United Mission Hospital

Tansen, Palpa

Sustainability project

Contents:

Report number: 2021001

Water Development Consult

www.waterdevelopmentconsult.com

OVERVIEW

Location: United Mission Hospital Tansen, Bhusaldada, Palpa District, Nepal

Purpose of project: To make the hospital more sustainable.

Estimated costs: A preliminary cost estimation comes to about USD 413,000.

Project Title: **Sustainability project**

Organization Name: **Tansen Mission Hospital**

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INTRODUCTION

Tansen hospital was established in 1954, when the United Mission was permitted to start work in Nepal. Tansen hospital was the first place where medical care was given. Up till then the Nepali people had to go to India for medical care.

At present the hospital has 169 beds, staffed with 257 medical and 159 supporting staff. Daily an average of 300 outpatients visit the hospital. Common diseases are infections (meningitis typhoid, gastroenteritis, TB, HIV and parasites), chronic lung disease, alcoholism, heart disease, diabetes, injuries, malnutrition and pregnancy complications.

United Mission Hospital, Tansen (UMHT) is an acute care general hospital situated in Tansen, Palpa District. UMHT is a referral hospital for Palpa and surrounding districts. The Mission of the Hospital is to promote health, prevent illness and treat disease among the people of Palpa and surrounding districts, by providing high-quality health care at the level of a zonal hospital in the Name and Spirit of Jesus Christ, irrespective of colour, caste, creed, gender or financial status and to make Him known in word and deed.
The United Mission Hospital, Tansen is committed to helping its staff to develop their full potential. UMHT is also a training hospital with a clear mission to train up medical nursing and paramedical professionals both for the immediate needs of the Hospital and for wider service in Nepal.
Tansen hospital was awarded the title "best hospital Nepal" in 2012, is fully non-governmental and is part of the activities run by UMN in Nepal. As a matter of fact, the government has requested UMN to continue its role and involvement, instead of handing it over to the state, as proposed by UMN. In 2015, a new agreement for the next five years was signed with the Government of Nepal. The vision is to grow the capacity of the hospital to 250 beds over a 5-year period as, at this point, patients still need to be turned away when all the spaces on the floor have been filled.

The team of anywhere between 10 to 20 expatriates, in an otherwise all Nepali-staffed hospital, has been able to make a remarkable difference in the quality of health care and the education of Nepali physicians over its 55 years of existence.
The budgeted running expense for the fiscal year from July year 2013-July 2014 is NRs 230,340.000 (USD 2,303,400) and capital expenditure is estimated at NRs 39,809,000 (USD 398,090). The capital expenditure will only be spent if revenue covers first the running expenses. The experience over the last 10 years shows that the hospital manages to cover these expenses. Roughly 80% of the patients are able to pay.
Salaries make up roughly 55 % of the budget, medical supplies and consumables about 25%. Thus approximately 80% of cost is directly “medical”. The hospital fees have been increased by about 10 % p.a.

SITUATION

United Mission Hospital Tansen is located in Tansen Municipality. On the south side of the hospital a small village has been built mainly to support the patients in the hospital. The name of this village is Bhusaldada. Shops where food can be bought, small guesthouses etc. are the main activities. The waste water from this community flows into the same gulley as the one in which the black water from the hospital is disposed of.

At present the disposal of waste and the care of the environment doesn’t have a high priority in Nepali society. For example taps are left running, without closing after use, waste is dropped at any place, there are hardly any waste water cleaning plants in the country.

In 2014, the hospital started with a program to make the hospital more sustainable also in respect to the environment. At those days, for example, hospital waste was mainly dropped outside the hospital compound, whereas papers and plastics were burned. In Tansen there is and has always been a shortage of potable water. In the dry season, surgery had to be postponed regularly because of the lack of water. Water, needed for the washing of hospital linen, had to be heated with propane gas. Waste water is disposed of via a gulley, untreated and the dirty water passes houses of poor people who use this for irrigating their crops. During the monsoon, the waste water mixes with the run off of rainwater, polluting

the clean rain water. People use this water for irrigation their fields. Nearby this dirty stream groundwater comes to the surface and people drink from this spring water.

Hospital management felt that this was an unwanted situation and a plan was drawn to make the hospital more sustainable. The following plan was drawn:

1. Use more rain water from monsoon rains to supplement the potable water frown town in order to become more self-sufficient so no water shortages have to hamper surgery.
2. Minimize the waste of water in the hospital. Use push taps and where applicable thermostat shower taps.
3. Install sun boilers to heat the water by sun necessary for the washing facility of the hospital.
4. Separate the waste. Collect all plastics to be recycled, glass to be recycled and burn paper in an effective new incinerator.
5. Oxygen project. In 2016 the hospital built their own oxygen plant.
6. Design and build a waste water sewerage plant that cleans the waste water of the hospital, village Bushaldada, situated next to the hospital and the compound of the hospital.

   The different stages of this project and its status is described as follows:

1. Watertank project

In 2014, the hospital had different water sources. The hospital receives piped water from the municipality. This water source is unreliable. The hospital has a small spring from which water is drawn and the hospital saves rainwater from the roofs of the hospital and stores it in underground water tanks. These water sources aren't sufficient for the hospital. Especially in the dry season (April-June) the running of the hospital is hampered due to a lack of water.

