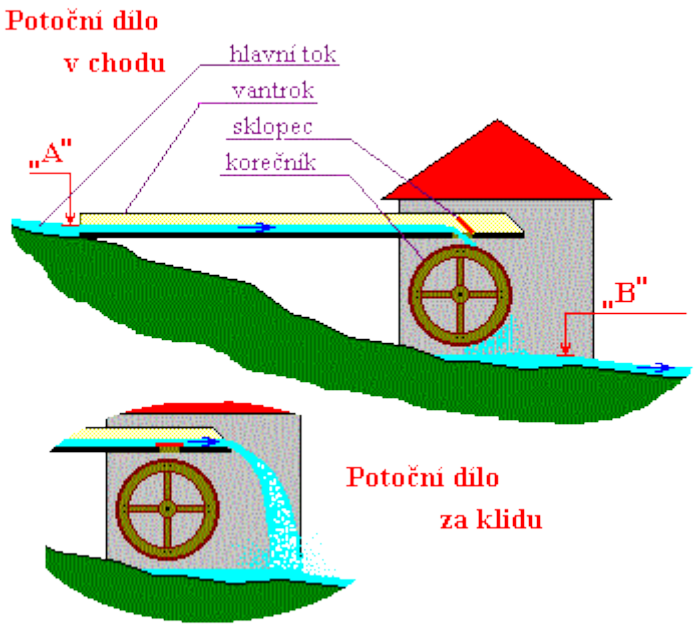
Distribution of the waterworks

1. Stream waterworks
   It is used on small streams to drive low-end devices
2. Weir waterworks
   It uses the backwater through the weir
3. Derivative waterworks
   It uses a bypass for the main backwater flow through the weir
4. Low pressure waterworks
   For drop to about 8 m
5. Low pressure waterworks with pressure feeder
   For small heads with concealed supply channel.
6. Combined waterworks
   It takes advantage of individual buildings.

Stream waterworks

Waterworks uses the level difference between points A and B. The gradient is obtained by sampling all the water from a high location of the main stream. Water is taken directly without gates, weir or similar objects. All buildings stand right next to the main stream. It is used as a full water profile without modification.



This work has been used in the past only for the sub-offices (local mills, churns, and the output washboards), which used a local creek flowing from the side. Water flows continuously, without the possibility of accumulation.

If there is no water motor used, the water is transferred by "**vantrok**" (trough) behind it. Water supply to the motor used to be solved by "**sklopec**" (plate-like valve at the bottom of the vantrok). When the stream overflows, vantrok must be able to safely accommodate this

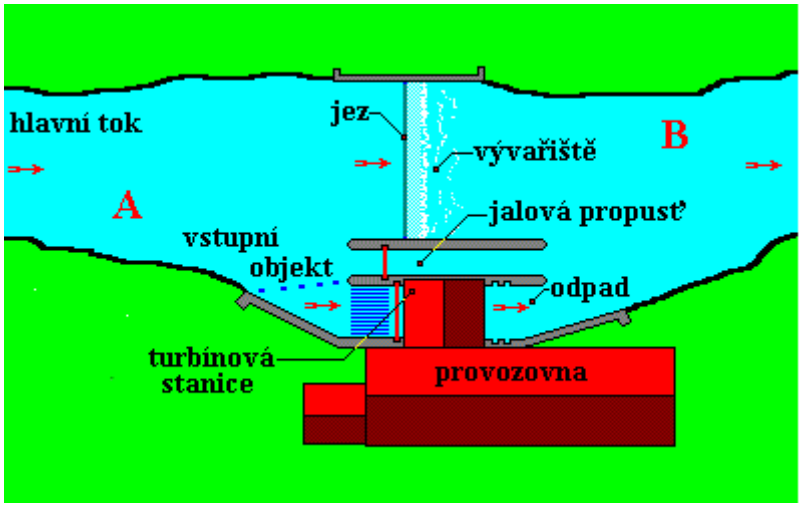
amount. It was used when the work was seasonal. The first part of vantrok was removed during out of order period and the water flowed by the original channel. Today, this solution is not used too much.

