

HYDRAULIC DIMENSIONING OF THE IRRIGATION NETWORK FOR THE MURGEANCA SPP21 IRRIGATION SYSTEM

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Abstract: The land arranged for irrigation is located in the river basin of the Danube river, from the perimeter of the Ialomița-Călmățui terrace. SPP21 is located on the CD3A channel in the north of the village of Țândărei. The Irrigation Water Users Organization Murgeanca owns the irrigation infrastructure (the pressure pumping station and the underground irrigation pipelines) on an area of 1135 ha related to the SPP21 plot which will be upgraded and located on the city radius. Țândărei, Ialomița county:

SPP21 is located on the CD3A channel in the north of the village of Țândărei;

Keywords: pumping station, irrigation system

1. INTRODUCTION

For the pumping station SPP21 the following categories of works were provided:

- refurbishment of a platform for mounting vertical pumps by pouring reinforced concrete around the metal parts used to raise and strengthen the pumps;

- installation of two electric pumps with vertical axis with a pumping height of 60mCA and flow 1320 mc / h using the crane on tires of 12.5 tf;

- mounting on the pump discharge of the elastic compensators, swinging valves, valves with drawer and oval body and the ultrasonic flow meter on the manifold on the pump discharge;

- assembly of PEHD discharge manifold of nominal diameter Dn = 500 mm - 50 m, which takes the water flow from the two discharge pipes of the new pumps DN = 350 mm - 40 m and is directed to the CP.

- assembly of bypass pipe, bypass valve and DAD-6 with diameter Dn = 200mm.

- for the protection of the pump and motor assemblies at the action of the atmospheric factors, it was foreseen the realization of a metallic structure covered with bituminous shingle covers;

- mounting of line valves with nominal diameter Dn = 300 mm - 8 pcs and Dn = 250 mm - 4 pcs and water meters with nominal diameter Dn = 300 mm - 8 pcs and Dn = 250 mm - 4 pcs.

For the buried pipeline network of plot SPP21, the following categories of works were provided:

- Realization of a network consisting of a main pipeline (CP) of water transport for irrigation to the

twelve water distribution antennas within the SPP21 plot. The main pipe CP1 will be located at a depth of 1.4 m in a ditch with a width of 0.8 m positioned along DE11 towards Țândărei. The CP1 pipe will have four sections with the following dimensions: section 1 of 510 m long made of PEHD pipe PE100 PN10 De = 560mm and Dn = 500mm; section 2 of 612 m long made of pipe PEHD PE100 PN10 From = 500mm and Dn = 450mm; section 3 1224 m long made of pipe PEHD PE100 PN10 From = 450mm and Dn = 400mm; section 4 of 1224m length made of pipe PEHD PE100 PN10 De = 400mm and Dn = 350mm. The pipes will be assembled on a 15 cm thick layer of sand, and the welding will be done "end to end" with the issue of a welding quality certification bulletin for each weld. At the end of section 1, the welding of two small HDPE PE100 SDR17 tees with De = 560 / 355mm will be performed, from which the right and left connections of the antennas A1 and A2 will be replaced, which will be replaced. At the end of section 2, we will perform the welding of two reduced tehs of PEHD PE100 SDR17 with De = 500 / 355mm, from which the right and left connection of the antennas A3 and A4 will be made, which will be replaced. In the middle of section 3, at 612 m, we will perform the welding of two small HDPE PE100 SDR17 with DE = 450 / 355mm, from which the right and left connections of the antennas A5 and A6 will be made, antennas that will be supplied. and from the old CP. At the end of section 3, we will perform the welding of two reduced tehs of PEHD PE100 SDR17 with De = 450 / 355mm and 450 / 280mm, from which the connection will be made on the right side of the antenna A7 and on the left side of the antenna A8, antennas that will be powered from the old CP. In the middle of section 4, at 612 m, the welding of two reduced HDPE PE100 SDR17 tees will be performed with De = 400 / 355mm and De = 400 / 280mm, from which the right and left connections of the A9 and A10 antennas will be made. , antennas that will be powered from the old PC. At the end of section 4 the welding will be carried out head to head of two reduced tees of PEHD PE100 SDR17 with 400 / 280mm, from which the connection will be made on the right side of the antenna A11 and on the left side of the antenna A12,

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antennas that will be supplied and from the old CP. The pressure test will be performed on sections to receive the works.

