

A photograph of two men wearing white hard hats and business suits, looking at a set of plans or a tablet on a construction site. In the background, there are large rectangular basins filled with blue water, likely part of a water treatment plant. The scene is set outdoors under a clear sky.

# LAGOON

technologies for cleaner water

FEATURING



A photograph of two men in hard hats reviewing blueprints on a construction site. The man on the left wears a yellow hard hat and a light grey jacket over a white shirt. The man on the right wears a white hard hat and a dark suit with a light blue tie. They are standing on a dirt embankment overlooking a large body of water, possibly a reservoir or dam. The background shows a green landscape under a blue sky with scattered clouds. The text "MEET THE" is overlaid in large white letters across the middle of the image.

**MEET THE**

optAER and SAGR installation  
north of Saskatoon, Saskatchewan

# NEXOM

# WAVE

## OF PROVEN LAGOON TECHNOLOGIES

**Nexom has been redefining the state-of-the-art lagoon since 1997** through the design and supply of hundreds of treatment systems. Having tested our technologies to the extreme at our own full-scale facilities, we ensure the facility you upgrade exceeds expectations, not nutrient limits.

The Nexom logo features the word "Nexom" in a white, sans-serif font. The letter "N" is stylized with a green swoosh that curves under it and extends to the right. A registered trademark symbol (®) is located at the top right of the word.



The technologies that change the world are simple.  
Fire creates warmth. Wheels enable transportation.  
The internet puts information in the palm of your hand.  
Simplicity is a sign of strength, not weakness.  
**So instead of replacing a simple technology  
like a lagoon, use it better.**

# MAXIMIZE YOUR LAGOON

optAER floating laterals installed  
northeast of Regina, Saskatchewan

optAER® simply maximizes the power already in a lagoon.

**Lagoons aren't just simple, they are also powerful.** Lagoons harness nature's pull toward equilibrium; Nexom amplifies this power with optAER.

 **optAER**®

Using fine-bubble aeration together with a suite of complementary technologies, optAER removes suspended solids, BOD, ammonia, nitrogen, phosphorus, even coliforms.

To make your lagoon project work better, faster, more consistently through the year, choose optAER. **It's that simple.**

#### TECHNOLOGY:

Fine-bubble aeration and other in-lagoon upgrades

#### ADVANTAGES:

- Improves BOD/TSS Treatment
- Stops odors
- Aerobically digests sludge

#### APPLICATIONS:

- New, efficient lagoon systems
- Upgrading existing facultative ponds
- Old/under-performing aerated lagoons
- Algae/pH control
- Water reuse



## New to fine-bubble aeration?

Using fine bubbles significantly improves oxygen transfer by having substantially more surface area per volume of air pumped, and by slowing bubble rise.

This is good news for lagoons. Suspended at a lagoon's bottom, optAER® diffusers oxygenate the water's full depth and induce mixing within it. This:

- enables BOD removal throughout the water column,
- eliminates odors,
- aids sludge digestion,
- destratifies the lagoon,
- encourages solids to settle by creating an upward flow in the bubble-rise column, which results in a downflow at the edge of the zone of influence.



# HOW IT WORKS

## Frequently asked questions.

### Does aeration require substantial energy?

The energy required for aeration depends on many factors including oxygen demand, site elevation, and water temperature. That said, Nexom uses high-efficiency fine bubble aeration, which provides both oxygen and mixing energy to the system. This results in considerable energy savings compared to other types of lagoon aeration.

**Why do some lagoon cells not need aeration?** In the interests of both energy savings and settling suspended solids, it may not make sense to

optAER aeration is fine-bubble, evolved.

Nexom's exclusive self-tensioning floating laterals and retrievable Float-Sink™ laterals allow for simple maintenance. Both systems allow for full installation and maintenance that can be done from the water's surface, with no equipment affixed to the pond bottom.

More than just aeration, optAER lagoon solutions include complete mix ponds, partial mix ponds, anoxic ponds, flow-optimization baffles, cover systems, SAGR® post-lagoon nitrification, BioPorts™ MBBRs, and chemical- and filtration-based phosphorus removal.

completely mix all lagoon cells. Partially aerated cells may supply enough oxygen to meet targets, and unaerated settling cells are a necessary part of many systems and can be used to create anoxic conditions that enable denitrification.

