

HOUSEHOLD CENTERED ENVIRONMENTAL SANITATION

ENVIRONMENTAL SANITATION IMPROVEMENT PLAN FOR NALA



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 **UN-HABITAT**
United Nations Human Settlements Programme

ABBREVIATIONS

CIUD	Center for Integrated Urban Development
DDC	District Development Committee
EAWAG	Swiss Federal Institute of Aquatic Science and Technology
HCES	Household Centered Environmental Sanitation
NIDC	Nala Integrated Development Committee
NRs	Nepali Rupees (1US\$ =)
UDDT	Urine Diversion Dehydration Toilets
UN-HABITAT	United Nations Human Settlement Programme
VDC	Village Development Committee
WATSAN	Water and sanitation

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ANNEX

1. INTRODUCTION

INTRODUCING NALA

Nala (Ugrachandi) VDC is one of the important historic towns in the trade route of Kathmandu to eastern part of Nepal and Tibet. Moreover, the town serves to its hinterland settlements like Kunta Valley and Melamchi/Indrawati Valley up to Helambu. Believed to be established during the reign of Lichchhivies this town lost its importance when Arniko Highway was constructed keeping Nala under shadow. Because of lack of facilities and livelihood opportunities, the township saw heavy out-migration of both well-off people and poor in search of opportunities in larger cities like Kathmandu Valley.

Nala is situated some 2.5 kilometers from Banepa with fairly good road. This town is also linked to Bhaktapur with a motorable road. Nala is a clustered settlement in the VDC. There are several other scattered settlements that are included in Ugrachandi Nala VDC.



Satellite image of Nala

In recent days, this settlement is again emerging as one of the vegetable backyards of Kathmandu and other nearer towns like Banepa and Dhulikhel. Moreover, an alternative road connecting Kathmandu Valley has just been initiated by the government. Apart from its hinterland service function to major towns and settlements the full fledged operation of Siddhartha University, the only Buddhist University in Nepal is expected to increase the town's population.

The gradual increase in population and lesser interest of political commitment to smaller towns has gradually led to the deterioration of the environment of the settlement. Therefore, there is a need to invest in basic services like water and sanitation.



Settlement of Nala

About a decade ago, the community constructed a water supply system with the support of NEWAH/Water Aid Nepal. Sanitation, however was not addressed at that time. The township does not have complete toilet coverage. Open defecation and unmanaged wastewater are a threat to the community and water borne diseases are common in the area. Therefore, there is a need for wastewater management system in Nala.

The communities in the settlement are quite homogeneous, both in terms of ethnicity and economic activities, raising hope for betterment. They are well organised making it easier to mobilise the community. There are several micro-credit groups organising women. Several cooperatives are active, supporting the agriculture and merchandise of the agricultural products. The attractive participation of community people in the meetings organised by CIUD for the project purpose also demonstrate their commitment in the proposed activities.

INTRODUCING WATER & ENVIRONMENTAL SANITATION IMPROVEMENT PLAN

Popularly known as WESI Plan, CIUD introduced integrated and comprehensive approach of dealing with water and sanitation in a nutshell. While working with UN HABITAT and Water Aid, CIUD tested this methodology in several settlements which are mostly peri-urban in nature. Lubhoo, Tigni, Siddhipur, Machchhegaun, Gamcha, are some to mention. Under this approach water and sanitation is taken together. It was obvious during the study of these settlements, that water and sanitation used to be addressed on piece-meal basis. Thus in the absence of comprehensiveness, the efforts did not turn benefitting in the long run, rather created problems like the challenges of treating wastewater, ground and surface sources pollution, etc. Therefore, under WESI approach all issues of water and sanitation are dealt together. Moreover, we are also trying to address personal hygiene issues to some extent.

HOUSEHOLD-CENTRED ENVIRONMENTAL SANITATION APPROACH

The Household-centered Environmental Sanitation approach validated in Nala is convergent with similar Nepali planning approaches such as the WESI approach mentioned above. Radically departing from past centralized planning, this approach places the household and its neighbourhood at the core of the planning process. The process follows a bottom-up approach against conventional top-down approach. Ten steps have been established as the process for implementing this approach. Some of the key steps include assessment of the existing situation, identification of user needs and priorities, assessment of potential sanitation options, identification of feasible service combinations and preparation of urban environmental sanitation service plan. In Nala this approach is being implemented to make decision on proposed improvements in environmental sanitation.

2. EXISTING WATER AND SANITATION SITUATION

This chapter deals with the existing problems of the water and sanitation situation in Nala. This includes sources of water, sanitation practices, storm water management, wastewater management, toilets and other environmental sanitation issues.

