

Reconstruction of WWTP Nižná

The Nižná Waste Water Treatment Plant was reconstructed in the Water Supply and Sewerage Project of the Orava Region, Stage 2. The objective of the project was to ensure the necessary capacity and to remove nutrients in accordance with the requirements of Government Regulation no. 269/2010 and Council Directive No. 91/271 / EEC on the treating of municipal waste water in the new Commission Directive No. 98/5 / EC and Regulation of the European Parliament and of the Council No. 1882/2003 / EC.

The waste water treatment plant was built in Nižná nad Oravou in 1991 as a mechanical and biological waste water treatment plant for the waste water of the Tvrdošín district, the town of Trstená, the municipality of Brezovica and Nižná and also for treating of waste water produced by local industrial sides. In the time of building the mechanical-biological treatment plant, the water treatment requirements were different, the increased removal of nitrogen and phosphorus was not a requirement. The need for WWTP reconstruction was created due to the current requirements for increasing the quality of the treated water in the nitrogen and phosphorus indicators, as well as due to the modernization of the technological equipment and the increase of its capacity.

The course of the construction

The reconstruction of WWTP Nižná was divided into two stages. The first works started in March 2014. In the first phase of the reconstruction, the following objects were reconstructed, respectively has been built up: bypass of the pumping station (PS) with relief, entrance PS, mechanical pre-treatment facility, one from the pair of circulation activation tanks, sludge recirculation PS, both clarifiers, effluent channel and a part of sludge treatment.

The first stage of the reconstruction was completed in May 2015 when the WWTP was put into the trial operation.

In the 2nd stage of reconstruction, the second circulation activation tank, sludge storage tanks, transformer station and landscaping were completed. The deadline for complete reconstruction was set for November 2015.

Description of the technological line of the Nižná WWTP

The planned capacity of WWTP is 26 000 PE (population equivalent). WWTP has been designed as a mechanical-biological treatment plant with simultaneous nitrification and denitrification and increased phosphorus removal. The concept of intensification and modernization envisaged the maximum utilization of existing WWTP building structures.

The waste water from Tvrdošín, Trstená, Brezovica and Nižná is treated at Nižná WWTP. Waste water is fed by a single sewer system. The canalization network is also connected with industrial water, especially food industry, of which the share of the load of WWTP is approximately 35%. Treated waste water is discharged into the Orava river.

Waste water is fed to the plant with a sewage pipe DN 1 000 into the first object - a bypass PS with a relief. The task of this object is to ensure that the maximum hydraulic capacity $Q = 400 \text{ l / s}$ of the subsequent mechanical stage is not exceeded. Waste water flow above 400 l / s is relieved directly into the recipient. From the bypass PS, the wastewater leads to the gravel trap, where the heaviest parts of the wastewater (gravels, dredging material) are captured. The retained gravel is picked up by the grapple on the runway and stored in the container. The waste water then flows through a rough, hand-scraped screens into the intake tank of the inlet PS, which is equipped by four sludge pumps with an automatic regulation of pumped volume- so called Prerostal system

The task of the inlet PS is to raise the wastewater to such an extent that enables its gravitational flow through the WWTP's technological line. From the inlet PS, waste water is pumped to the beginning of the mechanical pre-treatment facility. Near the gravel trap, a tank for the facial waste water is located. These waters are pumped before the sand trap.

Mechanical pretreatment

In the mechanical pretreatment facility, 3 automated fine screens are installed in three parallel chutes to ensure the capture of the undissolved particles over 6 mm. The trapped material is conveyed by a common threaded conveyor into a hydraulic press, which drains the material and then pushes the pipe into the container. Waste water is then led into two parallel aerated sand and grease traps. Captured sand is pumped onto the common transfer bridge to the sand separator, where it is separated from the water. From the separator, the sand is passed through the threaded conveyor into the container. The trapped grease is swept away by the rails installed on the bridge to the grease reservoir. The last part of the mechanical pre-treatment facility is a relief chamber which ensures that the capacity of the biological stage is not exceeded. Waste water flow over 200 l / s bypasses to the shaft before flood PS, is mixed with biologically treated wastewater and discharged. The mechanical pre-treatment facility is also contains a blower room with two blowers for sand and grease traps and a three blowers for the biological treatment stage.



