BIOPOLUS
The Living Technology Alliance

METABOLIC HUBS

INTEGRATING WATER TREATMENT AND REUSE INTO URBAN ENVIRONMENT

FUTURE-PROOF

Engineered ecosystems, interconnected into a decentralized network of high tech infrastructure solutions, transforming urban areas into smart, sustainable, circular economies.

MODULAR IN FUNCTION

- ✓ **WATER TREATMENT**
- ✓ **WATER RECYCLING & REUSE**
- ✓ **ENERGY RECOVERY**
- ✓ **RESOURCE RECOVERY**
- ✓ **FOOD PRODUCTION**
- ✓ **COMMUNITY**

VARIABLE SHAPE & FORM

SCALABLE & EXTENDABLE

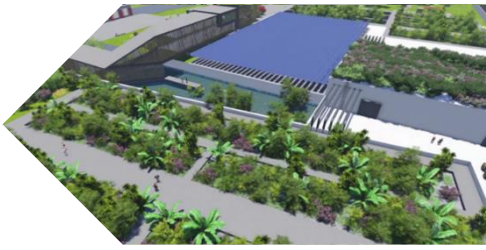
- ✓ **CAPACITY INCREASE**
- ✓ **XS-XL SIZES** (1,500-300,000 PS)
- ✓ **DE-CENTRALIZED & INTER-CONNECTABLE**

WASTEWATER TREATMENT

Smaller, nicer, and more efficient.
Fits into any urban area

RETROFIT

Free up High Value Land
for Redevelopment



URBAN SURFACE WATERS

Rehabilitation and
maintenance

PLATFORM TECHNOLOGY

Integrated, waterbased
Urban Circularity

GLOBAL PARTNERSHIP NETWORK

Headquartered in the European Union

ENGINEERING · EQUIPMENT · RESEARCH

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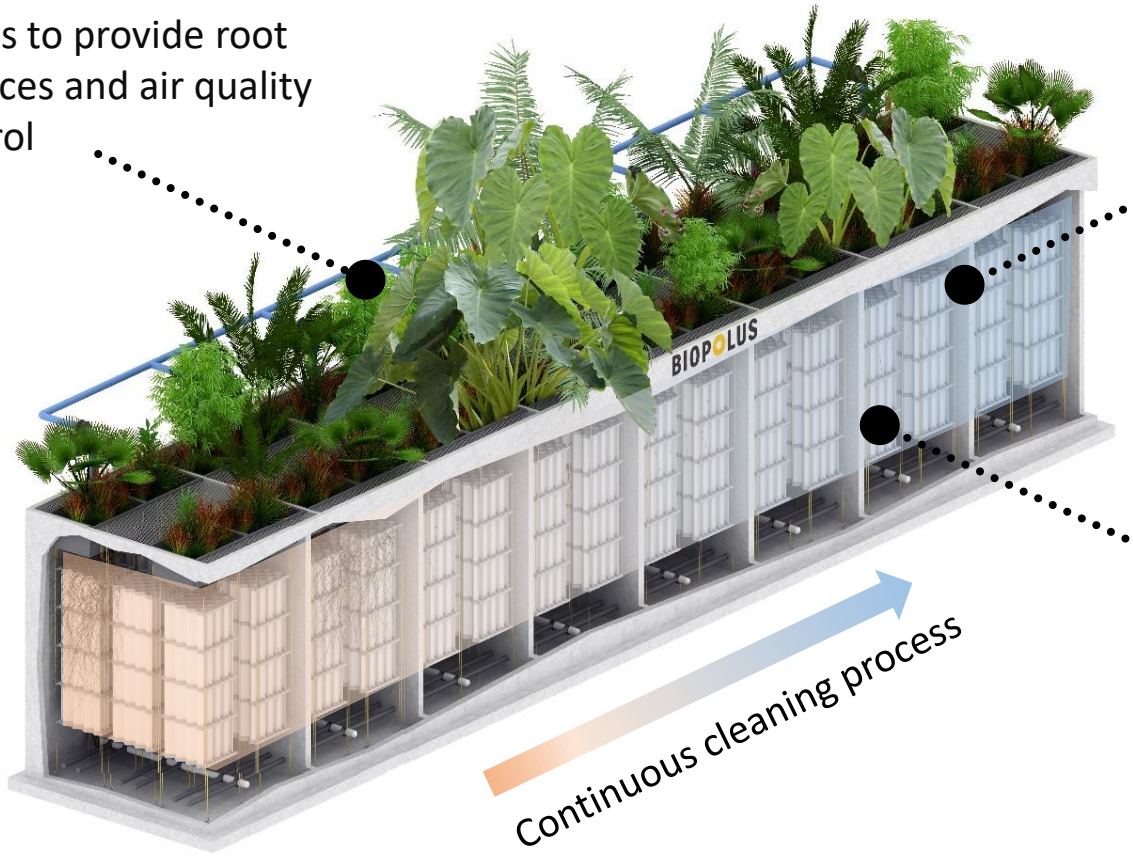
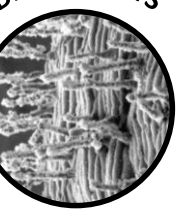
WATER TECHNOLOGY