First it was investigated how much water the hospital is using. Then how much rain comes down during the monsoon, how many liters of water can we catch using the roofs? How much piped water is supplied by the municipality and how much can we expect from the own source of the hospital. On the basis of these data it was calculated what size of water tank would be needed in an average year. It seemed, that a water tank of 1,000,000 liters would do the job. The hospital has a tennis court on the compound and that was situated much lower than the hospital compound buildings. This was an ideal situation for the new water tank.
It was calculated that the costs would be around USD 300,000. As the hospital aims to treat poor people as cheaply as possible, the hospital didn't have the funds to finance this water tank. So outside funds were sought. Five private charities were willing to support the construction of this water tank. In the beginning of 2015 we were able to start with the construction. Luckily, the big earthquake of April 2015 didn't affect the construction as no concrete was poured yet. The water tank was ready in the beginning of 2016 and it was inaugurated on the 1st of May 2016. Up till now the hospital's own source and the storage capacity from rainwater supplies about 17 % of its needs.

Water saving project
In Nepal in general, people tend to let water flow lavishly without bothering if enough water is available. The hospital has worked hard to make people aware of the shortages of water and the costs involved. It has become clear that it is very difficult to get a change of behavior in which water is used sparingly. So the hospital investigated all the places in the hospital where water is used and in how to reduce outflow. It was found that push taps serve this purpose so that only the necessary water is being used and no water is wasted. At most places push taps have been installed. At bathrooms thermostat taps will be installed to minimize wastage of water.

Sun boilers
The hospital has a laundry where clothing and linen of the hospital is being washed. They use a lot of hot water. This water had to be heated by means of electricity. Communal electricity isn't very reliable, regularly power is shut off and hospital has to switch to its own diesel generator. This isn't cheap and also bad for the environment. In 2014 the hospital installed sun boilers with which the hot water for the washing area is heated. In Nepal the sun shines nearly all days except during the monsoon when cloudy days occur. The costs for these sun boilers (solar panels) were USD 8,100.

Waste project
The hospital had an old incinerator, located just outside the hospital compound. Most items were burned with the exception of glass that was just dumped into a bamboo area. On most days, the smoke of the incinerator drifted towards the hospital. This smoke was very unhealthy. Management wanted to improve this situation. So the waste disposal project was started. At a convenient location on the hospital compound a new incinerator was constructed and covered and locked premises were erected where waste is separated. There are partitions where waste glass is stored, plastics, paper, rubber gloves etc. At a regular basis waste is collected and transported to a recycling factory. The costs for the incinerator and sheds were about USD 11,574.

Oxygen project
The hospital was used to purchase and use oxygen cylinders. We built an oxygen plant so that we can produce our own oxygen. This is important for several reasons. After a natural disaster such as the 2015 great earthquake, landslides blocking the roads during the monsoon each year, or political disturbance such as the Indian border blockade or strikes, we can maintain our oxygen supply to our patients. It is environmentally sound too not to have 2 journeys per week to collect oxygen cylinders from 40 km away and reduces our carbon footprint.
It also appeared to be cheaper to produce our own oxygen. In 2016 an oxygen plant was erected on the premises of the hospital. The costs for this plant were USD 128,395.

Waste water project
At present the waste water of the hospital, the compound buildings and the village next to the hospital (Bhusaldada) is being collected and disposed of at several locations. The waste water from the compound buildings passes through a septic tank (unknown if they still work) and sink pit and is dumped over the cliff into the

environment.
The waste water from the hospital and the village Bhusaldada is heavily polluted and runs through a gulley down the hill till a stream with the name Sisne Khola. On the way this water penetrates the soil, and may pollute ground water. Close to this gulley, a natural spring exists where local (poor) people collect their drinking water and use the water for their household. Beside this the waste water is used from time to time to water gardens of the poor people living close to the gulley, as piped water is in short supply. During the monsoon the rainwater from the pavement round the hospital and Bhusaldada runs down the gulley and is heavily polluted through the waste water from the hospital and Bhusaldada. This water is used to irrigate the paddy fields. Further downstream this polluted water flows into the Tinau river from where the population of Butwal and Bhairawa take their drinking water (approx. 1 million people) An unhealthy situation. The aim of the hospital is to heal people who are sick. Because of this untreated waste water, the hospital may also be eligible to sickness of people. The hospital wants to prevent it. The hospital has a program on preventive healthcare, so it is very much motivated to remove this illness source.

The design for a waste water plant that is easy to maintain and that can be copied at other places in Nepal was made by a Dutch Water Board. The design of this waste water system is ready, the hospital is looking for funds to be able to build this system through which it is possible to eliminate this source of illnesses. It is estimated that this plant will cost about USD 413,000. A description of the proposed works with a cost estimation is below.

The aim of the hospital is to work as much as possible on sustainability. It has a maintenance department to maintain the hospital buildings and other systems a biomedical maintenance department where hospital equipment is repaired. With these new initiatives, the hospital has solved most of the hazards it caused to the environment. The hospital will promote these achievements as much as possible, motivating other hospitals and parties to work on sustainability. Up till now, the managers of other Nepali hospitals have come to see for themselves what impacts these projects have on the environment.

Water tank is below tennis field; building at the back is oxygen plant; on the left side hospital buildings.