The advantage is its simplicity, the use of full flow.
The disadvantage is the dependence on the strength of the flow. If there is too much water, it can be damaged ..

There is a well-known proverb: Stupid as a vantrok.

Weir waterworks

Waterworks uses the level difference between points A and B. The entire slope is obtained by swell (by increasing levels) of water in the weir. The engine room of this type of work is right on the banks of the main stream. Water is drawn immediately to the dam and back returns for its plunge pools. The weir must be high. All buildings located directly in the main flow. This eliminates long drive and waste channel. This work is suitable for low heads and large flows. Water storage can be used only within the backwater of the weir. Compared to differentiator water work, there are small demands on the built-up area of land.



Water works in the lowlands can be thus dealt like that. Facilities are structurally easier; however, they are more vulnerable to flooding. The construction and repairs must be carried out at a constant flow of water. Water flow can be diverted.
The advantage is the possibility of partial accumulation, stable performance, suitable for powerful machines.
The disadvantage is the inability to divert the flow of work. If there is too much water, there is a great risk of water flooding of the building premises.

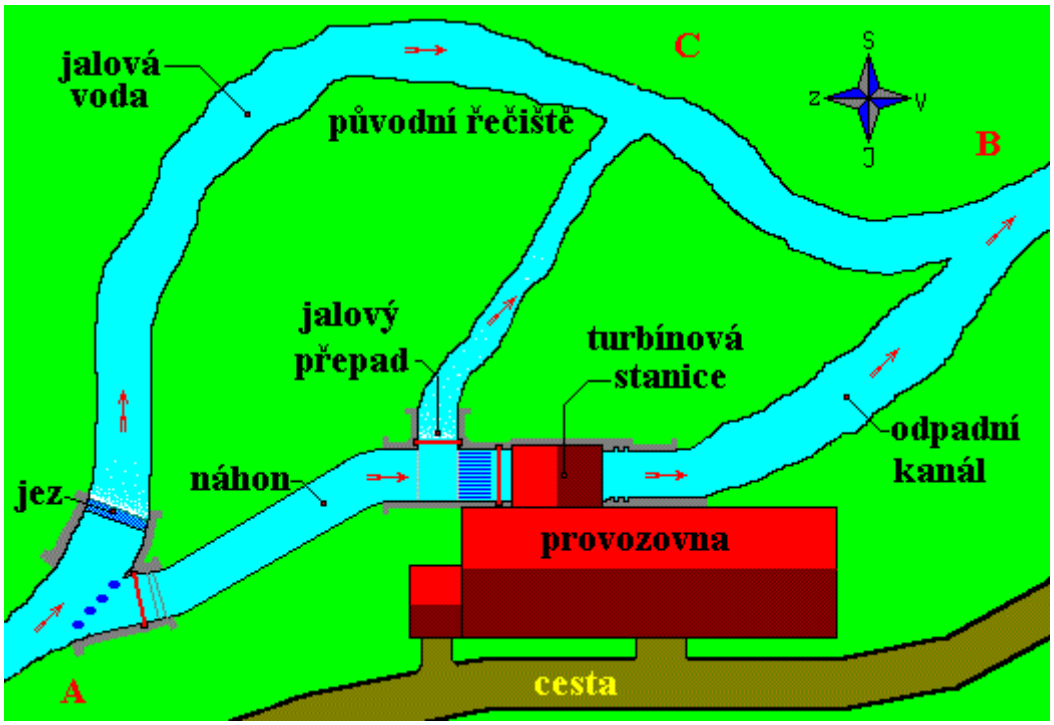
Distribution of waterworks

Derivative waterworks

Waterworks uses the gradient difference between "A" and "B." Engineering for the derivation of this type is outside the main stream. Water is supplied through the drive and returns back by waste channel. There are no structures and interventions outside the weir and diversion structure. The weir does not have to be high. There can be just such a height that the water can be collected in the drive (from 0.2 meters).

