

INTEGRATED MANAGEMENT OF WATER RESOURCES IN BERCA VILLAGE, BUZAU COUNTY

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Abstract

Integrated management of water resources approach promoted the development and management of water, land and their resources in order to optimize, balanced economic and social development without compromising the sustainability of ecosystems. The paper is presenting how water resources management was done in Berca community, from Buzau County, covering the full cycle of water use – from water intake of raw water, water treatment, water distribution, collecting waste water and discharging of treated wastewater in natural water bodies, and issues associated with the sustainable services of water supply and sewerage. In this work are presenting all the works contained in the systems of water supply and waste water, describing also the water treatment plant(WTP) and the wastewater treatment plant, under construction at present. Currently, the Berca village is supplied from groundwater sources, water treatment is made only through chlorination, the system works gravitational, and the wastewater treatment plant(WWTP) has a physico-mechanical level and a biological level treatment. Some public institutions and businesses in Berca and neighboring villages, have their own pre-treatment equipment - septic tanks of wastewater resulting from these activities, the wastewater from these tanks are discharged into the Berca WWTP. These systems are managed by the company SC APAPRIMA BERCA SRL, founded in 2011, with only one shareholder, the Local Council of Berca. In conclusion, proper management of water resources in Berca village ensures environmental protection and elimination of risk factors for human health.

Key words: integrated water management, natural water bodies, water supply system, wastewater, sludge management, public health.

INTRODUCTION

Buzau County is located in the south-east part of Romania, with an area of 6,102.55 sq km, representing 2.6% of the country.

It occupies most of the Buzau River Basin, including harmoniously all forms of relief: mountains in north and plains in south, between them is located Carpathian hilly.

Maximum altitude records in Penteleu peak (1,772 m) and the minimum in the valley Călmățui (40 m).

It is bordered to the North-West with Brasov and Covasna counties, North-East with Vrancea County, at East with Braila, at South with Ialomita County, and in the West part with Prahova County.

In terms of administrative organization, Buzau County has 85 villages, of which 2 municipalities - Buzau and Ramnicu Sarat, 2 cities – Nehoiu and Pogoanele and 81

communes with 481 villages. The City of Buzau is the capital county.



Figure 1. Buzău County

The objective under study is situated mainly on the administrative territory of Berca and

Vernesti, commune Berca is located in the central area of the county at 29 km from the town of Buzau and is disposed on the side of the River Buzau. This valley has developed in the area a lot of terraces were are located the 13 villages of the commune.

Being on a lowland, the relief predominantly hilly, is completed with a relatively small riverside. 2% of the commune Berca area is included within the protected area of the Riverside Buzau.

Berca commune is formed of 13 villages, namely: Baceni, Berca (residence) Cojanu, Joseni, Mănăstirea Rătești, Pâclele, Pleșcoi, Pleșești, Rătești, Satuc, Tâțârligu, Valea Nucului și Viforâta.



Figure 2. Berca village

According to the census of January 2011, the population of Berca locality amounts to 8,534 inhabitants, lower than the previous census in 2002, when 9,602 inhabitants had registered.

Berca territory is crossed by 4 km of the national road, 20 km from the county road and 12 km of municipal road, all rehabilitated. The villages are served by 18 km of gas network, 15 km of cable TV network, which is in expansion.

In terms of local tourism here is the most interesting reserves mixed (geological and botanical) in Romania, namely the mud volcanoes from Pâclele Mari and Pâclele Mici. Berca village is also known for its authentic Plescoi sausages, which are trade-marked recognized at European level.



Figure 3. Pâclele Mari Mud volcanoes

The approach of an integrated management of water resources promotes the development and coordination of water, land and their resources, in order to optimize and balance economic and social development, without compromising the sustainability of ecosystems.

Development policies can not be effective without taking into account water resources. The concept of integrated management of water resources requires, in contrast to traditional water resource management, an integrated approach to both their physical and technical level and at the level of regional planning and management. The level of integration is the catchment area forming a natural unit of water resources.

The most important aspects of system development of water resources are, as follows:

- physical aspects of sustainability - which means maintaining the natural cycle of water and nutrients;
- environmental sustainability - "zero tolerance" for pollution exceeding the self-purification capacity of the environment; no long-term effects or irreversible effects on the environment;
- social sustainability - maintaining water requirements and the need for insurance payment of water resources;
- economic sustainability - economic support measures that ensure a high standard of living in terms of water for all citizens;
- institutional sustainability - maintaining the capacity to plan, manage and operate the water resources system.

After Romania's accession to the European Union, Romanians must benefit from the same standards for the water services within the other

EU countries, that have drinking water of good quality and sufficient quantity of water, clean environment and protection from floods and droughts risks.