Inside water tank

Solar water heaters

Waste separation building; at the back incinerator

Detail of waste separation building

WASTE WATER CLEANING PLANT

Introduction

At present, all the waste water from the toilets, sinks etc. from the hospital is collected at a central place near the vehicle entrance of the hospital and disposed of down a gulley. This water mixes with the waste water from the small village and during the monsoon the discharge of black water from the hospital mixes with the flow of water from the pavement near the entrance of the hospital, creating a small river down the hill. The water from the washing area of the hospital goes through a separate system and is disposed of at another place outside the hospital compound.
The compound housing and guesthouse each has a septic tank and in some cases a sink pit. The effluent from these systems is mainly disposed of over the cliff. The drawing on page 13 gives an insight into how the waste water from the hospital compound is disposed of. It is unknown how well or poorly the septic tanks function. If bleach is used, the septic tank has hardly any effect on the quality of the water.

The use of water by the hospital and compound buildings give an indication of the total waste water produced by the hospital. The discharges are:

Compound - 13 m3 water per day
Laundry - 7 m3 water per day
Hospital - 30 m3 water per day

Around the hospital Bhusaldada village has come into existence where people who have relatives in the hospital can stay and where also food for hospital patients is prepared. These houses don't have running water in the houses. Water needed is collected in jars and carried inside. The municipality gave the following statistics about the houses/population in that village:

Total no. houses 115,
total number of population 659
toilets 227
septic tanks 10
open drains 3
Attached to the sewerage system of the hospital - all
Hotel number 46
Daily guests 359

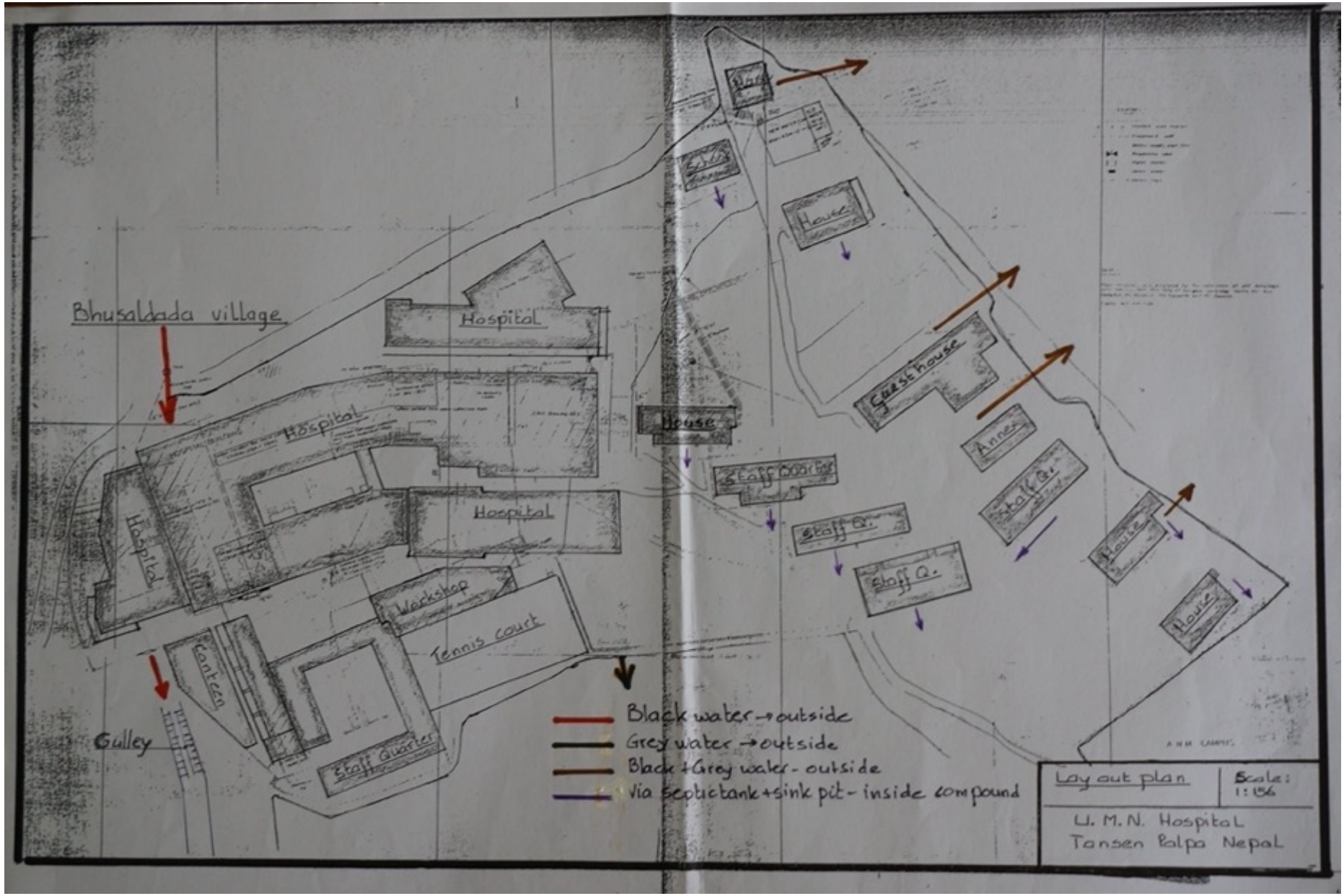
The following pictures give an impression of the present situation.

Location where black waste water is disposed of from the hospital

Gulley down the hill to carry black waste water

During rains, rainwater from pavement mixes with black waste water

Disposal of grey water used by washing room



Situation of hospital compound with the way waste water is disposed of .

