Left: Unlined earthen road harvesting pond in Dailekh district with a storage capacity of ~1,500 m³ (WARM-P)

Right: Unlined earthen recharge pond in Dailekh district with a storage capacity of 60 m³ (WARM-P)

Community Recharge Ponds

Nepal – सामुदायिक पुर्नभरण पोखरी

Unlined earthen community recharge ponds in the rural mid-hills of Nepal.

The climate of the Nepal mid-hills is characterized by a four-month rainy season (monsoon from June to September) confined by comparatively dry pre- and post-monsoon periods. This temporal precipitation pattern gives rise to dwindling surface, spring, and ground water sources toward the end of the dry season. Induced by decreasing groundwater levels, spring sources in elevated areas tend to be particularly prone to rapid depletion and early dry-up, causing severe water shortages in uphill regions. As a result, domestic water supply is often not adequate, i.e., sources are remote or intermittent and households spend on average two hours per day on fetching water, with a significant portion spent on queuing up at water sources. Climate change may further aggravate local water scarcity by accentuating variations in seasonal precipitation.

Multi-purpose recharge ponds represent a low-cost option to partly reconcile temporal imbalances in water supply on a local scale by replenishing natural soil moisture and ground water reservoirs, thus storing excess precipitation water for the dry season. Besides refuelling underground storage and recharging spring water sources, the collected water may also be used immediately for irrigation, watering animals, or domestic purposes like the washing of clothes. Furthermore, reduced surface runoff and increased percolation may reduce the downstream risk of flooding and landslides.

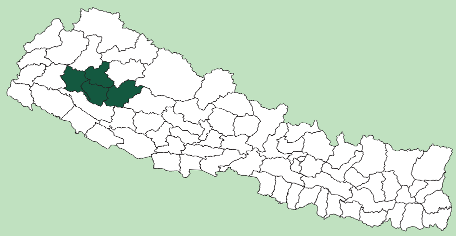
While the dimensions and specifications of the excavated earthen ponds are adapted to local conditions, they share some common characteristics:

- **Implementation on community level:** Ponds serve multiple households and are of a larger size than private ponds, with storage capacities between 60 and 1,500 m³.
- **Unlined pond walls and floors:** To enhance percolation and recharge of the surrounding ground.
- **Slope stabilization:** The pond outline is protected with a grass cover (local species like Dubo, Cynodondactylon or Napier, pennisetum purpureum) and a low masonry wall to reduce surface flow velocity, control erosion, and minimize soil deposition in the pond.
- **Selection of location:** Pond locations are selected according to the local terrain (natural depressions, existing conventional rural ponds) and their designated purposes (soil moisture recharge of adjacent agricultural fields, recharge of downhill spring water sources, irrigation, cattle watering). Where needed, life fencing keeps small children from falling into the pond, while ramps enable pond access for cattle to water and wallow.

The recharge ponds implemented by the programme can be grouped as follows:

- **New earthen unlined ponds:** Newly excavated regular ponds
- **Improvement of conventional ponds:** Improvement of existing ponds usually involves increasing the ponds' storage capacity and implementing erosion control measures on the pond outline
- **Road-drainage ponds:** Constructed near sealed roads in sloping terrain, these ponds collect the roads' drainage water and are usually larger, due to their more extensive catchment area

The target group of the technology are financially and socially deprived communities, living mostly from subsistence farming in the Nepal mid-hills. The community's in-kind contribution amounts to about half of the necessary excavation works, which are carried out by manual labour with shovels and picks. The programme pays for skilled labour input, required for the erection of low masonry walls along the pond outline.



Location: Four districts in the Western, Mid-Western, and Far-Western Development Regions of Nepal

Technology area: per pond 1–10 km²

Conservation measure(s): Structural, (Vegetative)

Land use type: Extensive grazing land

Climate: Humid subtropical

WOCAT database reference: QT NEP 45

Related approach: QA NEP 36

Compiled by: Lukas Egloff, Madan Bhatta, Mohan Bhatta, Rubika Shrestha, HELVETAS Swiss Intercooperation

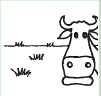
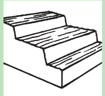
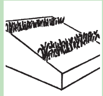
Date: June 2015

Comments: The community recharge ponds described here complement gravity flow water supply schemes (QT NEP 40) and are part of the water supply measures planned and implemented within the Water Use Master Plan (WUMP) framework for poor communities in the rural mid-hills of Nepal.