METABOLIC NETWORK REACTOR (MNR)

Patented 3rd generation integrated fixed-film activated sludge (IFAS)

Plants to provide root surfaces and air quality control





Engineered ecosystem using 2-3,000 species

NATURAL AND SYNTHETIC PLANT ROOTS TO PROVIDE SUFFICIENT SURFACE FOR MICROBIAL GROWTH

- ✓ **Small physical footprint**
- ✓ **Financial savings**
- ✓ **Energy efficient**
  (low TSS, high α-factor)
- ✓ **Looks & smells like a garden**
- ✓ **Large amount of biomass**
- ✓ **High SRT, efficient NH_4 removal**
- ✓ **Resilient to shock loading**

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URBAN SOLUTIONS

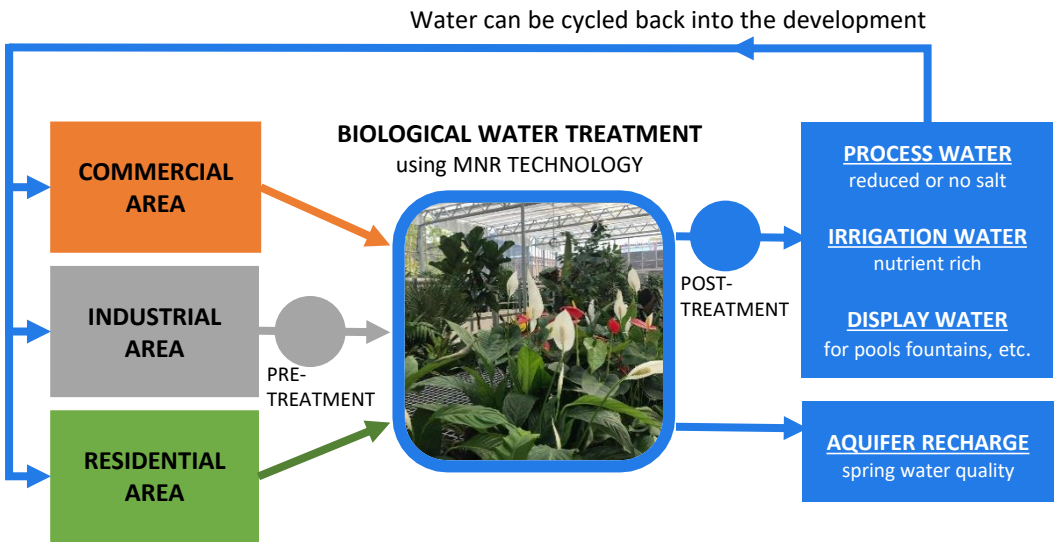
MIXED USE REAL ESTATE – MODULAR APPROACH

WATER-BASED URBAN CIRCULARITY FOR A SUSTAINABLE DEVELOPMENT

Above: Interior view of a 20,000 PE Netherlands facility treating mixed industrial and municipal wastewater.

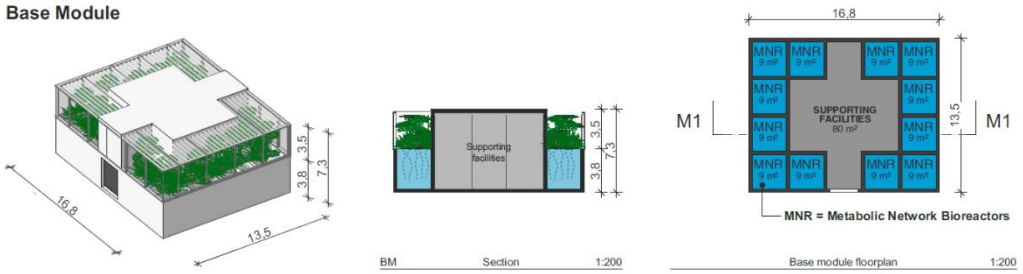
CIRCULAR SOLUTION for:

