solid waste. The process is slow, but scientists are researching solutions to speed up the process of microbial population growth enough to incorporate these processes into practical, low-cost solutions that have the ability to keep up with the never-ending waste we produce.

New companies are emerging to meet this new demand to eliminate PFAS from our wastewater solids. The solutions they offer are based on new gasification technology that heats the waste material to over 1,000 degrees F. These proven technologies can reduce the PFAS down to parts per trillion, which is such a miniscule amount, it cannot definitively me measured. Biosolid waste processed by this new technology falls well below the EPA threshold for PFAS content and are approved for use on food crops. The only stumbling block is the hefty price tag for the manufacturing infrastructure and processing which drives the cost of the end user product way up.

Microplastics

Microbes can also break down microplastics through a process called biodegradation. They have the ability to manufacture metabolites and enzymes that work to breakdown polymer chains into even smaller molecules, these smaller molecules of plastics become a food source for the microbes, which converts to carbon and energy. By isolating specific microbial strains, we can target microplastics in every environment. This includes the salt water of our oceans, our soils, and our waste.

This is monumental given the research focusing on the buildup of microplastics in our bodies. Scientists are finding microplastics stored in our body tissue that register at excessively high levels, causing everything from clogged arteries to a plethora of chronic diseases. Once the microplastics make it into our bodies, it remains, and continues to build with each exposure. I believe beneficial microbes will provide solutions to this problem somewhere in the not-too-distant future.

Wastewater Effluent

I previously talked about the technology that removes most of the nitrates and phosphates from wastewater effluent using a crystallization process. This technology has failed to catch on for several reason.

It has never been mandated. This all ties back to the astronomical cost of the infrastructure required for the process. Municipal budgets are tight, and politicians avoid raising taxes to preserve their standing and control over government at every level. Meanwhile, the broken system continues to contribute to inflation through soaring healthcare costs and expensive attempts to clean our waterways that fall short of what the goals should be. Every new strategy and government regulation implemented, adds more expense to every aspect of the supply chain, pushing inflation higher in the process. Government subsidies for agriculture and other critical industries, equate to higher taxes and government spending of borrowed money, pushing the national deficit to unprecedented levels that we as a country might never recover from.

The solution to the waste water effluent pollution problem is, sustainable, low-cost, simple to implement, a potential boon for the economy, and an added layer of protection against higher taxes, and deficit spending.

Much of the infrastructure already exists at the wastewater treatment plants. The process is driven by specific species of algae discovered over a decade ago, that efficiently extract and use nutrients contained in wastewater effluent to reproduce rapidly. Once harvested, the nutrient rich algae can be processed into biofuel or carbon-rich fertilizers that are more efficient, and lower cost than conventional fertilizers that have a significantly low impact on the environment.

The equipment required for the processing algae into fertilizer includes dewatering and granulation infrastructure that most wastewater treatment plants use every day to process wastewater solids. The rest of the infrastructure is simple, and low cost. All that would be required is the space to install inexpensive wastewater collection ponds, pumps to circulate the effluent, and equipment to harvest the algae and transport it to digesters and drying equipment located directly adjacent to the harvesting site.

This is proven technology that has yet to be implemented on a large-scale for multiple reasons. The evidence to support this claim is readily available to the masses. Below is one example of this.

ODU Algae Research Aims to Fuel Bioeconomy

August 02, 2018

Patrick Hatcher

Sandeep Kumar
By Sarah Huddle

Historically eschewed as slimy and gross, it turns out algae might be the solution to many of the most pressing environmental-sustainability issues.

The part of the economy that uses renewable biological resources such as algae to produce food, materials and energy is called the bioeconomy, a growing sector that has captured the interest of academia and major corporations and industry worldwide.

Cutting-edge research in the Batten College of Engineering and Technology at Old Dominion University is fueling the bioeconomy through the discovery of useful applications for algae as well as a proprietary process that can make these applications scalable for commercialization through partnerships with the private sector. The U.S. Department of Energy, Environmental Protection Agency and the National Science Foundation have funded research.