All gradient for water motor is derived by almost horizontal leadership drive, while the original riverbed drops significantly. Waste channel is handled similarly. Therefore, the water under the water turbine is significantly lower than the water table at point "C".

The vast majority of small dams were solved like that. The advantage was that only the necessary amount of water it led to the establishment, which was more protected during flooding. The downside was laborious maintenance of a long drive.



This simple solution was not always sufficient so that it was necessary to choose more complicated systems. Water was often collected on one weir, but the race got through several water parts below them in the cascade. The cost of construction and maintenance of water-raising devices was divided among other owners. Water that was once purified on the first bar screens served to the others. It was also possible to make it just with one accumulation tank and use it for more workshops. There use to be (as it is typical with most co-ownerships) some disputes. There was a rule that for a particular section a particular owner is responsible.

The situation at three mills that were built one after another...

for the section from **the weir to the first part**
responsibility of the owner of the first mill
for the section of the **first work to the second one**
responsibility of the owner of the second mill
a section from the **second to the third work**
the responsibility of the owner of the third work
for the **third section of the work back to the original flow**
the responsibility of the owner of the third work (he had a greater range of maintenance because he had already received water that was cleansed by other users and thus he had less work on "česlice")

It was also ordered that nobody can stop or divert water without a reason. In some cases, several cascades followed behind.
The advantage is sustained surge, bypass capability at high water, better control of the flow through the turbine, it is possible to conclude individual branches

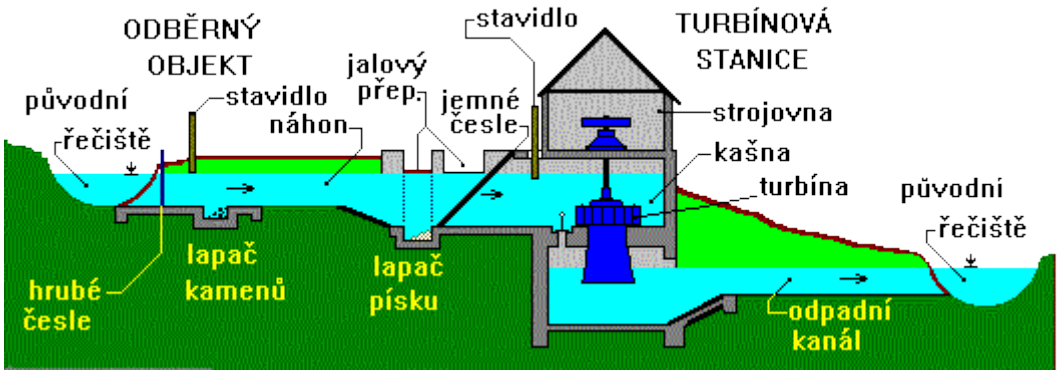
The disadvantage is the greater portion of land and the maintenance of the waterworks is more demanding

Distribution of waterworks

Low-pressure waterworks

This type of water project is built to drop about 8 meters. Turbine fountain would have been too deep for larger drops. In this case it is better to use a pressure feeder (pipe).

Scheme of the low-pressure water work



Low-pressure piece normally consists of:

- Water-raising device (weir)
- sampling object
- Influx (drive)
- Reactive overflow
- equipment to remove contaminants (screens)
- shutoff (sluice gates)
- Open fountain with a water engine
- exhaust duct

Besides, it can be fitted even with a hydroelectric storage reservoir. In that case In this case, this tank is between the weir and the sampling facility. Water from the weir is led to the sampling object, and then into the pipe. Pipe decreases in the slope, so that it is easier to get a gradient. Thus, water is brought up to the fountain. The water rises in the fountain (on the principle of connected vessels, apart from losses in the pipeline) to the same level as it is in the sampling object. Turbine is installed in the wall of the fountain or on the bottom. The water from the fountain flows around the circumference to the turbine tract. The turbine draft tube goes into plunge pools and goes into the waste channel. Waste channel again joins the original riverbed downstream. After closing the floodgates, the water from the fountain can be completely removed by lifting the cap on the bottom.

