

Okhaldunga Community Hospital



Sustainability project

Contents:

Overview.....	3
Introduction.....	4
Situation	6
Proposed waste water treatment system.....	7
Sustainability of the project.....	9
Preliminary cost estimation.....	11
Conclusion.....	11

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Water Development Consult

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OVERVIEW

Location:	Okhaldunga Community Hospital, Sobru Town, Okhaldunga District, Nepal
Purpose of project:	To make the hospital more sustainable and to protect the environment
Estimated costs:	A preliminary cost estimation of the waste water project comes to about USD 195,150.
Project Title:	Sustainability project
Organization Name:	Okhaldunga Community Hospital
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INTRODUCTION

High in the mid-hills of eastern Nepal, where winding foot trails cut through forests and villages cling to steep slopes, stands a hospital that has quietly carried hope for more than six decades. This is Okhaldhunga Community Hospital.

The story begins in 1962. At a time when modern healthcare was almost non-existent in this region, Ms Mildred Ballard came to Okhaldhunga on horseback in 1956-1958 to do a medical survey. Inspired by Mildred's survey and recommendation, United Mission to Nepal (UMN) sought permission from the Government of Nepal to open a health service in Okhaldhunga. This eventually led to the approval of a dispensary in Okhaldhunga in 1961, and in 1962, Dr. James "Jimmy" Dick and his team established what would become Okhaldhunga Community Hospital. Then, Okhaldhunga Community Hospital was established by the United Mission to Nepal, operating from what was once a typical Nepali home. There were no hospital buildings, no paved roads, and no advanced equipment but only a deep commitment to serve.

For the people of Okhaldhunga, and the surrounding districts of Solukhumbu, Khotang, Udayapur, and Sindhuli, this was the only health institution available. To reach the hospital from Kathmandu, one had to walk seven to eight days across hills and valleys. Supplies—medicines, equipment, and essentials—were carried entirely by people, taking more than ten days to arrive. Yet despite these hardships, the hospital endured—because the need was immense, and the mission was clear.

Growing with the Community

As word spread, more patients came. Slowly, the hospital grew. New facilities were added. A dedicated hospital building was constructed. Bed capacity increased to 15 beds, and the number of expatriate and Nepali staff expanded. This was not growth for prestige but growth in response to trust. Families walked for days, carrying sick children, elderly parents, and injured loved ones. They came because Okhaldhunga Community Hospital represented something rare: care with dignity.

Resilience Through Disaster

In 1988, a powerful earthquake struck the region, causing severe damage to the hospital. For many institutions, this might have marked the end. But for Okhaldhunga Community Hospital, it marked a turning point. With the generous support of FELM, a Finnish Christian organization, a new hospital building was constructed. The hospital was upgraded to a 25-bed facility, and services expanded to include minor and some major surgeries. Patient numbers increased—both inpatient and outpatient—because once again, the hospital rose to meet the needs of its people.

Disaster struck Nepal again in 2015

Again, Okhaldhunga Community Hospital faced destruction—but once more, it rose back up. With the support of Normisjon of Norway, a new hospital building was constructed, adding essential health facilities and improving service capacity. The Government of Nepal's Koshi Province approved the hospital as a 50-bed facility, recognizing its critical role in regional healthcare.

Each day:



- Around 100 patients are treated in the outpatient department
- Approximately 50 patients receive inpatient care

Behind every number is a story—of survival, recovery, and hope. The hospital now offers not only a wide range of medical services once unimaginable in this remote setting. But it also runs a community based inclusive disability Community Based Inclusive Development (CBID) program through its Community Health Department. This is again thanks to the Norwegian Government.



Okhaldunga Community Hospital – red buildings

The hospital is staffed by 11 medical professionals and 115 support staff and provides care to an average of 100 outpatients each day. Common conditions treated include infectious diseases such as meningitis, typhoid, gastroenteritis, tuberculosis, HIV, and parasitic infections, as well as chronic lung disease, alcoholism, heart disease, diabetes, injuries, malnutrition, and pregnancy-related complications.

For the fiscal year July 2024 to July 2025 (FY 2025/26), the hospital's budgeted operating expenses total NPR 186,910,417 (USD 1,288,000), while projected income is NPR 177,424,530 (USD 1,224,960). Planned capital expenditure is NPR 1,008,259 (USD 6,958). Major capital investments are undertaken only when operating costs are fully covered or when specific donor funding is available. Of the total projected income for this fiscal year, approximately 66% comes from patient service fees, 26% from external grants, 3% from government grants (primarily reimbursements for government programs such as the Safe Motherhood Program), and 5% from other sources. On the expenditure side, staff salaries



account for 53% of total costs, medical supplies 15%, hospital charity care 13%, and general and other operational expenses 19%.