- WATER RECYCLING
- ENERGY RECOVERY
- ORGANIC RESOURCE RECOVERY

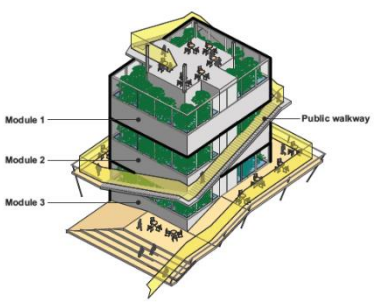


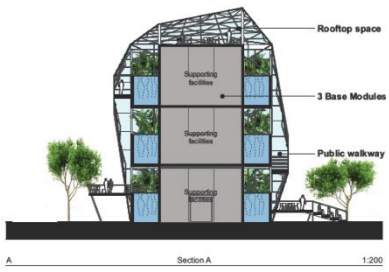
- ✓ **COMPACT TECHNOLOGY FOR A SMALL BUILDING FOOTPRINT**
- ✓ **MODULAR AND FLEXIBLE IN DESIGN**
- ✓ **CIRCULAR SYSTEM**
- ✓ **WATER RE-USE**
- ✓ **BEAUTIFUL ENVIRONMENT FOR EASY INTEGRATION**
- ✓ **ODOR FREE**
- ✓ **EFFICIENT AND ECONOMICAL**

Variations on the Base Module



The base module capacity ranges from 500 m^3/day to 1000 m^3/day, which is equivalent to 2500 - 5000 person equivalents (PE). The actual capacity depends on the influent water parameters and temperature, and the desired effluent requirements.





The modular nature of the MNR reactor technology allows for maximum architectural flexibility, where the facility can be arranged in a vertical or horizontal layout depending on space availability.

In the event that construction occurs in phases, the facility can be designed to expand with the growing development.

Additional functions for energy recovery, and organic waste recovery can also be added to meet the needs of the community.

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REFERENCE PROJECTS

TRAPPIST ABBEY & BREWERY

Koningshoeven, The Netherlands

CAPACITY: 438 m³/d (10,800 PE)
TYPE: Industrial & Municipal
INDUSTRY: Food & Beverage
INFLUENT: 3,080 mg/l COD
EFFLUENT: reused for irrigation

World-wide around 2 billion hectoliters of beer is produced annually. The brewery industry is directly affected by the growing international problem of **water insecurity**.

The Koningshoeven brewery is a subsidiary of **Bavaria Brewery**, the **second largest brewery** in the Netherlands, producing around 7.5 million hectoliters of beer a year.

KONINGSHOEVEN WILL SERVE AS A BEACON FOR CIRCULAR BEVERAGE PRODUCTION

2019 Dutch Ministry **Circular Economy** Waterboards Award

2018 Dutch **Water Innovation** Audience Award

- ✓ **INTEGRATED INTO HISTORICAL SITE**
- ✓ **SMALL 847 m² FOOTPRINT**
- ✓ **ODOR-FREE**
- ✓ **WATER REUSE**
- ✓ **EFFICIENT & ECONOMICAL**
- ✓ **NATURAL APPEARANCE**
- ✓ **WATER CIRCULARITY SHOWCASE**

PARTNER: Waterboard De Dommel

2019 **Interior Landscaping** of the Year Top-Three Finalist

Integrated long-term solution for **WATER MANAGEMENT with** a **VISITOR CENTER** for community education.

OPENED 2018.10.15

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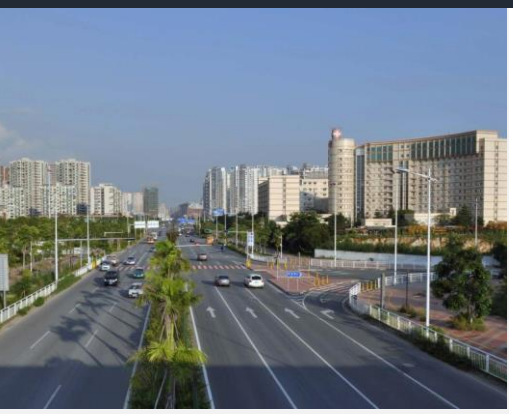
REFERENCE PROJECTS

FLEXIBLE TOUCH SCREEN FACTORY - INDUSTRIAL

Shenzhen, China



CAPACITY: 5,000 m³/d
25,000 PE
TYPE: Industrial & Municipal
INDUSTRY: Electronics

The dynamic growth of industrial parks in China creates new urban centers with diverse economic activity and residential life. This unique coexistence produces mixed industrial and municipal wastewaters, which require tailored, site specific engineering solutions.