Classification

Water use problems

- Growing water demand for both domestic and agricultural use and diminishing or fluctuating water supply due to climate change
- Water sources in uphill areas are often intermittent and prone to rapid depletion and early dry-up during the dry season; households spend upwards of two hours per day on water fetching and queuing at the water source
- Water sources can be compromised by floods and landslides

Land use	Climate	Degradation		Conservation measure(s)	
					
Extensive grazing land	Humid subtropics	Physical degradation: Decline of water quantity	Water erosion: loss of topsoil by water; gully erosion	Structural: excavation of earthen ponds, masonry walls along outline	Vegetative: plantation along pond outline

Stage of intervention	Origin	Level of technical knowledge
Prevention Mitigation/reduction Rehabilitation	Land users' initiative: Experiments/research Externally introduced: 10-50 years ago	Field staff User

Main causes of local water scarcity

- **Natural causes:** temporary water scarcity during hot dry season (Dec.-May); deterioration of water quality during monsoon period; higher fluctuations in supply due to change in seasonal rainfall patterns; diminishing supply and increasing water demand due to increase in temperature
- **Human-induced causes:** poor water governance; lack of infrastructure; increase in water demand due to progressively higher living standards and augmented agricultural production

Main technical functions

- improve infiltration/spring recharge rates
- increase local soil moisture level
- reduce surface runoff and soil erosion
- water storage for irrigation and cattle watering

Secondary technical functions

- reduce downstream risk of flooding and landslides

Legend

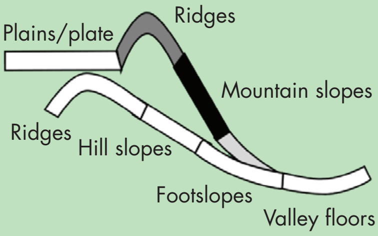
high
moderate
low
insignificant

Environment

Natural environment

Average annual rainfall (mm)	Altitude (masl)
>4000	>4000
3000-4000	3000-4000
2000-3000	2500-3000
1500-2000	2000-2500
1000-1500	1500-2000
750-1000	1000-1500
500-750	500-1000
250-500	100-500
<250	<100

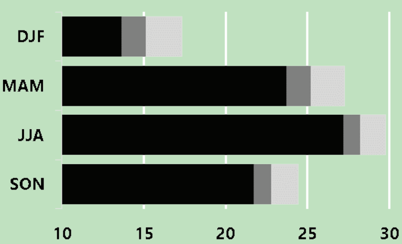
Landform



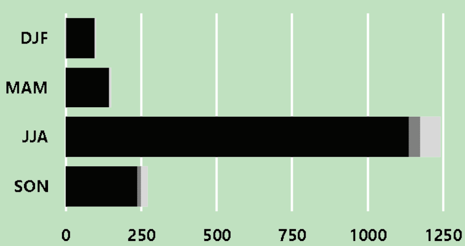
Slope (%)

Climate change[1]

Temperature (T) in °C



Precipitation (P) in mm



- Future **T** increase projected to be most pronounced in dry season
- **P** projections still with large uncertainty; **P** predicted to stay constant or slightly decrease in winter (DJF) and increase during the monsoon period (JJA)

→ Possibility of more frequent winter droughts and summer floods

Historical climate: 2001 - 2010
Future climate: 2020 - 2039
Future climate: 2040 - 2059

Tolerant of climatic extremes: wind storms/dust storms; decreasing length of growing period

Sensitive to climatic extremes: temperature increase; seasonal rainfall increase/decrease; heavy rainfall events; droughts/dry spells; floods