Patrick Hatcher, Batten Endowed chair of Physical Science Department of Chemistry and Biochemistry, and Sandeep Kumar, associate professor in the Department of Civil and Environmental Engineering and director of ODU's Energy Cluster, are at the forefront of this research which started at the University a decade ago. The goal then was to produce a biofuel from algae that could reduce oil dependence and minimize harmful emissions.

"We have been developing the technology to utilize algae as a good fuel source for a number of years and Old Dominion University holds several patents as a result," Hatcher said. "Our work also focuses on developing other parts of algae not used for fuel into high-value and economical chemicals."

A viable biofuel can be made from algae, Hatcher said, but interest in funding for further research has waned as political priorities have shifted and the cost of gas at the pump has dropped. As often occurs in research, the original work revealed exciting possibilities for additional algae applications.

According to Kumar, algae contain oil, which can be used for making biofuels. But they also contain proteins, which can be extracted from the oil and used as sustainable substitutes for petroleum-based fuels and chemicals.

"The problem we had to solve was how to extract the proteins from the algae in a scalable and inexpensive process to make it a viable resource for industrial use," Kumar said.

The National Science Foundation (NSF) awarded a research grant to Kumar in 2013 to develop a process utilizing flash hydrolysis to recover proteins, carbohydrates and lipids from algae oil. Then hydrothermal mineralization is used to recover inorganic nutrients for recycling.

The NSF awarded Kumar a second grant in 2016 to develop a pilot-scale mobile flash hydrolyzer unit to rapidly and economically harvest products made from micro-algae. Micro-algae have been on the forefront as an alternative feedstock to produce liquid transportation fuels, bioproducts and for wastewater treatment for nutrients recovery. The technology provides an economical way to harvest these products for commercialization.

Potential uses for the flash hydrolyzer include onsite algae processing at commercial algae cultivation facilities, recovery of bioproducts and nutrients at algae bloom sites, processing algae from the tertiary treatment of wastewater effluents and integration into a municipal solid-waste processing facility.

"Among the strengths we have at ODU is our ability to collaborate with businesses to bring technology to the marketplace that helps them succeed," Kumar said.

Conclusion

The scope of this proposed plan for wastewater solids and effluent encompasses a three-pronged approach.

1. Regulations

Implementation of broader testing programs at wastewater treatment plants to include identifying levels of PFAS and microplastics.

Regulations for producers, wholesalers, and applicators of fertilizers that align with regional goals for water preservation and restoration. A prime example would be The Chesapeake Bay Preservation Act.

Rewrite current fertilizer regulations to allow exemptions for nutrients from recycled waste.

2. Subsidies

Local, state, and federal subsidies for wastewater processing that help fund the required infrastructure for wastewater solids and effluent processing that will ensure safe, sustainable, and low environmental impact fertilizers. Set limits on these subsidies to ensure completion and implementation is done in a timely matter while circumventing wasteful spending and cronyism.

3. Incentives

Provide incentives to producers, wholesalers, and applicators of fertilizer to stimulate market growth of recycled waste to fertilizer products. This could be in the form of tax incentives in conjunction with rebates and rewards programs that are tied-in with sales volume increases.

This three-pronged approach should be backed by science-based, research proven strategies that provide the lowest cost solutions with the greatest impact on improving and preserving water quality.

It is disconcerting to learn about the exorbitant fines being imposed on municipalities for violations stemming from wastewater treatment plants that fail

to maintain equipment and provide oversite and proper training for employees. Baltimore City Maryland provides just one example of the urgent need to enact and implement new technology and strategies. The money spent on fines, restoration, and compliance after the fact, could help fund the infrastructure identified in this outline while bringing plants into compliance and stimulating new income streams for the municipalities and the regional economy.

What's most disturbing about all of this is the time that transpires to catch these violations. Budgets are stretched so thin that we have come to rely on environmental watchdog organizations to step in and force action. By the time the violations are discovered and order is restored, a heavy price has been paid and the hole we are digging for our environment grows ever deeper,

Baltimore city has agreed to pay a penalty of up to $4.75 million to settle lawsuits filed by Maryland and an environmental watchdog group over multiple pollution and other violations at its two municipal wastewater treatment plants.