Royole Corporation, one of the largest flexible touch screen manufacturers in the world, will have a new production line in a mixed residential/industrial park in Shenzhen Yu.

TAILORED INTEGRATIVE WATER TREATMENT IN A HIGHLY-SENSITIVE URBAN AREA

- ✓ **INTEGRATED INTO OFFICE PARK**
- ✓ **SMALL 850 m² FOOTPRINT**
- ✓ **FREE VALUABLE AREA FOR FURTHER DEVELOPMENTS**
- ✓ **ODOR-FREE**
- ✓ **WATER TREATMENT**
- ✓ **EFFICIENT & ECONOMICAL**
- ✓ **NATURAL APPEARANCE**

PARTNER: Shenzhen DIDA Water Engineering

Biopolus technology installation; early phase of plant growth.

Site-specific and aesthetically pleasing **WASTEWATER TREATMENT** that perfectly fits into the dynamically developing, mixed office park.

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REFERENCE PROJECTS

MIXED DEVELOPMENT - MUNICIPAL

Yangxin, China

CAPACITY: 30,000 m³/d
120,000 PE

TYPE: Municipal

Yangxin is a dynamically growing urban district in the Wuhan metro area in Hubei, China. The city lies in the highly sensitive catchment area of the Yangtze river, in a landscape dominated by several lakes.
Fueled by rapid population growth the municipality commissioned a second wastewater treatment plant. Based on mixed experiences with the previous activated sludge plant, they opted to implement a state of the art new technology for a long-term, efficient solution.

EFFICIENT WATER TREATMENT IN A HIGHLY-SENSITIVE NATURAL AREA

- ✓ PHASED DEVELOPMENT
- ✓ SMALL FOOTPRINT
- ✓ FREE VALUABLE AREA FOR FURTHER DEVELOPMENTS
- ✓ ODOR-FREE
- ✓ WATER TREATMENT
- ✓ EFFICIENT & ECONOMICAL
- ✓ NATURAL APPEARANCE

PARTNER: Shenzhen DIDA Water Engineering

Satellite imagery of completed first phase

Small footprint and highly efficient **WASTEWATER TREATMENT** that meets effluent limits in a sensitive environment and enables future growth.

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REFERENCE PROJECTS

ALKMAAR - RETROFIT

North Holland, The Netherlands

CAPACITY: 11,000 m³/d
90,000 PE
TYPE: Municipal
INFLUENT: 220 BOD mg/l
55 TN mg/l
CURRENT WWTP AREA: 8 ha

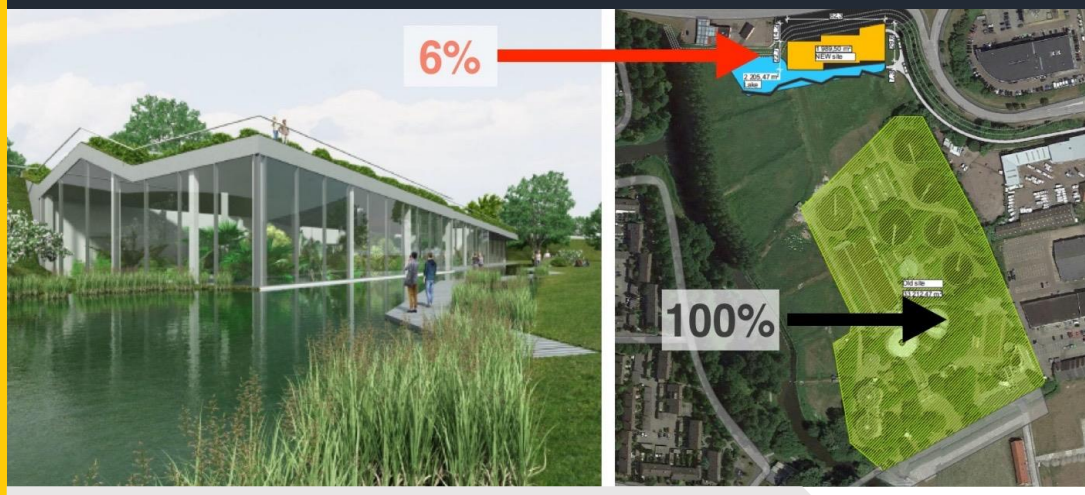
There are about 5000-8000 inner city sewage treatment plants around the globe, which occupy **very high value lands** and are surrounded by offices and residential spaces.