However, in our country, water management is still facing numerous problems, especially regarding the provision of water services to meet the European standards. Among these difficulties, it is mentioned:

- lackof water sourcesof qualityneeded for water supply to some urban and rural areas;
- precarious situation of infrastructure of centralized water supply and sewerage systems;
- improperly quality of water flowing on some sectors, of lakes, groundwater in numerous hydrostructures, mainly due to pollution by sewage and industrial wastewater;
- insufficient hydro facilities in rural areas;
- large agricultural areas and numerous localities at risk of flooding;
- difficulties in mitigating the effects of drought due to the impossibility of using the entire surface arranged for irrigation;
- intensified erosion and land degradation.

Proposed investments by local authorities and providers of water and wastewater services



Figure 4. Approach for integrated management of water resources

must cover the full cycle of water use - from capturing and treating raw water, distribution of treated water, wastewater collection and discharge of treated wastewater into natural bodies of water, and issues associated with the provision of sustainable water supply and sanitation, as shown in the figure below.

This approach to integrated water management is in full compliance with current national legislation, and also meets the provisions of the relevant EU Directives for the water supply and sewerage development.

It is understood that such an integral approach is associated with high costs for investments that have been prioritized and developed in multiple phases of implementation, depending on financial resources available locally or at county level.

MATERIALS AND METHODS

The source for water supply of localities of the Berca commune, is groundwater abstracted by drilling medium depth wells, as follows:

- Wells in the area Vernesti, which has 10 medium depth drilling wells, completed at a depth of 150-153 m each, and located north of Vernesti village, on the right side terrace of Buzau River, upstream of the confluence with the Niscov stream.



Figure 5. Drilling area

- Source Valea Nucului, consisting of two drilling wells in Valea Nucului, one well is working and the second is under conservation.

- Source Niscov, consisting of three drilling wells, of which 1 well is under operation feeding the village Niscov, and two are under conservation.

The water from groundwater sources (from those three fronts) is treated in a semi-automatic chlorination station, located within the water treatment plant Vernesti. The plant is equipped with chlorination device and warehouse for chlorine tanks. The water treatment is made with chlorine, with an injector in the water storage tank, so after treatment, free residual chlorine should not exceed 0.5 mg / l water.

From Vernesti water source (intake Vernesti) to household water Vernesti basin storage, water is transported through a pipe culvert steel in length of 1,800 m, of which 800 m pipeline

steel Dn 358 mm, and 1,000 m steel Dn 521 mm.

At the household water Vernesti, a water tank of reinforced concrete is placed, which is playing simultaneously roles, as basin pump discharge of drilling and tank suction for the pump station of Vernesti, the basin has a storage capacity of $V = 500$ mc.

The pumping station Vernesti is placed in a brick building with the following destinations: pump room, board room, warehouse, workshop, dressing room, transformer station.



Figure 6. Vernesti pumping station

Water supply in the localities benefiting from the analyzed components, is done by pumping water through pumping station Vernesti and repumping station Satuc, in culvert underground pipes totaling a length of about 39.9 km.

Culvert pipe water from the pumping station Satuc to Berca, Satuc, Plesesti, Plescoi, Valea Nucului localities, is a steel pipe of $L = 11.2$ km length, of which:

-SRP Satuc culvert section Berca Dn 250 mm, $L = 1.9$ km in that branch network of water distribution to consumers (distribution pipes in Berca) totaling a length of 2.25 km.

-Section of water main in Satuc is of $L = 1.2$ km, in that branch network of water distribution to consumers (distribution pipes in Satuc), totaling a length of 2.65 km. For industrial culvert pipe through the manhole connection; other consumers - public and private are supplied from a pipeline pumping station Satuc.

-Section Berca – Plesesti with Dn 100 mm and $L = 1.3$ km in that branch network of water distribution to consumers (distribution pipes in Plesesti) totaling a length of 1.2 km.

-Section Plesesti - Plescoi with Dn 100 mm and $L = 4.7$ km in that branch network of water

distribution to consumers (distribution pipes in the town Plescoi) totaling a length of 7.2 km.

- Section Plescoi – Valea Nucului with Dn 150 mm and $L = 2.585$ km in that branch network of water distribution to consumers (distribution pipes in Valea Nucului) totaling a length of 2.4 km.

Berca pumping station is a building of brick masonry of structure from reinforced concrete, with ground floor and basement, with a total area of 174.77 sqm. The building is divided into rooms that serve as pumping station operation: the pump room on the ground floor, storeroom, transformer station and pump room in the basement.

Overground tank for pumping station Berca is made of concrete with a capacity of 1,000 cubic meters and it is in conservation.