**Will optAER aeration reduce ammonia levels?** Ammonia reduction is often limited by dissolved oxygen, so likely yes. Depending on the climate and system limits, optAER aeration alone may keep a system compliant. In cold climates, however, other factors may also limit nitrification, which is why Nexom developed the SAGR®.

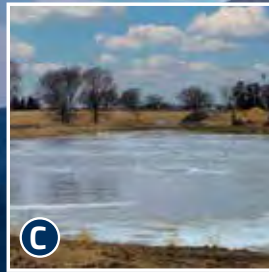
optAER installation at a National Park in Alberta



A



B



C



D

**Make lagoons run like a Swiss timepiece**  
with optAER as your finely-calibrated toolkit.



E

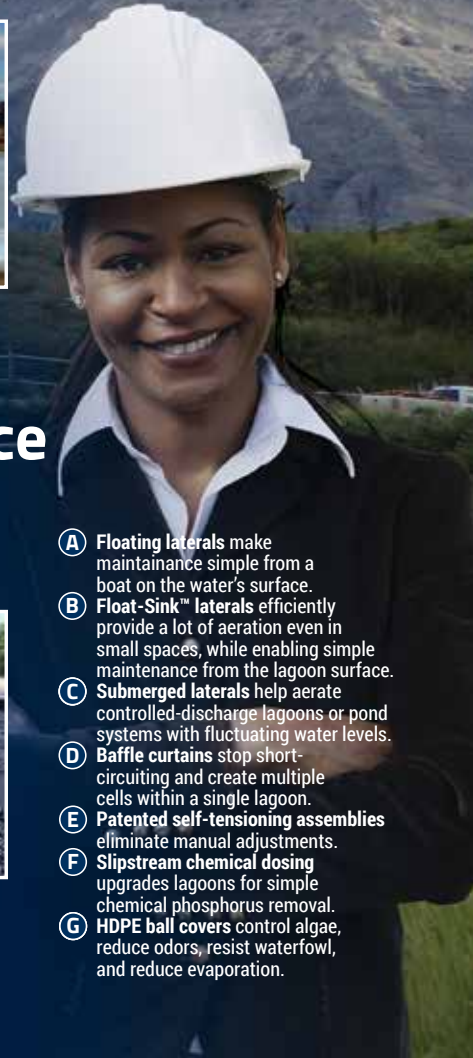


F



G

- A** Floating laterals make maintenance simple from a boat on the water's surface.
- B** Float-Sink™ laterals efficiently provide a lot of aeration even in small spaces, while enabling simple maintenance from the lagoon surface.
- C** Submerged laterals help aerate controlled-discharge lagoons or pond systems with fluctuating water levels.
- D** Baffle curtains stop short-circuiting and create multiple cells within a single lagoon.
- E** Patented self-tensioning assemblies eliminate manual adjustments.
- F** Slipstream chemical dosing upgrades lagoons for simple chemical phosphorus removal.
- G** HDPE ball covers control algae, reduce odors, resist waterfowl, and reduce evaporation.





# optAER's side effects may include reduced stress and increased smiling.

With decades of experience from hundreds of installations, optAER offers peace of mind with performance that will put a smile on your face.



When it's easier to put DO in,  
it's simpler to get BOD out.

**optAER® reduces lagoon BOD and TSS to <20mg/L with minimal O&M.** It's no wonder optAER has become the aeration of choice for hundreds of sites across North America.

**This is what one town in central New Brunswick found.** In 2010, the town installed optAER fine-bubble aeration in the first of its two lagoons, and used a baffle curtain to divide the second lagoon into two cells, maximizing retention time and preventing short-circuiting. The results are remarkable.

FIND THE WHOLE STORY AT  
[NEXOM.COM/BAFFLED](http://NEXOM.COM/BAFFLED).