Timothy B. Wheeler November 6th. 2023

The penalty, one of the largest assessed in Maryland for water pollution violations, is part of a deal that city officials negotiated with the Maryland Department of the Environment and the nonprofit. It is to be filed in Baltimore Circuit Court once it is approved by the city's Board of Estimates, which plans to take it up Nov. 15.

The deal announced Nov. 2 marks a critical milestone in resolving more than two years' worth of violations at the city's Back River and Patapsco treatment plants. Blue Water Baltimore and MDE are seeking to force corrective actions, and state regulators at one point took the unprecedented step of seizing control over the Back River facility.

“This settlement puts us on the right path to repair and upgrade our state’s two largest wastewater treatment plants, which means healthier waterways, a healthier Chesapeake Bay, and a healthier Maryland,” MDE Secretary Serena McIlwain said in announcing the agreement.

In addition to paying the penalty, Baltimore’s Department of Public Works would be required to fix and replace broken and malfunctioning equipment, clean and maintain clogged treatment systems and rehabilitate or upgrade some others. It must also submit a plan for recruiting, training, and retaining sufficient staff to run the plants properly.

Baltimore's Patapsco Wastewater Treatment Plant discharges about 55 million gallons or effluent a day into the Patapsco River just upriver of the Key Bridge. (Jane Thomas, Integration and Application Network, UMCES)

“I think we’re headed in the right direction” concurred Alice Volpitta, Blue Water’s Baltimore Harbor Waterkeeper. Her group reported detecting elevated bacteria levels in the discharge from the Patapsco treatment plant in early 2021, and state inspectors subsequently documented a litany of problems at both plants.

Th settlement calls for 40% of the total penalty, or $1.9 million, to be spent on environmental restoration projects over the next two years in the Back River and Patapsco River watersheds. The Chesapeake Bay Trust will be responsible for awarding grants and overseeing those projects. Another $1.4 million is to be paid to MDE, while the remaining $1.4 million will only be due if the city fails to make required improvements on time.

If the total penalty is assessed, it will surpass the $4 million MDE collected in 2008 from Exxon Mobil for an underground gasoline leak that contaminated residential wells in Baltimore County.

Volpitta called the wastewater consent decree “a huge victory for clean water and Baltimore residents.” Not only does it assure that some of the penalty will go back into improving conditions in the affected communities, she

noted but it also requires transparency and independent oversight of the required rehabilitation at both plants.

The city must file quarterly reports with MDE and Blue Water Baltimore and hold public meetings at least once a year to report on its progress. It also must hire a private engineering firm to oversee and report on its work. Moreover, the city must install signs and warning lights at the outfalls for both plants to alert river users if inadequately treated sewage is being discharged into the Patapsco or Back rivers.

The city Department of Public Works released a statement acknowledging compliance issues at both plants, attributing them to staffing shortages and "supply chain disruptions" that began during the COVID 19 pandemic when commerce and workplaces everywhere were affected.

Some problems predated the pandemic, though, and they continued even as it waned. After receiving complaints from residents along Back River about a fish kill and discharges of inadequately treated sewage from the plant, MDE's then secretary, Ben Grumbles, directed the Maryland Environmental Service, a not-for-profit business unit of the state, to investigate and assess what it would take to get the plant back in compliance. The MES subsequently issued a damning report on conditions there and faulted the city's management, including top DPW officials.

The city, after initially challenging the state intervention, ultimately negotiated an agreement with MDE to allow continued MES staffing at Back River. That ended recently, according to Volpitta.

The city's statement says both plants have made "significant improvements" since last year, with the Back River facility in full compliance of its effluent limits since June 2022 and Patapsco since September 2022.

“As we work to tackle the longer-term action items,” DPW interim director Richard Luna said in the statement, “we will continue to coordinate with our regulators and advocates to ensure a more secure future for these plants.”