Assembling of sand and grease trap
Inžinierske stavby/ Engineering constructions 2/2016



Activation tank

- INFLUENT, FAECAL WATER
- CLARIFIERS
- MECHANICAL PRE-TREATMENT
- EFFLUENT AND MEASUREMENT
- ACTIVATION TANKS
- SLUDGE MANAGEMENT

ACTIVATION TANKS

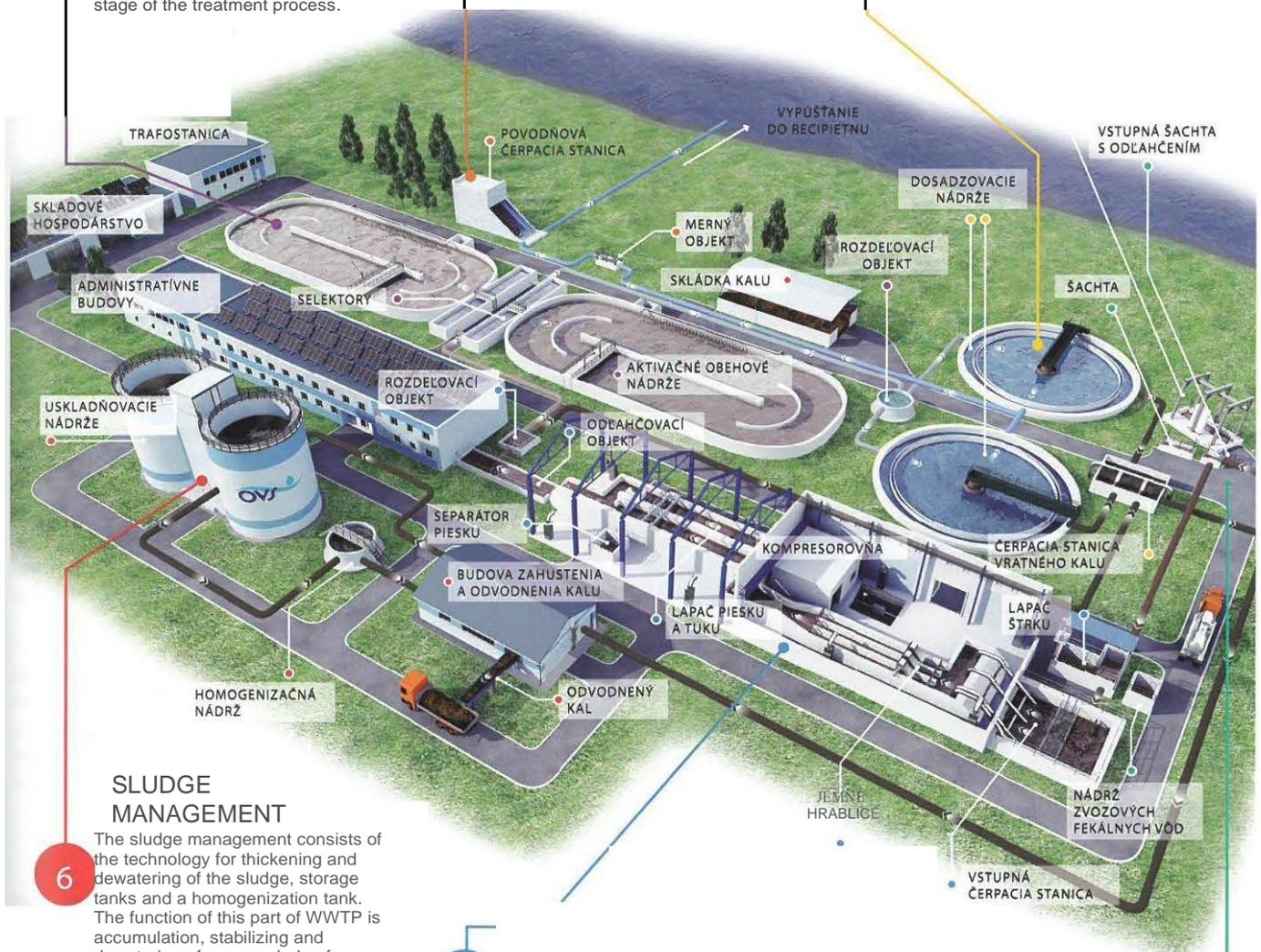
Mechanically pretreated waste water flows into two lines of biological stage of WWTP which consists of anoxic selectors and circulating low-loaded activation tanks. The principle of treating resides in the removal of organic pollutants and nutrients with the activated sludge. Activated sludge is subsequently separated in the next stage of the treatment process.

MEASUREMENT AND EFFLUENT

Biologically treated waste water gravitationally flows into the clarifiers, than through the measurement object into the recipient where the concentration values for discharge are monitored. In the case of the high level in the recipient, flood pumping station will be in use

CLARIFIERS

Biologically treated water flows from the clarifiers through the drain line into the recipient. The sludge is pumped from the bottom of the clarifiers back to the activation tanks. In the process the sludge concentration gradually increases naturally, and therefore part of the sludge is drained as excess sludge for further processing into the sludge management.