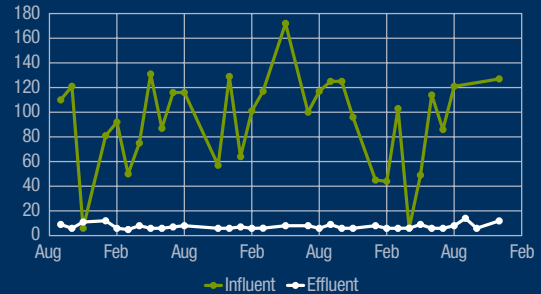
**optAER®**

# HOW IT PERFORMS

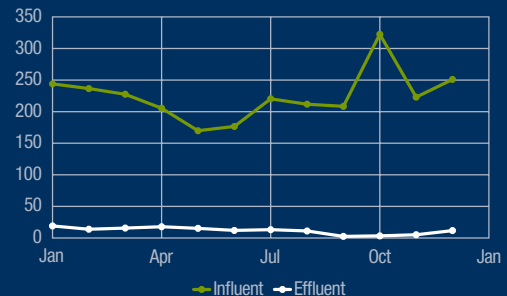
**At another municipality in west-central Alberta, the challenge was even greater.** Located two hours' drive north of Calgary, the town's three lagoon cells needed more dissolved oxygen to reduce BOD below a target of 25 mg/L. Today, using optAER aeration, BOD removal is maximized while O&M requirements are minimized.

FIND THE WHOLE STORY AT  
[NEXOM.COM/REDUCE-BOD](http://NEXOM.COM/REDUCE-BOD).

Central New Brunswick Lagoon cBOD<sub>5</sub> (mg/L)



West-Central Alberta Lagoon cBOD<sub>5</sub> (mg/L)





# <1 mg/L AMMONIA IN <1°C WATER

Under the surface of a Nexom SAGR are two biomasses nitrifying lagoon effluent until there's <1 mg/L of TAN left, even if the water is <0.5°C/33°F for months. That's right: the SAGR is fine in cold weather, **without heating the water.**



Municipal SAGR facility  
north of Cedar Rapids, Iowa.

## SAGR sets the standard for cold-climate nitrification.

**Ammonia in wastewater treatment effluent can be fatally toxic to aquatic life in receiving streams.**

For this reason, ammonia limits have arrived in the vast majority of North America's states and provinces. The problem is, where water turns to ice in winter, lagoons also stop nitrifying.



# SAGR®

**Even if the water is <math><0.5^{\circ}\text{C}</math>, the SAGR post-lagoon fully-aerated stone bed reduces Total Ammonia to <math><1\text{ mg/L}</math>. In addition, SAGRs polish BOD to <math><5\text{ mg/L}</math>, reduce TSS to <math><10\text{ mg/L}</math>, and can render supplementary disinfection unnecessary.**

In warmer climates, the SAGR performs even better, reducing the size and footprint of the system.

Plus, regardless of temperatures, the SAGR does all this with no more O&M complexity than most aerated lagoons.

TECHNOLOGY:  
Post-lagoon cold-water nitrification

ADVANTAGES:

- Nitrifies TAN in the cold
- Polishes BOD/TSS
- Simple O&M

APPLICATIONS:

- Cold-climate nitrification
- Post-lagoon polishing
- De-icing fluid treatment
- Water reuse

## Solving the whole puzzle.

It doesn't work to solve just one part of the four-piece puzzle that is cold-climate nitrification. The SAGR® solves all four:

1. **Attached-growth area:** Nitrifiers are attached-growth bacteria. A SAGR's clean stone optimizes surface area while maximizing contact opportunity. The best part is, most SAGR systems use locally-sourced aggregate, simplifying construction.
2. **Dissolved oxygen:** A SAGR's base is dense with aeration diffusers, making it dissolved oxygen-rich throughout.
3. **Fierce competition:** BOD-consuming bacteria multiply so fast they dominate nitrifiers until BOD drops to <25 mg/L. A SAGR is sized to fully nitrify after it polishes off influent BOD.
4. **Cold cruelty:** The cold both stops new nitrifier growth AND slows metabolism so existing bacteria nitrify less. SAGRs respond by:
  - pre-growing nitrifying bacteria when the water is warm.
  - buffering water temperature changes.

