

## The SPA1 Cetate pumping station modernization, Floating pumping station and irrigation System

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**Abstract:** Starting with 1975 the SPA1 Cetate base station supplied water from the Danube to the entire Cetate - Galicea Mare irrigation system, which at that time had an area of 38053 ha and spread over the area of Perișor, Cioroiși, Afumați, Portărești, Giubega, Galicea Mare, Balilești, Moțăței and Cetate, with an area of over 7000 ha in the third pumping stage and over 10,000 ha arranged for pumps. After the revolution the area in which it was irrigated was restricted to the stations in the first bifurcation of the channel CA Cetate - Galicea Mare, respectively to the station at SRP1 Galicea Mare and the stations on the channel CD3, an area that adds up to the 17908 ha that were declared useful. published in 2005 and which were the object of the transfer to the property of FOUAI Cetate - Galicea Mare, the rest of the area of 20145 ha has entered conservation since 2005 and will be rehabilitated by ANIF.

**Keywords:** pumping station, irrigation system

### 1. INTRODUCTION

The water source is the Danube river.

The outlet is directly at the Danube, through an outlet channel with a length of 400 m and a width of 80 m unpaired.

The irrigation water collection is carried out with the SPA1 Cetate base station, located on the left bank of the Danube at km 813 + 560, which flows water into the CA0 adduction channel on a length of 1180 m waterproofed with concrete slabs of 3x1,5x0.06 m. On this channel there is the SPA 2 Cetate filling station, which supplies water to the CA Cetate-Galicea Mare channel, which supplies the pressure pumping stations SPP 1M, SPP 2M, SPP 3M belonging to OUAI Cetate, stations SPP4, SPP5, SPP6 and SPP7 belonging to OUAI Motatei - Dobridor, SPP23 FB station belonging to OUAI Fânâna Banului, SPP24 station belonging to FOUAI Cetate- Galicea Mare and pumping stations on channel CD3: SPP27, SPP12, SPP13, SPP28, SPP14 and SPP15 belonging to FOU-Mare (Figure 1).

In the area of the stations SPP2M and SPP3M on the right side of the AC channel there is the plot APT Cetate on a surface of 1010 ha arranged for irrigation with pumps on 9 antennas, this plot is within the OUAI Ban Fountain. In the area of the SPP4 station on the right side of the AC channel and on the CD6 channel,

there is the plot of APT Moțăță on an area of 1164 ha arranged for irrigation with pumps on 15 antennas, this plot is within the OUAI Solvent - Rodesco.

The SPA1 Cetate base station is composed of two pumping pontoons (floating) with 4, respectively 6 aggregates each, namely: the first pontoon upgraded by FEADR funds with aggregates type DV2-87 with electromotor with power 315 kW, speed 490 rpm, voltage 6.3 kV, and the second pontoon, not modernized, has aggregates type AVR 902 with electric motors with power 500 kW, speed 490 rpm, voltage 6.3 kV. Total flow installed at the station is  $Q = 26.4 \text{ mc / s}$ , an installed power  $P = 4.32 \text{ MW}$  and the pumping height  $H = 12 \text{ m}$ .

SPA 2 Cetate refueling station is equipped with 6 RV 120-170 aggregates with synchronous motors power 3300 kW, speed 375 rpm, voltage 6.3 kV, pumping height  $H = 52 \text{ m}$ , which flows water on the AC channel with a installed flow rate  $Q = 30.60 \text{ mc / s}$  and installed power  $P = 20.3 \text{ MW}$ .

The adduction channel CA0 has the following characteristics: small base  $b = 4 \text{ m}$ ; large base  $B = 20 \text{ m}$ ; water height  $h = 4 \text{ m}$  and inclination  $m = 2$ . It is 1180 m long and is lined with 3x1,5x0.06 concrete slabs.

The channel of adduction CA bieful 1 has the following characteristics: small base  $b = 4 \text{ m}$ ; large base  $B = 17 \text{ m}$ ; water height  $h = 4.2 \text{ m}$  and inclination  $m = 1.5$ . It is 24950 m long and is lined with 3x1,5x0.06 m concrete slabs.

