

Evaluation of Himalayan Trust Lukla Drinking Water Project In the Khumbu, Nepal

A Pre-Earthquake Evaluation of Lukla's
Water and Fire-fighting system

31 May 2015

Prepared by:
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Introduction

As safe drinking water and sanitation is the focus of my work, the Himalayan Trust (HT) asked if I could conduct an evaluation of the HT funded Lukla Water Project as it had recently been completed. The evaluator had been to Lukla in September 2013 with HT Board Chair, Mike Gill and HT General Manager, Prue Smith, to meet the locals, discuss the concept and see the old system. The concept design included water supply to the village and a fire fighting system to reduce the risk of fire in Lukla. The concept was revised in 2013, following a review and some recommendations made by engineers from BECA interested in water system design. I was therefore keen to revisit Lukla to see how things had progressed. Oxfam granted leave from my role as Pacific WASH Advisor, viewing this as an opportunity for cross country learning in my field, so I joined Prue Smith in Lukla on 7 April 2015 to evaluate the project. The Lukla Water Committee had been working on the project for two years and the system was, from October 2014, delivering water to the village. I was keen to see what impact the project had made on the lives of residents and in particular whether the firefighting system helped reduce the risk of fire in Lukla.

Methodology

I reviewed the contract, concept design drawings and progress reports the HT had received from LDWC prior to arrival in Lukla. The technical drawings had been reviewed back in 2013 and changes made to simplify the system. I flew to Lukla on 7 April 2015 and held meetings with members of the Lukla Drinking Water Committee (Lakpa Thering Sherpa, Committee Chair, Lakpa Chirri Sherpa, Treasurer and the Pasang Lama, Lukla Hospital Manager), staff employed by the Committee to operate and manage the system and Lukla water users to get their views on the effectiveness of the system. I also had a site visit to check on the quality of the construction.

A summary of the project goals, the objectives and targets, evaluation findings and general observations are presented following the background section below.

Background

Even though the government of Nepal has committed itself to providing all its citizens with a basic level of water supply, sanitation and fire safety services, large numbers of districts and villages in rural Nepal still suffer from lack of water and even more suffer from adequate sanitation and fire safety. Ensuring citizens have access to water and sanitation and fire safety services, as well as increased knowledge and practice on appropriate hygiene behaviour, is one of the great challenges for developing countries like Nepal. Lukla village which is based in Solukhumbu district, Chaurikharka VDC, ward no – 8 is one such village which has suffered from the lack of safe drinking water, adequate sanitation and fire safety facilities for decades.

Lukla village has a population of approximately three thousand people and more than two hundred houses. Because Lukla is a major tourist business centre in the Everest region, the population and the demand for water supply in the village increase every year. Unfortunately, while the population is growing, the water supply system in the village has remained the same as it was 25 years ago. The village has a good water source but the water is delivered through cracked pipes from an old reservoir built by UNICEF and the villagers many years ago. The water system has now deteriorated to the point where it is useless. Water leaks from the pipeline and from the cracked walls and base of the reservoir and thousands of litres of water are wasted every day without any use. The old

reservoir, which holds only the capacity of twenty thousand litres, is now not sufficient for supplying water to the entire village. The shortage of drinking water supply in the village has meant that villagers (every household, lodge, hotel, school etc) are going through hard times collecting water from the nearby river. It takes them hours to fill up each gallon of water. Lodges and houses have to collect their water by way of a tangle of pipes spreading up the hillside behind the village, picking up water wherever they can find it and acquiring faecal contamination along the way.



With an increase in the population there is also a significant increase in the number of houses in Lukla. Almost all the houses being constructed in Lukla are attached to one another and this has created another risk in the village. In 1992 and 2006 major fire accidents occurred in the village destroying more than 10 houses. The fires started from one house and spread to another and then another. In this way houses were destroyed causing a huge loss of property. The chance of such an accident happening again in Lukla is high as the village does not have a fire fighting system.

Lukla Drinking Water and Sanitation Committee was formed in 2013 with 19 members from Lukla, after several meetings amongst villagers concerned about the current water supply system which failed to meet the needs of the community. Water shortages were increasingly occurring. The committee consulted with water expert engineers and fire-fighting engineers and through their advice and suggestions the committee and villagers in 2013 drew up their own plan and raised money locally, USD\$25,000, an impressive sum but still a long way short of the USD\$100,000 their plan required. They approached the Himalayan Trust for financial support to get their project off the ground.