**SAGR**®

# HOW IT WORKS

## Frequently asked questions.

**How does it keep from plugging?** More than 20 years in, the oldest SAGRs have no hydraulic conductivity issues because:

- the stone goes in clear of fines and sized to optimize flow,
- the horizontal-flow distribution chambers effectively distribute the influent across the entire width of the bed,
- the plentiful attached-growth bacteria break down ammonia, BOD, and TSS completely, preventing buildup.

**Do upstream lagoons need covers?** No. SAGRs treat effluent at temperatures below 0.5°C, so there is no need to retain process heat.

**Is wastewater pumping required?** No. The vast majority of SAGRs are entirely gravity fed with no pumping required, simplifying system maintenance.

**What are the maintenance requirements?** The only moving parts are the aeration's blowers. Other than seasonal valve adjustments, an operator will typically run through an inspection checklist and, on occasion, change the oil.

**Is the system compatible with future upgrades?**

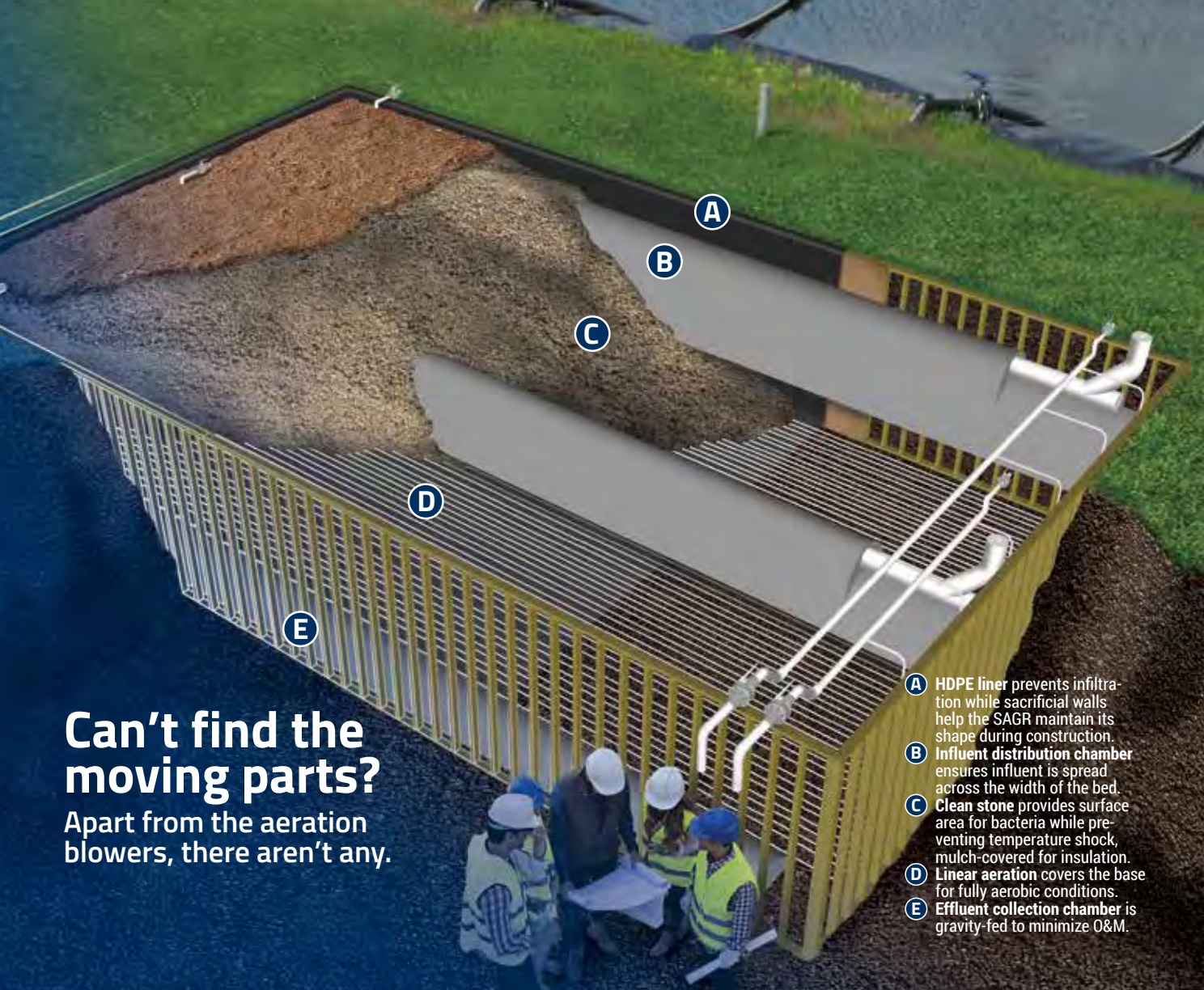
The SAGR is fully compatible with other Nexom lagoon-based process.

