PROJECT REPORT

ENGINEERS WITHOUT BORDERS
KARLSRUHE INSTITUTE OF TECHNOLOGY

PROJECT DHUSKUN, NEPAL

OUR VISION

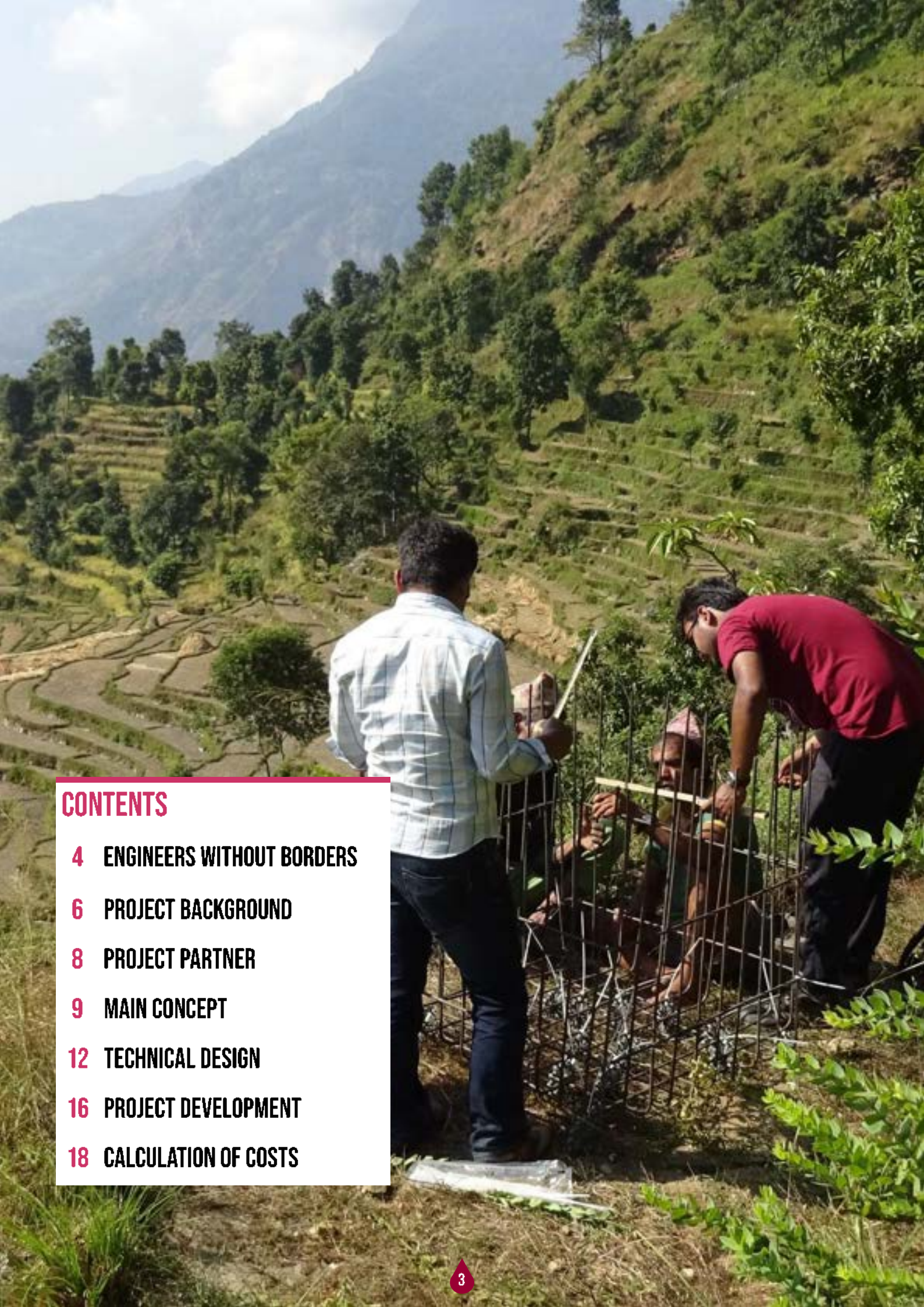
Everyone needs water. Water forms the basis for existential needs and is the foundation of social and economic development, especially in agricultural regions.

OUR GOAL

We want to guarantee all inhabitants of the Nepalese mountain village Dhuskun easy access to water all year round. Through efficient use of water resources, sufficient water is to be made available for households and field cultivation.

OUR JOURNEY

In cooperation with the villagers and our local project partner with many years of experience on site, we would like to develop and implement a water supply system. We attach particular importance to the exchange of knowledge, so that our system will be self-managed after project completion.



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ENGINEERS WITHOUT BORDERS

Engineers Without Borders - Karlsruhe Institute of Technology (EWB) is a student university group specialising in technical projects in development cooperation. The aim is to create new perspectives in economically, socially or politically disadvantaged regions through sustainable engineering projects. All projects are designed, planned and implemented by the members on a voluntary basis and on their own responsibility.