During a site visit in September 2013, to investigate the Committee funding proposal, the Lukla team took Mike Gill, Prue Smith and Andy Thomson, up through the tall forest 400 metres above the village to the water source, a permanent stream of clean water emerging from a gorge. A decaying and leaking pipe slanted down to the reservoir whose concrete lining had deteriorated past the point where it could be restored. Three of the core Committee members (the two Lakpas and engineer Sonam Sherpa) described the components of their new water supply. A new large-bore pipe would run underground from the source to a new main reservoir holding 60,000 litres, 3 times the capacity of the old UNICEF tank. From here four pipes would run down to four subsidiary 10,000 litre tanks spaced out in a line above the village, each supplying the houses and lodges below it. Domestic water would be drawn off only from the tops of the reservoirs which would therefore always remain full. In the event of a fire, a system of manually operated valves would redirect water from the domestic distribution system to a wide bore, high pressure system drawing water from the bottoms of the five reservoirs and directing the water to fire hydrants.

The Himalayan Trust decided to support the Lukla Committee water project and asked Lakpa Thering Sherpa and his wife Dr Jangmoo Sherpa to visit New Zealand to talk about the project and support our public fundraising. They spoke to Trust supporters, engineering groups and schools up and down the country about the Project, including a gala Trust fundraising dinner at the Auckland Museum. It

would not only provide safe water to the whole village, but also a fire-fighting system to reduce the risk of fire. Many will remember the fire in the centre of the village in 2006 when four houses were burnt to the ground due to a fire starting from a faulty gas cylinder. The village had no fire hoses and their only water reservoir had decayed to the point it held little water. Destruction of the continuous line of lodges and houses was prevented by the drastic measure of immediately destroying adjacent houses to create a fire break. The Himalayan Trust raised the USD\$75,000 required to complete the project.

The Lukla team is headed by three locals: Lakpa Thering Sherpa (chair), Sonam Sherpa (engineer) and Lakpa Chirri Sherpa. Lakpa Thering is articulate with excellent English, and is known for his leadership skills, commitment to excellence and as a hard worker. His wife, a doctor who has worked for two years at Lukla Hospital, and has just completed a postgraduate degree in Public Health in Australia. Sonam has worked as an engineer in Japan but returned in 2013 to work fulltime on the Water Project as field engineer and coordinator of this project. Lakpa Chirri runs Paradise Lodge with his parents, Da Phuti and Ang Pasang, and is known for his integrity and knowledge of accounting.

The Lukla team had a very ambitious project. They had the energy and expertise to make it a reality. The Himalayan Trust supported their proposal for the following reasons:

1. A clean water supply is fundamental to the health of any community. Faecal contamination of drinking water causes gastrointestinal infections and Lukla Hospital confirmed that such infections are common. They were strong supporters of the new Water Project proposal and would monitor its success by recording the changing incidence of diarrhoeal diseases.
2. A readily available supply of running water prevents disease by facilitating personal hygiene generally and hand washing in particular.
3. Fire-fighting capability is essential in any community, particularly where lines of adjoining houses down the main street can spread fire so quickly from one house to the next. As well as being a danger to human life, a major fire is a financial catastrophe for the whole community whose livelihood is built on tourism.
4. HT were impressed by the committee managing the Project. They had taken the initiative into their own hands and raised a substantial sum of money. They had drawn up detailed plans which were practicable and met engineering requirements. They had already built one reservoir and had started a second. A timetable which saw completion before the end of the following year looked entirely feasible.
5. The Himalayan Trust had not been involved with a water project since the 1960s when Sir Ed put a lot of effort into building water supplies. The Objects of the Trust include:
 - 3.1 g. To construct works for the supply of water and to undertake engineering and other projects aimed at increasing the amenities available to the Himalayan peoples.
 - 3.1 h. To undertake works and to provide instruction in relation to the improvement of sanitation and health generally.

The Himalayan Trust thought it highly appropriate during the year of the 60th Anniversary of the Ascent of Everest – which led to Sir Ed’s involvement with development work – that the Trust should support a project which they believe would have his whole-hearted approval. Ed always warmed to a project requested by the villagers themselves and supported with their own money and labour.

6. The Lukla Hospital’s Manager, Pasang Lhamu Sherpa, writes on 23/10/13, “We have evidence of an upsurge of waterborne diseases like diarrhoea, dysentery and gastritis...”

