J. KRISMER Handelsgesellschaft m.b.H
A - 6020 Innsbruck - Rum | Bundesstrasse 23 | Tel. (0043) 512/ 263800 | Fax. 263819
E-mail: office@krismer.at | http://www.krismer.com

Project Report

Channel Lining on the Bank of the Traun River in Schleißheim near Wels (Austria)

Fig. 1: Stabilised terrain - lower section
(Upward view from river)

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General project data

Client	Oberösterreich (Upper Austria) Energy Company AG A-4020 Linz, Oberösterreich (Upper Austria)
Design	Horst Felbermayr Bau GmbH Machstraße 7 A-4600 Wels J. Krismer Handelsgesellschaft m.b.H.
Installation	Horst Felbermayr Bau GmbH Machstraße 7 A-4600 Wels
Assignments	Lining of a deeply eroded trench that runs from the ditch of the Weißkirchen country road down to the Traun River, near Schleißheim/Wels Constructing a stabilised drainage channel fastened to a steep slope, to drain off surface water from the road down to the Traun River
Construction method	The existing erosion trench was converted into a drainage channel which was reinforced with the Krismer® System and filled with crushed gravel. Then, to guarantee stabilization and drainage, the surface was given the form of a funnel which was also secured with the Krismer® System.
Execution PERIOD	Spring - Summer 2000

Project volume

Total channel length (measured on slope):	~ 117 m
Width of the drainage channel:	~ 0.6 - 1.2 m
Total surface Krismer® System (funnel):	~ 700 m²
Total width of the funnel:	~ 6 m
Gradient of slope and channel:	~ 40°
Vertical height (difference of river/road level):	~ 75 m

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Initial Situation

To maintain roadways securely, rainwater must be properly drained away. This is done by building roads with a slight lateral inclination to lead water to roadside ditches where drainage troughs or gutters are installed.

Current legislation makes returning drainage water to the natural water cycle mandatory. Where possible, this usually happens immediately, by allowing water to seep out into the surrounding terrain where it is absorbed into the ground.

In recent times, global climate changes have caused an increase in severe weather conditions. The frequency and intensity of extreme rain and snowfall have grown steadily in many parts of Europe during the past years. Roadway drainage installations are directly affected by this since they were not originally designed to cope with the quantities of water brought on by new and higher degrees of precipitation; therefore they can no longer control drainage adequately to avoid heavy erosion damage to surrounding terrain.

In the "Traunufer, Wels" project described here, the uncontrolled draining of water from the roadway into a surrounding wooded area caused a deep vertical erosion trench to form. Over time, the trench grew continuously due to the large quantities of the surface water that flowed over it.

The eroded trench that developed along the steep terrain between the road and the Traun River was 117 m in length and had a depth of up to 1,50 m. Half of an adjacent forest maintenance trail was swept away by the water and access to the forest was limited.

In this area, close to the town of Wels, the Traun River is used for energy production and is hence dammed up to supply a hydroelectric power station. Through embankment erosion, the water often became muddy and the washing of fine sediment into the turbines caused damage to the power station.

Consequently the main tasks included the repair of the deeply eroded trench, the reconstruction of the forest maintenance trail so that it could be used again, and to convert the trench into a stabilised drainage channel with proper capacity to, in future, remove excess water from the road above, the forest trail and the entire slope surface.

The first solution that was considered was to line the trench with a rock filling made out of coarse river stones with an individual weight of approx. 1.000 up to 2.000 kg per stone.

The coarse rock fill would have started at the bank of the Traun River and run up at least to the level of the forest trail. For the section in between the forest trail and the road above, the installation of a drain pipe was planned, which would have allowed water to flow from the road directly into the coarse rock fill channel.

This option was deemed to be too complicated, due to the logistics involved in transporting such large blocks of stone with very limited access to the work site. The installation of the drainage pipe was also considered to be too complex and expensive.

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In addition, the entire project was to be executed with a minimum environmental impact, taking into account the high natural value of the landscape, which is used by local citizens as a recreation area.

This prompted the Felbermayr Construction Company to submit a specific proposal that offered the Krismer® System as the solution to solve the different problems that this job presented.

Construction proposal with the Krismer® System

- Conversion of the existing erosion trench to a drainage channel, width 0.60 m to 1.20m, minimum depth 1.0 m to 1.50 m;
- Filling the drainage channel with easy to deliver stone material, crushed gravel size 32 mm to 60 mm (max.)
- Stabilising of the draining surface with three-dimensional steel screen panels (J.K.S.), anchored to the ground with soil nails, forming a terrain funnel (opening width approx. 6 m)
- stabilising of the whole funnel with the Krismer® System as additional surface drainage for excess water in case of flooding.
- Applying humus and greening of the areas that are not permanently inundated with water, to guarantee the perfect reintegration of the construction work into the surrounding natural river landscape.

