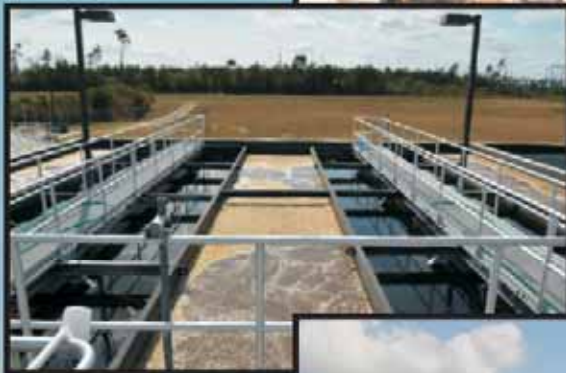




**randazza**  
Enterprises, Inc.

**Advanced Wastewater Treatment Solutions  
ECOfluid Systems, Inc.  
Upflow Sludge Blanket Filtration System  
(USBF™) Patented Process**



**Complete Design  
Manufacturing  
Equipment Supply  
Installation  
Commissioning  
Personnel Training**

  
**ECOfluid**

**USBF™**

**Upflow Sludge Blanket  
Filtration**



# USBF

## Technology Summary

The USBF process is the result of over fifty years of research, development, testing and practical experience. It is a modification of the conventional activated sludge process that incorporates an anoxic selector zone and an upflow sludge blanket filtration clarifier, all in one integrated bioreactor vessel.

The treatment includes not only the efficient reduction of BOD<sub>5</sub> and TSS but also biological nutrient removal (BNR) by the processes of denitrification and "biological luxury uptake."

The ensuing compact, modular system takes up significantly less space and contains very few moving parts. The result is an efficient, highly affordable wastewater treatment with low maintenance and operating costs.



USBF technology has no inherent capacity limits and is used in a wide range of applications. Plants serving the domestic and municipal sectors or treating industrial, food processing and agricultural wastewater are in successful operation worldwide.

Since the high treatment efficiency of the advanced secondary USBF process opens the door to cost effective tertiary post-treatment, the process has been increasingly utilized in the design of water reclamation plants.



## Three Features That Increase Efficiency and Reduce Costs

### Upflow Sludge Blanket Filtration Clarifier

Upflow sludge blanket filtration introduces a significantly higher specific rate of separation than other commonly used separation techniques. Unlike conventional clarifiers, the influent enters at the bottom and flows upwards. As the cross sectional area increases, the upflow velocity decreases until the activated sludge flocs become stationary and thus form a filtering media for activated sludge flowing through. High filtration efficiency is achieved and even particles with settling velocities too low to be removed by settling alone are filtered out.

### High Sludge Concentration

Most traditional plants operate at low or medium sludge concentrations, typically 2,500 - 3,500 mg/l. USBF filters/clarifiers by contrast operate at higher sludge concentrations, typically 4,000 - 6,000 mg/l resulting in longer sludge age and increased biological efficiency.



### All Processes Integrated into One Reactor

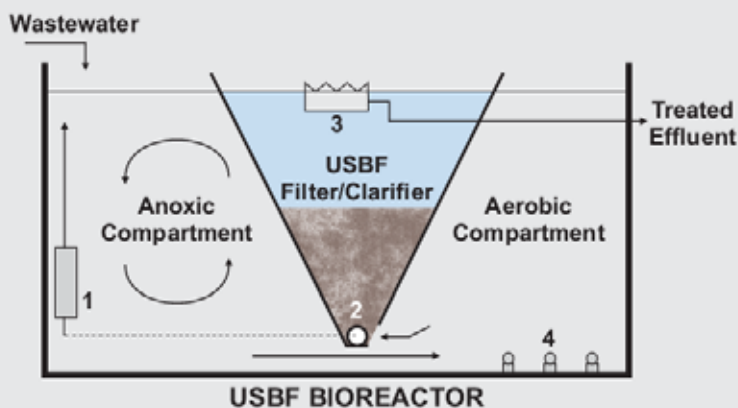
Most conventional technologies carry out processes of nitrification, denitrification, clarification and sludge stabilization in a number of dedicated vessels. By contrast, USBF technology incorporates all these processes inside one compact bioreactor, reducing equipment size and liquid handling requirements.