The hospital undertakes to monitor water quality for coliform bacteria, helminths, protozoa, and entamoeba, before and after implementation of the new water supply. They would also conduct a health awareness programme in Lukla School with respect to sanitation and hygiene. Their hospital records would track changes in disease incidence before and after implementation.

7. This was a chance for the Trust, in its renewal phase, “to get runs on the board” in the form of a project that would be completed within a year – if they provided the funding – and it would be a tangible and visible achievement for both parties.
8. Finally this was a chance for the Trust to deepen its relationship with the Lukla/Chaurikharka community. They could add to the HT strong links through Education in these two villages, an initiative that would prevent disease and insure against the commercial damage that would follow a major fire.



Project Summary

Project Goal

To provide safe and adequate supply of drinking water to the entire village (Lukla)

To set up a fire fighting system for the safety of the village from fire accidents.

Outcome 1	Indicators	Means of Verification
Adequate supply of safe drinking water for Lukla village	<ul style="list-style-type: none"> Water system built to design standards and meets safe drinking water needs of Lukla Village Main reservoir 60,000 litres 4 x Sub reservoirs @ 12,000 litres each Regular water quality testing undertaken 	<ul style="list-style-type: none"> Observation Interview with Committee members, installation team and beneficiaries Interview with Hospital staff re water quality testing

Outcome 2	Indicators	Means of Verification
House safety from fire accidents / reduced risk of fire in Lukla.	<ul style="list-style-type: none"> High pressure water supply for fire-fighting reduces risk of fire Number of hydrants 	<p>Observation</p> <p>Evidence of community training sessions</p>

Outcome 3	Indicators	Means of Verification
Villagers able to use fire-fighting system to protect the village from fire	<ul style="list-style-type: none"> Community awareness of fire hazard Lukla residents proficient in using fire-fighting system. Number of trained firefighters Reduction in fire risk 	<p>Records of each training session kept and provided to Project Manager.</p> <p>Interview with trained firefighter</p>

Outcome 4	Indicators	Means of Verification
Villagers have improved health through safe water supply and hygiene practice	<ul style="list-style-type: none"> Reduction in water-borne diseases Community health awareness trainings by Lukla Hospital staff 90% adults and children of Luka trained in good hygiene practices 	<p>Interview with Lukla Hospital staff</p>

Outcome 5	Indicators	Means of Verification
Lukla village operates and maintains its own water supply infrastructure	<ul style="list-style-type: none"> • O&M Manual completed by 31 July 2014 • Manual is in language and complexity suitable for the users. 	<p>Observation</p> <p>Interviews with LDWP O&M employees</p> <p>Records kept of maintenance activities</p>



Project Evaluation

Date of review:

: April 2015

Name/position of monitor(s)

: Andy Thomson (WASH Advisor)

Expected result for Outcome 1: Adequate supply of safe drinking water for Lukla village

Indicators	Final Results	Achievement
<ul style="list-style-type: none"> Water system built to design standards and meets safe drinking water needs of Lukla Village Main reservoir 60,000 litres 4 x Sub reservoirs @ 12,000 litres each Regular water quality testing undertaken 	<p><u>LDWC indicated in a report submitted to HT in March 2015 that:</u></p> <ul style="list-style-type: none"> Each household had been supplied with water from the month of October 2014. A report is yet to come from hospital. 95% people do not have to travel up and down every day to the river to fix the water pipe line. People have saved their time. The project has made easy accessibility of water to villagers. The lodge owners and the family houses now do not have to hire a person just to fix the pipe line. Women have much relief as they have saved a lot of time, energy and money. The project has made it a lot easier to run their daily life. <p><u>Evaluator field visit first week of April 2015 confirmed outputs as follows:</u></p> <ul style="list-style-type: none"> The source is adequate and protected. The main reservoir of 85,000 litres has been completed (bigger than the proposed 60,000 litre reservoir) and in use 4 sub reservoirs @ 12,500 litres each have been completed (also bigger than planned) and in use The main reservoir and sub reservoirs are fully covered and protected. No leaks to tanks for pipes were evident during the site visit One sub reservoir is fenced, the other 3 do not need fencing. All reservoirs are secure and monitored by LDWC staff 	<p><u>ACHIEVED</u></p>