SITUATION

At present the disposal of waste, waste water 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 anywhere, and there are hardly any waste water cleaning plants in the country. The release of pharmaceutical compounds and organic/inorganic pollutants present in hospital effluents (bacteria, viruses and harmful chemicals) are known to have hazardous effects on humans as well as animals, vegetation and aquatic ecosystems, even at low concentrations. (Sharma, C., Gupta, S., Kumar, V. *et al.* **Hospital-associated effluents: the masked environmental threat that needs urgent attention and action** <https://doi.org/10.1007/s42452-024-06456-2>)

Once the hospital solid waste and wastewater situation is fully addressed and the source of water borne diseases and other contaminants is eliminated, all life will be positively impacted – for plants, animals and humans.

In 2016 with the reconstruction of the hospital, a biogas plant with a wetland was constructed. As the hospital didn't have sufficient space, new land was created by erecting an approximately 12 m high gabion wall with a landfill. On the area created, the wetland was constructed. Because of settings in the landfill the concrete reservoir of the wetland cracked and leakage occurred. Because of this the wetland lost its function and untreated water started to seep out and eventually the wetland stopped working.



Existing wetland with open settling pond

The waste water from the hospital compound buildings passes through a biogas plant and the effluent is piped to the existing wetland. This wetland has a settling basin followed by a wetland. The wetland consists out of a Reinforced Concrete basin with dimensions of



approx. 10 x 35 meters in which gravel, sand and plants clean the waste water. The treated water is disposed of into the small river known as Lippe khola. This wetland has been functioning over 9 years and the sand and gravel have to be replaced by new materials as these materials are polluted with sludge that blocks a proper flow of water. As the structure is built on a high landfill of around 12m high, the waste water seeks its way through the cracks in the reinforced structure of the basin to the river.

There are two possible options to solve this problem:

- To repair the basin and renew the sand and gravel. This appears to be a costly solution, especially as this wetland didn't perform well.
- To choose another biological system, also used at Tansen Mission Hospital. With this solution we use a septic tank and a Moving Bed Biofilm Reactor (MBBR). This system was constructed for United Mission Hospital Tansen recently and it performs well. This biological system is altogether a cheaper and better solution.

Solid Waste Project

At present the hospital doesn't have a proper solid waste disposal system. The Government's plan is to replace incinerators with autoclaves in future. Additionally, under the Minimum Service Standards for hospitals in Nepal, incinerators are being phased out. Therefore, hospital management decided to install an autoclave to prevent further polluting the environment. At a convenient location on the hospital compound a solid waste disposal building will be erected with locked premises 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 hospital's goal is to work as much as possible on sustainability. It has a maintenance department to maintain the hospital buildings and other systems, and a biomedical maintenance department where hospital equipment is repaired. With these new initiatives, the hospital has solved most of the hazards to the environment. Once the solid waste and wastewater systems are up and running, the hospital can promote these achievements too, motivating other hospitals and parties to become more sustainable themselves.

PROPOSED WASTE WATER TREATMENT SYSTEM

Introduction

At the moment, the hospital produces contaminated water that pollutes the environment. Since hospitals are established in order to care for the health of people and to teach the population on how to prevent getting sick, 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.

The use of water by the hospital is a maximum of 27 m³ per day. A daily maximum of approximately 350 people are using the premises.

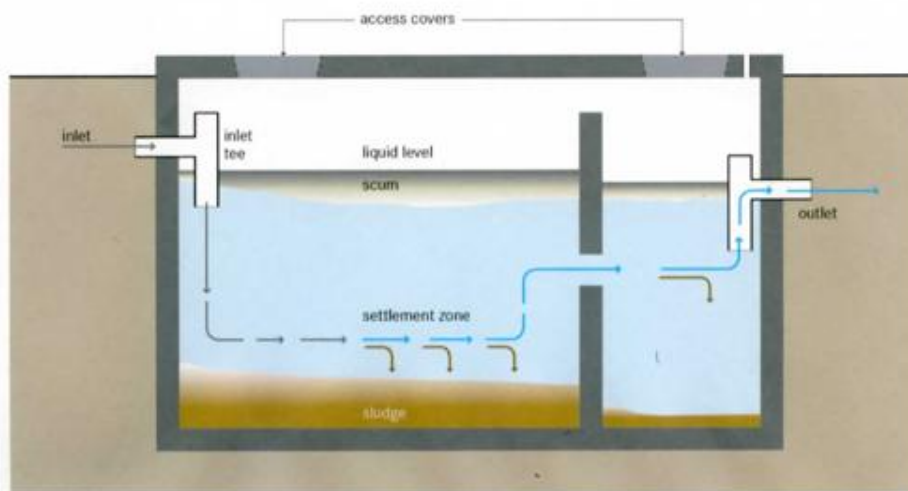
The waste water from the toilets is directed to a biogas plant. At present, all the waste water from the toilets, sinks etc. from the hospital is collected and led to a bio gas plant. This gas is



used in the Maternal Waiting Home kitchen for cooking purposes. This waste water is very contaminated and carries bacteria and other harmful substances.