The fountain has to be high, especially when the water is brought from the storage tank, where the water table varies during the filling. It is sometimes provided by another hollow overflow. It than safely diverts the surplus of the water in case of a sudden closure of the turbine because the excess water flows through the pipeline into the fountain thanks to the inertia.

The arrangement of this type was used frequently in sawmills and industrial buildings, where the nature of work required free and flat terrain around the entire facility. This type of waterworks was often used in cities when originally open raceways were drained into the pipe.

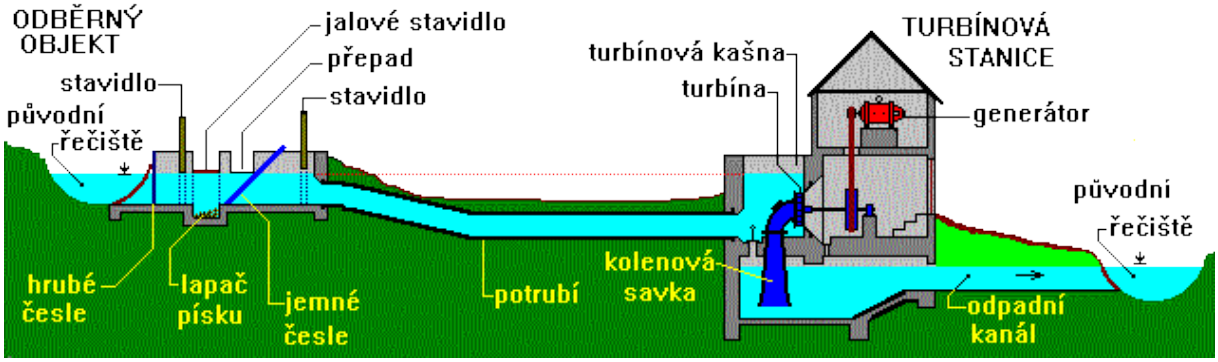
Distribution of water works

Low pressure waterworks with a pressure conduit

The turbine fountain and pressure feeder

This type of water project is constructed to drop to about 8 m in case when we cannot set up an embankment for a raceway distribution in the terrain.

Scheme of work



This low-pressure waterworks normally comprises:

• water-raising device (weir)
• sampling object :
with a device for removing impurities (screens)
the reactive overflow
the closing element (sluice)
• pressure feeder (pipe)
• Open fountain with a water engine
• exhaust duct

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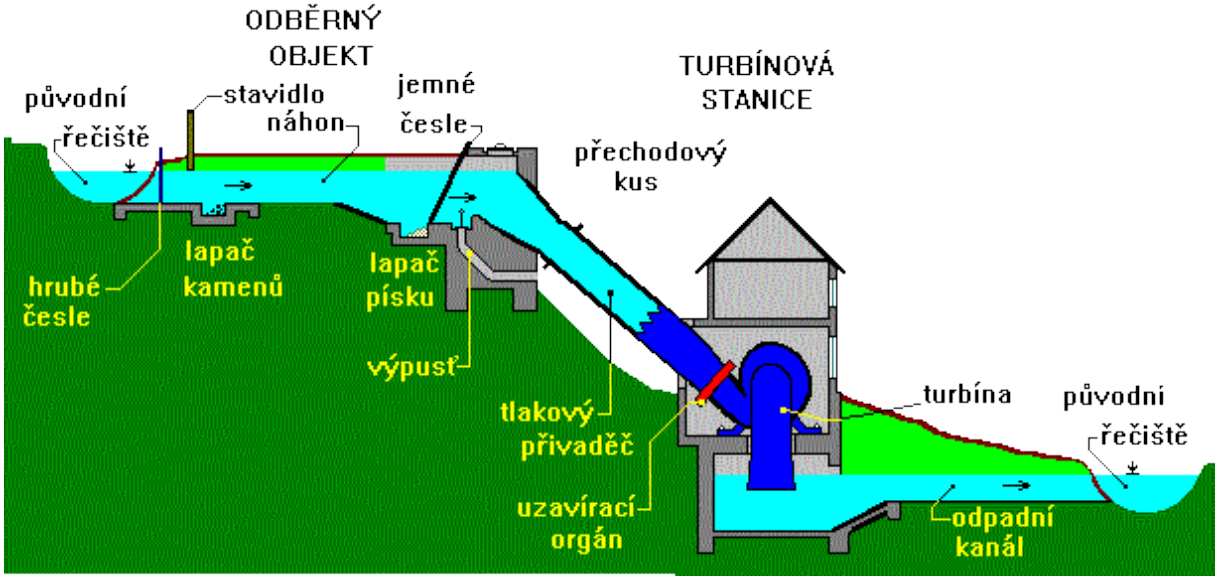
Distribution of waterworks

