Constructed Wetlands
Wastewater treatment with the power of nature
Nature has all the solutions we need

Introduction

A constructed wetland is a natural water treatment system. Contaminants are removed via a range of natural processes mediated by complex interactions between water, plants, microorganisms, soil/gravel media and the atmosphere. While utilizing the power of nature and energy from the sun, polluted water can be cleaned in a sustainable way, with minimum operation and maintenance cost.

Over the years, Bauer has developed and installed hundreds of wetland applications worldwide, including the largest constructed wetland project in the world: the Nimr Water Treatment Plant in Oman, consisting of 780 ha of wetlands and ponds treating 115,000 m³/day of produced water from nearby oil fields. Bauer’s Constructed Wetland Competence Centre provides expertise internationally in the engineering design, financing, construction and operation of wetland treatment systems for a wide range of contaminated water and wastewater issues.

Applications

- Domestic/Municipal sewage
- Sludge dewatering
- Industrial wastewater
- Produced water
- Stormwater
- Agricultural wastewater
- Groundwater remediation
- Landfill leachate
- Mine drainage

Benefits

- Lower capital and operational expenditure
- Natural, green and sustainable
- No treatment by-products
- Treated effluent suitable for re-use
- Short construction period
- Long life-span
- Simple maintenance and operation
- Low energy consumption
- No use of chemicals
- Creates wildlife habitat
- Landscaped design
- Integrated sludge treatment

The PURE Treatment System

The PURE treatment systems combines several wetland treatment approaches, allowing us the flexibility to select and design the optimal treatment solution for the given set of site conditions, wastewater characteristics and required treatment targets. We make use of three main wetland treatment systems individually or in combination (hybrid system), depending on the project requirements.

Type 1 is a vertical flow system that can be used for treatment of sewage.

Type 2 is a horizontal subsurface flow system which is being used in combination with pretreatment (e.g. septic tank) or with the Type 1 system. The combined Hybrid System (Type 1 followed by Type 2) achieves high treatment quality while eliminating the production of sewage sludge.

Type 3 is a surface flow wetland which is suitable for large-scale applications including polishing of sewage effluent, produced water from the oil and gas industry, agricultural runoff and urban stormwater.
**The Sultanate of Oman is adopting an exemplary ecological approach in the oil industry. A large scale surface flow constructed wetland is used to biologically purify hydrocarbon-contaminated water from oil production. BAUER Umwelt GmbH in Germany and its sister company BAUER Nimr LLC in Oman launched this pioneering project in 2008. The Nimr Water Treatment Plant (NWTP) is a unique model treating 115,000 m³/d of produced water. Bauer designed, built and is now operating the facility successfully since 5 years. The plant layout includes a produced water supply pipeline, which enters the NWTP system and leads to an oil and water separator. The water is then distributed by gravity into 4 terraces of surface flow constructed wetlands in series. The overall area of the wetland, planted with a variety of endemic wetland plant species, is approximately 360 ha. Treated water from the wetland is then evaporated in 520 ha pond areas for future salt recovery in order to reuse the salt for drilling operations in the oilfields of Oman. Nowadays, research activities aim to investigate alternative re-use options of treated produced water for specific algae growth, agriculture and potable water production. The NWTP has become a rich ecosystem in the Sultanate of Oman and attracts more than 120 bird species every year.**

**Sludge Treatment Wetlands**

Sludge handling and management is a major issue in conventional treatment plants (e.g. activated sludge). Sludge Treatment Wetlands represent a unique ecological way for on-site sludge dewatering and drying. Sludge Treatment Wetlands provide a cost-effective and sustainable alternative to daily sludge disposal or other expensive mechanical technologies. After 8-12 years of operation, the final product of sludge mineralization is transformed to a valuable biosolid material. Bio solids can then be re-used as fertilizer, soil amendment, for composting, energy production or other applications.

**Aerated Wetlands**

Aerated Wetlands represent a state-of-the-art design modification of constructed wetlands technology. Artificial aeration enhances oxygen availability for organic and inorganic compounds removal from wastewater. The implementation of artificial aeration in constructed wetlands enables a significant reduction of the footprint and CAPEX cost. Aerated wetland is an eco-friendly solution with low energy requirement, reduced land area demands, therefore it provides lower OPEX compared to conventional treatment systems.

**The Nimr Water Treatment Project, Oman**

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SERVICES WE PROVIDE

Bauer provides integrated solutions based on the specific needs of each client. Our services and skills include:

- Consulting
- Feasibility studies
- Lab- and pilot-scale treatability testing
- Engineering
- Procurement
- Construction
- Plant propagation and planting
- Operation and maintenance
- Project management
- R&D
- After-sales support and training

SELECTED REFERENCES

- Feasibility Study, Urban Development
  (Turkey 2013)
- Sewage Treatment Plant, Abu Butubul
  Construction Camp (Oman 2008)
- Sewage Treatment Plant, Farha Oil & Gas
  Facility (Oman 2015)
- Sludge Mineralisation Plant, 5 Star Hotel
  (Oman 2009)
- Sludge Treatment Plant, Mid-size Town
  (Jordan 2012)
- Produced Water Treatment Plant, Oilfield
  (Oman 2009-2012)
- Ma'aden Aluminum Complex, Industrial
  NEWT™ System (Saudi Arabia 2013)
- Wichita Falls, Industrial NEWT™ System
  (Texas 2015)

http://www.bauer.de/en/bre/