Since 2004, numerous students have successfully implemented 15 projects in various countries around the world. Currently EWB works with more than 300 members on projects in 10 different countries.

The projects range from the construction of a hydropower plant to the development of an administration software for social workers and the construction of an orphanage with integrated school. Besides the technical planning and execution of the projects, the focus of EMU in particular on relations with the project partners These are characterised by intercultural exchange and cooperation at eye level. In doing so, EWB members are sensitised to other cultures and global contexts in their actions and can thus constantly broaden their horizons in parallel to their technical work at EWB.

visit www.ewb-karlsruhe.de for more information

TEAM NEPAL

Our project group Nepal consists of about 25 students from different study programmes and nationalities. The group was founded in 2015 after the great earthquake. Before the team became active in Dhuskun, there was already a waste incineration and water supply project in other villages.

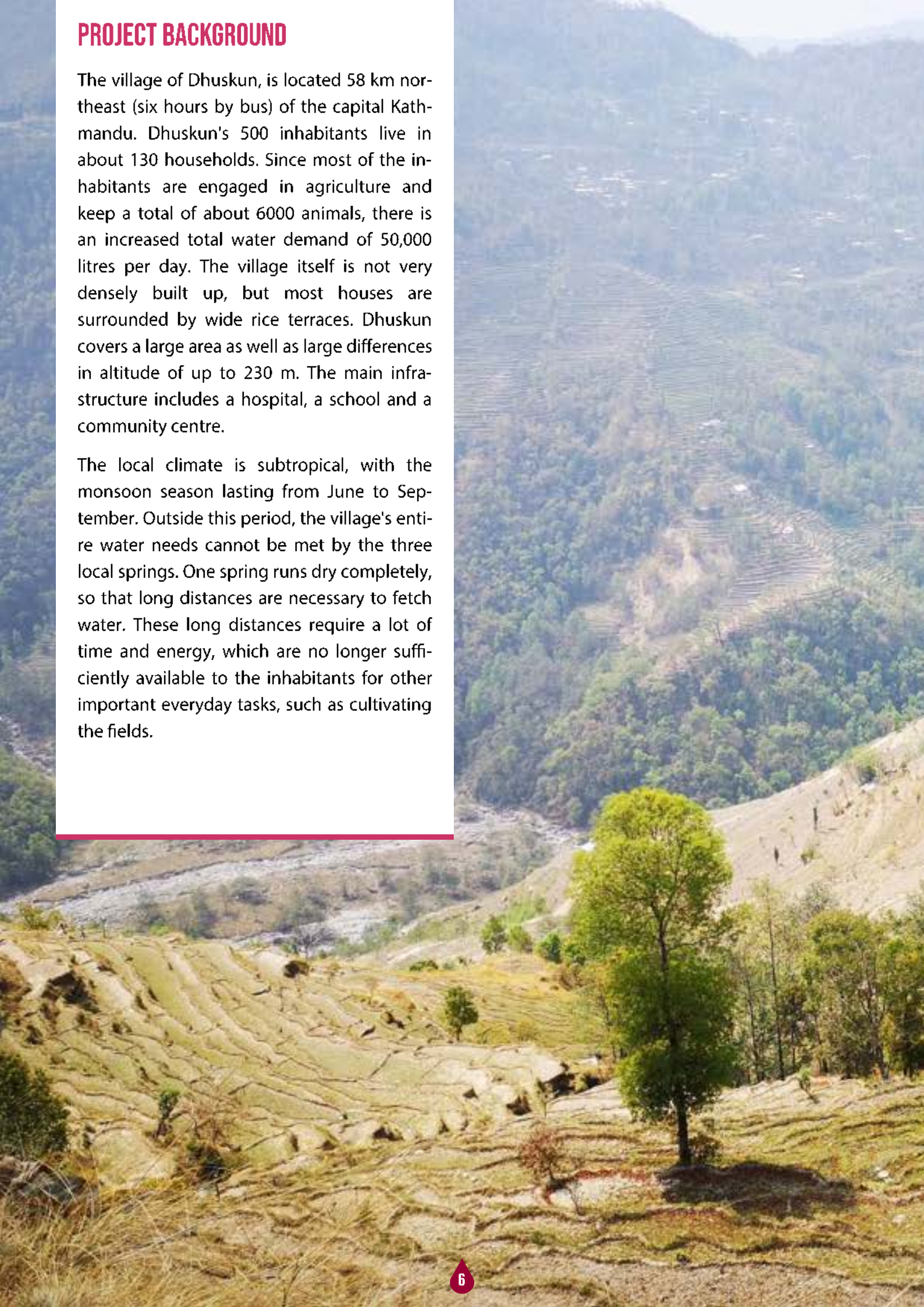
In the now four years of our weekly meetings, we have not only dealt with the technical solutions, but also with the people and culture of Nepal and have learned to love the country.

