WATER SOURCE AND ACCUMULATION BASIN FOR SPRINKLER IRRIGATION ON 800 HA IN OTELEC (IOHANESFELD) AND GIULVĂZ (IVANDA), TIMIS COUNTY, ROMANIA

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Abstract

The paper presents a new source of water for irrigation using the network of drainage channels located in the operational drainage system Teba - Timisat, over which will be implemented the irrigated area. The water source is the Bega river, with appropriate quality for irrigation, through the rehabilitation of an existing old water intake. Works will include unclogging of drainage network of channels on a length of 12.9 km, repairing of weirs at the confluence on the route of water in the irrigation transport channel and other drainage channels. This network of drainage channels will work during autumn, winter and spring for drainage, and for irrigation in summer. The paper presents a case study for a privately irrigation arrangement which will irrigate an area of 800 hectares, of which 400 ha in stage 1, located near Otelec (Iohanesfeld) and 400 ha in stage 2, located near Giulvăz (Ivanda), in Timis County, Romania. The water intake was studied in two variants. Water for irrigation will be collected from the irrigation transport channel in a accumulation basin for storage, were through a pressurizing pumping system is pumped into the network of underground pipes and distributed to crops through modern mobile sprinkler instalations consisting of 4 central pivot instalations and 2 instalations with hose and drum longitudinal propelled.

Key words: mobile irrigation instalations, irrigation system, water resources, water quantity, water quality, climate change

INTRODUCTION

In the Banat Plain 50 years ago groundwater was high in many areas, even swamp, and there was excess moisture so there were implemented drainage facilities and in dry years agricultural production was good by ensuring water needs in aquifers by capillary raising to the crops.

Accelerated drainage in the last 45 years, following the work of damming, regularization of rivers, construction of other drainage works, resulted in lowering the groundwater so that in dry years in this area has become absolutely necessary to apply irrigation to give secure harvests, independent of climatic evolution. Increased global warming in the last decade imposes priority to the irrigation facilities to make sustainable agriculture.

In this context it is necessary to identify limited surface water courses source in the Banat Plain (Mures, Bega, Timis) and a small amount of groundwater. The existence of a network of dense drainage channels that

during spring would allow the accumulation of a quantity of water to be used for the application of the first watering for some areas related to them, and in summer when is a lack of water, where technical condition allows the slope of water flowing direction to be changed, to be supplied with water for irrigation. So it be fulfill the dual role, drainage during autumn, winter and spring, and in summer ensuring the transportation of water for irrigation to surfaces to be irrigated.

Starting from the systematization / completion / rehabilitation of drainage channels in the area of 450 ha property owned by SC AGROTOT2000 SRL, the challenge was to find the source of water for irrigation on a surface of 800 ha.

MATERIAL AND METHOD

Sprinkler irrigation arrangement at SC AGROTOT 2000 SRL consist of a total of 800 ha composed of a body of 400 ha (stage 1) on administrative land of Otelec commune in Iohanesfeld village and another body of 400 ha (stage 2) on administrative land of Giulvaz commune in Ivanda village. Owner of the arrangement is the beneficiary of arable land in tabular and extratabular of Iohanisfeld village, Otelec commune, Timis County, covering the total area to be irrigated in stage 1.

The proposed site for this project is located extratabular in the western part of the village Iohanisfeld, near road link towards Ivanda village, county road DJ693B. Water source is a water intake rehabilitated on the river course of Bega River at kilometer 8 (Figures 1 and 2).

According to STAS 4273-88 the work is covered by Class IV of the importance, Category 3, life span – final and after functional role - secondary. The operating mode of use is 20 hours / day, respectively 50 days / year.

In the Timis County predominates temperate - continental climate with temperatures falling within the monthly average of – 2.0° C to – 10.0° C in January and 21.0° C to 22.0° in the months from July to August, with an average 10.0° C to 11.0° C.