EXISTING WATER SUPPLY SITUATION

SOURCES OF WATER

The traditional source of water in this foothill town was primarily wells and stone spouts. For bathing and laundry they use to go to the spouts or rivers in earlier time. Later piped water service was available in Nala. At present there are three main sources of water:

1. Jaljale Community Water Supply Scheme
2. NWSC water supply from Thulo Ban
3. Traditional wells and stone spouts

Jaljale Community Water Supply Scheme is the major source of water for Nala. This community water supply scheme was installed in 1990 in the support of Newah/Water Aid with the total investment of 1.9 million NRs including community participation. Nala Water Users' Committee was formed to look after the system which at present is a registered users' committee for the system. The intake of the system is at Hile Jaljale which is 6 km from the settlement. There are 35 public taps



A stand post waiting for water delivery

distributed under this system considering at least 10 households per tap. The system delivers 5 hours supply of water every day (5:30 to 8:00 am in the morning and 5:00 to 7:30pm in the evening).

All the members of each public tap paid Rs. 5000 as core funding, additionally each member family pays NRs. 200 as water charge every year. The collected fund is utilised for the operation and maintenance of the system. For the water operator monthly Rs. 2500 is paid. Until now they are

utilising interest of core fund for the maintenance activities. The annual fee is paid by most of the members of the society.

The Government of Nepal established Thulo Ban Water Supply System four decades back to serve Nala and Banepa. Established in 1957, this oldest system is managed by Nepal Water Supply Corporation at present. The source of this system is 1.5 km north of Nala which is extended to Banepa for major distribution. There are 11 public taps and 54 private connections distributed under this system in Nala. The public taps are distributed considering one tap serving 35 households or more. Water is rationed for one hour in the morning and one hour in the evening differed timing in different wards. Water tariff for the private taps is Rs. 50 for first 10 cubic meters of water and Rs. 15 for additional cubic meters. There is a need of improving the pipe lines as they are very old.



Standpost and traditional well in Nala

One more public tap was established in Nala at the temple premises of Karunamaya Temple. With the support of Nepal RedCross Society, Kabhre this tap was installed in 1988 under the Basic Health Service Project. The intake of this tap is in some 2 km distance. Maintenance work is done by the users as per need.

Along with these piped water systems there are traditional sources most of which are still working. There are four traditional stone spouts and eight public wells (see Table 1 in Annex IV).

After the introduction of piped water, these sources were not used very often. The water from wells is no longer used for drinking or cooking purposes, but used for other auxiliary purposes like washing, animal feeding, etc. As the traditional system broke, the stone spouts were converted into public stand post by connecting pipes in the carved spouts.



Traditional stone spouts converted to stand post

As discussed above, the primary source of water in Nala are public taps. Table 2 shows the use of water for various purposes against the source. As more than 90% of the population is relying on public taps, it needs proper attention. Community-based organisation Nala Water Users' Committee is managing the Jaljale system. Only 16% of the population relies on the private taps from NWSC supply. The higher percentage in the table (even more than 100%) is due to the use of several sources. Although, very few are using wells, mainly for washing purposes, yet wells have a very important role to play. Besides its present use, it can help in disasters and difficulties. With future urbanisation of the area there will be more and more water demand. In a long run there will be need of a water plan to serve the settlement with individual house connections.

QUALITY OF WATER

In the household survey, more than 56% of the respondents were happy with the quality of water, while 39% were satisfied with what they get from the taps. Only 18% were unhappy with the quality of water served through the taps. Their concern on water quality however may be observed from the cloth filter in every spout. As the water is simply tapped from a spring source, muddy water is discharged through the taps in the absence of a proper treatment facility. This shows that there is lack of understanding about water quality.



Turbid well water



Cloth filters on stand posts

The study team tested water from various sources in the month of October using a portable water testing kit developed by ENPHO. Results are presented in Table 3, Annex IV. The test results clearly show that all the sources have microbial contamination. The nitrate contamination in local sources may be attributed to current waste management practices.

Only 18% households reported that they do some sort of point-of-use treatment before drinking. For the treatment of water their most preferred choice is porcelain filter. 20% reported boiling before drinking and 1.8% uses SODIS (solar water disinfection).

IN-HOUSE SANITATION

In general, sanitary conditions in Nala are poor. Sanitation in this study is divided into two major parts: in-house sanitation and environmental sanitation. The first part deals with the issues related to sanitation activities inside the house, the second part deals with community sanitation issues.

TOILET

Open defecation is one of the major reasons for the spread of water washed and water borne diseases. Haphazard defecation in open spaces near water sources and in the area where it can route into the food chain is the main cause of these diseases. However, improper handling of night soil, leaking and leaching of wastewater to the groundwater and accumulation of untreated wastewater are further issues that present real challenges in emerging towns and cities. It is important to understand the present practices of wastewater management, starting with the user interface (toilets).

Traditionally, Newari settlements did not have toilets inside their houses. To avoid pollution of ground water they use to go for defecation in designated area called Khikahmugah or Malah in the outer fringe of their settlements. With the change in lifestyle and expansion of the towns, such places are vanishing. Nala use to have two such places which are no more in use. These places are occupied for other public use. In recent years, individual toilets have become popular in Nala. Our 2009 survey of Nala showed that toilet coverage is very high. Out of 352 houses, only 60 houses do not have toilet facilities (17%). The type of toilets used in Nala is presented in Table 4, Annex IV.