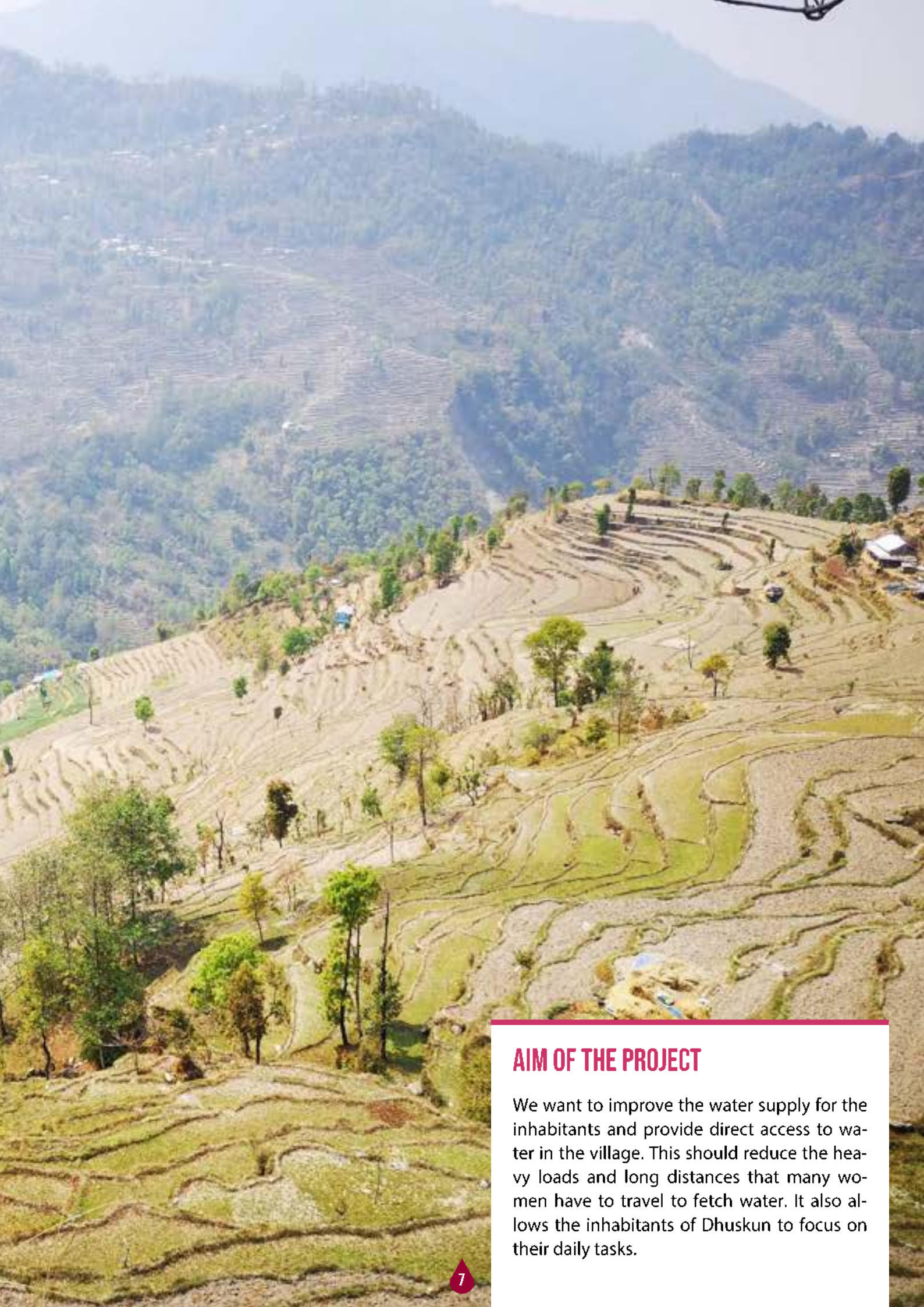
The members of the Nepal group are busy planning the project in Karlsruhe throughout the year. Usually there are two implementation phases per year in which the planned system is implemented. For this purpose, a group of four to five members is on site to coordinate the work and actively participate in the construction.

PROJECT BACKGROUND

The village of Dhuskun, is located 58 km northeast (six hours by bus) of the capital Kathmandu. Dhuskun's 500 inhabitants live in about 130 households. Since most of the inhabitants are engaged in agriculture and keep a total of about 6000 animals, there is an increased total water demand of 50,000 litres per day. The village itself is not very densely built up, but most houses are surrounded by wide rice terraces. Dhuskun covers a large area as well as large differences in altitude of up to 230 m. The main infrastructure includes a hospital, a school and a community centre.

The local climate is subtropical, with the monsoon season lasting from June to September. Outside this period, the village's entire water needs cannot be met by the three local springs. One spring runs dry completely, so that long distances are necessary to fetch water. These long distances require a lot of time and energy, which are no longer sufficiently available to the inhabitants for other important everyday tasks, such as cultivating the fields.





AIM OF THE PROJECT

We want to improve the water supply for the inhabitants and provide direct access to water in the village. This should reduce the heavy loads and long distances that many women have to travel to fetch water. It also allows the inhabitants of Dhuskun to focus on their daily tasks.