The SPA1 Cetate base station is composed of two pumping pontoons (floating) with 4, respectively 6 aggregates each, namely: the first pontoon upgraded by FEADR funds with aggregates type DV2-87 with four 315kW power motors, speed 490 rpm, voltage 6.3 kV, and the second pontoon, not modernized, has six AVR 902 aggregates with electric motors with power 500 kW, speed 490 rpm, 6.3 kV voltage. Total installed flow per station is  $Q = 26.4 \text{ mc / s}$ , installed power  $P = 4.32 \text{ MW}$  and pumping height  $H = 12 \text{ m}$ .

SPA1 basic pumping station Cetate subject to the expertise, is a basic pumping station, which draws water from the outlet channel 400 m long and 80 m wide unpaved, which brings water from the Danube to the two (floating) pontoons equipped one with 4 DV2-87 type aggregates driven by asynchronous motors with a

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power of 315 kw, voltage 6.3 kV and the other one with 6 AVR 902 type aggregates driven by asynchronous motors with a power of 500 kw, voltage 6.3 kV and

which discharge water in the discharge basin of the channel CA0 by 12 metal pipes with a diameter of 1400 mm (Figure 2 and 3).

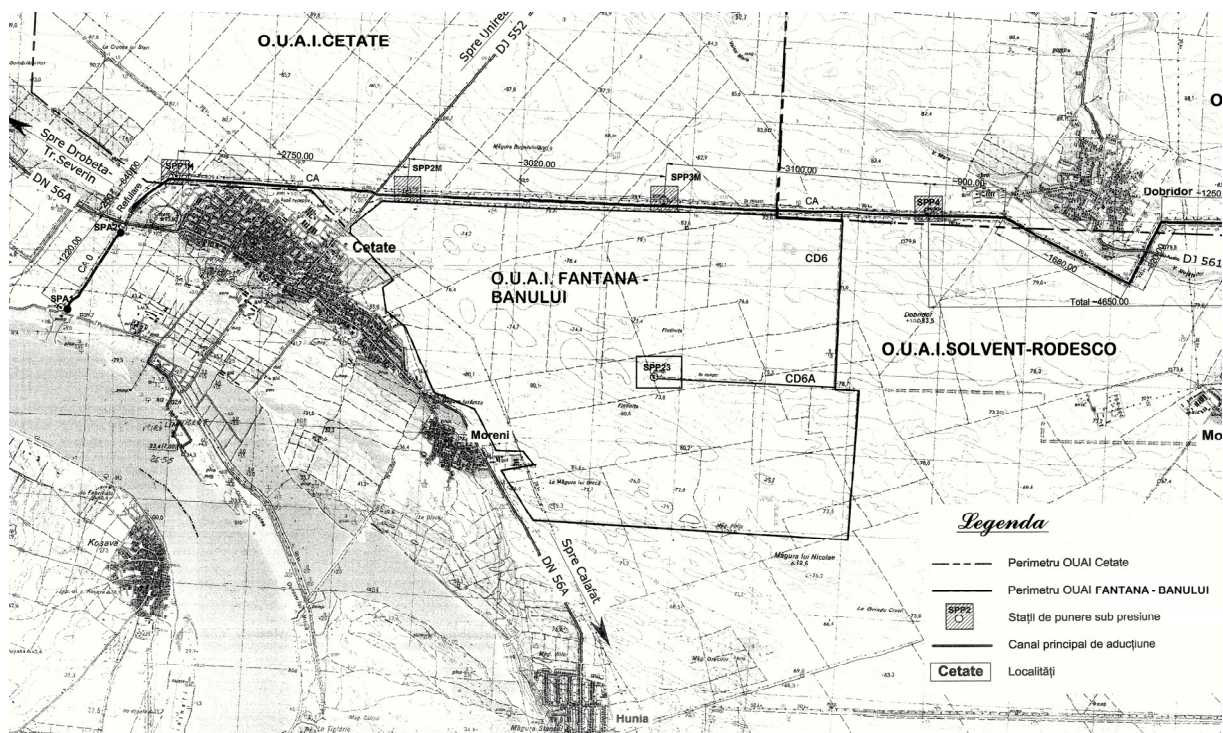


Figure 1. Master plan

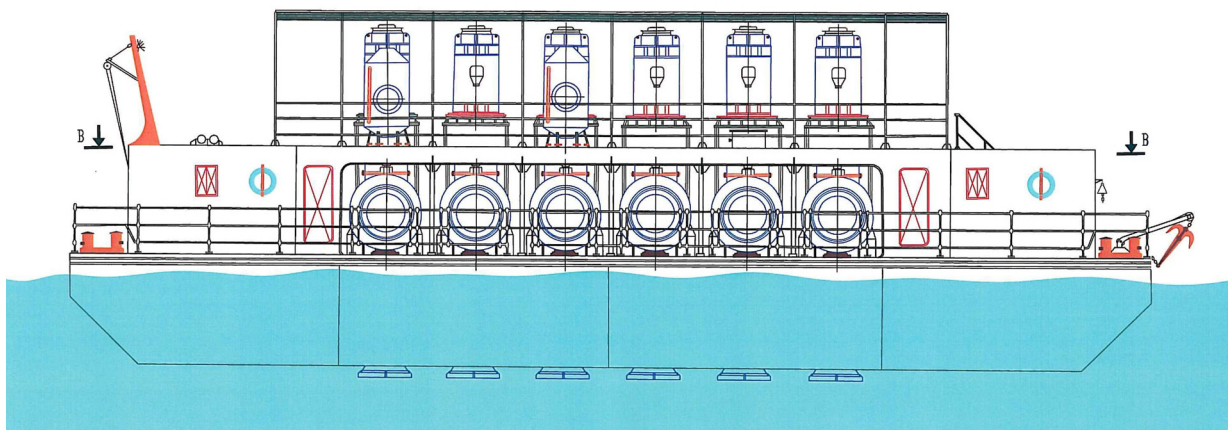


Figure 2. Lateral view floating pump station

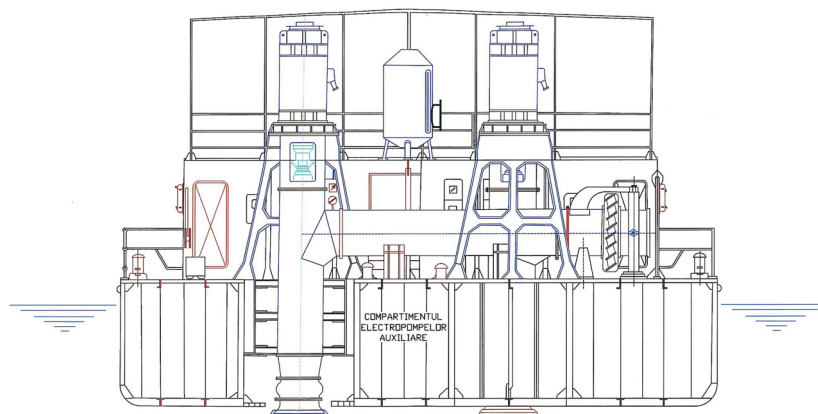


Figure 3. Rear view floating pump station

The irrigation water is taken from the Danube from the SPA1 Cetate base station and pumped into the CA0 Cetate refueling station in the CA Cetate - Galicea Mare channel, after which it is repurposed by the SPA2

channel, after which the water is taken over by the pressure pumping stations held. of four eggs.

SPA1 Base pumping station Cetate proposed for rehabilitation, was put into operation about 35 years ago is an open ground construction consisting of two (floating) pontoons, which are vertical type flow pumps

and actuating motors, pipelines a discharge (12 wires) with a diameter of 1400 mm starting from the two vessels crosses the protection dike from the Danube and reaches to the bottom of the discharge basin of the channel CA0 and the building of the electric starting cells of the engines.

