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# LOCAL IRRIGATION SYSTEM USING THE WASTEWATER STORAGE TANKS IN RĂUŢI – SÂNMIHAIU GERMAN DRAINAGE UNIT, CENEI, TIMIS COUNTY

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***Abstract***

*This paper aims to present the main features of a local sprinkler irrigation system in the draining unit Răuţi – Sânmihaiu German, Timiş county, using wastewater storage tanks from pig breeding complex Cenei that are transformed in water reservoirs used for application of irrigation on a land area of 450 ha.*
*The paper presents the pumping station, adduction from the river Bega-Veche, the storage tanks, the high pressure pumping station, the piping network for irrigation and the irrigation equipment.*

***Key words****: irrigation, storage tanks, drainage unit, irrigation equipment.*

## INTRODUCTION

In context of aridisation and drought periods appeared in the western part of Romania, in order to increase crop yields on agricultural land, is found necessary to apply irrigation.
The studied area of 450 ha is located in the south-east of Cenei locality, Timis County, and south of the BegaVeche River.
The analyzed surface spatial overlaps with part of the draining unit Răuţi – Sânmihaiu German territory administered by the National Agency for Land Reclamation, Timis Branch, and in the same area are found the wastewater storage tanks under the administration of National Society for Land Reclamation, Banat Branch.
The existing works were originally designed and built in order to use wastewater from pig farm in Cenei for farmland irrigation, but the works were only partially completed.
Due to the environmental legislation, currently, the storage tanks can no longer fulfill their initial role so that it was brought to discussion the possibility of using them for another purpose, that of water reservoirs.

## MATERIALS AND METHODS

In order to use the storage tanks for irrigation they must be brought to the initial projected characteristics.

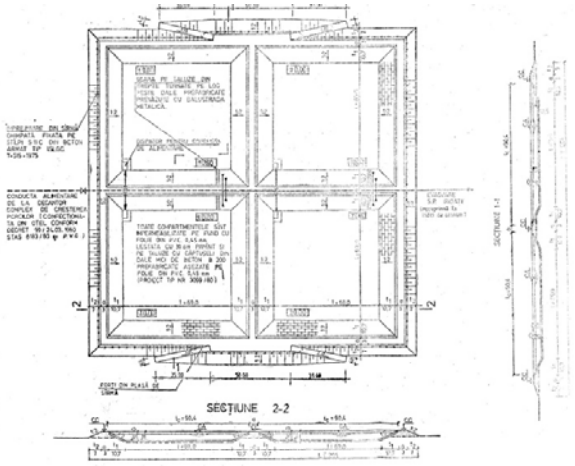


Figure 1.Initial design of storage tanks

Since the water supply source is different it is necessary to redesign the local irrigation system including the pumping station from the BegaVeche river, the adduction pipe, the high pressure pumping station, the piping network for irrigation and the irrigation equipment.

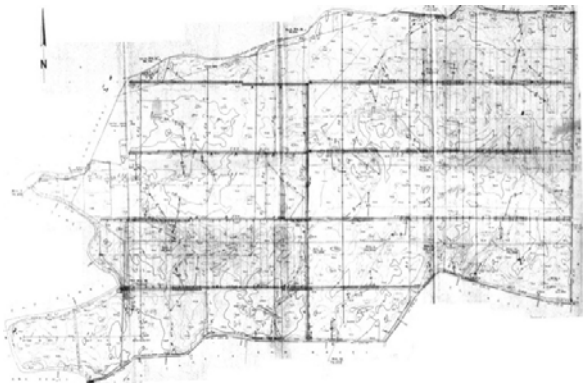

Figure 2. Initial design of the irrigation scheme

Regarding the average rate of multiannual monthly flow on Bega-Veche River it was examined the Cenei section.
For calculating the irrigation parameters were taken into account two crop rotations: wheat (planted on 25 % of the total surface) and corn (planted on 75 % of the total surface).
The irrigation scheme is calculated for a period of six months for each crop rotation.

Table 1.Irrigation scheme for crop per month

| Month / Crop | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|
| wheat | 1 | 2 | 0 | 0 | 0 | 0 |
| corn | 0 | 0 | 0 | 2 | 2 | 0 |

The irrigation norm are taken from tables based on experimental research in various stationary fields, representing monthly average daily consumption for the main plant during the growing season and irrigation water requirements for crop in research fields.

Table 2.Irrigation norm for crop

| Crop | wheat | corn |
|---|---|---|
| H (m) | 0,5 | 0,75 |
| Ni (mc/ha) | 1500 | 2800 |

Qi - the entire surface flow rate is calculated with the following equation:

$$Q_i = q_i \cdot Si \text{ [l/s]}$$

In which:
Si – irrigated area;
qi - watering module determined by the formula:

$$q_i = \frac{m_{STAS}}{3{,}6 \cdot Ti \cdot ti}$$

Ti - 10 days – the time that is given to irrigate the entire area occupied by crop „i'';
ti – 20 hours - working time per day;
$m_{STAS}$: - for wheat is 500 mc/ha;
- for corn is 700 mc/ha.

## RESULTS AND DISCUSSIONS

The entire surface flow rate - Qi results are presented in table 3:

Table 3.Results for entire surface flow rate Qi

| Crop | wheat | corn |
|---|---|---|
| Si (ha) | 112,5 | 337,5 |
| $q_i$ ( l/s/ha) | 0,69 | 0,97 |
| $Q_i$ ( l/s) | 77,62 | 253,12 |

The hidromodul calculated in the month with maximum consumption is about 0,486 l/s/ha, in July or August.
Total flow required to be installed in the high pressure pumping station is about 219 l/s, in which case the hidromodule at the high pressure pumping station will be about 256 l/s·ha.
Calculations were made for a loss of 5 % on the pipeline network.
The pumping station will be dimensioned to cover the use of water from the high pressure pumping station, so that in the reservoirs will be a reserve of water at all time.
After the wastewater storage tanks will be rehabilitated to their use as reservoirs, the maximum amount of water storage will be around 400.000 mc.
The pumping station on the river Bega-Veche will consist of a heat pump unit mounted on a platform.