In the area of connection of the antennas with the pipes pipes will be executed 12 homes of the same type in which will be fitted the valves of drawer line type oval body drawer Dn = 300mm - 8pcs and Dn = 250mm - 4pcs, after which will be executed other 12 homes of the same type in which the water meters on each antenna will be fitted with Dn = 300mm - 8pcs and Dn = 250mm - 4pcs. In order to protect the network of buried pipes, the line homes will be provided with ventilation valves type DAD-6 Dn = 200mm. At the end of the CP there will be installed a drain valve of drawer type oval body Dn = 250mm. In order to take over the axial forces, massive anchoring of reinforced concrete will be poured at the change of direction, at the change of diameter and at the end of the CP.

- Conduits of antennas of the type PEHD PE100 PN10 SDR17 De = 355mm / Dn = 300mm, De = 280mm / Dn = 250mm, De = 225mm / Dn = 200mm and De = 180mm / Dn = 150mm will be located at a depth of 1.1m in ditches with a width of 0.6m positioned perpendicular to the main pipe as follows: antenna A1 with a length of 2268m with section 1 with a length of 240m with a nominal diameter Dn = 300mm, section 2 with a length of 216m with a nominal diameter Dn = 250mm, section 3 with the length 1236m nominal diameter Dn = 200mm and section 4 with 576m length nominal diameter Dn = 150mm; antenna A2 with a length of 2268m with section 1 with a length of 240m nominal diameter Dn = 300mm, section 2 with a length of 216m nominal diameter Dn = 250mm, section 3 with a length of 1236m nominal diameter Dn = 200mm and section 4 with length of 576m diameter nominal Dn = 150mm. The pipes will be assembled on a 15 cm thick layer of sand, and the welding will be done "end to end" with the issue of a welding quality certification bulletin for each weld. The pressure test will be performed on sections to receive the works. On the routes of the antennas will be welded end-to-end low tee PEHD PE100 SDR17 with: Dn = 300/100 / 300mm 14pcs as follows: antenna A1 - 4pcs; antenna A2 - 3pcs; antenna A3 - 4 pcs; antenna A4 - 3pcs. Dn = 250/100 / 250mm 12pcs as follows: antenna A1 - 3pcs; antenna A2 - 3pcs; antenna A3 - 3pcs; antenna A4 - 3pcs. Dn = 200/100 / 200mm 68 pcs as follows: antenna A1 - 17pcs; antenna A2 - 17pcs; antenna A3 - 17pcs; antenna A4 - 17pcs; Dn = 150/100 / 150mm 32pcs as follows: antenna A1 - 8pcs; antenna A2 - 8pcs; antenna A3 - 8pcs; antenna A4 - 8pcs. The same number of butterfly valves Dn = 100mm with PEHD connection element will be installed for all A1, A2, A3 and A4 antennas, respectively 126 pcs. At the ends opposite the CP of the four antennas there will be installed 4 drain valves of drawer type oval body Dn = 150 mm.