	<ul style="list-style-type: none"> • Pipes are buried to protect the pipeline • A bridge was built to protect pipeline crossing a riverbed • Adequate and uninterrupted water supply has been provided to Lukla village from October 2014 • Water quality tests have been sent to Katmandu for analysis and staff awaiting the results at time of visit. • 180-200 households (often with more than one family per household) and lodges have improved consistent access to water supply • Number of beneficiaries estimated at approx. 3,000 water users 	
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Expected result Outcome 2: Reduced risk of fire in Lukla		
Indicators	Final Results	Achievement
<ul style="list-style-type: none"> • High pressure water supply for fire-fighting reduces risk of fire • 20 hydrants operational 	<p><u>The LDWP Committee reported as follows in March 2015</u></p> <ul style="list-style-type: none"> • 17 fire- fighting points installed at regular intervals in Lukla. All the 17 water point's pressure tested and checked. The result is 99 % to what was expected. 3 more fire-fighting points yet to be completed. <p><u>Field visit first week of April 2015 confirmed outputs as follows:</u></p> <ul style="list-style-type: none"> • Water pressure is more than adequate at 5.5 bars (the minimum required is 3.0 bars) • A further 3 hydrants were installed making a total of 20 fire hydrants throughout the village • Fire hoses housed in red boxes near hydrants, highly visible • A fire-fighting drill was held in March 2015 with various community groups participating. The groups participating included youth, women, men, police committee members and community members 	<u>ACHIEVED</u>

Expected result Outcome 3: Lukla villagers uses fire-fighting system to protect Lukla village from fire		
Indicators	Final Results	Achievement
<ul style="list-style-type: none"> • Community awareness of fire hazard • Training for villagers in use of fire-fighting system • Each household proficient in use of fire-fighting system. • Number of trained firefighters • Regular practice drills • Reduction in fire risk 	<p><u>The LDWC indicated in their March 2015 report:</u></p> <p>The first basic training will be conducted in 6th and 7th of March 2015 by trainers from Australia. One person from each house of Lukla will be participating in the training.</p> <p><u>Field visit first week of April 2015 confirmed outputs as follows:</u></p> <ul style="list-style-type: none"> • In March 2015 Australian fire fighters provided a basic 2 day training course to raise awareness of the potential for a fire and held a fire drill with community groups to demonstrate what to do in the event of a fire. • A strong focus was on fire prevention and the importance for every lodge and household to have a <u>Fire Plan</u> to reduce preventable death by fire. • Fire’s often start in kitchens so making kitchens safer was a key focus of the training. Their recommendations included – regular checks on gas bottles for gas leaks, metal backing behind stoves to reduce the risk of wooden walls catching fire during cooking. • 40 people were trained in the use of the fire-fighting equipment and a drill was held with participants. • A separate training was conducted at Lukla primary school. • The Australian fire fighters indicated that they will conduct fire drills and training each year. • the village will consider the options available for a fire early warning system (possibly a siren). • Other recommendations included training for all lodge staff in how to put out a fire and the installation of smoke detectors in lodges and houses. • The Australian fire-fighters also indicated that they would provide more fire-fighting equipment including fire blankets in subsequent visits. 	<p><u>ACHIEVED</u></p>

Expected result Output 4: Lukla village has improved health through improved access to safe water and health and hygiene trainings.		
Indicators	Final Results	Achievement
<ul style="list-style-type: none"> Reduction in water borne diseases – diarrhoea, skin diseases, boils and rashes Community health awareness trainings conducted by Lukla Hospital staff 90% adults and children trained in good hygiene practice 	<p><u>Interview with Pasang Llama, Lukla Hospital Manager and initial survey information confirm following:</u></p> <ul style="list-style-type: none"> Health and Hygiene Trainings were conducted in Lukla schools (grades 4,5,6) to raise awareness of good hygiene practices including hand washing. It is too early to evaluate this outcome. Lukla Hospital is currently collecting data which will be analysed and available in October 2015 after the monsoon. 	<p><u>RESULT PENDING UNTIL DATA AVAILABLE</u></p>