PROPOSED SEWERAGE AND TREATMENT SYSTEM

Introduction
The present system is that the hospital produces black water that is being disposed of without any treatment. This black water is very contaminated and carries bacteria etc. Water from the washing facility in the hospital is also disposed of outside the compound without any treatment. The waste water from the houses and other buildings on the compound go into a septic tank near the house, on through to a sink pit and is then disposed of inside the compound or dumped over the cliff.
The waste water from Bhusaldada village is disposed in the same gulley where the black waste water of the hospital is being disposed of.

The facility that produces this contaminated water is the hospital. Since hospitals are established in order to care for the health of people, it is evident that a hospital should not dispose of contaminated water in a way that creates a possible health hazard to people. It is therefore of utmost importance that the waste water of the hospital is treated in such a way as to prevent people from getting sick if they come into contact with this waste water. This is even more important as people fetch water from springs in the neighborhood of the "waste water gulley"

The management of the hospital requested me to design a waste water cleaning system to end the situation where the waste water of the hospital pollutes the environment. As there are no waste water systems in Tansen with a second line treatment it will be used as an example for Tansen and Nepal.

I used to work for a Water Board in The Netherlands and I asked them to make proposals. This Water Board, HDSR (www.hdsr.nl), manages 17 waste water plants in sizes from the city of Utrecht (340.000 inhabitants) to small villages. They suggested three options for a waste water system:

1. Septic tank with wetlands.
2. A Sequencing Batch Reactor (SBR), a state of the art waste water system.
3. A fully automated SBR, named ICEAS.
4. A fully automated MBBR system.

Septic tank with wetlands
The advantage of solution 1 is, that it is simple with technology that is known in Nepal. The septic tanks have to be cleaned every 5 to 10 years and this is a known process. With this solution, no energy is required as the system works on the free flow of water. The wetlands need minimal maintenance. The quality of the effluent of the wetlands is up to international standards. The disadvantage is, that no chlorines for cleaning can be used and that it needs a bigger area of land.

A Sequencing Batch Reactor (SBR),
The advantage of solution 2 is, that it is an industrialized way of the process. It is compact and gives a good quality of effluent. The disadvantage is that it is more difficult to maintain, expert staff is needed and a lot of energy is needed to keep the process going. Maintenance people will have to be trained to be able to operate the system. Another disadvantage is, that this system gives a daily volume of sludge that has to be removed and brought to drying beds. The hospital doesn't have room for drying beds and the transport equipment isn't available in Nepal. It is costly to make and maintain such a vehicle only for

use of this one waste water plant of the hospital.

An automated SBR, named ICEAS
The third option is even more complicated than option 2 and therefore beyond the possibilities of the hospital.

Automated MBBR system
After the design of a system with a wetland it appeared that a wetland will be expensive due to the high price of sand. We came than across a system invented by a Norwegian professor that is being used in the Scandinavian countries and several other countries worldwide. This systems appears to be good alternative for the wetland. A Dutch research institute (STOWA) investigated this system and is positive about this cleaning system. It consists of two chambers with pumps and aeration. In one of the tanks they have flooding plastic particles. The system needs about 7,5 kWh of electricity. It produces sludge that is dewatered and has to be disposed of. However the investment costs are a fraction of the costs for a wetland. An American Company (EEC – www.eecusa.com) build this system in a container and works automatic. They have a manufacturing company in India