The distribution network currently measures about 18 km of pipelines only for Berca and will be completely rehabilitated; it is composed in 88% of old pipes from steel leading to high losses of water and pressure. Also the new polyethylene of high density (PEHD) pipes with diameter of Dn 110 mm, which is over 4km, are undersized and must be replaced at least 50%.

Of the four localities, only Berca has a collection system and wastewater discharge. The system contains sewerage networks - collecting secondary, wastewater treatment plant and main wastewater collector. It collects wastewater from subscribers connections (population - apartment buildings and individual households) from Berca.

The sewerage network length is approximative 7,500 m, it is made of concrete pipes with Dn 300-500 mm and discharges the wastewater in the wastewater treatment plant, located on the left side of the River Buzau.

The entire sewer system in Berca works gravitationally. In the main sewer pipeline routes are placed concrete manhole, through them are connected main wastewater collection pipes from various areas. Also are located homes line for maintenance of sewerage networks (cleaning, water pressure wash valves, etc.)

Rainwater collected from a network of gullies street of the village, is taken from a rainwater collector which works gravitational with directly discharge into the River Buzau.

The wastewater treatment plant is located on the left side of the River Buzau, in the village Plesesti, on an area of 5,200 square meters, and serves Berca commune.



Figure 7. Berca WWTP

The existing sewerage system presents deficiencies in operation, such as:

- sewage and stormwater systems from Berca should be in a separate system, but actually work in some areas, as an unitary system, so in the wastewater treatment plant arrives also stormwater, and in addition in different areas these sewerage is undersized.

- the existing wastewater treatment plant works without biological stage, leading to overcoming the conditions imposed to treated wastewater discharge into the River Buzau.

The components of existing wastewater treatment plant are: grill with desander, grease separator, flowmeter, primary sedimentation tanks, aeration basin, secondary sedimentation tanks, mud pumping station, chlorine contact basin, mud drying platform.

RESULTS AND DISCUSSIONS

Currently, the rehabilitation of the water supply system, sewerage and wastewater treatment for common Berca, are the following:

- uptake rehabilitation, replacement of culvert pipe;
- rehabilitation of pumping station Satuc;
- replacement of pipes leading to the storage tank of 1,000 cubic meters volume, and its repairment;

- installation of two new pumping stations in the water network;

- resizing of all pipes in the network and replacement of undersized or life exceeded (very old steel pipe) with polyethylene pipes;

- fitting all the required flowmeters, valves and fittings.

At the wastewater treatment plant, the following works are included:

- replacing existing grill, corroded, low-efficiency retention with a new grill with the distance between bars of 10 mm, made of galvanized steel or stainless steel;

- the existing desander which has low volume of retention time and efficiency relatively low in retention of sand will remain, but will be completed with a module for mechanical treatment;

- grease separator will be kept, but it will be used with blowing air from a compressor;

- replace existing aerators biological cleansing, with purification module, with two parallel lines and the possibility of future expansion;

- quitting platforms mud existing and mud will be pumped periodically from the collecting mud basin to mud dewatering container, where mud is collected in bags and stored on the drying beds that will be rearranged as a platform for temporary storage containers and filter bags;

- quitting the chlorine contact tank and treated water to be disinfected with ultraviolet;

- the existing operating pavilion with two more containers, including a laboratory, reagent storage tank, a bathroom and a cloakroom.

Following the rehabilitation of the wastewater treatment plant, it is expected to have an increase in the wastewater treatment capacity and compliance with quality parameters of treated wastewater within the limits imposed by current standards, respectively NTPA-001.

All investment objectives presented above, fall into the approved urban planning and land management development for the area.

These water and wastewater systems in the Berca village are managed by SC APAPRIMA BERCA S.R.L, company founded in 2011 with only one shareholder, the Local Council of Berca Commune.

CONCLUSIONS

The existence of a centralized water supply and wastewater sewage system, including a wastewater treatment plant, is contributing to the development of the commune, with all its component villages, with the following advantages:

- elimination of risk factors for human health;
- ensuring environmental protection;
- creating better conditions of living that would lead to stabilization of the population and reducing migration of the inhabitants;
- attracting potential investors;
- the possibility of economic development by activating old occupations or creating new activities;
- the development of public services, which would lead to employment of local human work force.

Works with potential environmental aggression (earthworks, installation, fitting, PVC pipes, metal and reinforced concrete) will be done only in intravillan area and are insignificant taking into account their dispersion area, similar in extravillan area.

Waste resulting from the work site will be properly collected in bins, and these will be evacuated to the nearest landfill. Any household waste resulted from the exploitation of the system are collected in a suitable container and disposed of in landfills.

It can be appreciated that all objectives achieved or in progress will have a positive

influence multivalent for rural residents and for the ecology and environment of Berca Commune.

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