Table 4.Characteristics of pumping station

| Pump type | Consumption (l/ora) | Diam. intake / Diam. pressure side (mm) | Characteristic points (l/min x bar) | Engine type |
|---|---|---|---|---|
| I22R501 Scova Italia | 16,2 | 250/250 | 6000 x 1,8<br>11000 x 1,7<br>15000 x 1,1 | Iveco 4 cil. 100 CP |

The aduction pipe is made from PAFSIN and has a length of 900 m, from the river Bega Veche in straigth line to the reservoirs.

Table 5.Characteristics of the aduction pipe

| Length (m) | Pipeline type | Dn (mm) | |
|---|---|---|---|
| | | 400 | 500 |
| 900 | PAFSIN PN 6 SN 10000 | 96 | 432 |
| | PAFSIN PN 16 SN 10000 | - | 372 |

The high pressure pumping station will consist of six heat pump unit mounted on a platform.

Table 6.Characteristics of high pressure pumping station

| Pump type | Consumption (l/ora) | Diam. intake / Diam. pressure side (mm) | Characteristic points (l/min x bar) | Engine type |
|---|---|---|---|---|
| MPI 043 | 20,1 | 150/125 | 3500 x 10,4<br>4000 x 10<br>4500 x 9,2 | Iveco 6 cil. 134 CP |

The number of pump units that are connected to distribution pipeline network depends, knowing that a pumping unit provides favorable conditions for simultaneous operating of five irrigation installations type RAINSTAR 100equipped with rain wing AS 50 Ø 6,4 mm and with a rainfall nozzle of 25 mm at a pressure of 6 bar at hydrant.

Figure 3.RAINSTAR 100 irrigation installation

The pipeline network for irrigation is composed of two main distribution pipes and six secondary distribution pipes.

Table 7.Characteristics of the pipeline network

| Pipeline | Length | Pipe type | Dn (mm) | | |
|---|---|---|---|---|---|
| | | | 315 | 355 | 400 |
| A 1 | 600 | PAFSIN PN 16 SN 10000 | - | - | 600 |
| A 1-1 | 985 | PEHD PE 100 SDR 17 PN 10 | | 985 | - |
| A 1-2 | 950 | PEHD PE 100 SDR 17 PN 10 | 950 | - | - |
| A 1-3 | 1600 | PEHD PE 100 SDR 17 PN 10 | - | 1600 | - |
| A 2 | 620 | PAFSIN PN 16 SN 10000 | - | - | 620 |
| A 2-1 | 1600 | PEHD PE 100 SDR 17 PN 10 | - | 1600 | - |
| A 2-2 | 260 | PEHD PE 100 SDR 17 PN 10 | - | 260 | - |
| A 2-3 | 1450 | PEHD PE 100 SDR 17 PN 10 | 1450 | - | - |
| TOTAL | 8065 | - | 2400 | 4445 | 1220 |

Because the irrigation works overlap with part of Răuţi – Sânmihaiu German drainage unit the pipeline network will have to under cross the drainage channels.

Table 8.Characteristics of channels under cross

| Pipeline | Number of under cross | Channel | Pipe type | Dn of under cross (mm) |
|---|---|---|---|---|
| CA | 3 | Hcn 1022/1 (CS5) | PAFSIN PN 16 SN 10000 | 500 |
| | | Hcn 1030/1 (CS6) | PAFSIN PN 16 SN 10000 | 500 |
| | | Hcn 1057/2 (CP2) | PAFSIN PN 16 SN 10000 | 400 |
| A 1 | 2 | Hcn 1057/2 (CP2) | PAFSIN PN 16 SN 10000 | 400 |
| | | Hcn 1030/1 (CS6) | PAFSIN PN 16 SN 10000 | 400 |
| A 1-1 | 1 | Hcn 1057/1 (CP1) | PEHD PE 100 SDR 17 PN 10 | 355 |
| A 1-2 | 1 | Hcn 1022/1 (CS5) | PEHD PE 100 SDR 17 PN 10 | 315 |
| A 2 | 2 | Hcn 1035/1(CS7) | PAFSIN PN 16 SN 10000 | 400 |
| | | Hcn 1047/1(CS8) | PAFSIN PN 16 SN 10000 | 400 |
| A 2-1 | 1 | Hcn 1035/1(CS7) | PEHD PE 100 SDR 17 PN 10 | 355 |
| A 2-3 | 1 | Hcn 1057/2 (CP2) | PEHD PE 100 SDR 17 PN 10 | 315 |
| TOTAL | 11 | - | - | - |

The new irrigation scheme will cover an area of 450 ha around the reservoirs.

Figure 4. New design of the irrigation scheme

## CONCLUSIONS

The studied area of 450 ha can be irrigated using the rehabilitated wastewater storage tanks avoiding environmental problems and using Bega-Veche River as a water source.

The new irrigation scheme can be implemented using innovative materials and irrigation installations making it easier to operate and to maintain.

Taking into account that part of the work should only be rehabilitated the investment costs will be reduced.

Because the analyzed surface spatial overlaps with part of draining unit Rauti–Sanmihaiu German territory irrigation works can give a higher efficiency.

Works will not negatively affect Rauti–Sanmihaiu German drainage unit, maintaining the draining management plan at maximum efficiency, ensuring maintenance for the channels network.


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