MDE’s statement says inspectors are seeing improvements both in operations and in control of nutrient pollution. Over the last year and a half, the agency noted, nitrogen levels in Patapsco’s discharge decreased by 85 percent, while at Back River they decreased by 70 percent. The Back River plant did discharge excessive amounts of phosphorus in April 2023, according to a June inspection report, but MDE spokesman Jay Apperson said the exceedance was not large enough to be classified as significant. The nutrients nitrogen and phosphorus feed algae blooms and contribute to the Bay’s oxygen-starved “dead zone.”

Volpitta, the Baltimore Harbor Waterkeeper, said the plants may have finally reduced their nutrient discharges to required levels, but are still not in overall compliance with their state-issued discharge permits. The 158-page consent decree details how much more work is needed to restore plant reliability. In it, MDE lists continuing sampling and reporting violations, plus a series of unauthorized discharges to storm drains.

The continuing staffing and equipment issues at both plants, Volpitta said, mean the facilities lack the resilience needed to assure proper treatment of wastewater if anything goes wrong.

“It’s not enough just to be meeting effluent limits,” she said. “You have to be sustainable to prevent this from happening again.”

Desiree Greaver, project manager for the Back River Restoration Committee, a citizens’ group, said residents who live along and use the river welcome the agreement after meeting with the city and the state over elevated bacteria levels in the river and conditions at the plant.

“We think a lot of good will come from this,” she said, noting in particular the requirement for an independent engineering firm to track the promised repairs and upgrades. “It’s nice that there’ll be some additional third-party oversight over the city, which has been much needed for a long time.”

Allison Colden, Maryland director of the Chesapeake Bay Foundation, said the settlement “is an encouraging step forward but is the first step of many needed to rectify the harm these plants have done to the Bay.

“Much of Maryland’s progress in Bay cleanup has been achieved by reducing pollution from wastewater,” she added, “and we cannot backslide on that progress.”

In 2008, fertilizer prices skyrocketed. Nitrogen sources increased from $200/ton to nearly $1,000/ton. Phosphorus and potassium were even higher at $1,100/ton. There were several factors that lead to the price increases, many of which are aligning now as we sit in the middle of winter 2025.

□. Higher global demand for fertilizer.

□. Current fertilizer inventories are too low to meet global demand. 2024 saw some stabilization, but supply issues have countered this. China has help back on exports to hold domestic prices steady which affected inventories around the globe.

□. Natural gas prices are climbing, and are forecasted to continue climbing due to increased demand, and a tightening of supply due mainly to tensions on the supply chain for exporting countries.

□. While the fertilizer industry struggles to scale up production in 2008 and 2009, it stabilized, but not before a second wave of skyrocketing fertilizer costs in 2012.

> What's coming has the potential to be a much larger disruption on the supply chain than the 2,000s.

Trump Administration Tariffs on China, Canada and Mexico imports in conjunction with higher demand and supply chain issues could prove to be an overwhelming obstacle for domestic fertilizer produces if they are to meet to demand coming in the spring when crops are planted.

The other significant factor in the 2008 fertilizer price hikes was a weak U.S. dollar. Currently, the dollar is stable, but January 2025 saw inflation rise by 3%. This was higher than forecasted and could indicate weakening of U.S. currency.

With so many key factors materializing, my prediction is another fertilizer market burst like we saw in 2022 and 2023 from the pandemic. If this comes true, agriculture, the professional landscape industry and golf course managers will have to make adjustments equating to higher consumer costs, and increased demand for wastewater biosolids.

Biosolids have a low cost per unit of nutrient, and has never been significantly affected by the fertilizer markets. Most conventional fertilizer blends contain as much as 50% inert filler. This is practiced for a few good reasons, but the cost of these inert fillers is not much lower than the cost of biosolids.

Hope for the best, but prepare for the worst? I say, be cautiously optimistic, but be prepared so you are not forced into reaction mode. Nothing good ever comes from reacting to a problem. It's usually too little, too late.