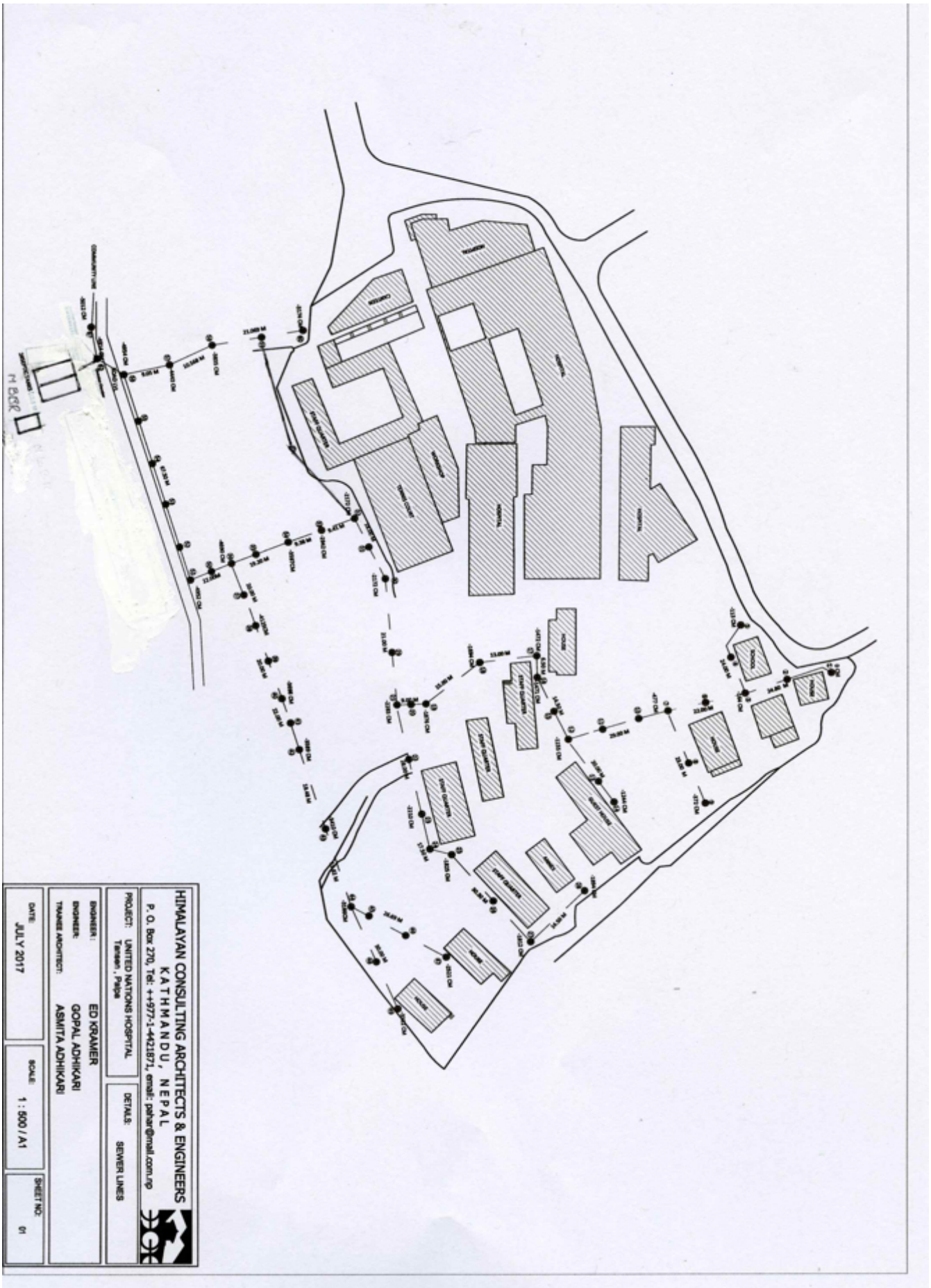
SYSTEM TO BE IMPLEMENTED

1. Transport system

The waste water from the hospital, the buildings of Bhusaldada village, the canteen and the compound buildings will have to be transported to the treatment plant.

a. The waste water from the hospital and is the so called “black water” It is waste from the toilets etc. and needs at least two types of treatment. Hotels and houses close to the entrance of the hospital are connected to pipes that carry the black water to a gulley outside the gate of the hospital. The waste water of this village and the hospital will be piped and brought to the water treatment plant.
b. The waste water from the houses and the waste water of the washing machines of the hospital are disposed of at several locations. All houses have a septic tank with sink pit. These septic pits will be abandoned as it is more difficult to maintain 10 small septic tanks than two big ones. The black water of the houses is piped and brought to the septic tanks.
c. Up till now, placenta’s, from the maternity unit are being burned in the incinerator. This practice was opposed by a number of the Nepali staff. The Maternity Hospital in Kathmandu uses a bio gas installation to dispose of placentas. In 2014 the Carl Friedericks building was completed. In that quarter, live about 50 staff members and has several teaching rooms. Besides that, the black water system is separated from the grey water system. An ideal situation to connect the black water system to a biogas plant; where also placenta’s can be disposed of. This biogas plant will be a part of the system.

The proposed infrastructure is given on page 16. We will use pipes of different diameters to bring this black and grey water to the first and second treatment plants. After the treatment is completed the effluent of the second treatment plant will be disposed of in the same gulley through which now the black water of the hospital with the surrounding hotels and houses is disposed of. The water quality of the water in this gulley will improve dramatically.


HIMALAYAN CONSULTING ARCHITECTS & ENGINEERS
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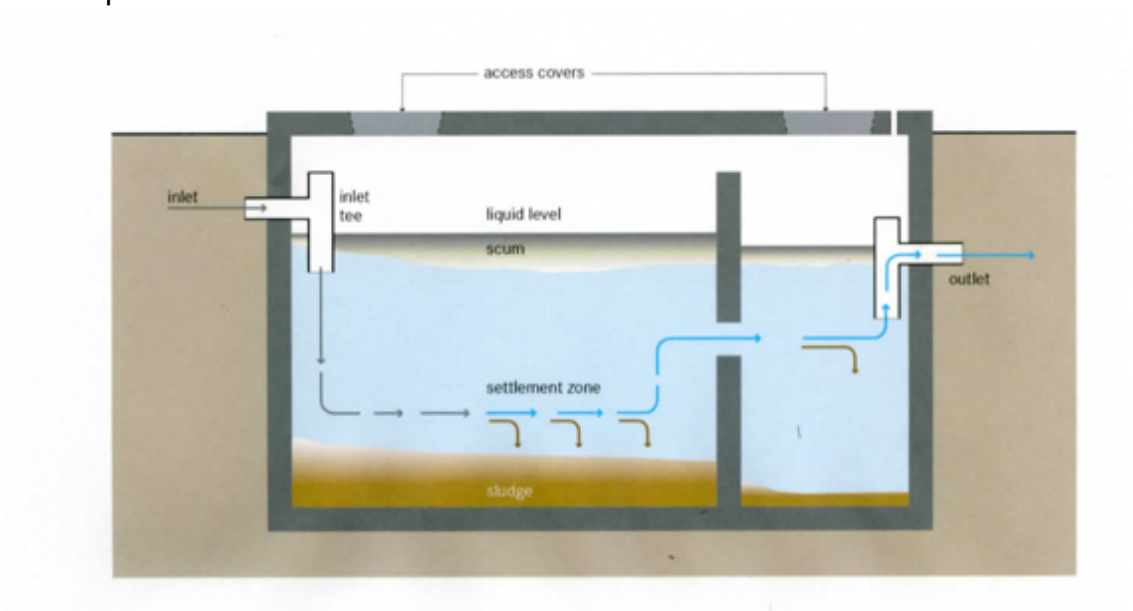
PROJECT: UNITED NATIONS HOSPITAL
Tansen , Palpa
DETAILS: SEWER LINES
ENGINEER: ED KRAMER
ENGINEER: GOPAL ADHIKARI
TRAINEE ARCHITECT: ASMITA ADHIKARI
DATE: JULY 2017
SCALE: 1 : 500 / A1
SHEET NO: 01