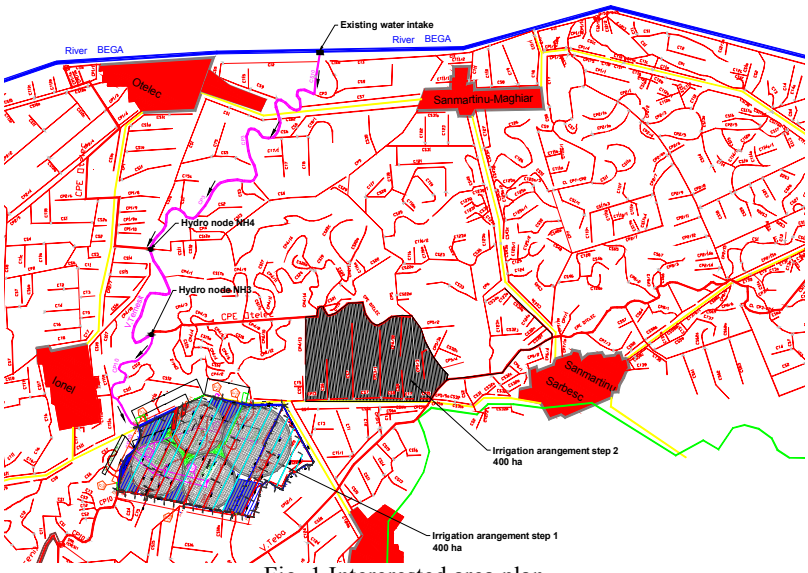

Fig. 1 Intererested area plan

In stage 1 workings will be carried to the water feed channel from Bega river at km 8, which is proposed to be rehabilitated, on the route of existing drainage channels in Teba - Timisat drainage system which are under the current exploitation of ANIF Timis - Lower Mures Territorial Branch, on the accumulation of water consisting in a basin of 3.1 ha with a possibility of accumulation of water volume of 120.000 cubic meters, respectively on the underground pipeline network of the body 1 consisting of an area of 400 ha in Ionel locality, on the pumping station and acquiring of mobile sprinkler irrigation equipment.

From the water source, Bega river at km. 8, the course of the water supply channel for irrigation is: Bega outlet channel, CS10 channel, CP3 channel, hydro node NH3, Temesit Valley, hydro node NH4, CP10 channel to the confluence with CS7 channel, where water is discharged into the accumulation basin.

Drainage channels proposed for clogging to ensure their functionality for irrigation - CS10 channel, CP3 channel, Temesit Valley, CP10 channel - during the summer have the following characteristics:

- Total channels length L = 11.939 m;
- Surface channel S = 114.845,94 sqm footprint;
- The protection zone 2 x 2,00 x L S= 47.755,93 sqm;
- The volume of excavation V= 21.426,71 m.

For art works along the water supply route from the outlet to the accumulation basin are necessary to execute the following works:

- Rehabilitation of culverts - 7 pieces: 2 pieces - Dn 600, 3 pieces - Dn 1200, 1 piece – Dn 1400, 1 piece - Dn 1800;

- Realization of flat weirs on side connection channels - 20 pieces - b = 0.5 m;

- Rehabilitation of bridges - 2 pieces;

- Rehabilitation of hydraulic nodes - 2 pieces;

It is worth mentioning that the supply channel route - CP3 channel, Temesit Valley, CP10 channel - after irrigation season - April, May, June, July, August - will resume the role of drainage channels.

In stage 2, through another project will be realized underground pipeline network for 400 ha in the second irrigation body in Ivanda village and the purchase of mobile sprinkler irrigation equipment (Figure 1).

It was calculated the water channel transmission capacity and respectively element calculation of irrigation system: irrigation rate (Ni), watering rate (m), interval between waterings (T), watering plan, irrigation hidromodulul for corn crop and calculation of the necessary water flow of water intake (Q), irrigation hidromodulul of the entire system and schedule of uncoordinated watering, determination of flow and volume of water required for corn crop throughout the growing season, sizing of water reservoirs.

The irrigation arrangement using mobile sprinkler equipment provides irrigation works for an area of 800 ha, resulting in a volume of water required for irrigation of 960.000 cubic meters / year in the final stage, of which 480.000 cubic meters in Stage 1, which represents a rate of 555,55 intake l / s in the final stage, of which 277,77 l / s in Stage 1, water flow intake from Bega river will be captured in 20 days / year during the growing season from April to September, representing an average annual rate of intake of 30.44 l / s in the final stage, of which 15.22 l / s in Stage 1 (Figures 2, 3 and 4).

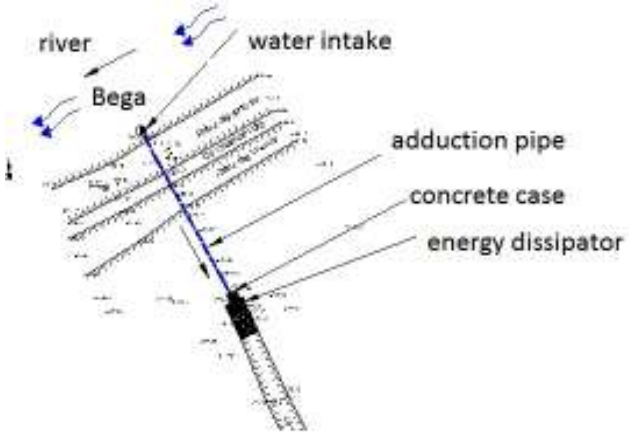

Fig. 2 Water outlet plan on the Bega river at kilometer 8

Version 1 of water intake - gravitational capture by under-crossing (Figure 3).

