

DESALINATION PLANT "La Marina" - Aguilas

In July 2000, "La Marina" Irrigation User Community realized a desalination plant draft project with 5 hm³/year capacity, in "La Marina de Cope" Council, in Aguilas municipality. The works were declared of General Interest by 14/2000 Law on 28 December, by Fiscal, Administrative and Social Measures. Moreover, in earlier august that year the environmental complaint has begun with the Agriculture and Environmental Ministry.

- *Energy saving cutting-edge technology*
- *Desalination plant construction specialists*
- *Consulting, technical support and maintenance*
 - *Specific turkey designs*

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WORK DESCRIPTION

Seawater intake

Seawater is obtained by mean of horizontal directed drillings, located under the seabed in the fossiliferous conglomerate of sandy carbonated siliceous cementation boulders (calcareenites). High density polyethylene perforated pipes are introduced in those drillings in the intake section, obtaining water by incursion through mentioned stratum.

Those polyethylene pipes ends in the ground stretch with a concrete reinforced chamber wherein the five 100 l/s pumps are located, driving seawater to the desalination plant through a discharge pipeline of 600 mm diameter made of glass reinforced polyester because of its durability features against high chloride content water action.

Raw water tank

Designed with a capacity of 1,500 m³ and internal dimensions of 34,00x14,80 m and 4,40 m walls height. The maximum expected water line height is 3,00 m.

Tank structure is made of reinforced concrete with 40 cm thickness walls, founded directly over 2,90 m total width footings. The tank is covered by prestressed concrete pre-fitted lightened plates, a concrete layer and waterproofed by mean of a PVC sheet which is top protected by a gravel layer.

Desalination plant building

The installation of desalination plant equipment and mechanical sets are carried out in a 45 m length, 25 m width building, shifted into two parts of 20 m (main) and 5 m (lateral).

The main building includes the desalination plant equipment .The lateral building contains the power transformers, control room, workshop and WC.

Desalinated water reservoir

Desalinated water by means of reverse osmosis is collected in a 33.000 m³ capacity dam, allowing pumping regulation to “Los Rubios” dam using off-peak hours and weekly cycle.



Brine manifold

Desalination plant discharge collection is carried out by means of an outdoors pit in which the brine manifold begins. The piping used for the manifold ground stretch is glass reinforced polyester with 500 mm diameter and 1.400 m length.



Marine manifold stretch is high density polyethylene made with 560 mm diameter installed in the same intake system by means of horizontal drilling under seabed, surfacing 370 m away from the coastline where the 35 m length diffuser stretch is located.

Desalinated water driving to “Los Rubios” dam

Discharge to “Los Rubios” dam takes part from the permeate reservoir 500 mm diameter outlet line. There are two pumps installed inside 800 mm diameter steel pipes soaked in concrete with manhole in attached platform and top located. There is installed a 10 m³ capacity pressure dampener for sudden pumping system shut off protection.

The discharge pipeline comprises a 500 mm inner diameter pipe, cast iron made for its initial 1.750 m and glass reinforced polyester with 16 and 10 kg/cm² nominal pressure for the resting final 2.872 m.

“Los Rubios” dam

It is foreseen to construct a dam with dikes made with the loose materials originated from the vessel excavation, with internal 2,5:1 and external 2:1 slopes and approximately 300.000 m³ of capacity for desalinated water regulation and storage.



Discharge “Los Rubios” Dam – “La Marina”

Discharge is taken in the “Los Rubios” outlet 500 mm diameter pipe and includes a single pumping system for a capacity of 100 l/s mounted inside a 650 mm diameter Steel tube, concrete soaked and connected to the 500 mm outlet pipe. Discharge pipe is 300 mm diameter with 16 and 10 kg/cm² nominal pressures.



DESALINATION PLANT

The facility is designed for a production capacity of 16.000 m³/day of desalinated water counting with three 5.333 m³/day lines contributing to module and adapt the plant operation aiming to optimize power costs depending on supply requirements and facility maintenance. The three lines will be supplied from the plant feed regulation tank which shall be hermetic to light and environmental dirt, a fact of maximum significance.

Low pressure pumps and filter cleaning

Low pressure pumps drive water from the feed tank by mean of glass reinforced polyester pipes of 350/400 mm diameter.