High-pressure waterworks

Waterworks is established for the high gradients having more than 8 meters, in some cases (when using spiral or Banki turbine) and for the smaller gradients too.

Scheme of arranging high-pressure waterworks:



A high-pressure waterworks normally consists of:

• water-raising device (weir)
• sampling object (screens)
• (open feeder)
• sink (water lock)
• the pressure conduit (pipe)
• shutoff device (valves)
• turbine
• exhaust duct

Moreover, the waterworks input can be equipped by a storage tank.

Normal arrangement of the waterworks is that that water from the weir is kept by open feeder road (raceway) along the contour of the valley hillside until it gets over the turbine station. At this point a buffer tank is established. From this tank a pressure pipe is lead to the engine room to the turbine. Water then freely flows from the turbine to the water drain channel and back to the original flow.

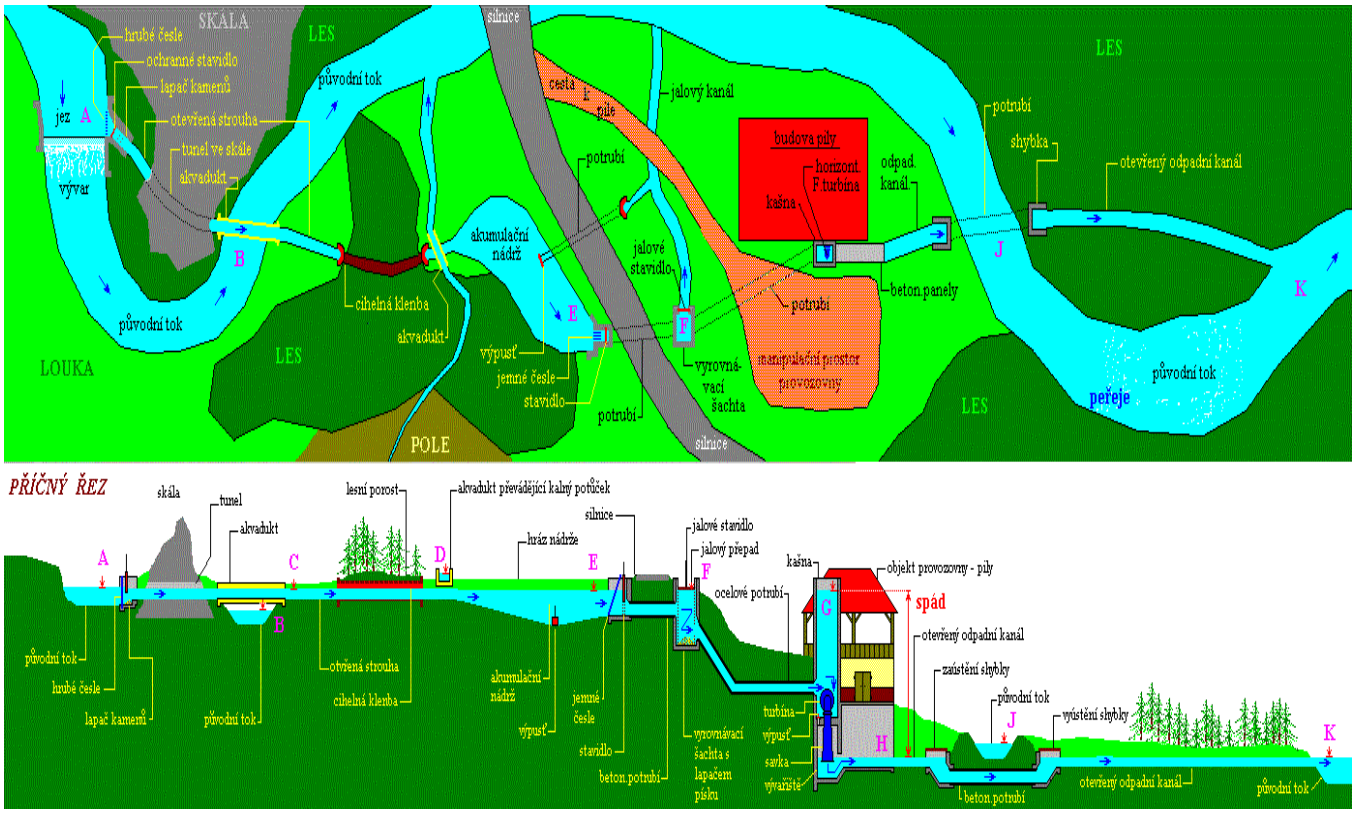
Distribution of the waterworks

Combined waterworks

Example of a more complex derivation low-pressure water work:
Not all the works are constructed in a typical way. The designer or builder is often forced by

the local circumstances to breakneck solution. In the past, especially during the gradual dissemination of the establishment, as it is in the following example:

Scheme of the waterworks



This work was established in the 18th century as a saw mill. The drive was water wheel, the working machine was a saw mill machine. Water was collected at the weir at the point " B". Drive skirted the forest along the river; the accumulation tanks were not needed. There was a **wooden vantrok** on the poles from the road to the saw. Water was returned in the point" J " .

Later, there was the **extension of the establishment** of two frame grids. The original drive was not sufficient. The work was installed by horizontal Francis turbine. Hydro potential flow, however, could not provide the required performance. The **Accumulation tank** was established and the gradient was raised. For this to happen, the drive had to be extended and laid up. The sampling site with a weir was built more upstream of the river.