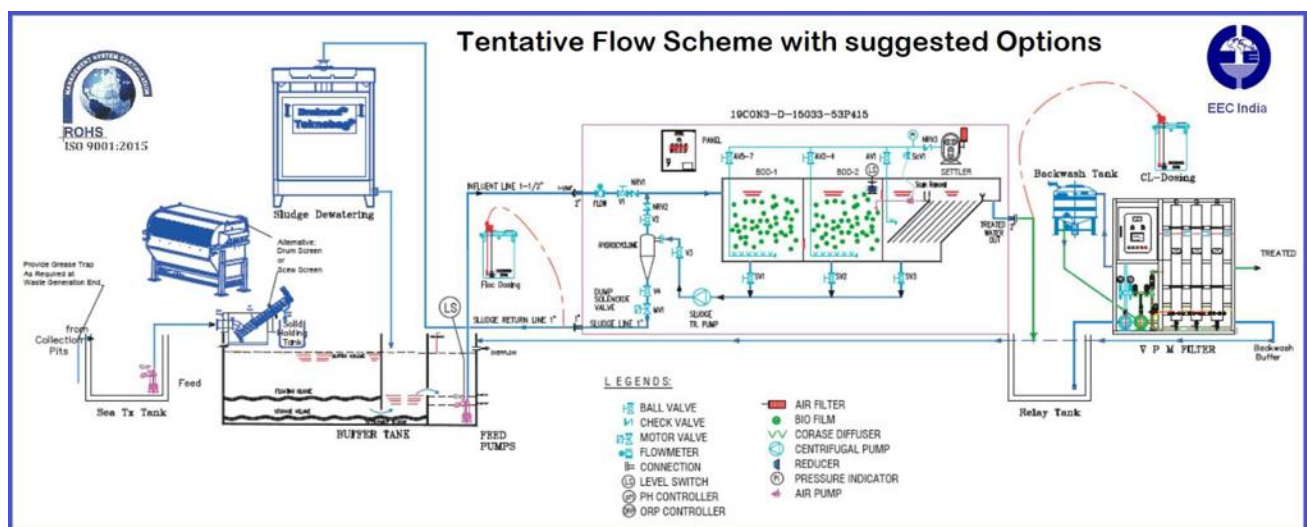
The effluent from the biogas plant joins the discharge of the less polluted water from sinks, washrooms etc. and will be directed to an intake structure with a 'trash rack' where bigger items will be prevented flowing towards the septic tank. This trash rack will be cleaned every day.

The polluted water flows into a septic tank of 84 m³ where it will stay for about 3 days. Water and sludge are separated. Bacteria eat sludge and the septic tank will need to be cleaned every 8 to 10 years.



Standard septic tank

The effluent of the septic tank will be pumped to a Moving Bed Biofilm Reactor (MBBR). This machine uses the oxygen out of the air to complete the treatment process. The effluent of this machine will be below the required "Biological Oxygen Demand" (BOD of 30 mg/l. This is according to European standards. The Nepali standard requires a minimum quality of 50 mg/l.



Schematic length section of MBBR



This MBBR machine is mounted into a container in which the process takes place. For this system 4,5 kWh is needed, but no additives are required. The system produces about 25 liters of sludge per day. This sludge is directed to a small field where it can dry. The dried material can be used as manure for the fields. The system is manufactured in India in a 10 feet container and can be brought to the site by truck.

The effluent of the MBBR can be discharged to a river or can be used for irrigation purposes.

SUSTAINABILITY OF THE PROJECT

Waste water; a source of water borne diseases

In Nepal there is currently much discussion about the treatment of waste water. It has been stated that because of the use of proper toilets, child deaths have reduced. However, now the problem arises what do we do with the waste water from these toilets? There is a lot of discussion, but without, as yet, sustainable solutions. See the following paper dealing with this discussion: <https://www.nepaltimes.com/banner/toilet-trained/>

Currently all the hospital waste water flows downhill to a river and is used to irrigate fields and thereby polluting water downstream. This creates significant health risks for all the people living and working downstream who use this polluted water to irrigate their rice fields and grow vegetables and at the same time, obtain their drinking water. These risks also extend to those who consume the crops that are grown in the same area.

In the study : “Inadequately Treated Wastewater as a Source of Human Enteric Viruses in the Environment” (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2905569/>) it is stated that waste water of hospitals contain viruses that are the potential source of illnesses.

