

Biological Denitrification Drinking Water Treatment Plant in Calaf (Catalonia, Spain)



Figure 1: BIOBOX Nitrate Biofiltration Plant of 88 GPM / 20m³/h

Technical Summary of the Article:

- **Influent:** Groundwater
- **Technology:** BIOBOX Nitrate
- **Flow rate:** 88 GPM / 20 m³/h
- **Influent N-NO₃:** 18 mg/L (**NO₃:** 80 mg/L)
- **Effluent N-NO₃:** <9 mg/L (**NO₃:** <40 mg/L)
- **Plant Features**
 - Influent measurement
 - Pumping group + Washing pump
 - Parallel working bioreactors – Denitrification
 - UV disinfection
 - Measurement
 - Aeration tank
 - Fine tuning filter
 - Chlorination

The biological denitrification project in Calaf (Catalonia) has ensured a high-quality **drinking water** supply for the local population, solving the issue of high nitrate concentrations in the groundwater. The plant, with a treatment capacity of 88.06 GPM, uses the BIOBOX Nitrate technology, a natural biological process that converts nitrate into nitrogen gas (N₂), meeting the quality standards set by health regulations.

Since its commissioning in 2022, the facility has successfully reduced N-NO₃ concentrations from 18 mg/L to less than 9 mg/L. In addition to being efficient and sustainable, the plant minimizes the waste generated and operates fully automated, optimizing resources and significantly improving the quality of life for the local residents.

Table 1 Treatment Results.

Parameter	Influent	Treated effluent
Flow rate (GPM)	88	
Flow rate (m ³ /h)	20	
N-NO ₃ (mg/L)	18	<9
NO ₃ (mg/L)	80	<40
COD (mg/L)	-	<3
Microbiology (CFU/mL)	-	0

**Aerobic bacteria at 22°C, Escherichia coli, total coliforms, enterococci, Clostridium perfringens.*

Process description:

The biological denitrification plant in Calaf treats water sourced from the municipal reservoir of the locality, with an initial nitrate nitrogen (N-NO₃) concentration of 18 mg/L. The process begins with measuring the nitrate concentration in the raw water. Subsequently, a pumping group pushes the water towards three biofilters installed in parallel, where biological denitrification occurs through heterotrophic microbial organisms supported on a highly porous filtering material. This process converts the nitrate into nitrogen gas (N₂) in a harmless manner, without generating any waste.



Figure 2: Interior / exterior images of the BIOBOX Nitrates Biofiltration Plant with 88 GPM capacity / 20m³/h

After denitrification, the water undergoes disinfection using ultraviolet lamps, followed by a redox potential measurement to verify biological activity and control the reducing state of the filters.

Next, a new pumping group drives the water to an aeration tank, equipped with diffusers to optimize oxygenation. Finally, the water passes through a fine-tuning filter and undergoes a final nitrate measurement before being chlorinated. The treated water is stored in a drinking water reservoir.

The entire process is fully automated, controlled by sensors and a PLC system that allows real-time monitoring and remote operation.