The right bank did not allow the drive to lead so high. Therefore, it was transferred to the **aqueduct** and a short tunnel was penetrated by a rocky promontory. By increasing the drive, it meant its shifting to the side. Transmission of the forest cover was (to avoid the filth and the mud) covered by **brick vault**.

Right-bank tributary of the plateau, carrying a lot of mud after the rain, would clog the tank. Therefore, the water of the brook in section "D " was transferred by a **wooden bed** through its own drive and a free drain into the river was kept.

An unconventional solution of taking the water from the storage tank “E” deserves our attention. The tank does not have an overflow or reactive floodgate. There is just a **cap** at the

lowest point in case of the complete deletion (it is called a sail). Because the dam of the pond is also a path, the dam of the pond is not affixed to the tank itself. Water passes through the pipeline to the cache pit, " F ". There is a reactive floodgate in its wall. The shaft, which is currently the sand traps, leads pipes into the turbine fountain " G". Deletion of “vantrok” was obtained a free handling area in front of the saw. The level in the fountain (on the principle of communicating vessels) ascends to the same level as in the storage tank and in the balancing shaft. The horizontal Francis turbine is in the wall of the fountain. A suction cup passes into plunge pools.

The groundwater level was reduced below the lever in the section “J” to obtain a larger gradient. The waste channel was connected to the original stream behind the rapids in " K". The right rocky shore did not allow the prolongation and deepening of the waste channel. The creek was undermined. The waste crosses it in the separated grade.

The solution uses almost all available " tricks " that can be used in complicated situations. You can only meet them in very small parts in confined valleys in the foothills. It is everywhere, where there is not measuring momentum, but the river had not obtained enough water yet.

Distribution of waterworks