PROJECT PARTNER

For the successful realization of the project in Dhuskun we work closely with the non-profit organizations "Namlo International" (Namlo) and their Nepalese partner "Dedicated Society for Broad Development" (DSCBD).

In Nepali, "Namlo" stands for a band that is put around the head to better carry the weight of a heavily loaded basket on the back. Namlo has also devoted itself to this assistance in the figurative sense. The American organization was founded in Colorado in 1999 and since then has set itself the goal of providing lasting support to Nepalis who want to improve their own living conditions.

Our other already mentioned partner organization DSCBD is the Nepalese hand of Namlo. Especially because of the cultural proximity to the local people, DSCBD is indispensable for the implementation of the project and enables us to be in contact with the inhabitants of Dhuskun all year round.

Together with Nepalese villagers, the two organizations are implementing projects in the areas of water supply, livestock breeding and economic development and are working on reconstruction after earthquakes. They also invest in local educational institutions and provide scholarships to give young people access to schooling.

For the success of the water supply system in Dhuskun, the relationship between the organizations and the local inhabitants plays a major role. Since our project partners have been active in the village for several years, they have been able to build up a trusting relationship with the villagers and enjoy a high reputation among them.

By cooperating with Namlo and DSCBD, we hope to combine the respective strengths in such a way that we can successfully realize the project together with the villagers. Through the long experience of our partners and their local contacts, as well as the technical knowledge of our EWB team, we would like to achieve that the implementation of the project leads to running water all year round.

NAMLO INTERNATIONAL

visit www.namlo.org for more information about Namlo and its commitment

MAIN CONCEPT

SUSTAINABILITY

Both our project partners and we attach great importance to creating an ecologically and socially sustainable system. The main focus is that the water supply in Dhuskun will be guaranteed in the future even without our presence. For this reason, we are intensively engaged in sustainability concepts, which are applied in planning as well as in implementation and utilization. In particular, the protection of long-term economic, ecological and social interests plays an integral role. In the following, the main methods for promoting the sustainability of the water project in Dhuskun will be discussed.

WATER USERS COMMITTEE

The Water Users Committee (WUC) was founded by the villagers and is responsible for the management and maintenance of the water supply system after the project is completed.

During planning and implementation, the WUC is in active exchange with EWB and Namlo. In this way it represents the link between the village community, EWB and Namlo. From the very beginning of the project, the interests of the village community have been directly incorporated into the planning. Decisive aspects on which the WUC decides include, for example, the positions of the tapping points and the design of the system. This not only promotes user-friendliness but also acceptance of the system.

FUNDING

In order to be able to finance sustainable management of the water supply system, the WUC is introducing a payment system. All inhabitants of the village regularly pay a small fee to the WUC. This amount is determined by the village community together with DSCBD. With the help of the income generated, the maintenance of the water supply system is financed. This includes, for example, the procurement of necessary materials or the employ-

of a maintenance worker.The levy also serves to increase awareness of personal responsibility. In order to legitimize the payment system among the villagers, special emphasis is placed on transparency in the handling of the collected funds. All inhabitants of the village regularly pay a small fee to the WUC, which will be managed and documented by the treasurer of the WUC.

MAINTENANCE

WUC is mainly responsible for the maintenance of the water supply system. It ensures regular inspection, cleaning and maintenance of the system. In addition, it coordinates the corresponding work in case of necessary repair measures. For this purpose, WUC appoints a maintenance worker and pays for his services. It also finances the tools and materials required. In order to be able to guarantee a long-term high quality of the maintenance work, WUC ensures the transfer of knowledge and documentation of all measures. EWB lays the foundation for this when the construction phases are completed with training courses for the village community.

SERVICE AND CONSTRUCTION

In order to be able to maintain the water supply system independently, we rely on local materials. This means that spare parts can be easily procured and installed in case of necessary repairs. During implementation, basic knowledge about the different construction methods will be shared with the villagers. In this way, the village community will be enabled to make their own improvements to the water supply system using the methods learned. It goes without saying that one of the main goals of the project is to ensure that in the long term as few repairs as possible are required. For this purpose, special attention is paid to the durability of the construction methods and components.

TECHNICAL DESIGN

OVERALL SYSTEM

The water supply system allows access to a spring about 4 kilometres away from Dhuskun. From there the water is directed towards the village, stored temporarily and then distributed at central points.

TECHNICAL DATA

- ALTITUDE DIFFERENCE: 200 M
- PIPE LENGTH: 3,700 M
- FLOW RATE: 70,000 L/DAY
- TOTAL CAPACITY OF STORAGE TANKS: 30,000 L
- POINTS OF WITHDRAWLS: 12
- NUMBER OF HOUSEHOLDS COVERED: 96

INTAKE STRUCTURE

The intake structure was designed as a Tyrolean weir. This is an optimal form for water extraction from wild and bedloaded mountain streams. The basis of the weir is a reinforced concrete structure sunk into the course of the stream to absorb the water. At the top, the weir is limited by a rake made of stainless steel pipes. This prevents the entry of coarse mineral and biological debris and diverts the water into the underwater. On the one hand, the discharge of the bedload ensures that water abstraction is not hindered, and on the other hand it also minimises the impact on the stream ecosystem, as the bedload remains in the stream course and can therefore be transported further. A drain is installed in the bottom of the Tyrolean weir. A plastic pipe adjoins this outlet, through which the water taken from the stream is transferred to the sedimentation tank.