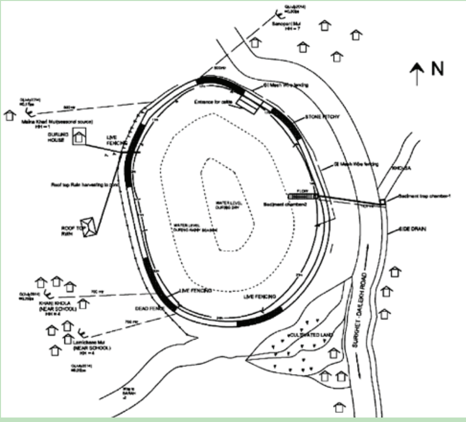
If sensitive, what modifications were made/are possible: consider deployment of more extensive vegetative and agronomic measures to further promote water recharge and soil conservation (e.g., plantation, contour trenches)

[1] Historical climate is drawn from local observational records. Future **T** and **P** anomalies are based on the ensemble median of 15 climate models employed in IPCC AR4 representing the SRES B1 emission scenario. Source: World Bank Climate Change Knowledge Portal

Human environment

Cropland per household (ha)

<0.5
0.5-1
1-2
2-5
5-15
15-50
50-100
100-500

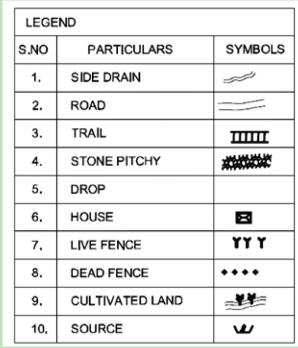


Land user: individual/household, small-scale land users, disadvantaged land users, men and women
Population density: 120 persons/km²
Annual population growth: 1-2%
Land ownership: individually owned/titled
Land use rights: individual
Water use rights: communal (organised)

Relative level of wealth: very poor and poor, which represent 39% and 27% of population in the area, respectively.
Importance of off-farm income: less than 10% of all income
Access to service and infrastructure: low: health, technical assistance, employment, market, energy, financial services; moderate: education; roads and transport; drinking water supply and sanitation
Market orientation: mainly subsistence (self-supply)

Technical drawing

Schematic of a road water harvesting recharge pond.



LEGEND

S.NO	PARTICULARS	SYMBOLS
1.	SIDE DRAIN	
2.	ROAD	
3.	TRAIL	
4.	STONE PITCHY	
5.	DROP	
6.	HOUSE	
7.	LIVE FENCE	
8.	DEAD FENCE	
9.	CULTIVATED LAND	
10.	SOURCE	

Implementation Activities, Inputs, and Costs

Establishment activities

Establishment is carried out under the supervision of field staff using shovels and picks. Establishment is carried out in the dry period and can be completed in one to two weeks. The major establishment steps are as follows:

1. Clear the pond area of all undesired vegetation.
2. Outline the proposed pond shape with stakes.
3. Dig out the pond pit with shovels and picks. Deposit the soil on the shoulder around the pond, beginning with the lower side. Make sure that the side slopes remain stable by compacting the soil in layers.
4. Dig small drainage channels in the uphill area to direct runoff into the pond.
5. Foresee a spillway for overflow during heavy precipitation events.
6. Plant grass and shrubs as a surface cover on the fresh soil deposit (= live fencing)

Total establishment costs and inputs for a medium-sized recharge pond (60 m³).

Inputs	Costs (US$)[1]	% met by users
Unskilled Labour (105 person days)	370	40
100 local grass seedlings (Dubo or Napier)	35	100
Bamboo for live fencing (30 pieces)	1	100
Construction tools (shovels and picks)	15	0
Total	**3,510**	**58**

[1] Exchange rate as per June 2015 USD 1 = NRs 100

Maintenance/recurrent activities

1. Cleaning pond floor of deposited sediment (at least every second year)
2. Maintenance of side slopes to prevent them from collapsing and repair of fencing (annually)
3. Fostering of seedlings, especially in the first few years.

Maintenance/recurrent inputs and costs per year (for above pond)

Inputs	Costs (US$)	% met by users
Labour (4 person days)	14	100%
Total	**14**	**100%**

Remarks: The above cost breakdown is based on the analysis of one medium-sized recharge pond implemented in 2014-15. Community contributions to the establishment costs typically range between 40% and 50%.