SLUDGE MANAGEMENT

The sludge management consists of the technology for thickening and dewatering of the sludge, storage tanks and a homogenization tank. The function of this part of WWTP is accumulation, stabilizing and dewatering of excess sludge from the process of wastewater treatment.

2 MECHANICAL PRE-TREATMENT

Mechanical pre-treatment serves as the first step of treating waste water. Gravel trap, machine-scraped screens, sand and grease trap and the sand separator ensure the capturing and removal of floating and drifting substances (gravel, wood, paper, organic waste, sand, grease) from the wastewater.

1 INFLUENT, FAECAL

Waste water is being fed to the WWTP through the sewer into the entrance shaft with relief. From here it flows further to mechanical pre-treatment. The tank for faecal water is used for collection of waste water brought by auto tankers





Assembling of the pump



Activation tank

Biological stage

Mechanically pre-treated waste water flows from the relief tank to the distribution tank before the biological stage. The wastewater is mixed here with recirculating sludge which is pumped from sludge PS and is divided evenly into two parallel lines of the biological treatment. In the biological stage, organic matter and nutrients are eliminated by the activity of mixed culture of microorganisms (activated sludge). Each biological line consists of a selector blended with three immersed hyperboloid mixers, a circulating activation tank, and one circular secondary clarifier. The upstream selector enhances biological phosphorus removal. The circulation activation tank is mixed with a pair of slow-moving propellers and at the same time is alternately aerated with a fine bubble aeration system. The compressed air is produced by three blowers installed in blower room. By alternating the ox and anox conditions in the circulation tanks, the process of simultaneous nitrification and denitrification is ensured - nitrogen removal process with the removal of organic pollutants.

Basic parameters WWTP Nižná

Investments :

Technological part ca 1 500 000 €

Electro-technical part ca 500 000€

Technological parameters

Capacity of WWTP:

Average inflow, no rain period Q24:

Max inflow during rain period:

Capacity of biological stage:

Volume of selectors:

Volume of circulated activation tanks:

Sludge age:

Dry matter sludge production:

Stabilized thickened sludge production:

Dewatered sludge production:

Compressed air for activation tanks:

Ferric sulfite consumption (40% solution):

Consumption of flocculants for sludge dewatering:

The process of biological phosphorus removal is supported by chemical precipitation, with the 40 percent ferric sulfate solution which is stored in a double-jacketed plastic reservoir of 28 m³ and dosed by a dosing pump assembly into the effluent from the circulation activation tanks. Separation of the activated sludge from the treated water takes place in a pair of circular settlement tanks. The settled activated sludge is withdrawn from the bottom of the two tanks and pumped back to the beginning of the biological stage via the recirculated sludge PS into the distribution object before the biological stage. Treated water flows from settlement tanks through the measurement object and flood PS into the river.

In the process of biological treatment, a further activated sludge is produced. In order to stabilize its steady concentration in the biological stage, a fraction must be withdrawn from the system as so called

excess sludge. Excess sludge is treated in sludge management facilities. First, it is mechanically thickened on a belt thickener and then stored in a pair of sludge storage tanks that are hydraulically and pneumatically mixed. The sludge stabilization process continues in the storage tanks, followed by the thickened and stabilized sludge being pumped onto a belt press to ensure its mechanical dewatering. The dewatered sludge is temporarily stored in a storage facility in the WWTP area before its final export for further processing. The whole process of wastewater treatment at Nižná waste water treatment plant is fully automated with on-line monitoring of the basic process parameters and remote control of individual technological units from the operator's workplace the WWTP, where the entire WWTP technological line is visualized. The MaR and ASRTP systems are in line with current global trends in municipal waste water treatment technology management.

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Miroslav Tatara, Igor Kordoš, Marián Bilanin and Pavol Fitko work in ČOVSPOL

Reconstruction of waste water treatment plant in Nižná

The WWTP Nižná has been reconstructed in the framework of the project Water supply and public sewer in the region of Orava, stage 2. The aim of the project was to ensure the necessary capacity and to remove nutrients in compliance with the requirements of the Government Regulation No 269/2010 and with the provisions of Council Directive 91/271/EEC concerning municipal waste water treatment as amended by the Regulation (EC) No 1882/2003 of the European Parliament and of the Council.

26 000 PE

70 l/s

400l/s

200l/s

600 m³

10 000 m³

26 days

1 900 kg/d

35 m³/d

7 m³/d

7 200 m³/h

200 l/d

7 kg/d