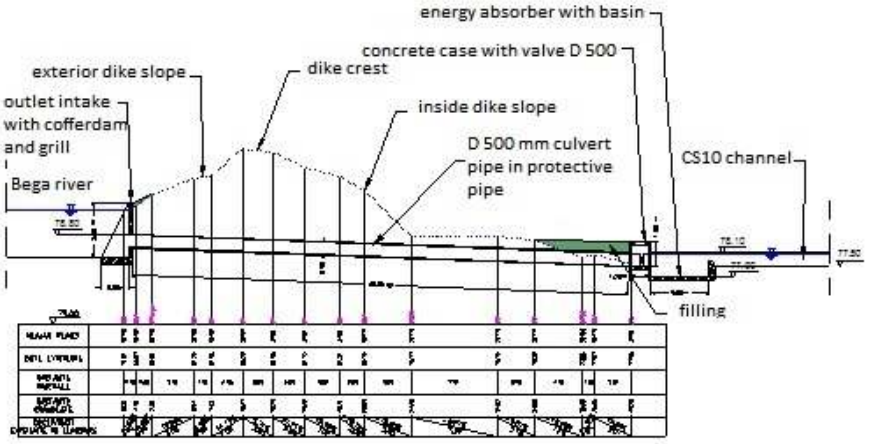

Fig. 3 Version 1 - gravitational intake by undercrossing

Version 2 of water intake - siphoning overpass capture (Figure 4).

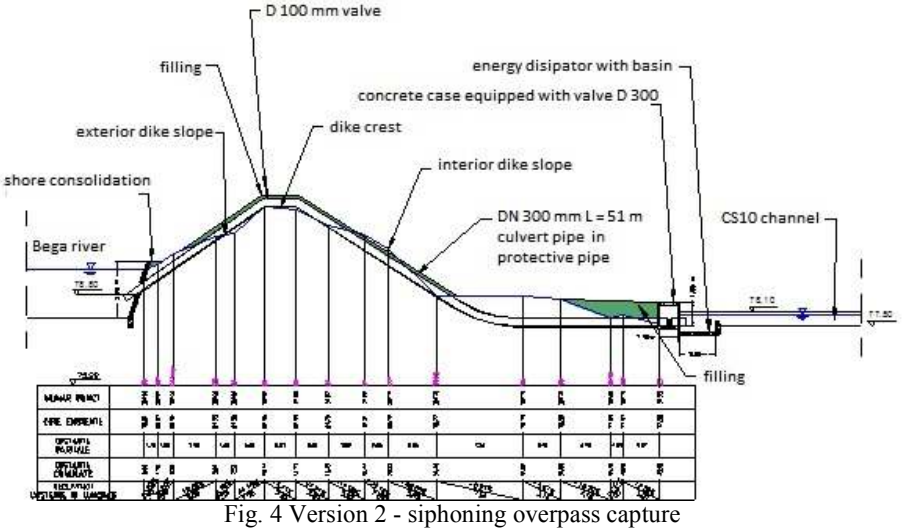

Fig. 4 Version 2 - siphoning overpass capture

It is expected that downstream to mount an installation for measuring water flow intake - hydrometric concrete parament mounted on energy absorber downstream on CS10 channel. Calibration of installation - MIRA hydrometric - will be made by Water Basin Administration Banat.

Irrigation water reservoirs (Figure 5) will be done by earthworks, leveling and compaction in the lateral of CP10 channel located at an

elevation of 77.30 m. The excavations will be carried out in depths between 1.0 and 4.0 m. Reservoirs area is about 31350 square meters and is water volume is 120000 cubic meters with an average depth of 4.0 m.

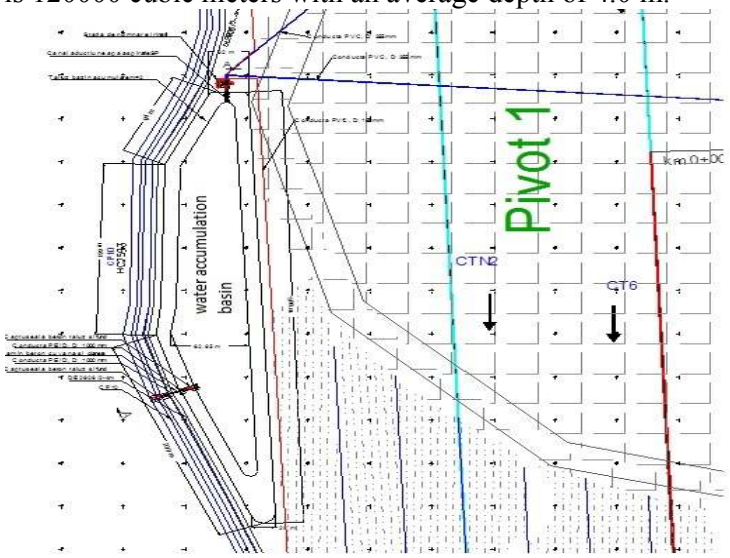

Fig. 5 Water irrigation accumulation basin

Basin excavation is conducted in the following characteristics:

- inside facing slope of 1:3;
- elevation of the terrain is 77.30 m;
- maximum water level elevation is 77.00 m.