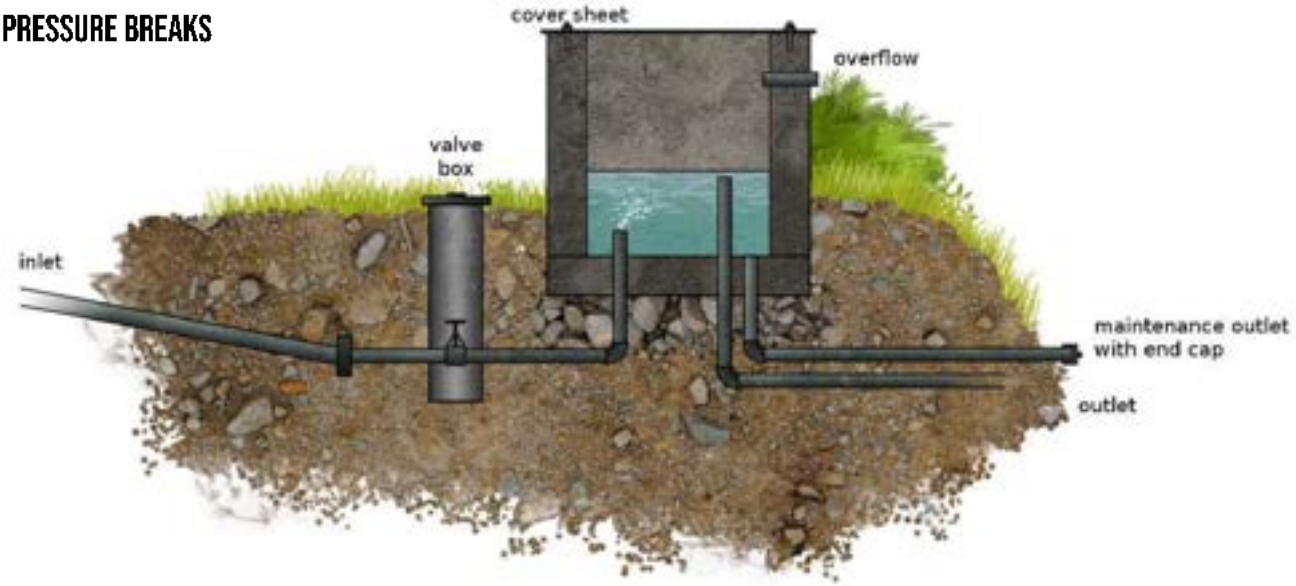
SEDIMENTATION TANK

The sedimentation tank is used to separate the water from the bedload that has not already been separated at the inlet of the intake structure. These are mainly sands. The sedimentation tank was constructed using a reinforced concrete structure that is closed on all sides. In the first chamber of the two-chamber system, the inflow from the intake structure takes place. Comparatively high flow velocities are achieved, which lead to turbulences within the first chamber. From this first chamber, the water is directed into the second one at a reduced flow rate. For this purpose, the partition wall between the two chambers was perforated with the help of pipes. In the second chamber the decisive part of the settling process takes place, which is favoured by the lower flow velocity at this point. The sediment-removed water is fed to the pipeline at a sufficient vertical distance from the separated bedload. Two inspection openings built into the ceiling and a drain built into the bottom of the tank serve to clean the tank.