= 200mm and section 4 with a length of 576m diameter nominal Dn = 150mm; antenna A3 with a length of 2268m with section 1 with a length of 240m nominal diameter Dn = 300mm, section 2 with a length of 216m nominal diameter Dn = 250mm, section 3 with a length of 1236m nominal diameter Dn = 200mm and section 4 with a length of 576m diameter nominal Dn = 150mm; antenna A4 with length of 2268m with section 1 with length of 240m nominal diameter Dn = 300mm, section 2 with length of 216m nominal diameter Dn = 250mm, section 3 with length of 1236m nominal diameter Dn = 200mm and section 4 with length of 576m diameter nominal Dn = 150mm. The pipes will be assembled on a 15 cm thick layer of sand, and the welding will be done "end to end" with the issue of a welding quality certification bulletin for each weld. The pressure test will be performed on sections to receive the works. On the routes of the antennas will be welded end-to-end low tee PEHD PE100 SDR17 with: Dn = 300/100 / 300mm 14pcs as follows: antenna A1 - 4pcs; antenna A2 - 3pcs; antenna A3 - 4 pcs; antenna A4 - 3pcs. Dn = 250/100 / 250mm 12pcs as follows: antenna A1 - 3pcs; antenna A2 - 3pcs; antenna A3 - 3pcs; antenna A4 - 3pcs. Dn = 200/100 / 200mm 68 pcs as follows: antenna A1 - 17pcs; antenna A2 - 17pcs; antenna A3 - 17pcs; antenna A4 - 17pcs; Dn = 150/100 / 150mm 32pcs as follows: antenna A1 - 8pcs; antenna A2 - 8pcs; antenna A3 - 8pcs; antenna A4 - 8pcs. The same number of butterfly valves Dn = 100mm with PEHD connection element will be installed for all A1, A2, A3 and A4 antennas, respectively 126 pcs. At the ends opposite the CP of the four antennas there will be installed 4 drain valves of drawer type oval body Dn = 150 mm.