First line treatment

On the hospital compound, first-line treatment is available for all buildings except the hospital. The living quarters, guesthouse etc. are all equipped with a septic tank. The black water from the hospital is not given any treatment. Therefore, a first-line treatment plant should be built for the hospital. The waste water from the hospital, 40 m3 per day, should be put through a standard septic tank with a capacity of 224 $m^{3.}$ It was considered to use an improved septic tank named an Anaerobic Baffled Reactor (ABR). It was decided to use an ordinary septic tank as an Anaerobic Baffled Reactor (ABR) has a little more efficiency (5-10%), but is more complicated to operate. This solution is thought to be the most cost effective. Two septic tanks with a capacity of 112 m3 will be build. The inside dimensions will be 14,00 x 4 x 2 meters. These tanks will be located near the road to the nursing campus. This location gives the opportunity to remove the sludge into trucks to be brought to a disposal area.

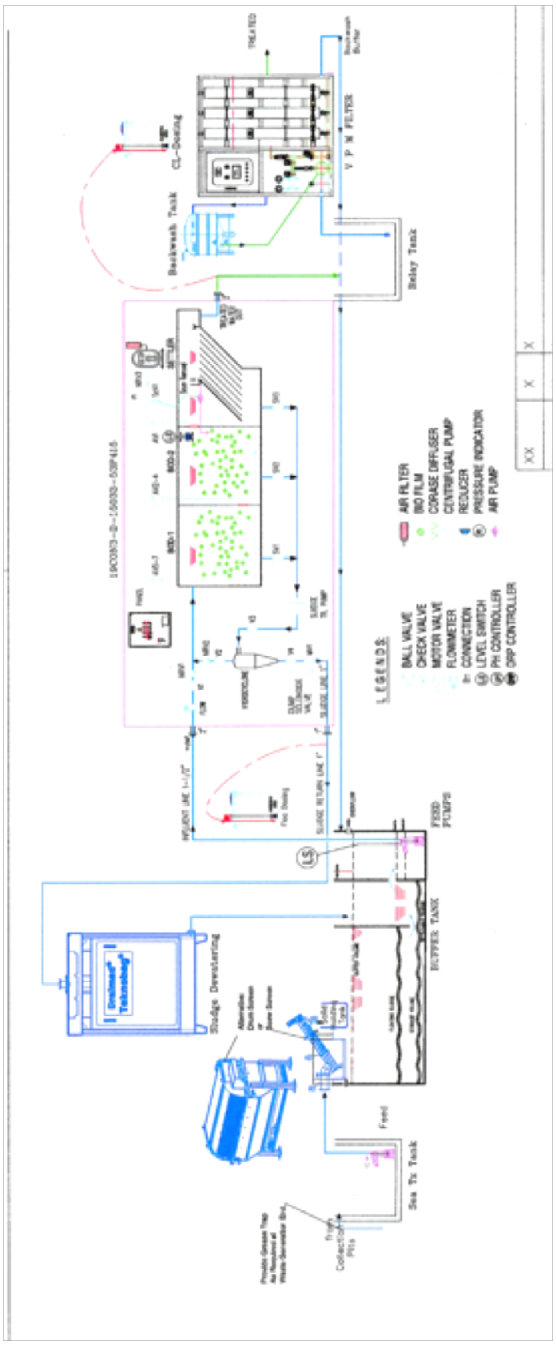


Standard septic tank

Location of the two septic tanks

2. Second line treatment

The effluent from the septic tanks, the water from the washing room facility from the hospital has to be treated in a secondary treatment plant. The choice has been made for a “Moving Bed Biofilm Reactor” (MBBR) that will be placed behind the septic tanks. The system is mounted into a container in which the process takes place. For this system 7,5 kWh is needed, but no additives are required. The system produces about 100 liters sludge per day and is dewatered at site. This sludge can be used a manure. The system is manufactured in India in a 15 feet container and be brought to the site by truck.
The effluent from this waste water treatment system is up to international standards. The effluent will be discharged into the gulley where at the moment the hospital waste water finds its way down the hill. This will have a huge impact on the surroundings as further downhill near this gulley springs exist from where people derive their drinking water from.



Schematic length section of MBBR

3. Implementation of the project

The total costs to realize this project are estimated at USD 413.000.
The main hazard for the local people living close to the waste water gulley is the waste water from the hospital and Bhusaldada village, as no treatment takes place. The waste water from the compound houses have a septic tank and a sink pit. The effluent of the sink pits is mainly disposed of into barren land and normally people don't come into contact with this waste water. As the costs to construct this waste water system is high it is decided to divide the project into two phases. These being:

- Phase 1: We build first the biogas installation. This is a standalone installation and can function without the need for the rest of the project. It is relatively cheap and quick to be realized. In this way we can solve the problem of the disposal of the placenta's quickly. The costs will be USD 8,000.
- In phase 2 we will build a waste water system for the hospital and Bhushaldanda only. We will collect all the waste water from the hospital (including the waste water from the laundry room) and Bhusaldanda village and bring it through a pipe to the waste water treatment plant, the MBBR. The capacity of this MBBR is for the entire project. In this way the waste water that effects the health of the local people is treated. After the realization of this phase, the water that flows through the waste water gulley will be clean water that safely can be used for irrigation purposes. The costs for this part of the project, has been estimated at USD 260,000.
- In phase 3 we will connect all compound buildings to a pipe system that takes all waste water to the already existing water treatment plant (the septic tanks and MBBR system) The costs for this phase comes to USD 145.000.