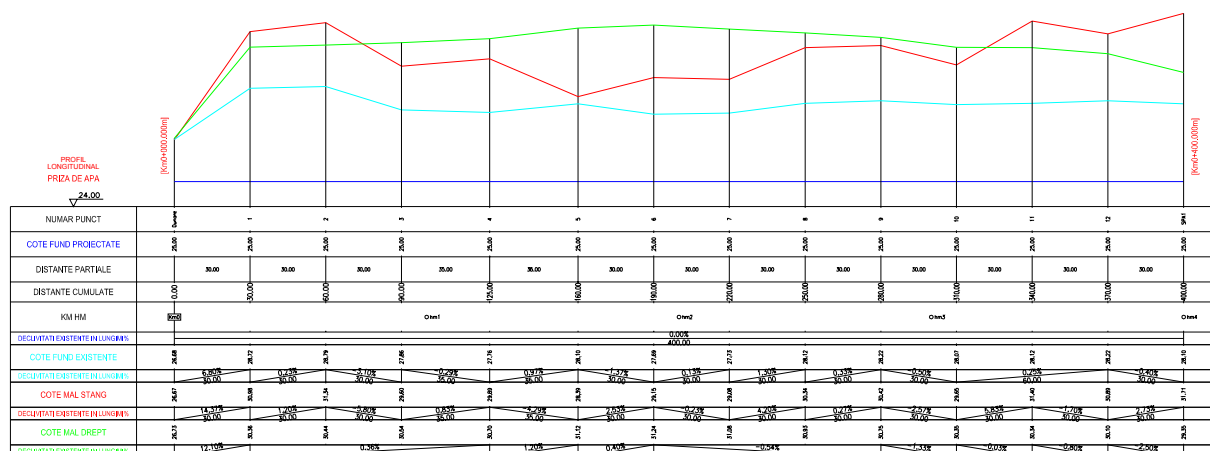


Figure 4. Longitudinal profile

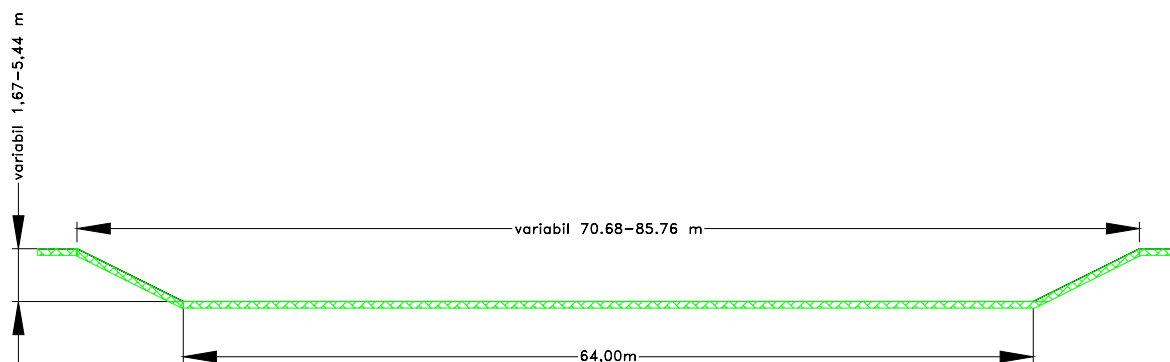


Figure 5. Transversal profile

Following the verifications carried out at the SPA1 base pumping station Cetate, it turned out that the construction works are in good condition at the building of the cells, they have no visible defects (cracks, collapses, displacements, inclinations, etc.), which impose consolidation works.

The ship with pumping units type DV 2-87 has been modernized with FEADR funds. The other ship with pumping units type AVR 902 also has 2 functional pumps, and the body of the ship has large rust surfaces and cracks.

Exterior lighting electrical installations will be restored. Landing and lightning protection installations and lifting installations will be restored.