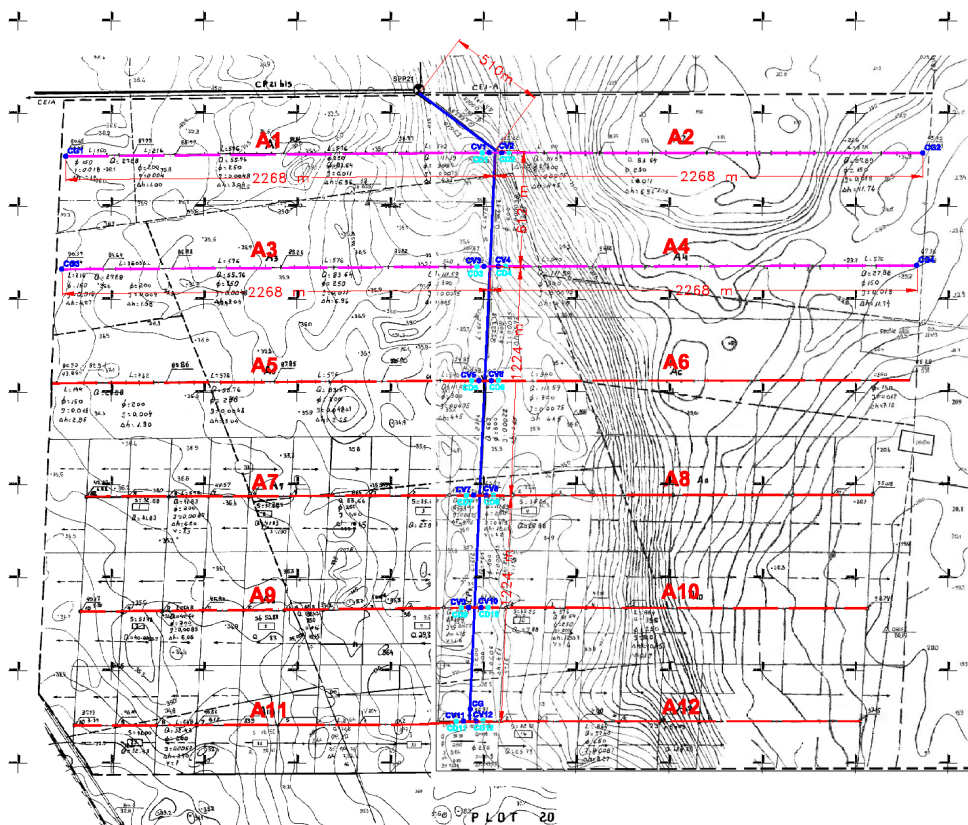


Figure 1. Master plan

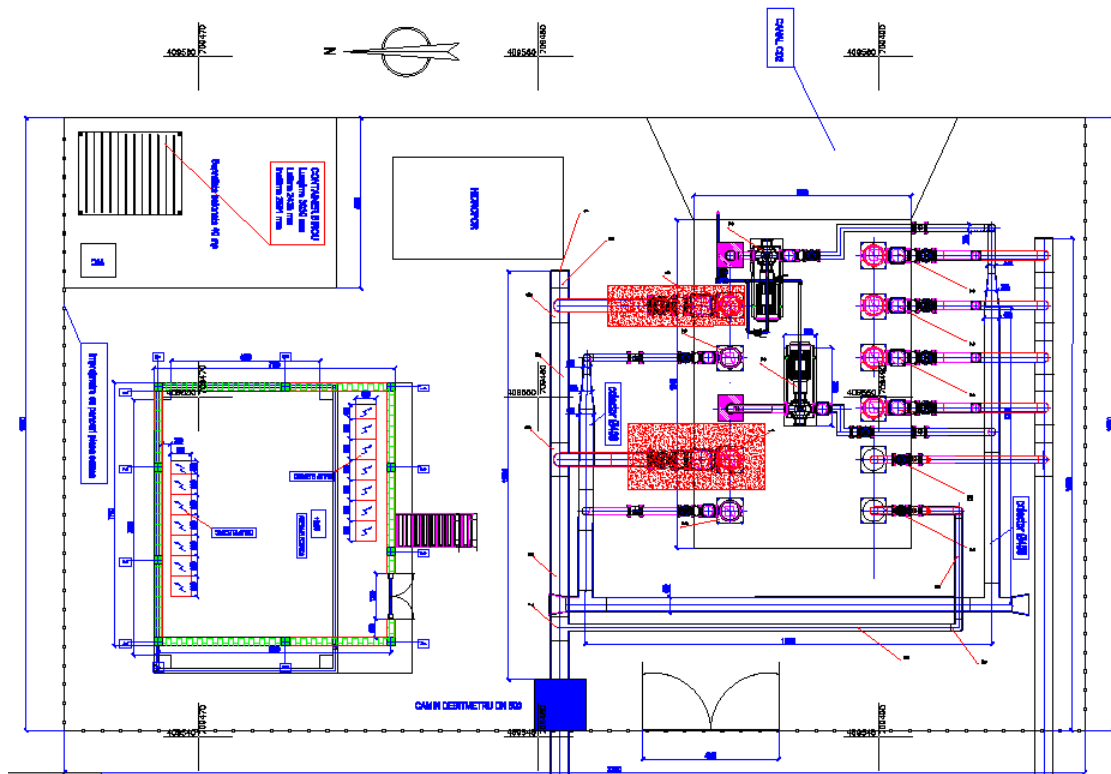


Figure 2. Pumping station SPP21

2. RESULTS AND DISCUSSIONS

The following basic elements are known:

- net hydromode flow, $\lambda = 0.520$ (l / s · ha);
- the total area of the plots, $S = 1135$ (ha);
- overall yield, $\eta = 70\%$;

The gross flow of the antennas under the given

conditions is calculated with the equation:

$$Q = \frac{\lambda S}{\eta} \quad (1)$$

The calculations have been made and are presented below:

Antena	S (ha)	hydromode flow (l/sxha)	overall yield (%)	Flow (mc/h)	
SPP21	A1	94.583	0.52	0.7	252.94
	A2	94.583			252.94
	A3	94.583			252.94
	A4	94.583			252.94
	A5	94.583			252.94
	A6	94.583			252.94
	A7	94.583			252.94
	A8	94.583			252.94
	A9	94.583			252.94
	A10	94.583			252.94
	A11	94.583			252.94
	A12	94.583			252.94
Total	1135			3035.3	

The pressures were determined in the most unfavorable hypothesis when each section of the main pipeline supplies too much water to the downstream antennas.