Basin water supply pipe from CP10 channel will have the following caracteristics: HDPE, PE80, PN6, D 1000 mm, L = 30.20 m.

On the pipe will be constructed an concrete case 2.0 m x 2.0 m x 4.10 m equipped with access and stairs. Inside the concrete case will be installed the following accesories:

- A manually operated valve DN 1000 mm (butterfly centric rubber flap valve PN65, geared manual);
- A check valve DN 1000 mm counterweight;
- A reduction D= 200 mm HDPE;
- A manually operated valve Dn= 200 mm (rubber centric butterfly flap valve PN65, geared manual);
- A adapter with Dn 200 mm flange for connection to a hydraulic suction pump attached to a tractor.

In the intake zone of the CP10 channel of the water supply pipeline and discharge pipe to the accumulation basin is provided with concrete lining of 10 cm thickness and with a width of 2.0 m on both sides supported on a beam foundation 0.3 m x 0.5 m, laid on a 10 cm thick bed of sand.

RESULTS AND DISSCUSIONS

According to theoretical fundaments key curves were made for all drainage channels that will be used for water transport from the water intake to the accumulation basin. The following key curves are presented for the channels (Figure 6).

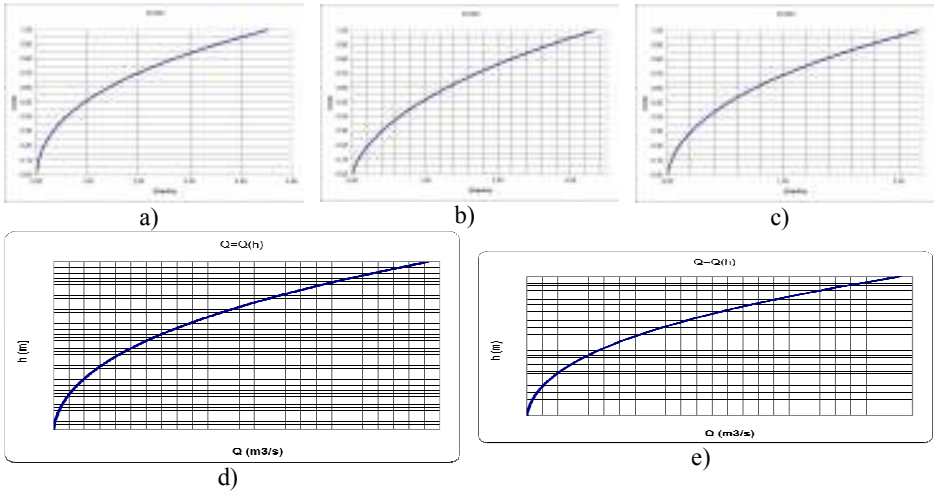

Fig. 6 Key curve for drainage channel
a) CS 10 - Km 0+000 ÷ 0+608 b) CP 3 - Km 0+000 ÷ 4+500
c) CP 3 - Km 4+500 ÷ 5+930 d) Temesit - Km 5+275 ÷ 7+846
e) CP 10 - Km 1+898 ÷ 5+346

CONCLUSIONS

By implementing this irrigation arrangement using the existing network of drainage channels, investment costs are lower and requires no additional earth excavating works which can lower agricultural land areas.

For measuring water flow hydrometric it is expected downstream to mount an installation for measuring water flow intake with an hydrometric concrete parament mounted on energy absorber downstream on CS10 channel. Calibration of installation - MIRA hydrometric - will be made by Water Basin Administration Banat.

Groundwater monitoring in the arrangement perimeter, which is comprised in Drainage Unit Temesit and on the route from the inflow on Bega river at kilometer 8 to CP10 channel, included in Drainage Unit East, are exploited by ANIF Timis - Lower Mures Territorial Branch and are available in the regulation of hydrogeology stationary which will be used for this purpose. This monitoring will provide data about evolution of the water quality and groundwater level in the landscaped area.

After the works implementation, contracts will be signed with the ANIF Timis - Lower Mures Territorial Branch for operation and maintenance of channels that will transport water, and with Romanian Water National Administration for water intake from Bega river.

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