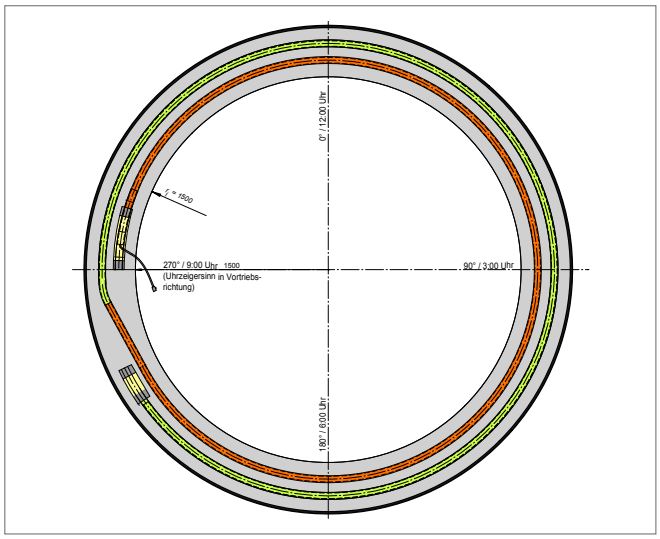
Hydropower penstock under many obstacles in the ground

The penstock of this Hydropower Plant with its hydraulically needed diameter of 3 m had to be placed in a demanding area with a lot of existing and partly sensitive periphery containing a railway line, roads and parking areas, other hydro power plants, sewers, electrical lines, storm water discharges and other. The big overburden of the hydraulically defined vertical alignment made an open dig construction method too expensive and would have provoked an unacceptable environmental impact, especially along the riverbanks. Under this boundary conditions Microtunneling was determined as the most suitable construction method to build the penstock.

However the geological and hydrogeological boundary conditions contained other challenges regarding the jacking operation. Especially the high abrasive mineralogy and the non-cohesive river gravel that had to be passed caused the need of exchangeable cutting tools, which had to be exchanged effectively, and well working Intermediate Jacking Stations (IJS) which were steadily used during the second half of the jacking distance. Thanks to the application of the Hydraulic Joint it was possible to use 4 m long jacking pipes also in the curves and without reduction of the admissible jacking force.



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AT A GLANCE

Project name	Cotlan Hydropower Plant
Project location	Rüti, Canton of Glarus, Switzerland
Purpose	Hydropower Penstock
Time of completion	2016 – 2017
Specialties	– Crossing of River and many underground obstacles – Curved alignment – Abrasive ground
Total length	639 m / 2096 ft (all in soft and saturated soil)
Pipe ID	3000 mm / 118,1 in
Pipe OD	3800 mm / 149,6 in
Alignment	Horizontal and vertical curve
Min. curve radius	500 m / 1640 ft
Pipe material	reinforced concrete
Pipe length	4 m / 13,1 ft
Geology & groundwater	Saturated debris; highly permeable, lose sandy / silty gravel with more than 20 % Quartz. In Groundwater.
Hydraulic Joint	JC120 and 224 / 3 and 2 loop. Admissible jacking force 17 800 kN
Guidance system	VMT SLS Microtunneling LT
TBM	Herrenknecht AVN 3000
Owner/Client	Cotlan Wasserkraft AG, Sätliboden, 8782 Rüti, Switzerland
Consultant / Designer	Jackcontrol AG, Glarus / Switzerland
Contractor	K-Boringen, Belgium

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monitoring microtunneling