To meet these requirements, the "System Krismer® for Drainage and Channel Protection" was chosen as the most favourable alternative to meet the requirements of this installation.

Fig. 2: Excavation work to clean the eroded trench and construction of the new drainage channel.
Work was done with an all-terrain excavator and, in part, manually.

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Drainage Channel and Funnel Construction with the Krismer® System - System Structure

Construction – Drainage Channel

(after the slope surface was prepared)

- cover net: wire netting, type Maccaferri, mesh size 50/70 mm, wire size 2 mm, galvanised, fixed with steel clamps type Spenax 11 G 40

- first layer (top layer) Krismer® System: three-dimensional steel screen panels laid diagonally to the vertical fall line, type J.K.S. A02-80|1,5-FEZ, height = 80 mm, fixed with special T-steel nails (with welded-on hook and point), reinforced with galvanised distribution rods Ø 10 mm, type R10/2500 or R10/3700

- approx. 50 – 60 cm deep stone filling of the trench underneath the first layer of steel screen panels, stone size 32 to 60mm, quantity per running metre approx. 0,50 m³

- second layer Krismer® System: three-dimensional steel screen panels laid vertically to drop line of the slope, type J.K.S. A02-80|1,5-FEZ, height = 80 mm, fixed with special T-steel nails (with welded-on hook and point), reinforced with galvanised distribution rods Ø 10 mm, type R10/1200

- crushed stone filling, approx. 50 – 60 cm deep - quantity per running metre approx. 0,50 m³

- third layer Krismer® System: same as second layer (vertical)

- geotextile, weight approx. 200g/m²

Construction – Drainage Funnel (Integration of the Channel into the Landscape)

(after the slope surface was prepared)

- approx. 3 cm humus with seeding to develop a compact layer of turf

- cover net: wire netting, type Maccaferri, mesh size 50/70 mm, wire size 2 mm, galvanised, fixed with steel clamps type Spenax 11 G 40

- top layer Krismer® System: three-dimensional steel screen panels laid diagonally to the vertical fall line, type J.K.S. A02-80|1,5-FEZ, height = 80 mm, fixed with special T-steel nails (with welded-on hook and point), reinforced with galvanised distribution rods Ø 10 mm, type R10/2500 or R10/3700

- stone filling of the three-dimensional J.K.S. steel screen panels with crushed gravel - stone size 32 to 60 mm, volume approx. 5 to 6 m³ per 100 m²

- geotextile, weight approx. 200g/m²

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Project Execution

Fig. 3: Drainage Channel – View from Above

+ trench excavation finished
+ geotextile placed
+ lowest layer of three-dimensional steel screen panels positioned (in line vertically with the channel) at the base of the channel, width approx. 0,60 m, fixed with special T-steel nails
+ first layer of stone filling

To increase the compound effect of the Krismer® System with the stable ground, additional distribution rods were systematically pushed into the three-dimensional screen panels. The distribution rods were manually cut to the corresponding length for installation in the channel (e.g. trench width = 0.60 m - length of distribution rod = 0.55 m)

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Fig. 4: Uphill view – partial gravel filling and vertical fall line placement of J.K.S. screen.

Installing the second (middle) layer of three-dimensional steel screen panels on top of the first layer of stone filling (approx. 50 – 60 cm deep), three-dimensional steel screen panels are laid down following the vertical fall line of the slope, width approx. 1.20 – 2.40 m

To increase the compound effect of the Krismer® System with the stable ground, additional distribution rods were systematically pushed into the three-dimensional screen panels. The distribution rods with were manually cut to fit the width of the channel (e.g. channel width = 1.20 m - length of distribution rod = 1.10 m)

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Fig. 5: Funnel seen looking uphill – J.K.S. panels placed diagonally to the fall line of the slope.

Creating a funnel, opening width approx. 6 m

Installing of the first (top) layer of three-dimensional steel screen panels on top of the second layer of stone filling approx. 0.50 m deep, laying of the J.K.S. panels diagonally to the run of the channel (=almost the drop line of the slope) reinforced with distribution rods R 10/2500 and fixed with galvanised soil nails T 25/1500 - T 25/1800.

Ramming of soil nails was done with a manual guided jack hammer with a special percussion attachment.

Along the sides of the funnel the complete construction was anchored into firm terrain to a width of 1.0 m - 1.5 m. Along the marginal zones the steel screen panels were fastened with soil nails placed at a distance of approx. 1 m. apart.

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Fig. 6: Drainage funnel seen looking downhill from the forest trail to the river

On both sides of the completed channel the three dimensional screen that covers stable terrain was topped with humus and a cover net was laid down over the entire surface.