# The Process

Operation of a USBF plant is simple and self-regulating. Wastewater enters the anoxic compartment of the bioreactor where it mixes with activated sludge recycled from the bottom of the filter/clarifier. Agitated and moved in a plug flow manner, the mixed liquor flows into the bioreactor's aerobic compartment.

After aeration, a stream of the mixed liquor enters the bottom of the filter/clarifier where the sludge flocs and water are separated by upflow sludge blanket filtration. After separation, filtered effluent overflows into a collection trough and is discharged from the system.



1. RAS Pump (Airlift or Axial Flow)
2. Randazza RAS Ejector
3. Treated Effluent Overflow Trough
4. Fine Bubble Aeration Diffusers

To complete the internal circulation loop, activated sludge collecting at the bottom of the filter/clarifier is recycled back into the bioreactor's anoxic compartment.

## The Benefits

### High Treatment Efficiency Including Biological Nutrient Removal (BNR)

The USBF process features an internal anoxic compartment for biological reduction of nitrogen and phosphorus by respectively nitrification/denitrification and 'luxury uptake' processes.

### Alkalinity Recovery & Filamentous Bacteria Control

The integral denitrification process facilitates partial recovery of alkalinity during nitrification. As well, the anoxic selector is used to control filamentous bacteria growth within the system.

### No Primary Clarification

USBF technology does not require primary clarification prior to biological treatment. A proper screening facility and for larger plants, grit removal system is all that is required upstream of the bioreactors.

### Hydraulic Flexibility

The clarifier's prism or cone shape not only allows other treatment processes to take place around it, but it also facilitates superior hydraulic flexibility. USBF technology easily accommodates high peak flows and flow swings in a self-regulating manner; the higher the flow, the higher the sludge blanket rises and the larger the filtration area becomes.

### Modular and Flexible Design

Modularity of design allows owners to stage plant development and balance early outset capital expenditures more easily. The modular nature of the system also ensures that plants can be quickly expanded if and when growth demands. A variety of construction materials can be used and USBF filters/clarifiers can be retrofitted into virtually any existing tank or packaged together as a completely self-contained unit.



### Reduced Operating & Maintenance Requirements

The compact design, minimal amount of moving parts, modularity of construction and self-regulating hydraulics result in reduced supervision requirements, contributing to lower operating and maintenance costs.

### Reduced Site Requirements

USBF technology incorporates nitrification/denitrification, clarification and sludge stabilization all into one compact bioreactor which reduces equipment size and liquid handling requirements and ultimately leads to a smaller plant footprint.

### Virtually No Odor

Aerobic conditions throughout the bioreactor and extended sludge age dramatically reduce the potential for odor allowing USBF plants to be located within populated areas.





AWT 22,000 GPD  
Angler's Reef  
Witley Key, Florida

## The Benefits *continued*

### Improved Sludge Characteristics

Low microbial loading (extended sludge age of 25-35 days) produces less excess, aerobically stabilized sludge and improves sludge structure and mechanical dewatering characteristics.

### Patented & Proven

With literally hundreds of plants in operation worldwide, USBF technology has been proven to consistently deliver high quality treated effluent in a variety of applications.

## The Applications

### Municipal and Domestic Wastewater

Literally thousands of customized and packaged USBF treatment plants serving municipalities, communities, subdivisions, ski resorts, shopping centers, summer resorts, golf courses, hotels, restaurants etc. are in operation worldwide.



AWT 0.3 MGD  
Eustis Water Reclamation Facility  
Eustis, Florida

### Water Reclamation

High advanced secondary treatment efficiency of the USBF process paves the way for efficient and economical tertiary treatment. USBF is increasingly and advantageously used in the design of treatment plants producing unrestricted access (Class A or Title 22) reclaimed water.



AWT 0.3 MGD  
Marco Shores Water Reclamation Facility  
Marco Shores, Florida

### Existing Plant Retrofits

The self-contained nature of the internal circulation loop and the structural independence of the USBF filter/clarifier insert makes it possible that virtually any tank can be converted to a wastewater treatment plant. Existing RBC's, oxidation ditches, trickling filters and other have been retrofitted with USBF filters/clarifiers to increase treatment efficiency and/or plant capacity.

### Industrial Wastewater

Plants treating high strength industrial wastewater including food processing plants, slaughterhouse and rendering plants, dairy plants and pulp mills have been designed and are in successful operation worldwide.

[www.randazzawastewater.com](http://www.randazzawastewater.com)



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