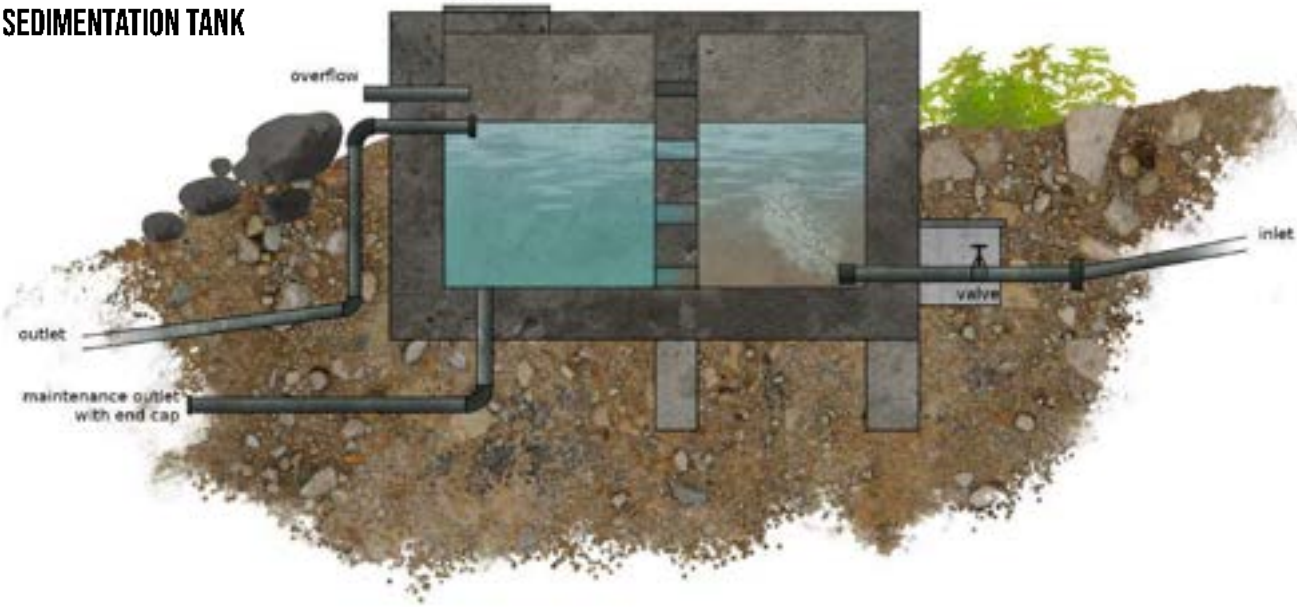
PIPELINE

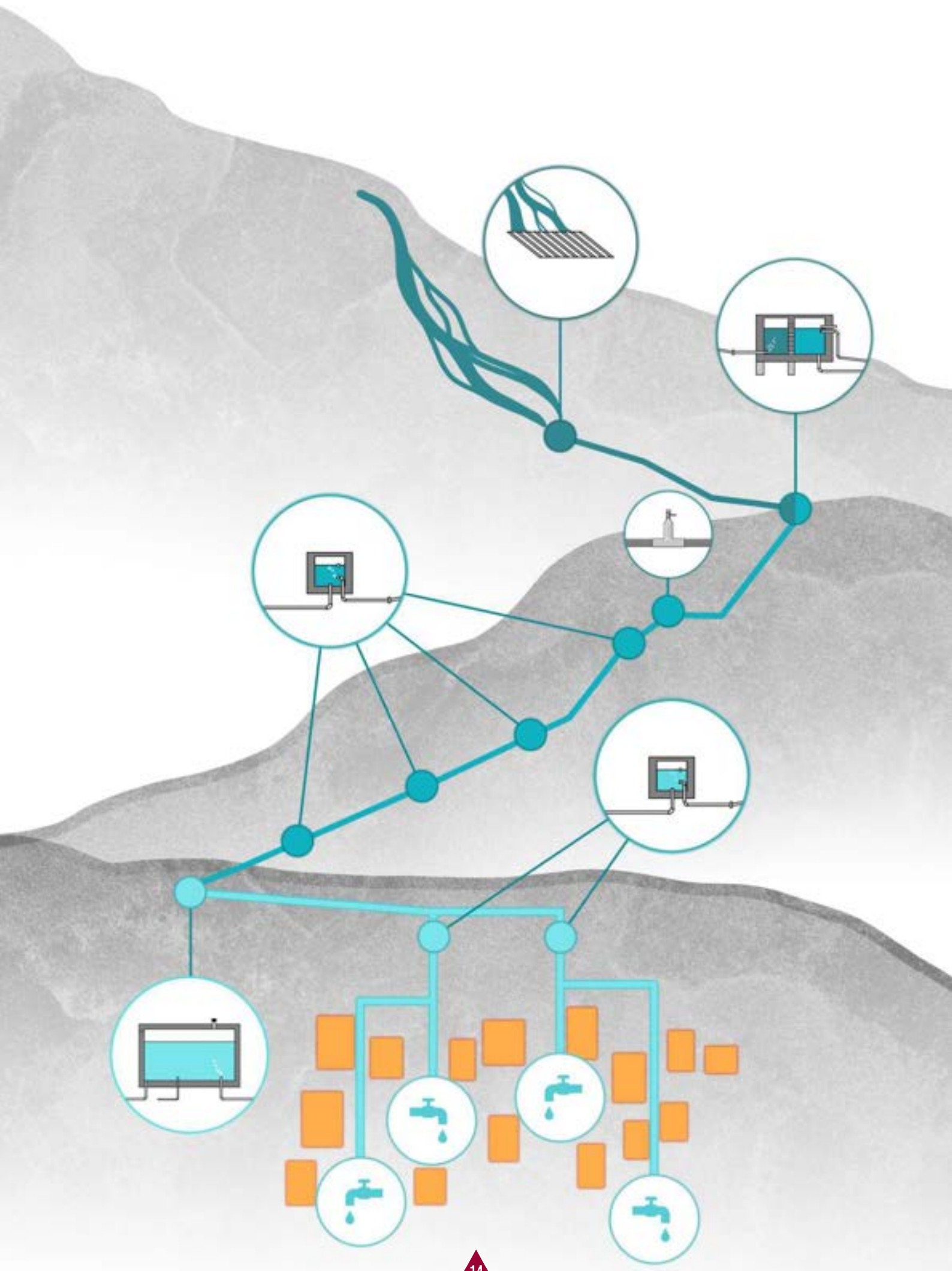
The pipeline made of durable HDPE pipes (plastic) with a diameter of 63 mm conducts the water from the sedimentation tank to the storage tanks above Dhuskun. To guarantee frost resistance of the pipeline, it is located 90 cm below the top of the terrain. The connections of the pipes were joined by means of so-called butt welding. This involves heating the plastic at the ends of the pipes and then joining them under pressure. After the plastic has cooled and hardened, high-strength joints are produced. In this way, the pipeline overcomes an altitude difference of around 200 metres over a distance of 3.7 kilometres. As a result of this enormous difference in height, the pressure in the pipeline increases steadily. It is therefore necessary to relieve the pipeline from a certain pressure. This is done by means of four pressure breaks, which are designed as simple tanks. A further technically necessary component of the pipeline construction are air release valves at local high points in the pipeline. If air bubbles are formed in the area of the outlet from the sedimentation tank, they can be drained through the air release valves. Without these valves, the pipeline can be blocked by the air bubbles at the relevant points.