- Phosphorus can be removed with Nexom's filtration-focused phosphorus removal processes
- Total Nitrogen limits can be met using SAGR Recycle combined with pre-anoxic zones within the lagoon system, or tertiary BioPorts™ denitrifying reactors.



# Can't find the moving parts?

Apart from the aeration blowers, there aren't any.



- A** HDPE liner prevents infiltration while sacrificial walls help the SAGR maintain its shape during construction.
- B** Influent distribution chamber ensures influent is spread across the width of the bed.
- C** Clean stone provides surface area for bacteria while preventing temperature shock, mulch-covered for insulation.
- D** Linear aeration covers the base for fully aerobic conditions.
- E** Effluent collection chamber is gravity-fed to minimize O&M.

SAGR installation at a town west  
of Fort Wayne, Indiana



## An underground success, literally.

It's no secret that the SAGR is the nitrification  
solution anywhere the lagoon temperature  
drops below  $6^{\circ}\text{C}/43^{\circ}\text{F}$ .

# Never worry about ammonia limits again.

That's the result of a system that consistently delivers <1 mg/L of TAN, <5 mg/L of BOD and <10 mg/L of TSS from a lagoon-based system that takes <30 mins/day to operate.

That's the experience of a western Manitoba First Nation community, located in one of the coldest populated regions of North America. In spite of limits that would allow 7 mg/L of TAN in winter, the SAGR has yet to produce a data point above 1 in the winter or above 0.2 in the summer in more than 3 years of service.

FIND THE WHOLE STORY AT [NEXOM.COM/COLDEST](http://NEXOM.COM/COLDEST).

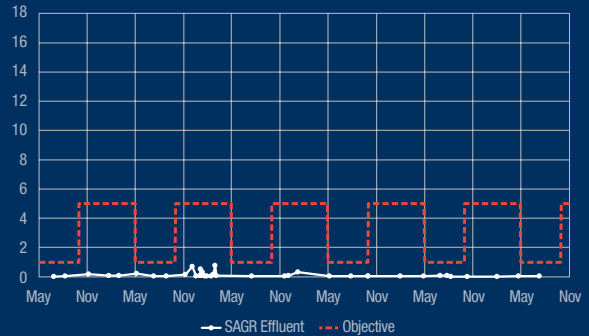


# HOW IT PERFORMS

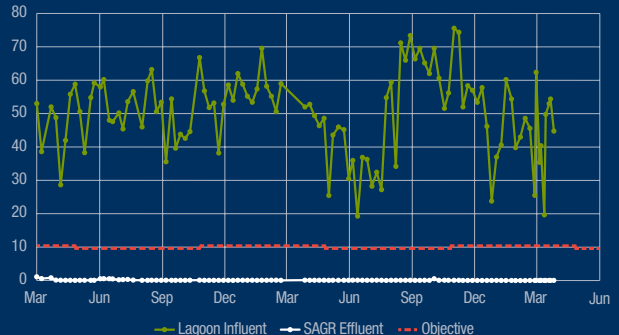
Likewise at a town west of Fort Wayne, Indiana, where the SAGR follows a large, two-cell facultative lagoon. Since 2014, the lagoon influent TAN has peaked at nearly 75 mg/L, but the SAGR effluent has always been in compliance, averaging 0.14 mg/L.

FIND THE WHOLE STORY AT [NEXOM.COM/POST-FACULTATIVE](http://NEXOM.COM/POST-FACULTATIVE).