The use of the Krismer® System to construct the funnel enables effective drainage of surface water in combination with a deeper lying drainage channel for frost-resistant gathering of slope water.

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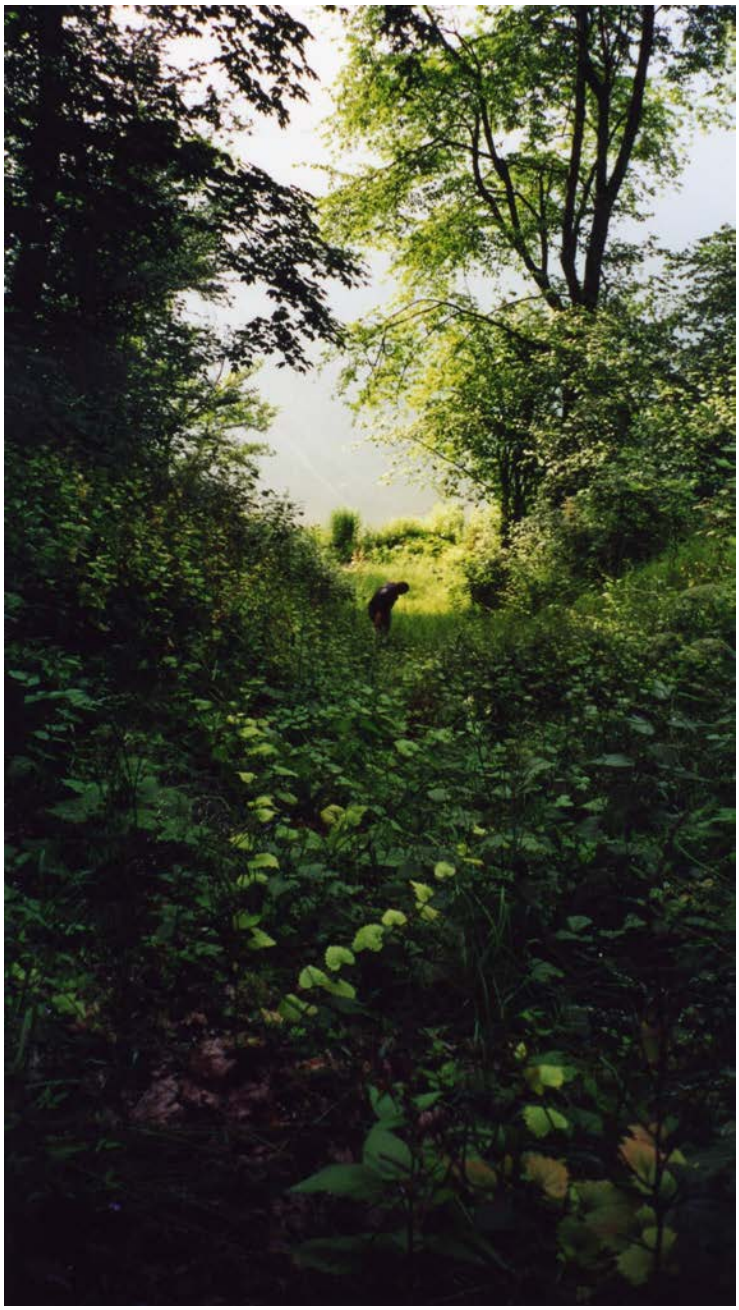

Fig. 7: View from the forest trail down to the river

Seeding was done with quick releasing mineral and biological long-term fertilizers. This ensures quick plant germination and establishment of the root system, which leads to additionally strengthened erosion protection.

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Fig. 8: Bank stabilisation with the Krismer® System (2000)

One year after construction work was completed, the surface of the Krismer® System stabilised drainage channel was given an additional fertilizing.

This was done to form a stronger and thicker layer of vegetation.

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Results

The Krismer® System was used to line and stabilise the terrain of a drainage channel on the bank of the Traun River.

The following are the results of this construction project:

- long-lasting protection of the bank surface against all types of erosion
- the deep reaching compound effect of all the system's components combined with the durable construction of the three-dimensional steel screen panels optimally resist hydraulic drag forces
- the surface stabilisation is water permeable and prevents an excessive build up of flow pressure
- the stone filling of the drainage channel significantly reduces the rate of water flow
- apart from the installed system nails no other foundations or anchoring were necessary
- the flexible construction allows for later settling or consolidation of the subsoil
- all system components, including the filling material, may be transported easily to the jobsite despite difficult access
- the stabilised top soil layer forms the basis for long-lasting plant growth
- Using the Krismer® System enabled us to optimally stabilise the channel on a steep slope (inclination 40°). Using this ecologically favourable system that allows planting of new vegetation, valuable natural landscape could be saved and an erosion devastated surface could be re-cultivated again.

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Appendix: Additional Photos

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