Expected result Outcome 5: Lukla village operates and maintains its own water supply infrastructure		
Indicators	Final Results	Achievement
<p>O&M Manual completed by 31 July 2014</p> <p>Manual to be in language and complexity suitable for the users.</p> <p>Manual to include checklist of tests on the system.</p>	<p><u>Field visit discussions and initial survey information indicated following:</u></p> <ul style="list-style-type: none"> The Manual is not yet complete but is underway. Leak testing is being undertaken regularly Regular monitoring and flushing of the tanks undertaken to remove sediment buildup Pipelines and fittings checked regularly by LDW staff for leaks <p>The manual should include a checklist of tests including (these are not exhaustive but are examples):</p> <ul style="list-style-type: none"> Checking of the pipelines and fittings downstream of the tanks for leaks (initially and then on a monthly basis) Leak testing (out of and into the tank). Weekly monitoring of the water surface of the tank to remove any floating material. Regular flushing of the tanks to remove any sediments from the floor of the tanks <p>NOTE: Reports indicate that the Lukla water system survived the Earthquake on 25 April (7.8 magnitude), the aftershocks and the 14 May earthquake (7.3 magnitude), with the epicenter close to Namche Bazaar. Testament to the structural strength of the system designed by Sonam Sherpa, and constructed by the team. Regular checks on the system should be undertaken as part of the O&M plan.</p>	<p><u>NOT ACHIEVED but underway</u></p>

General Observations of the Results

Water Supply Scheme

Sonam Sherpa, the project engineer, who worked in Japan for six years following the Tsunami, developed the concept design and applied methods he learnt in Japan to good effect during the construction phase. As a resident of Lukla he has a good understanding of the town and its terrain and the constructability of the water system he designed. He is a very competent engineer. However further technical advice was requested from BECA a New Zealand engineering consultancy. They were asked to run their eye over the concept design as expressed in the technical drawings and raise any issues that they felt needed further clarity. There was general consensus amongst the engineers that the design was an appropriate solution to the water problems that Lukla was experiencing.



Sonam was not available during the evaluators visit

to discuss any changes to the concept design drawings as a result of those early discussions, as he was building a bridge near Monjo, however it is important that any changes to the system are recorded in the as-built drawings so that a permanent record is readily accessible to staff. This should also be linked to the O&M manual so that staff is clear about what has been built and how to maintain it. This includes all interconnections and isolation or control valves, which need to be shown in the design drawings. It is suggested that Sonam follow up on this if it hasn't been done.

As can be seen from the photographs, the tanks are cast in-situ reinforced concrete. The main reservoir and sub-reservoirs appear to be built to design standards using proven technologies. They looked to be structurally sound and constructed well. Unfortunately it was not possible to discuss the structural design and strength/integrity of the tanks and the pressure rating/capacity of the pipelines and fittings with Sonam so I think these can be supplied to the Himalayan Trust so that they have some assurance on the system. Having said that, the system survived two severe earthquakes (7.8 and 7.3 magnitude), and a number of aftershocks in April and May 2015. The system demonstrated its structural strength as it is reported



that there were no cracks or leaks in any part of the system following the earthquakes, however a close inspection of the system following such events is warranted.



The water reservoirs were sealed to stop leakage and none were visible at the time of the field visit. The reservoirs were also covered to protect the water quality. The system appeared to be robust, functional and at the time of the visit in

April had been delivering safe water reliably to the village since October 2014.

The water source, which was viewed by the evaluator two years previously has provided Lukla's water supply for many years. It has sufficient volume for the size of the Lukla population but the water system itself has never been properly managed. System management will be an important factor for the Committee to get right this time around.



The bridge to protect the pipeline river crossing was not budgeted for, but necessary so the team found the budget and the time to complete this to a high standard as the pipeline would have been otherwise exposed to potential damage during the monsoon.



The new water pipe line was placed underground from the river to the main reservoir to get the water to the village. From the main reservoir the water is supplied to the four different sub tanks. These four sub tanks were placed strategically so that that they could deliver water to four different suburbs. From each sub tank the water is supplied by connecting pipe lines to each household in that particular suburb. For the buildings down valley from the main town of Lukla water taps are placed at regular intervals.

The Lukla team increased the size of both the main reservoir and the sub tanks to ensure the needs of the Lukla community could be met. Some O&M measures are included in the recommendations.

On February 7th 2015 Lukla water project committee gathered all the people of Lukla for public auditing. (Public auditing means telling people about the final cost and expenses of the project in detail and wanting to know if people have any question regarding the cost and expense of the project). The people had no objection with the project cost that was announced by the committee. All the attendees signed the audit report as they were satisfied with the projects final cost.



In the meeting the committee and people also decided on a metering cost. The minimum cost for users per month was finalized to be Rs.300 and Rs.500.

The minimum cost of Rs.300 allows people to use water up to 20,000 liters per month and Rs.500 allows people to use 40,000 liters of water per month. Once they cross 20,000 liters the people who are paying Rs.300 as a minimum cost will have to pay Rs.15 per unit (Rs.15 per 1000 liters) and it is same for the people who are paying minimum cost of Rs.500. The cost per unit is Rs.15 for everyone.