In the study : “Water Microbiology. Bacterial Pathogens and Water” (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996186/>) it is stated that waste water of hospitals contain bacteria that are a source of infections. This article gives an insight into the way that bacteria from polluted water affects public health, causing viral infections such as hepatitis and Rota virus, as well as bacterial infections like Salmonella, Shigella, Vibrio Cholera and pathogenic E coli.

The proposed water treatment plant, in the form of a septic tank with a Moving Bed Bio Reactor system, complies with the European standards on cleaning waste water. The removal of bacterial pathogens complies therefore to the standards used in the EU.

Tables: United Mission Hospital Tansen statistics of water borne diseases

15-04 2021 to 14-04-2022

In Patient Department 2077/78 (April 2021- April 2022)

Typhoid Cases		AGE*		Amoebic Dysentery		Bacillary Dysentery	
Female	28	Female	99	Female	24	Female	3
Male	57	Male	120	Male	17	Male	3
Total	85	Total	219	Total	41	Total	6



Out Patient Department 2077/78 ((April 2021- April 2022)

Typhoid Cases		AGE*		Amoebic Dysentery		Bacillary Dysentery	
Female	80	Female	249	Female	31	Female	2
Male	102	Male	268	Male	54	Male	2
Total	182	Total	517	Total	85	Total	4

*AGE= Acute Gastroenteritis

Last year (2077-78), AGE ranked number 10 in top 10 diseases among in-patients.

Questionnaire among people living close to the waste water gulley Tansen Hospital

This information demonstrates that providing good sanitation is a key factor in improving the population's health.

This is what the focus group said about the effect of the water:

Focus group Discussion Questions and responses:

Q. How does this polluted gully affect you?

- It smells badly*
- The environment is dirty*
- Health issues: skin problems, diarrhoea and jaundice, typhoid dysentery*

Q. How does this pollution affect your environment?

- Unpleasant smell*
- Flies and Mosquitos*
- Our livestock goes into the water and spreads the dirt*

Q. Do you think this dirty water is affecting your health?

- skin problems, diarrhoea vomiting jaundice, and typhoid*
- Mental illness*
- Financial problems*
- Cannot smell anymore*

We do not have quantitative data on illnesses in this population but they raised "Diarrhoea vomiting jaundice, and typhoid" as common health issues.

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

The chosen solution is sustainable because septic tanks are known in Nepal and local personnel is able to maintain the system. The inflow and outflow pipes have to be checked regularly to ensure there are no obstructions.

By choosing septic tanks and a Moving Bio Bed Reactor, a sustainable solution is found in the treatment of waste water that easily can be copied elsewhere. The writers of this document, Water Development Consult from The Netherlands are 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.

Amounts are Nepali Rupees. There are about 148 NRs in 1 USD, 200 NRs in 1 GBP and 174 NRs in 1 Eur.

1. Civil works

Costs incl. VAT and contingencies NRs **9,450,585**

2. MBBR

Offer manufacturer Dec 2025	NRS 3,972,300
19% import duty and transportation	NRs 1,100,000
Installation, start up, training for operators.	NRs 1,250,000
BOD, COD measuring instrument	<u>NRs 1,566,000</u>
Sub total	NRs 7,888,300
VAT 13% of taxable items NRs 1,250,000	NRs. 162,500
Contingencies 10%	NRs <u>788,830</u>
Sub Total	NRs. 8,839,630

3. Autoclave

Costs civil works July 2023 incl VAT	NRs 3,066,130
Costs autoclave etc. July 2023 incl VAT	NRs. 4,239,760
Costs software programs etc. July 2023 incl VAT	Nrs 118,650
Contingencies 20%	<u>NRs. 1,484,908</u>
Sub Total	NRs 8,909,448

4. Design, supervision, project management etc.

Costs Nepali consultant design septic tank	NRs 260,000
Local Supervision costs waste w and autoclave	NRs 1.000,000
Design costs autoclave	<u>NRs. 420,000</u>
Sub Total	NRs. 1,680,000

Summary cost factors:

1. Civil works	NRs. 9,450,585
2. MBBR	NRs. 8,839.630
3. Autoclave	NRs. 8,909,448
4. Design, supervision etc .	NRs. 1,680,000

Estimated total costs NRs 28,879,663

At the current exchange rate of today, 18.4.26, **Nrs 28,879,663** is **194,194** USD, **143,864** GBP and **164,927** Euros

CONCLUSION

After the waste water cleaning system and autoclave are installed, it will greatly benefit humans and environment. Polluted water has a negative impact on all people, animals and vegetation that come in contact with contaminated water. Diseases and other harmful chemicals are spread in the environment causing illnesses, and have a negative influence



on vegetation. The quality of life - in the broad sense - will be improved because the source of water borne diseases and other effects are eliminated.

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

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

Ed Kramer
Oudewater
Netherlands
March 2026