The theoretical basis for calculating the loss of

load in general, in technical applications, is currently

used Chezy type formulas:

$$V = C\sqrt{Ri} \quad (2)$$

By replacing with the Manning relationship you get:

$$Q = \frac{1}{n} \frac{S^{\frac{5}{3}}}{P^{\frac{2}{3}}} \sqrt{i} \quad (3)$$

For circular pipes we have:

$$S = \frac{\pi D^2}{4}, P = \pi D \quad (4)$$

By substitution you get:

$$Q = \frac{1}{n} \frac{\left(\frac{\pi D^2}{4}\right)^{\frac{5}{3}}}{(\pi D)^{\frac{2}{3}}} \sqrt{i} = \frac{\pi D^{\frac{8}{3}}}{n 4^{\frac{5}{3}}} \sqrt{i} \quad (5)$$

$$K = \frac{\pi D^{\frac{8}{3}}}{n 4^{\frac{5}{3}}} \quad (6)$$

Hydraulic resistance:

$$M = \frac{l}{K^2} \quad (7)$$

Result of loss of pressure:

$$h_r = M Q^2 \quad (8)$$

The calculations have been made and are presented below:

Table 1.

Pipe	L (m)	D (mm)	K (m ³ /s)	n	M (s ² /m ⁵)	Q (m ³ /h)	hr (m)	Land share		Piezometric dimension		Presiune disponibila (mca)	
								upstream	downstream	upstream	downstream	upstream	downstream
SPP21 - A1,2	510	500	16.36	0.003	1.90	3035.3	1.35	33.00	30.50	93.00	91.65	60.00	61.15
A1,2 - A3,4	612	450	12.35	0.003	4.01	2529.4	1.98	30.50	34.50	91.65	89.67	61.15	55.17
A3,4 - A5,6	612	400	9.02	0.003	7.51	2023.5	2.37	34.50	35.50	89.67	87.29	55.17	51.79
A5,6 - A7,8	612	400	9.02	0.003	7.51	1517.7	1.34	35.50	35.50	87.29	85.96	51.79	50.46
A7,8 - A9,10	612	350	6.32	0.003	15.32	1011.8	1.21	35.50	35.50	85.96	84.75	50.46	49.25
A9,10 - A11,12	612	350	6.32	0.003	15.32	505.89	0.30	35.50	35.50	87.29	86.99	51.79	51.49

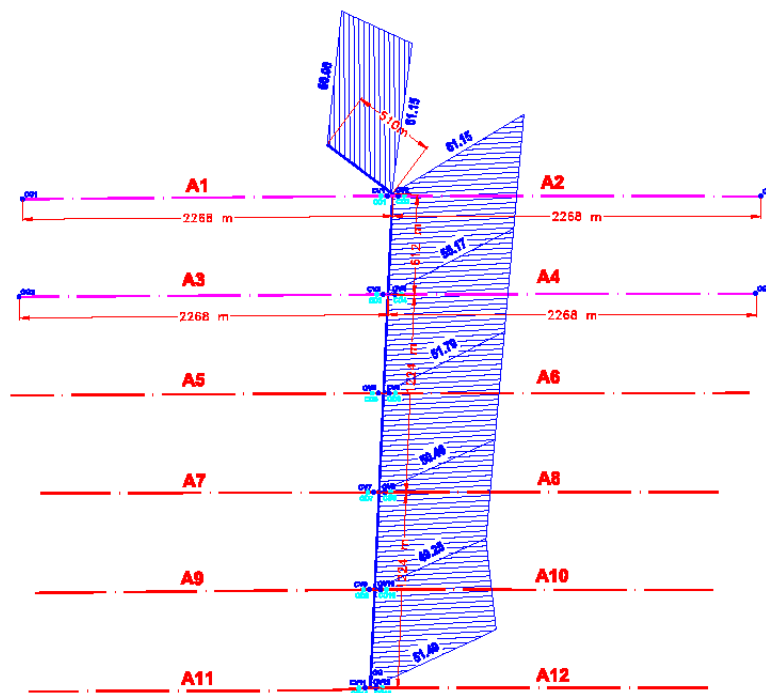


Figure 3. Pressure diagram

REFERENCES

- [1] Wehry, A. Pantu, H. 2008. *Amenajări hidroameliorative. Vol 1*, Timișoara Editura Aprilia Print. Timișoara
- [2] Man, E.T. (2014) *Drenaje vol I*. Ed. Orizonturi Universitare.
- [3] ANIF, *Arhiva 1975 -2019*
- [4] *Proiect tehnic SPP21 Murgeanca*, 2019.