After phase 2 has been realized the health hazard of the people living close to the waste water gulley has been solved. Phase 3 can be realized at a later date as it doesn't effect the health of people.

SUSTAINABILITY OF THE PROJECT

In Nepal there is at the moment a lot of discussion about the treatment of waste water. It is said, that because of the use of proper toilets child deaths are minimized. However now the problem arises what do we do with the waste water from these toilets? There is a lot of discussion but there aren't yet sustainable solutions. See the following paper about this discussion: https://www.nepaltimes.com/banner/toilet-trained/

Hospital management took the initiative for this waste water plant. It was proposed to the local Mayor and he was enthusiastic about it. He called the local Advisory Board and this was discussed. They were very positive about this project, that it should proceed. As the hospital doesn't have the space to locate the wetland, the local authorities made it possible to use a part of the land of the Forest Department. The so called "Forest User Group" will assist to implement this project and take care of the distribution of the cleaned water. Besides this the F.U.G. has agreed to assist the Municipality in promoting waste water cleaning plants for other institutions in Tansen. They are very motivated as most members are mothers. They take care of the health of the family and they see the results of the use of polluted water.
Municipality chief wrote a letter stating the support of the municipality (see below)

In Nepal, the United Mission Hospital Tansen hospital is seen as a forerunner to improve its health care. It won the following prizes:

- Best hospital in Nepal given in July 2012 by the Minister of Health in the name of the medical magazine: “Swasthya Kabar Magazine”
- In November 2012 it received the “Healthcare Leadership Award 2012” of the “Knowledge Resource Development & Welfare group” Delhi for “Outstanding Contribution in Promoting Inclusive Healthcare”.
- In 2014 the “Dixa-Daxa Sewa Puraskar 2014” award was received from the “National TB Centre on international TB day” for “the spectacular service of the hospital in view of the TB checks.” This was the second time this award was won by the hospital

The hospital is well known in Nepal and managers of other hospitals come regularly to Tansen to look at the improvements the hospital makes. The AMDA hospital from Jhapa (Nepal) sent the following mail:

“ Dear Dr. Karrach,

Namaskar and warm greetings.

We are thankful on the kind cooperation of your and your team that exposed during the visit of AMDA SCWH team in your esteemed hospital. We are highly influenced with the efficient management of each unit as well as the complete cleanness of the hospital inward/outward premises. I am personally much impressed the waste management. In
this regards considering our concern about incinerator, we are grateful that you share the design with details.

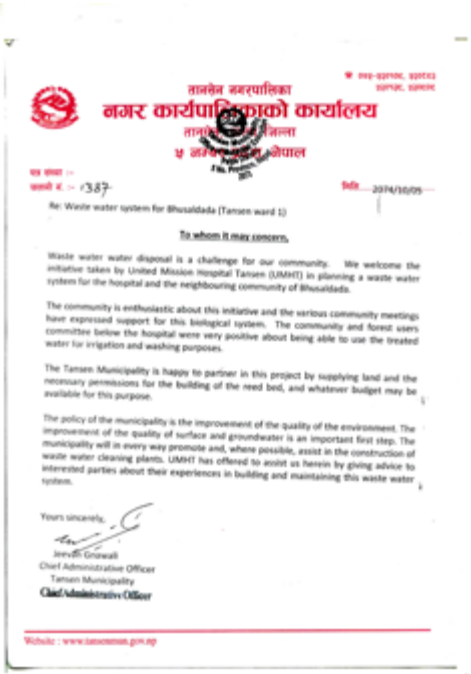
In coming days, we hope to have such coordination meeting for mutual cooperation.

Thank you.

With Regards,

Achyut Sapkota
Senior Officer (Amin/Finance)”

The hospital will promote and show this waste water plant to other interested parties.



नगर कार्यपालिकाको कार्यालय

To whom it may concern,

Waste water water disposal is a challenge for our community. We welcome the initiative taken by United Mission Hospital Tansen (UMHT) in planning a waste water system for the hospital and the neighbouring community of Bhusaldada.

The community is enthusiastic about this initiative and the various community meetings have expressed support for this biological system. The community and forest users committee below the hospital were very positive about being able to use the treated water for irrigation and washing purposes.

The Tansen Municipality is happy to partner in this project by supplying land and the necessary permissions for the building of the reed bed, and whatever budget may be available for this purpose.

The policy of the municipality is the improvement of the quality of the environment. The improvement of the quality of surface and groundwater is an important first step. The municipality will in every way promote and, where possible, assist in the construction of waste water cleaning plants. UMHT has offered to assist us herein by giving advice to interested parties about their experiences in building and maintaining this waste water system.