Western Manitoba First Nation SAGR Total Ammonia-Nitrogen (mg/L)



Indiana SAGR Total Ammonia-Nitrogen (mg/L)





# ARE TOTAL NITROGEN OR NITRATE RESTRICTIONS ON THE HORIZON?

SAGR provides full nitrification in severe cold and incorporates anoxic lagoon(s) to remove Total Nitrogen.

SAGR facility with recycle for Total Nitrogen installed east of Regina, Saskatchewan.

# Never worry about nitrate limits again.

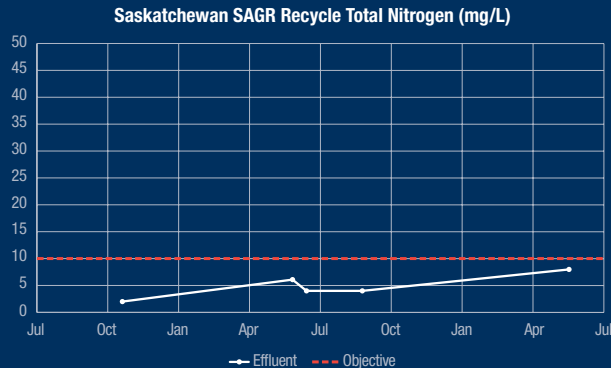
By incorporating a recycle pump station, SAGR effluent can be returned to the front of the lagoon system, where aeration is reduced to create anoxic zones.

The benefit is twofold:

1. The anoxic conditions enable denitrification, enabling sites to meet effluent nitrate limits year-round.
2. Utilizing the nitrates in the water at the front end improves cBOD removal, reducing the required aeration energy and providing real operations savings.

## **SAGR**® RECYCLE

At a Regina, Saskatchewan bedroom community's wastewater treatment facility, the SAGR with recycle system has been removing nitrates at a rate comparable to many more complicated, difficult-to-operate systems, achieving year-round total nutrient compliance.



TECHNOLOGY:

SAGR with recycle for total nutrient removal

ADVANTAGES:

- No carbon dosing required
- Worry-free operation
- Saves energy
- No clarifier or solids stream to deal with

A Montana lagoon-based BioPorts MBBR  
just north of Yellowstone National Park.



# RELIABLE. SIMPLE. INTENSE.

Now, thanks to the BioPorts MBBR,  
you don't have choose between them.



## Finally, an MBBR that works with your lagoons.

Whether you need to meet tight ammonia limits, reduce BOD levels, or improve your nitrate removal rates, the Bioports MBBR is the flexible solution that increases the capacity of your treatment plant within its existing footprint.

# BioPORTS™ MBBR

**BioPorts' secret is creating massive amounts of biologically-friendly surface area in a relatively small space. As a result, it can accommodate highly-variable loads and flows with ease, rapidly increasing bacterial concentrations to meet the need and stay in compliance with minimal O&M requirements.**

### TECHNOLOGY:

Moving bed biofilm reactors for lagoon-based treatment

### ADVANTAGES:

- Remove nutrients including Total Nitrogen
- Handles wide range of loads and flows
- Simple O&M

### APPLICATIONS:

- Post-lagoon ammonia and/or nitrate polishing
- Mid-lagoon treatment intensification

## Maximize your biomass concentration.

**Biomass is easiest to retain when it's fixed to a surface.** Whether the intent is to remove BOD, nitrify ammonia, or even denitrify nitrates, growing biomass on a surface minimizes the washout that occurs in a suspended-growth environment. BioPorts provides that surface area—and plenty of it—in the form of dynamic media that is submerged and contained in a tank.

**While the biofilm is fixed on the media,** the media itself circulates in the tank. The integrated aeration not only ensures high dissolved-oxygen levels throughout, it also moves the media within the tank, enabling a more even distribution of loading and oxygenation to the biomass.

**As a result, BioPorts™ MBBRs can accommodate rapid increases in loading or flows.** Because there is ample surface area for biomass expansion and loading is effectively distributed across the media, BioPorts MBBRs are applicable not only to municipal treatment, but can be used in other applications including removing highly-variable BOD and nitrogen levels at industrial sites.

**Looking for pre- or post-denitrification instead?** Nexom uses mechanical mixing to keep media in suspension without increasing dissolved oxygen. And only Nexom offers the patented Screen Scour™ capability that keeps your effluent screens clear even in anoxic basins.