The committee's two hired staff manage the water system. The committee agreed to pay Rs.10, 000 per month to each staff member. Both the hired staff worked with the water project from the beginning. The committee selected the two staff based on their knowledge and the experience they had gained working with the water project.

Fire-fighting system / ongoing training

For the prevention of fire accidents, the main firefighting pipe line is connected to the main reserve tank of eighty five thousand litres and runs down to the village and under the main road to 20 fire hydrants placed at regular intervals along the road so that each house/lodge can be reached with the fire hose. Fire hoses are located near each hydrant so that every house is within range.

The fire-fighting system has been tested, the water pressure is extremely good, the system works well and combined with regular drills and training will help to reduce the risk of fire in Lukla.

A two day fire safety training was conducted by Australian firefighters in March 2015. This included theory and practice sessions with 40 residents. A primary focus was fire awareness and prevention. They identified a number of actions that the Lukla community could do to reduce the risk of fire. Each household and lodge is to develop a fire Safety Plan which outlines the evacuation route and a meeting point in the event of fire. All lodge staff are to be trained in how to put out a fire. Households and lodges



also intend to improve safety in their kitchens (as this is often where fires start) checking for gas leaks and improving gas bottle storage practices. The firefighters would like to see every house and lodge fitted with a smoke alarm over the next five years. In their view this would be the best fire prevention possible. The firefighters are working on signage that should eventually be in all lodges. An exit sign that point the way from every part of the building to the best fire escape exit is an important fire prevention measure. Another is signs in different languages that request people to not smoke, cook, burn incense or candles in their rooms. 'Please help us keep Lukla safe from fire'. The firefighters are looking into various ways of alerting firefighters if there is a fire. The aim is to get them to a fire within 10 minutes if they want any chance of saving a building. Further fire safety



trainings have been planned each year with the support of the Australian firefighters. They plan to return with more equipment and trainings to help meet the fire safety needs of the Lukla community.

Health improvements

A baseline survey was administered at the commencement of this project. Health and hygiene trainings were conducted by Lukla Hospital staff, to school children from Grades 4, 5 and 6. The trainings included individual, household and environmental health and hygiene practices. A Health impact assessment will be conducted after the monsoon (June/July) to identify any changes in health stats, particularly water borne diseases.

Gender

The new water system has made life easier for residents, particularly women and girls, who often have the burden of ensuring that water is readily available for their families. Often, they used to spend hours walking up the hill to the old reservoir or the creek for water. They would sometimes hire someone to find it for them if they had no time to do it themselves. The new system means that they have access to constant supply. This improved access to water has saved them time and money.



The lodges particularly had to send people up the hill all the time to fix their water pipes as tourists expect running water for bathing and washing. The new water system has made a big difference to the lodge owners who have more time for other activities.

Three women served on the water committee. They and other committee members had a major role to play in convincing Lukla residents of the benefits of this project for Lukla. Some residents hadn't paid for drinking water prior to this project, but found themselves spending a great deal of time fixing pipes in order to get their water supply so most were keen to see an improvement in the supply, but at a cost they could afford. The fixed water rates appear to be affordable to residents and lodges alike.

Sustainability

There are a number of factors that make this project sustainable. The quality of the construction is one component. The construction team has delivered a high quality, robust



water supply system to the Lukla community. The reinforced concrete reservoir and sub reservoirs

have been sealed to ensure there are no leaks (even after the earthquakes in April and May 2015). The pipes are protected – either by being buried or supported where necessary across river crossings (a bridge was constructed to support the pipeline). This work will increase the life of the system.

Another aspect of sustainability is good governance and management of the system. Lukla did not have this in the past. Lukla had a tangle of household pipes running from the old reservoir, with people constantly walking up and down the hill to the old reservoir to remove each other's pipelines to get water into their own taps. This has now stopped. The system is managed by the Lukla Drinking Water Committee and the two staff employed by the committee to manage and maintain the system to meet the needs of the whole community. This saves people time and angst in the knowledge that the water supply system is being managed for them by a team that can look after it.



The two staff members are funded from the income received from users. This ensures that the system is operated and maintained to a high standard. The O&M paid staff have been working on the project from its inception and are fully conversant with the system. They were also trained by the system engineer to deal with any type of problem that might come up with the water supply systems. They have good technical skills and knowledge of the existing system and conduct regular checks to ensure the system is maintained regularly. They provide updates about the entire supply situation to the committee every month. The system engineer is currently putting together the O&M Manual in Sherpa and Nepali for future staff to follow. The manual will be a crucial resource for those, new to the project, to learn more about the system and how to look after it into the future.