Alkmaar WWTP is located in the city center. The large footprint of the current facility and the necessary exclusion zone prevent residential and business developments in the area.

A SUSTAINABLE URBAN ENVIRONMENT WITH FUNCTIONAL GREEN SPACES

- ✓ **WATER TREATMENT AND REUSE**
- ✓ **CLOSED SYSTEM**
- ✓ **ODOR-FREE**
- ✓ **FOOTPRINT LESS THAN 10% OF CURRENT WWTP (1,990 m²)**
- ✓ **AREA FREED UP FOR DEVELOPMENT**
- ✓ **EFFICIENT & ECONOMICAL**

PARTNER: HHNK Waterboard



FEASIBILITY & CONCEPT DESIGN

CONCEPT: Replace the existing Inner City WWTP, **freeing up 94%** of the 3.3-hectare area for further development. **The value of the freed up land is estimated to be €25-30 million,** 3x the investment cost of the new facility.

WATER PRODUCTS

Different quality for each reuse purpose

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REFERENCE PROJECTS

STRIJP-S - DECENTRALIZATION

Eindhoven, The Netherlands

CAPACITY: 1,600 m³/d
13,500 PE
TYPE: Municipal
TOTAL SITE SIZE: 30 ha

The Netherlands has one of the most efficient, centralized water management systems in the world. To take the next step toward a sustainable circular solution, an additional layer of decentralized and interconnected water treatment facilities are needed.

Strijp-S is the large urban rehabilitation project of a former industrial park, located close to the city center of Eindhoven.

CENTER FOR THE DEVELOPMENT AND PRACTICE OF CIRCULAR ECONOMY VALUES & FUNCTIONS

- ✓ **WATER TREATMENT & REUSE**
- ✓ **LIVING LEARNING LABORATORY**
- ✓ **FOOTPRINT ONLY 222 m²**
- ✓ **MODULAR & FLEXIBLE IN DESIGN**
- ✓ **EXPANDABLE IN SIZE & FUNCTIONALITY**
- ✓ **PARTNERING WITH KNOWLEDGE INSTITUTIONS**

PARTNERS: Waterboard De Dommel, City of Eindhoven, Province of Noord-Brabant

FEASIBILITY & CONCEPT DESIGN

The first decentralized Dutch **WATER TREATMENT & RECYCLING** facility, with a pilot system for **GROUNDWATER TREATMENT**.

INTEGRATING CENTRALIZED & DECENTRALIZED

Inter-connectable with other HUBs and with existing infrastructure

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REFERENCE PROJECTS

FAMU CAMPUS – INTEGRATED METABOLIC HUB

Florida, The United States

CAPACITY: 640 m³/d

TYPE: Municipal

WASTE: 100 kg/d food
100 kg/d green

The **linear Take, Make, Dispose lifestyle** of our cities increasingly depletes finite resources. Closing the Water, the Energy, the Waste and the Food loops allows greater utilization of resources.

Florida A&M University (FAMU) is located in Florida's State capital, Tallahassee. FAMU is dedicated to the advancement of knowledge, the resolution of complex issues, and the empowerment of its citizens and communities.

OPEN INNOVATION PLATFORM FOR SUSTAINABLE ENERGY, WATER, AND FOOD SOLUTIONS.

- ✓ **NEW MODEL FOR CIRCULAR EDUCATION**
- ✓ **WATER TREATMENT & REUSE (580 m³/d)**
- ✓ **500 m² WATER FACILITY**
- ✓ **290 m² FOR ORGANIC & GREEN WASTE BIOREFINERY**
- ✓ **PROTEIN & CELLULOSE PRODUCTION**
- ✓ **500 m² PLANT FACTORY FOR FOOD PRODUCTION (HYDRO-, AEROPONICS)**

PARTNERS: EnergyWaterFood Nexus

FEASIBILITY & CONCEPT DESIGN

A **COLLABORATION SPACE** for research, business, and education for the advancement of innovation in sustainable sciences.

WATER TREATMENT

EDUCATION

FOOD PRODUCTION