# HOW IT WORKS

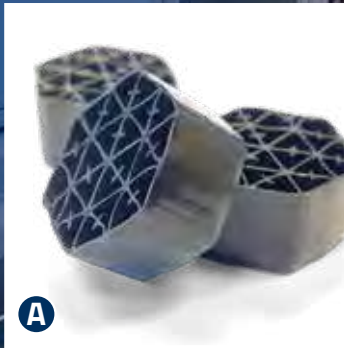
## Frequently asked questions.

**How warm does the water need to be, for BioPorts to work?** Nexom's lagoon- and intensified-treatment experts can implement engineering tools like split feed, function-of-temperature D.O. controls, and multi-stage configurations, in order to mitigate the temperature impact and enable BioPorts MBBRs to work with influent water temperatures as low as 1°C.

**How are effluent solids handled?** Depending on the influent solids loading, solids handling may not be required at all. Where required, however, Nexom can offer solutions including clarifiers, DAFs, our proprietary MITA pile cloth or Centra-flo® sand filters, and more.

# Creating the conditions for biology to thrive.

A BioPorts MBBR provides the surfaces, aeration, mixing, and media retention to better build and preserve the specific bacteria your treatment needs.



**A** BioPorts 900-09 media is proprietary designed to optimize biologically-active surface area to up to  $942 \text{ m}^2/\text{m}^3$  ( $287 \text{ ft}^2/\text{ft}^3$ ). It is made of high-quality HDPE with standard carbon black added for UV protection.



**B** CoarsAir Max aeration provides the mixing energy required to keep the media and influent in contact, while ensuring aerobic conditions when so desired. (Mechanical mixing is available where anoxic conditions are required.)



**C** Retention screens are uniquely designed to keep media in the basin, prevent solids blinding, and provide easy operator access for sampling or maintenance.

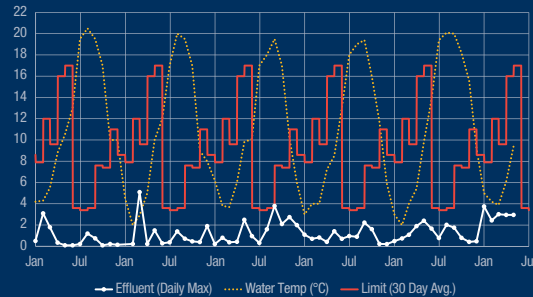
## Years of data establishing long-term compliance.

When building MBBRs at lagoon-based wastewater treatment plants, turn to the lagoon experts at Nexom. Lagoons are not only complex ecosystems unto themselves, they also present challenges the local climate imposes on the wide open expanse of the lagoon.

At an elevation of 2,200m (1.4mi) above sea level, for example, the post-lagoon BioPorts MBBR at one Colorado town northwest of Denver experiences warm summers and water temperatures that plunge in fall. In spite of this, the BioPorts MBBR has operated for more than a decade, within two sets of permitted limits, and has demonstrated long-term compliance.

FIND THE WHOLE STORY AT [NEXOM.COM/ELEVATION](http://NEXOM.COM/ELEVATION).

Colorado Post-Lagoon BioPorts MBBR Total Ammonia-Nitrogen (mg/L)



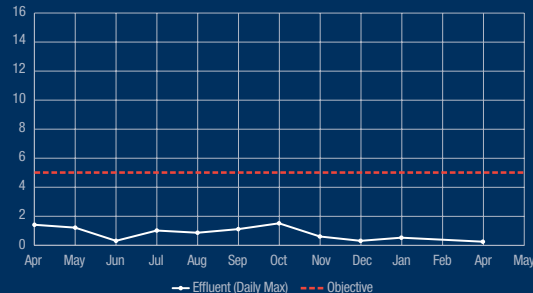
**Biop**  **RTS™**  
MBBR

# HOW IT PERFORMS

Meanwhile, at a 3-cell lagoon-based treatment plant west of Milwaukee, Wisconsin, the post-lagoon BioPorts MBBR is exceeding expectations for treatment. Designed to meet an ammonia target of 5 mg/L, daily maximums have stayed below 2 mg/L.