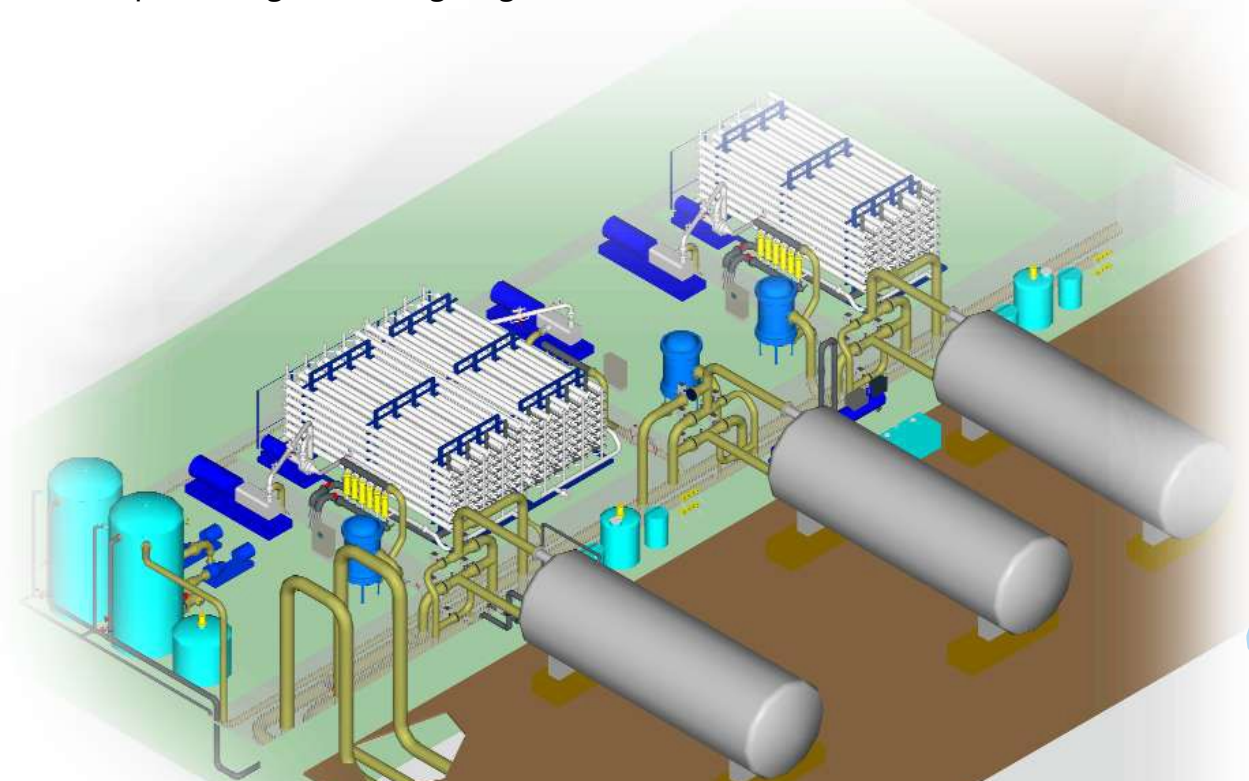
Aiming to avoid pressure loss in pre-treatment when driving seawater to the high pressure desalination plant process, three horizontal centrifugal pumps are installed, impelling seawater into silex-anthracite filters.

The silex-anthracite filter cleaning will be performed with forward-backward flow coming from raw water storage tank by mean of the cleaning pumps and backward air flow proceeding from a blower.

Pre-treatment

Is essential to carry out a raw water pre-treatment previous to desalination process in order to remove membrane harmful substances from water (suspended solids, colloidal silica, organic matter, etc.).

The horizontal drilling intake type used in this project provide subterranean zone water from the seabed with vital important features, thanks to the natural soil filtration with light and oxygen absence preventing bacteriological growth.



Two stage pretreatment was chosen in this project:

- Mixed layer silex-anthracite filtration. Each line disposes a 3.600 mm diameter and 10.000 mm cylindrical length filter with internal natural rubber coating.
- Microfiltration with 5 μm cartridges. Each cartridge filter has a capacity of 215 cartridges with 40 inch length.

High pressure pumping and energy recovery

Reverse osmosis desalination process is based on semi-permeable membrane water pass through, rejecting almost the totality of dissolved salts. Water should be pumped to the membranes with greater pressure than the osmotic pressure of the raw water. Once this pressure is surpassed, permeated flow is proportional to the excess of pressure applied.

The desalination plant counts with three 5.333 m³/d production lines. Each line has 57 pressure vessels installed with a capacity of 7 membranes per vessel, resulting in 399 membranes per line.

High pressure pipes are made of AVESTA 254- SMO alloy highly resistant to seawater corrosion.

From pretreatment filtration stages to membrane reverse osmosis feed there are two parallel processes which allows to increase pressure and recover energy from brine,

- On one hand, 45% of membranes feed flow is impelled directly by the segmented high pressure pumps installed in each production line with a pressure of 60-65 kg/cm² depending on seawater temperature and salinity.
- On the other hand, the remaining 55% flow is provided through ceramic energy recovery devices, transmitting the residual brine pressure directly to the raw water, optimizing plant energetic costs. Energy recovery process is completed with a booster pump which provides the additional pressure required for membrane feed, equaling the 60-65 kg/cm² pressure in high pressure pump discharge flow.



Flushing and Cleaning in place (CIP) equipment

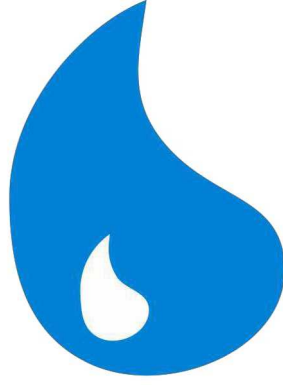
A flushing and cleaning in place equipment including two 25 m³ glass reinforced polyester tanks shall be installed. One of them will count with electric heaters and both connected to two stainless steel pumps and a cartridge filter. The reverse osmosis lines may be filled with desalinated water in case of extended shut-downs, removing seawater from membranes and equipment.

Furthermore, a 5 m³ tank with electric agitator is included for dilution preparation and homogenization.

Instrumentation and control

Desalination plant supervision is carried out by mean of a computer system which allows to know at any moment real-time operation parameters and also perform data graphics, logs, etc.

All the process sections such as intake, low pressure pumping, filtration, reverse osmosis, desalinated water pumping are guaranteed by the use of several PLC automates which control the process.



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Construction, assembly and commisioning

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