Assessment

Impacts of the technology			
Production and socioeconomic benefits		**Production and socioeconomic disadvantages**	
+ +	Improved water availability due to increased source recharge rates	– –	Loss of land for livestock grazing
+	Improved agricultural productivity due to increased soil moisture levels		
Sociocultural benefits		**Sociocultural disadvantages**	
+	Reduced incidents of water-borne diseases due to more reliable water access		None
Ecological benefits		**Ecological disadvantages**	
+ + +	Increased water infiltration and source recharge rates		None
+ + +	Increased soil moisture level in adjacent fields		
+ + +	Reduced soil erosion and landslides		
Off-site benefits		**Off-site disadvantages**	
+	Reduced risk of downstream flooding	–	
Contribution to human well-being/livelihoods			
+	Decreased workload due to reduced time for water fetching/queueing at source		

+++: high / ++: medium / +: low

Analysis of benefits and costs	Benefits compared with costs	short-term	long-term
Recharge ponds were first introduced two to three years ago. As such, the cost/benefit analysis is not covering a long-term timeframe yet. Over the first few years, the labor-intensive establishment activities usually still outweigh the benefits of surplus discharge. In contrast, maintenance activities are not seen as a big issue.	Establishment Maintenance/recurrent	negative neutral	as yet unknown as yet unknown

Acceptance/adoption

The implemented recharge ponds are identified and prioritized based on inclusively planned WUMPs (QA NEP 36). Moreover, representatives of the community take a lead role in the detailed planning and implementation process, resulting in a high acceptance rate of the implemented technologies. In principle, the combination of low-cost and low-tech facilitates the adoption by other communities. However, medium- to large-sized community ponds require substantial labour input, which only few communities are willing or able to put up by themselves. Replication by community members is generally observed on a smaller scale (pond size <10 m^3), i.e., on the household level with recharge ponds for surplus or wastewater fuelling kitchen gardens.

Concluding Statements

Strengths and ➔ how to sustain/improve	Weaknesses and ➔ how to overcome
The multi-purpose nature of recharge ponds allows customized designs, which may account for a variety of local needs and requirements (spring and soil moisture recharge, irrigation, cattle watering) ➔ careful analysis of local conditions and a participatory planning approach are vital to identify favourable pond locations and set-ups	Impact appraisals of recharge ponds prior to intervention are challenging, with geological conditions often unknown and seepage and percolation rates difficult to predict ➔ regard and employ recharge ponds as auxiliary measures with mid- to long-term impacts, which may evolve over time (e.g., infiltration rates may decrease with time due to colmatation of the pond floor)
Recharge ponds are straightforward to construct and maintain; especially smaller private ponds can be excavated by community members themselves ➔ in addition to building community ponds, consider showcasing the benefits of smaller ponds by building a few demonstration ponds on the household level	Ponds provide a potential breeding habitat for mosquitos and pose a danger to small children ➔ regular cleaning of pond scum keeps mosquito numbers in check while life fencing prevents small children from falling into the pond
Augmenting soil moisture levels by facilitating seepage into the surrounding soil not only increases agricultural productivity but also alleviates climate change impacts by building resilience to cope with flood and drought episodes ➔ adopt a more holistic "landscape" view and combine (multiple) recharge ponds with other conservation measures	Large ponds in steep terrain may break and flood/erode downhill areas ➔ reduce pond size in steep terrain; consider contour trenches and eyebrow basins); ensure regular maintenance of side slopes

Key references: SWISS Water & Sanitation NGO Consortium (2013) Beneficiary Assessment of WARM-P, Nepal. Lalitpur, Nepal: WARM-P/HELVETAS;
HELVETAS (2013) The Effectiveness and Outcomes of Approaches to Functionality of Drinking Water and Sanitation Schemes. Lalitpur, Nepal: WARM-P/HELVETAS

Contact person: Country Office, HELVETAS Swiss Intercooperation Nepal, GPO Box 688, Kathmandu/Nepal, co.np@helvetas.org, +977 1 5524925;
Madan R. Bhatta, Programme Manager, Tel: +977 1 5524926; 9858051902 (M), HELVETAS Swiss Intercooperation Nepal, madan.bhatta@helvetas.org