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Civil Engineering

Benchmark structure for protecting water resources in extremely arid zone Ghardaia in the M'Zab Valley in Algeria acquires a natural sewage treatment station in natural lagoon

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A centuries-old hydraulic structure in danger

Natural sewage treatment in lagoon: the optimal solution for depollution of the water table

Teranap TP geomembrane: a waterproofing solution, perfectly suitable for this particular job site



Located 600 km south of Algiers, at the gate of the Sahara, the M'Zab Valley region must face up to a crucial problem of pollution of its water resources. Important implications for the local populations which live mainly from raising dates. To deal with this particular problem, a natural sewage treatment station in lagoon was implemented, laying more than 600,000 m² of waterproofing geomembrane of Teranap 331 TP elastomeric bitumen. The work was done by the Amenhyd contracting firm. Here we retrace the broad scale project.

The Ghardaia district is located in the northern part of the Algerian Sahara. It extends over more than 86,000 km² and is bordered by the districts of Laghouat and Djelfa to the north, Ouargla to the east, Adrar and El Bayadh to the west and Tamanrasset to the south.

Located at the heart of the Sahara Desert, the five attractive ksours (fortified towns) of the M'Zab Valley: El-Atteuf, Bounoura, Melika, Béni-Isguen and Ghardaia (founded between 1012 and 1350), reflect a sedentary and urban civilization, possessing an original culture that has succeeded in preserving its cohesion across the centuries. Since the 11th century, the inhabitants of this valley, the Mozabites, have maintained practically the same type of habitats and the same building techniques. Its population is about 380,000.

The towns in the M'Zab Valley are characterised notably by an original architecture which has been a source of inspiration for 20th century architects and urbanists, such as Ravereau, Wright, Le Corbusier or Pouillon.

To be able to endure in the valley in quasi-autarky, the Mozabites have succeeded in developing an agricultural economy appropriate to the region. During more than nine centuries, they have displayed exceptional ingenuity in working to create and maintain conditions enabling them to cultivate the date palm from which they have drawn the essential of their subsistence.

That ingenuity reveals itself mainly in two ways: on the one hand, the use of wells and the sharing of water (the foggara), classified today among the prized heritages of humanity and, on the other hand, the improvement in the system of refilling the water table.





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Unfortunately, that water table had been receiving more and more infiltration waters coming from irrigation along with the discharges of sewage (soil leaching, septic tanks, etc.).

Moreover, under the combined effects of the reduced extraction of water and the increase in refill, this water table had tended to rise considerably in certain low areas such as the palm-groves, to the point that the crops had been wasting away (asphyxia of the palm trees).



Fiche d'identité du chantier

Location:

Ghardia, M'Zab, Algeria

Contracting Authority:

Ministry of Water Resources (MWR)

Contracting Authority, delegate:

National Sewage Office (NSO)

Project Management:

Bonnard & Gardel - Switzerland

Consulting firm:

Aquatec Axor - Canada

Waterproofing contracting firm:

Amenhyd SPA - Algeria

Surface:

600,000 m²

Dates of the waterproofing works on the site:

end of 2010 to May 2011

Product used:

Teranap 331 TP

The sanitary situation of the M'Zab Valley had become critical. It was necessary to take action.

This is why the Algerian authorities, considering this project to be of national importance, decided to implement works of drainage and protection of the M'Zab Valley, the essential goals of which were:

- Eliminating the detrimental phenomena and the risks of contamination in the urbanised zones, by collecting all the effluents via a main collecting drain;
- Protecting the receiving medium and the water resources of the valley and, in particular, those of the water table;
- Providing the possibility of reusing the treated effluents for irrigation.

Following these conclusions, it was decided to build natural lagoons of very large dimensions (60 hectares) in the M'Zab Valley so as to collect and treat all these effluents.

The chosen treatment system comprises:

- Pre-treatment;
- Primary treatment stage in "anaerobic" lagoon;
- Secondary treatment stage in "optional" lagoon;
- Sludge drying beds.

Two systems of eight aerated lagoons each, that is a total of 16, are to be given the task of purifying the water by successive decantations, while eight small aerated lagoons collect the sludge which, once it is dry, will be spread on the land to be cultivated. So this is a completely ecological arrangement.

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To waterproof the lagoons, a waterproofing system using geomembrane (DEG) was decided upon. Teranap TP elastomeric bitumen membrane



was selected so as to fit the specific nature of the south Algerian region along with the typology of the terrain and the particular conditions of execution of the works.

A total surface of 600,000 m² of Teranap 331 TP elastomeric geomembrane was laid. The waterproofing works were carried out by the Amenhyd contracting firm with, at its head a new generation of contracting experts, who can respond to Algeria's major needs in the fields of water and of the environment, and who are capable of joining efficiency and cost-effectiveness. In a short time, thanks to the participation of its teams and of its technical expertise, Amenhyd has become the pioneer in the field of waterproofing and drainage works in Algeria.

For this particularly large project, after the earthworks and the site transformation that began in 2009, the aerated lagoons were dug then waterproofed between the end of 2010 and May 2011. To stay on the project schedule but also to avoid the midday heat, several teams have worked concurrently, including during the early morning and at night. In this way, the laying of the membrane was carried out in a very short time (1,200 m²/day) thanks to teams of well-trained welders. The works were accompanied by a Quality Assurance Plan (QAP).

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Teranap TP geomembrane has proved to be highly applicable to the site's weather conditions, in particular during windy periods, since its weight makes it quite stable during the laying. Its insensitivity to the wide temperature swings encountered in this region, were also a decisive criterion in choosing this bituminous geomembrane. Its puncture resistance and its flexibility were also strong factors without forgetting the fact that it holds the Asqual Technical Certification.

Thanks to this project, the M'Zab Valley will return to its traditional conditions of hygiene and well-being. This benchmark work for the protection of the environment is going to generate positive effects with multiple implications:

- Ecological: drainage of sewage waters and protection of the water table;
- Economic: improvement of the yields of the date-groves with increased financial resources for the local population;
- Sociological: maintaining the population in place and reducing rural exodus;
- Cultural: return to the traditional balance of Mozabite traditions with the enhancement of the value of their oases.

To download the Teranap TP manual, [click here](#)



12 rue de la Renaissance - F 92184 ANTONY Cedex - Tél. : +33 1 40 96 35 00