On the occasion of the verification of the technical status of the unmodernized ship, the following results were obtained:

- The body of the ship with pumps of type AVR 902 requires extensive repair work to ensure the buoyancy of the ship.
- The equipment related to the six AVR 902 type aggregates mounted on pontoon 2 are old (over 40 years old), are physically and morally worn and damaged;
- The basic pumps and the electric motors related to the six AVR 902 units are malfunctioning, with low

efficiency and high energy consumption;

- The electrical installations related to the six AVR 902 units are old, physically and morally worn and no longer present in operational safety;

## 2. RESULTS AND DISCUSSIONS

To bring the SPA1 Cetate base pumping station to the higher operating parameters, operating with high efficiency and low energy consumption, rehabilitation works will be required which will consist of:

- disassembly of the equipment related to the six AVR 902 type aggregates existing on the pontoon 2 (pumps, motors, valves, valves, mounting compensators, pipe sections, etc.);
- procurement of technological pumping equipment (pump and motor) with a pumping height of 12mCA and flow rates of 8640 mc / h for the basic pumps; the pumps will be submersible for the maximum drowning of the pumps;
- valves will be provided on the discharge pipes and ultrasonic flowmeters on the discharge of each pump;
- medium voltage electric power installations will

be dismantled and replaced with new installations (motor cells, line cell and measuring cell, power and control cable);

- the external lighting installation of the station, the grounding and surge protection installation, the lifting installation on the pontoon 2 will be restored;

- works will be carried out to rehabilitate the body of the ship to ensure buoyancy;

- rebuilding the station fence;

- the dismantling of old equipment and installations will be done by qualified personnel respecting the current norms of protection and hygiene of the work;

- the tools, equipment, pipes and fittings to be replaced will be removed from the station's location and stored in specially designed spaces for the purpose of recovery;

- the rehabilitation works will not affect the environment and the health of the people.

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The annual tariff charged by FOUAI for 2016 is 14.7 lei / ha for the areas contracted with the four OUAIs that make up the federation, on water delivery points. This tariff is charged by FOUAI for maintenance and repairs at the base station, the repacking station and the irrigation water supply channel.

The water delivery rate for the water delivery points of the four OUAIs is for 2016 in the amount of 342 lei / 1000mc. This tariff is charged by FOUAI for pumping water to the base stations, transporting it through the pipeline up to the SPP and the value of the filling and loss volumes through infiltration and evaporation.

To reduce the water delivery tariff to the five

delivery points, it must operate at minimum operating levels in the channel, between 1 m and 3 m. In order to operate at minimum levels, the suction pipes of the pumping units from the five SPPs were modernized by the OUAİ by FEADR, they were extended from the channel's slope up to a height of 0.5 m from the bottom of the channel, and the stations were provided with priming installations for starting the pumping units at low levels in the channel.

Considering the degree of use of 100%, from the surface of the stations that have a water supply contract, which is 10537 ha, we have 10537 ha contracted by OUAİ in 2016 with a crop structure so that we have 2637 ha corn, 3100 ha wheat, 3100 ha of sunflower and 1700 ha of other crops (rapeseed, barley, barley); the watering norms are 1000mc / ha for maize and 500mc / ha for wheat, sunflower and other crops, resulting in a volume of plant water of 6587 thousand cubic meters; using 75% field watering efficiency, transport efficiency between SPP and 90% field, 80% SPP pumping efficiency, 70% channel channel transport efficiency and 60% aggregate base station efficiency - as per the Project for the Rehabilitation and Reform of Irrigation in Romania (page 17 table no. 1 DHV BV) - we will have a volume of water taken from the source of 24045 thousand cubic meters. This volume is used for three months: May, June and July so for one month we will have 8015 thousand cubic meters of water taken from the source.

In order to reduce the cost of water delivery to the SPP and reduce the cost of electricity, the pumps of type AVR 902 operated by electromotor with  $P = 500\text{kW}$  and  $n = 490\text{ rpm}$ , with efficient electric pumps with  $P = 400\text{kW}$ ,  $n = 750\text{rot / min}$  will be replaced. , flow = 8640 mc / h.

Currently the station has a specific consumption of 46 kWh / 1000 mc. By replacing AVR 902 pumps with high performance electric pumps, the specific consumption will be 42 kWh / 1000 cubic meters, the cost of water delivery will be reduced by 3.6% and the cost of electricity will be reduced by 4.9%.

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