The Committee is proactive and transparent in their liaison with the community. They meet regularly to hear the ideas and issues from community members and update them on income and expenditure and operations and maintenance.

The Lukla Water Committee members have led the project's implementation from the beginning. The Committee allocated specific tasks to its members, such as field coordinator, accountant, procurement of materials from Kathmandu, reporting to villages and donor agencies, arranging meetings every month and quarterly. The members appear to have been fully accountable for the responsibility they were given. Meetings were held monthly with the villagers so that the Committee could update them on progress. Each quarter the Committee published a financial report among the villagers. The Committee also sent quarterly reports to donor agencies and once the project was completed an audit report was completed by the government auditor and forwarded to each and every household, lodge, hotel and donor agency. Lukla villagers had not seen this level of accountability before.

The project was monitored carefully by Water Committee members, local engineers, government agencies from district headquarters, and the head members from the Village Development

Committee and the villagers. The staff from the Himalayan Trust New Zealand reserved the right to inspect at any phase at their discretion and to make necessary suggestions.

The accountant sends a financial report every month to committee members updating income and expenditure. Every quarter the committee meet with the entire village to find out if the villagers have any problems with the water supply system.

To save water and to inform people not to use the water unnecessarily, small stickers with a slogan about saving water were placed in houses, hotels, lodges and the main public area of Lukla.

The Himalayan Trust New Zealand had their involvement mentioned on every one of these.



Another aspect of sustainability is that users of the water supply pay for the water they use. When the water system was completed, the Committee set up a meter system in every lodge, hotel and household so that they pay every month, according to their meter. The metering system and tariff agreed to by the Lukla community is transparent and affordable – the users pay for the amount of water they use and can monitor their water use accordingly. The money collected from meters is used for operations and maintenance; to pay the salaries of the two plumber staff, and an amount is also collected to ensure that the Committee has funds to provide new connections to new residents who arrive in Lukla. Surplus funds will be used for other community projects. Drainage is one area that the Committee is currently looking into.

Lessons Learned

Lakpa Thering felt that there were a number of factors that made this project successful. A good team was assembled to form the Lukla Drinking Water Committee. The core group – the chair, engineer and treasurer worked well together and inspired others to join them to improve the drinking water in Lukla. They were dedicated and genuinely wanted to improve the quality of life for all residents. They worked well together and convinced the town to believe in them, and to pay for the water they use. The team was young and energized. They all knew each other and got on well together. They had clearly defined roles and responsibilities and they took them seriously.

Lakpa thought that they had the right people in the right place at the right time to get the job done – good leadership and facilitation skills to get the community on board to support the project, good technical skills to design an appropriate solution to their water problem and good financial and management skills to keep people informed on progress, the cost of materials, transport and construction.



The financial transparency displayed throughout the project was important as it quickly gained the support of the community. The community had not seen this level of transparency before in any project in the village. Regular community meetings were held to keep people informed and leaflets about the project were prominently displayed throughout the village on public notice boards. This included keeping people informed on the project costs, the income and expenditure and the challenges, particularly when it came to the logistics and procurement.



The team was always keen to learn. One area that they thought they could improve on was in the area of project budgeting - they found that they had to do some activities that were not in the plan. For example a bridge was required to protect the pipeline from damage. This was an unbudgeted expense but was needed to ensure the pipeline was not compromised by a river crossing.

Getting the project materials to Lukla was extremely challenging for the team. It was not always possible to transport materials at a reasonable rate. People who pay more per kilo for the chopper generally get priority, so this made it difficult for the team to keep the costs down and to get materials when they needed them. Preferred supplier agreements which lock in price for longer may be one way around this in future projects.

Impact

This project set out to improve water infrastructure and to manage it so that the residents of Lukla could get on with their lives. Lukla residents no longer have to face the inconvenience of irregular supply and the frustrations and costs related with that. The team has achieved this with full support of the community who decided that they were willing to pay for a reliable system that met their needs. The main impacts of this project are:

Social – every household is on the system and has the convenience of regular water supply for drinking, cooking, washing and cleaning. They no longer have to constantly fix pipes many times a day to get safe water. It is also affordable for most users with a two tier tariff system that reflects the volume of water used. The fact that this system serves all households and can be extended to new arrivals is commendable. There are still a few residents who use parts of the old system to get water from the river and fix their own pipes to get free water. It is expected that this duality (two systems) will continue for a while but will eventually fall away as people get used to the convenience of a reliable supply. Some use the new system for drinking and cooking and the old one for everything else to keep their costs down.