Yours sincerely,

Jeevan Gnawali
Chief Administrative Officer
Tansen Municipality

The chosen solution is sustainable because septic tanks are known in Nepal and local personnel is able to maintain the system. The MBBR is basically free from maintenance. The inflow and outflow pipes have to be checked if there aren’t obstructions.

By choosing septic tanks and a MBBR a sustainable solution is found in the treatment of waste water that easily can be copied elsewhere. The advisor of the hospital of this project is willing and capable in giving advice to other parties if so requested. Therefore, this project will be an example to the discussion about the waste of toilets and can give a boost to the implementation of more waste water systems in Nepal.

PRELIMINARY COST ESTIMATION

Details cost estimation.
NRs are Nepali Rupees. There are about 114 NRs in 1 USD and 1,10 USD in 1 €

Estimated costs for phase 1 of the project:

1. Biogas plant

Biogas plant with removal system		868,570
5% unforeseen		43,430
Total	NRs	**912,000**

In USD / 114= **USD 8,000**

Estimated costs for phase 2 of the project:

2. Sewer lines

Cost estimation architect NRs		1,900,000
Divert rain at outpatients Department		1,000,000
Diversion pipe from hospital near road.		600,000
Pipe from washroom to black water pipe		1,280,500
Pipe MBBR to gulley		500,000
Sub Total		5,280,500
5% unforeseen		264,025
	NRs	**5,544,525**

In USD / 114 = **USD 48,636**

3. Septic tanks

Cost estimation architect:		
Septic tanks 2 pcs		9,006,975
Sub Total		9,006,975
5% unforeseen		450,349
	NRs	**9,457,324**

In USD /114 = **USD 82,959**

4. MBBR

Estimated costs by manufacturer		7,980,000
RCC foundation slab 6m3		575,000
Transportation, Installation and start up		750,000
Generator 8kWh		450,000
Sub Total		9,755,000
5% unforeseen		487,750
Total	NRs	**10,242,750**

Optional is a solar system NRs 2,439,000= USD 21,395 instead of generator of Nrs 450,000

In USD /114 = **USD 89,850**

5. Design, supervision, project management etc.

Costs of architect (60%)		785,000
Supervision costs		720,000
Sub Total		1,505,000
Unforeseen 5 %		75,250
Total	NRs	**1,580,250**

In USD /114 = **USD 13,862**

6. VAT

Total costs project is	NRs	26,824,849
VAT not applicable to:		
Supervision costs		720,000
MBBR container and generator		8,430.000
Total	NRS	**9,150,000**

Costs applicable to VAT = Nrs 26,824,849 – 9,150,000 = **NRs 17,674,849**

VAT is 13 % = NRs 2,297,730 or **USD 20,155**

Summary major cost factors:

Construction of the sewerage system	USD	**48,636**
Construction of septic tanks	USD	**82,959**
MBBR	USD	**89,850**
Design, supervision, monitoring and evaluation costs	USD	**13,862**
VAT (13% not over all costs)	USD	**20,155**
Estimated total costs	**USD**	**255,462**
Exchange risks 1,5 %	**USD**	**3,832**
Round off	**USD**	**706**
Total costs	**USD**	**260,000**

The total estimated costs for phase 2 are USD 260,000 or Euro 236,364.

Estimated costs for phase 3 of the project:

1. Sewer lines

Cost estimation architect NRs		12,799,925
Sub Total		12,799,925
5% unforeseen		639,996
	NRs	**13,439,921**

In USD /114 = **USD 117,849**

2. Design, supervision, project management etc.

Costs of architect (40%)		526,765
Supervision costs		480,000
Sub Total		1,006,765
Unforeseen 5 %		50,338
Total	NRs	**1,057,103**

In USD /114 = **USD 9,273**

3. VAT

Total costs phase 3 are NRs 14,497,024

VAT not applicable to:
Supervision costs NRs 480,000
Costs applicable to VAT = Nrs 14,497,024 – 480,000 = **NRs 14,017,024**
VAT is 13 % = NRs 1,822,213 or **USD 15,984**

Summary major cost factors:

Construction of the sewerage system	USD	**117,894**
Design, supervision, monitoring and evaluation costs	USD	**9,273**
VAT (13% not over all costs)	USD	**15,984**
Estimated total costs	**USD**	**143,151**
Exchange risks 1,5 %	**USD**	**2,147**
Round off	USD	**298-**
Total	**USD**	**145,000**

The total estimated costs for this project for phase 3 are USD 145,000 or Euro 131,818.

Total costs of the project

The total estimated costs for this project (phase 1, 2 and 3) are:
USD 8,000 + USD 260,000 + USD 145,000 being USD 413,000 or € 375,455

CONCLUSION

The hospital has made a big step forward by making processes more sustainable by collecting rainwater, eliminating the spilling of water and using the sun to heat water. It also reduced the carbon footprint by making its own oxygen and by recycling the used plastics and glassware. The last hurdle to take is the cleaning of the waste water of the hospital and the surrounding build up area. After the waste water cleaning system has been implemented it will greatly benefit people living near the so-called waste water gulley. The quality of life will be improved because the source of water borne diseases will be eliminated.

In Nepal there are hardly any waste water cleaning facilities. This is also a pilot project showing hospitals and municipalities what can be achieved by making a relatively simply water cleaning facility that can be maintained by local people. The hospital will promote, where possible, this concept of care for the environment and its inhabitants.

As the aim of the hospital is make health care available to poor people, it isn't able to carry the costs for this waste water system. Therefore, your help is most appreciated.

ing. Ed Kramer
Oudewater
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