PRESSURE BREAKS



SEDIMENTATION TANK





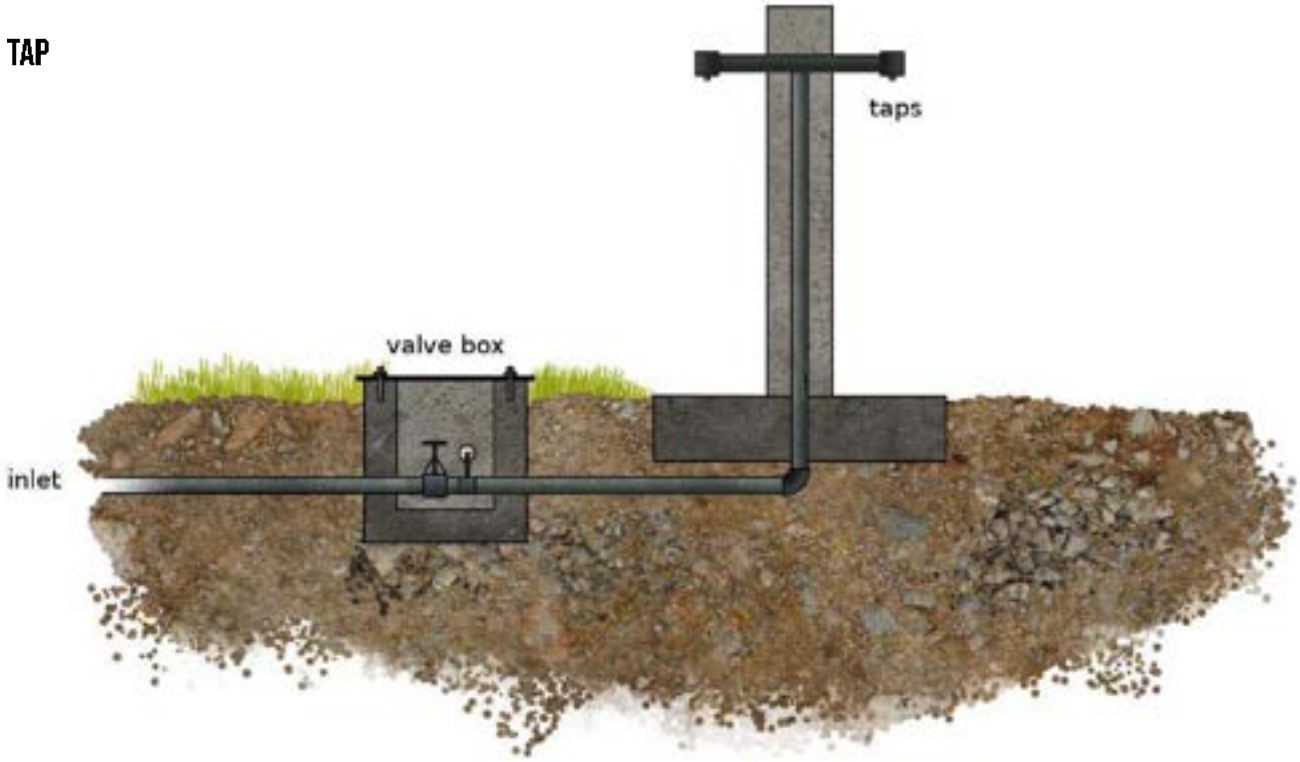
STORAGE TANKS

The pipeline flows into three storage tanks above the village of Dhuskun. These are founded on a former agricultural terrace and have a total capacity of 30,000 litres. They are used for the intermediate storage of the transported water in order to serve bottlenecks in the inflow as well as peak demand during withdrawal. This enables a reliable water supply for the whole village even in the dry season.