FIND THE WHOLE STORY AT [NEXOM.COM/WESTOFMILWAUKEE](http://NEXOM.COM/WESTOFMILWAUKEE).

Wisconsin Post-Lagoon BioPorts MBBR Total Ammonia-Nitrogen (mg/L)





## Flexible to suit your needs.

Whether you need to remove BOD, ammonia, nitrates, or any combination of those, a BioPorts MBBR can help.

A post-lagoon BioPorts MBBR  
west of Milwaukee, Wisconsin.

# TRANSFORM LAGOONS INTO THEIR IDEAL FORM

IDEAL reduces footprint by using a single lagoon/earthen basin to treat a continuous inflow by maintaining biomass within the system.



An IDEAL treatment system just west of Salt Lake City, UT.

## How IDEAL works

An IDEAL system intensifies treatment by concentrating the biomass that naturally occurs in conventional lagoons. Although the influent flow (A) to the system is continuous, the effluent is intermittent. The system cycles through:

- aerated periods in which the biomass is fully suspended and most of the treatment is achieved,
- settling periods when aeration is turned off, and
- decant periods when effluent is evacuated with a minimum loss of biomass.

The mixing and oxygen requirements are satisfied using optAER fine-bubble aeration (B). Static effluent decanters (C) are used to minimize moving parts and to increase system reliability. Air blowers and process controls are situated in the building (D) near the pond.

For systems with Total Nitrogen limits, modifying the aeration sequence allows denitrification within the reactor.

The IDEAL system can be paired with an optAER partial-mix zone (E) and/or a quiescent zone (F) to further polish effluent and promote solids settling.

## IDEAL systems maximize the capacity of small- and medium-sized lagoon facilities.

IDEAL is an advanced treatment system for nutrient removal within a lagoon format. The intermittent decant intensifies the treatment and reduces the footprint while continuous influent eliminates pre-equilization.

# IDEAL

IDEAL provides up to 70% total nitrogen removal as part of basic operations, which means you are already prepared for future increases in nitrogen requirements. The process also requires no active sludge management and extremely high flow events present no operational problem or concern from washout of the reactor. The unique ability of the IDEAL to provide front-of-plant treatment provides several benefits over other lagoon-based technologies.

### TECHNOLOGY:

Front-of-Plant  
Total Nutrient Removal

### ADVANTAGES:

- Maximizes lagoon capacity
- Proven cold temperature nitrification at 5°C
- Up to 70% Total Nitrogen removal
- Phosphorus removal and filtration options available
- Worry-free operation during and after peak-plus flow events

A Blue PRO-equipped  
facility includes

# BEST OF ALL, WE'LL DO THE DIRTY WORK

In many cases, lagoon upgrades and service can be done with the system in operation and full of wastewater. Trust your installation and maintenance to the pros who know them best.





SiteWorks performs diffuser maintenance at a First Nation in northern Quebec.

Trust your lagoon's upgrade or service to the people who have done hundreds of them.

**Experienced SiteWorks™ field service professionals are experts at installing and maintaining wastewater systems.** Work with SiteWorks to get the most out of your equipment, from day one, and through its entire life.

# SITEWORKS

## Duckett Creek, Missouri

**Our relationship with the Duckett Creek Sanitary District began in 1994.**

The initial upgrade helped the 5 MGD (19,000 m<sup>3</sup>/day) plant near St. Charles, Missouri save over \$60,000 USD in energy and operating costs annually.

Since partnering with SiteWorks, Duckett Creek has doubled the plant's capacity and seen superior DO results, and today, SiteWorks continues to deliver them services in the form of replacement parts and system upgrades.

LEARN MORE ABOUT SERVICES AT [NEXOM.COM/SITEWORKS](http://NEXOM.COM/SITEWORKS).

### **SERVICE:**

SiteWorks on-site wastewater equipment installation & maintenance

### **ADVANTAGES:**

- Experienced professionals deliver fast, reliable install and maintenance
- Services all brands, enabling single-source maintenance programs
- Single point of responsibility for Nexom equipment

The wastewater industry has seen how nutrients and energy costs expose the limits of existing solutions. Nexom designs and supplies

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