Economic - every lodge is on the system and has improved access to safe water supply to meet the demands of their businesses. The new system has made life a lot better for lodge owners.

Safety – the fire-fighting system, fire drills and fire prevention trainings have raised community awareness to the risk of fire and their ability to respond to a fire in Lukla. The committee and



community may want to agree on an appropriate early warning system that alerts people to a fire and that they need to assemble to contain it.

Conclusion and Recommendations

This project is the best example of a high impact, low cost, sustainable community development project I have seen in the water sector and one that could be replicated in other parts of Nepal.

The key to the success of this project was the leadership shown by the LDWC and the trust and support they generated amongst community members as this project progressed. They remained accountable to the community throughout and the openness and transparency in how funds were spent throughout the project convinced the community that the committee was genuinely working in their collective best interest to improve access to safe water supply and improve fire safety throughout the village. It has meant that villagers no longer have to search for water or repair their own tangled pipelines to get access to water. The system has provided continuous flow of water to the community since October 2014.



The LDWC held a number of public meetings and displayed updates to the community on progress and project costs on public notice boards throughout Lukla so that everyone was aware how funds were being spent. The high level of accountability and transparency by the LDWC to the community is seldom seen in development projects and is to be commended and sets the bar for other development projects in Nepal.

The Lukla Drinking Water Project provides safe water supply to the village of Lukla and reduces the risk of fire through installation of a fire fighting system throughout the village. The main reservoir and 4 sub reservoirs have been designed to ensure there is adequate supply for the everyday use and for use in the event of a fire.

200 households and lodges have had a water meter installed to log their daily water use; the community agreed on a tariff structure that would be applied to all water users for water delivered by the system. The tariff is affordable and also ensures the system can be operated and maintained by staff employed by the LDWC. Any surplus will be put back into community projects agreed through the LDWC.



20 fire hydrants and hoses have been located throughout the village to fight fires; community members have been trained in the use of the fire-fighting system; regular drills will be scheduled and ongoing training will be led by fire-fighters from Australia.

I would suggest that the Committee ensures the following:

- The as-built-design drawings and operations and maintenance manual are kept together so that future staff and Committee members has access to the current plans / technical design and O&M systems for business continuity.
- The business plan/model is available so that staff and Committee members are clear about the long term budgetary projections of income and expenditure for the Water System.
- An assessment of possible health benefits of improved access to water supply and hygiene education after the monsoon.
- Regular water quality tests are conducted to ensure public health/safety.

Some O&M measures include (not an exhaustive list but to illustrate what I mean):

- Leak testing (out of and into the tank) for several days to show that the tank is properly sealed against water losses OR ingress of poor quality water from outside.
- Thorough cleaning/flushing according to a regular schedule.
- Weekly monitoring of the water surface of the tank to remove any floating material (which may rot and cause taste, odour and PH risk).
- Regular (depends on the concentration of suspended solids in the raw water supply) flushing of the tanks to remove any sediments from the floor of the tanks – this should be through a normally closed valve right at the base of each tank, which is mounted BELOW the normal takeoff valves by (say) 25-40mm so that solids don't get sucked into the water supply to houses etc.
- Checking of the pipelines and fittings downstream of the tanks for leaks (initially and then on a monthly basis).
- Water quality into and out of the tanks to be tested from time to time to confirm the public health / safe water quality (particularly after the monsoon)- this should form part of the broader operation and maintenance measures put in place.

I commend the Lukla Drinking Water Project Committee and the community for their work and dedication to improving access to water supply and fire safety in Lukla. The evaluator would like to thank HT and LDWC and members of the community for their openness and cooperation during this evaluation. Also a big thanks to Oxfam for supporting this opportunity for work related learning.

Signed and dated:

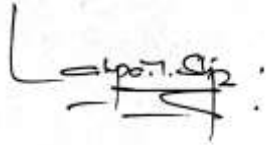
WASH Advisor

A handwritten signature in black ink, appearing to read 'A Thomson'.

Andy Thomson
May 31, 2015

Endorsed as a fair reflection:

LDWP Committee Chairman

A handwritten signature in black ink, appearing to read 'Lakpa Thering Sherpa'.

Lakpa Thering Sherpa
May 31, 2015