DISTRIBUTION SYSTEM

The distribution system leading to the village is directly connected to the storage tanks and transports the water to fixed nodes in the village. In total, households are supplied with water via 12 public taps. The distance between the households and the respective tapping point should be as short as possible.

TAP



RETROTFITTING OPTIONS

During the planning phase, the technical concept included possibilities for subsequent improvement and expansion. To improve the water quality, a water treatment plant can be connected between the storage tank and the extraction points. In addition, it is possible to connect to the sedimentation tank further intake structures of other streams. The extraction points themselves can also be adapted or relocated or moved by the villagers themselves as required.

PROJECT DEVELOPMENT

1ST EXPLORATION PHASE

After completion of the two previous projects in Brabal and Langtang, where a water supply system and a waste incinerator respectively were implemented, the search for a new project began in the summer of 2017. Various potential projects were initially identified. After a pre-selection process, a team of four EWB members travelled to Nepal in spring 2018 to visit five projects. The focus of this exploratory phase was to gather information on site about the projects and boundary conditions, but also to gain a personal impression of the respective situation. Afterwards, the collected data was evaluated in Karlsruhe and the preparation for the choice of the future project was made. Aspects such as the benefit of the project, the existence of a reliable project partner and the technical feasibility played a decisive role. On the basis of these in-depth considerations, the internal decision for the water supply system in Dhuskun was made in June 2018. From this point on, the first concepts were developed on the basis of the already established objectives and ideas. Based on this concretization of the implementation, the project was finally approved by the EWB board of directors in February 2019.

2ND EXPLORATION PHASE

With the first concepts and drafts, four team members of EWB went to Dhuskun in autumn 2018. The goal was to collect more detailed information about these drafts, so that the development of a feasible technical plan could begin. In particular, it was necessary to determine the water demand of the village in order to be able to address the exact dimensioning of the water supply system. In addition, a survey of the terrain and the geographical spread of the village was carried out. Various technical measurements were taken, such as the flow of springs.

1ST IMPLEMENTATION PHASE

At the beginning of the first implementation phase in spring 2019 EWB presented the planning of the project to the inhabitants of Dhuskun. In addition, discussions with the villagers also addressed the timing and project cooperation. Besides the possibility to address questions and uncertainties, this was the optimal framework for getting to know the different project partners. Immediately afterwards, work on the intake structure and the sedimentation tank began. Together with the villagers these two components were successfully built under the coordination of EWB. Parallel to this, the pipeline construction from the sedimentation tank towards Dhuskun took place, which lasted until June 2019. This was done under the leadership of the Ward President, whose role can be compared to that of a mayor.

2ND IMPLEMENTATION PHASE

Work on the second implementation phase began in October 2019. This mainly involved the installation of pressure breaks. Due to the partly difficult access in steep terrain and the reinforced concrete construction method, this was a challenging construction task. Furthermore air release valves were added to the pipeline allow any air bubbles that may have formed to escape and the already laid pipeline was checked for defective spots. Our team again received active support from the villagers, who were thus familiarized with the project.

DEVELOPMENTS DUE TO COVID-19

Due to the global spread of the corona virus in spring 2020, the planned implementation trip could not be started and no further one can bn planned so far. Therefore an adaption of the original concept (including two work phases on site each year) to the new circumstances became necessary. Since the beginning of the pandemic, the project continues to be planned and managed from Germany, while DSCBD takes over the management of the construction work and training in Dhuskun. This new solution ensures a steady progress of the project until we can finally come back to Dhuskun and continue working together on site.

TIME SCHEDULE

CALCULATION OF COSTS

Preparation and exploration	€2,300
Intake structure (Tyrolean weir)	€400
Sedimentation tank	€4,000
Pipeline*	€10,000
Pipeline— technical components**	€2,100
Storage tanks	€25,000
Distribution system — pipeline	€7,900
Distribution system — technical installation parts	€5,700
Distribution system — tapping points	€10,500
TOTAL INVESTMENT REQUIRED	**€67,900**
AMOUNT TO BE PAID BY EWB	**€55,800**

*paid by the Nepalese government
**paid by Namlo International

PREVIOUS EARNINGS

Support through foundations and associations	€1,000
Private donors	€8,500
Donations made by companies	€9,400
Profits from economic activities (e.g. selling cakes on a market)	€1,000
TOTAL EARNINGS TO DATE	**€19,900**

PREVIOUS EXPENDITURES

Preparation and exploration	€2,300
Intake structure (Tyrolean weir)	€400
Sedimentation tank	€4,000
TOTAL EXPENDITURES TO DATE	**€6,700**

FOR MORE INFORMATION

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www.facebook.com/ewb.karlsruhe
www.instagram.com/ewb.karlsruhe
www.betterplace.org/p70981

DONATIONS

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ENGINEERS WITHOUT BORDERS

About 300 Karlsruhe students are involved in the association Engineers Without Borders as volunteers for development cooperation worldwide. Together with the local population, they implement projects and impart knowledge.

Further projects on www.ewb-karlsruhe.de

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