As presented in Table 5 (Annex IV), out of 295 toilets, 82% are pour-flush pit latrines. Only one toilet is connected to a biogas plant. Most of the houses built their toilet on their own. Only 8% houses reported that they were encouraged by social organizations. There are few temporary toilets. These toilets are pit latrines with temporary walls. 4% of households with toilets still practice open defecation regularly.



An unimproved toilet in a backyard



Toilet management is a challenge

Among the households who do not have a toilet, 58% goes to open fields and 28% use the neighbour's toilet. The main reasons for not having a toilet were reported as not having space for toilet (43%) while about a third blamed their economic circumstances.

DISPOSAL OF WASTEWATER

Nala lacks sewer lines for waste water discharge. There are stormwater drains which are also used for greywater disposal. In the survey, six families reported that they dispose their waste into stormwater drains. The great majority construct cesspits. These pits are simple lined pits which cannot be considered as “septic tanks”, even though some use this terminology. It may be considered as a larger pit, lined with a brick wall and covered with a concrete slab. 88% of the toilets surveyed utilize such pits.

18% of the houses with such pits need to empty it every six months. This is very costly effort to manage wastewater. Only 38% households empty their septic tanks every 2 years. The obvious reason for this is the high water table in most of the areas. The water table varies from place to place. There were wells that have water even one meter below the ground. Infiltration of wastewater into groundwater is a further worry.

Illegal emptying practices include spreading the sludge in the backyard and then covering it with soil or it is carried to a nearby field. Some also discharge their pits during rainy days to nearby open drains.

GREYWATER MANAGEMENT

Greywater includes wastewater from kitchen, bathrooms and laundries. As Nala has limited private taps at household level, the quantity of greywater generation is very limited. They do many water consuming activities outside house like washing large volume of cloths, taking bath, cleaning large utensils, etc. Many households come to front yard for washing and cleaning which helps them to avoid carrying water inside the house and allows throwing the wastewater into the open drain. Refer to Table 7 in Annex IV for the disposal alternatives adopted in Nala.



67% households have a proper place for washing pots in their home while the rest do it in the open. 63% of the households discharge their greywater in the existing drains while 10% use their backyard pits. 22% households do not have proper disposal place.

Most of the houses (85%) do not have bathing place inside house (or toilet). Therefore, either they go to stand posts, wells, or even to nearby streams. Therefore, there is limited amount of greywater produced in Nala. Existing drains are good for the discharge of this water which ultimately reaches the fields or discharges into the river. The difficulty in greywater management is the poorly maintained stormwater drain which restricts the flow of greywater and provides good ground for breeding of mosquitoes and other insects.

61% of the households have Saa Gah, the traditional manure pits and even 6% are practicing Nau Gah, the ash pit. Proper management of these pits is significant from the health point of view.



Open spaces are places for bathing and washing

PERSONAL HYGIENE

Personal hygiene is yet another important issue that needs to be considered from the sanitation view point. One of the important hygiene practices is handwashing. When Nala people were asked when they wash their hands, it was reported that 93% households said that they wash hands before eating and 74% after eating. 67% informed that they wash hands after defecation while only 49% reported that they wash hands after touching dirt. These numbers may be inflated, as people tend to present better picture of themselves. For example, 67% of households stated that they use soap to wash their hands after defecation, which may not be true as many of the toilets do not have soap inside the toilet.

Similarly when asked for washing hands after anal cleaning of babies, 89% households claim that they use soap water. While asking where they dispose faeces of their children, 10% said in nearby places and 61% dispose in toilets. 99% of respondents informed that they use shoes to go to toilet. From our own observation, the surrounding environment of 57% of households was found to be relatively clean.

The majority of the community interprets personal hygiene as taking a bath regularly and wearing clean clothes. Whereas the most important practice i.e. washing hand after defecation receives only 39% of the vote (see Table 8, Annex IV).

With these findings, it is suggested that the settlement needs support in raising hygiene awareness and improving behavioural practices.

Diseases, treatments and hygiene behaviour

Nala has a health post providing general treatment. There is absence of doctor service in the centre. There are two simple pharmacies in the settlement. From Table 9 in annex IV it is obvious that the dominant diseases in the settlement are water washed diseases. Therefore, personal hygiene and neighbourhood environment are very important for healthy Nala.

For diarrhea, most of the households (60%) prepare Jeevan Jal while 32% go to nearby health post for the treatment. 72% households in Nala already know how to prepare Jeevan jal.

One of the personal hygiene issues that has been raised among women is the regular use of sanitary pads during their menstrual period. For this purpose 91% women use old clothes, 96% of which they reuse it.

60% of the respondent in Nala said that they understand HIV AIDs.

StormWater Management

Nala residing on the foothills is settled on the upland (Tar land) sloping towards south and east. Rain water can be easily discharged towards these areas in the agricultural land. Punyamata stream on the west and south, and Nandimata on east. There is a network of traditional drains in the settlement discharging the flow in the low land fields and in Punyamata stream. Nala features open drains in most part of the settlement. Because of the sloping terrain drainage is a must for the speedy water during the monsoon season.

Most of these drains are brick lined and covered by irregular stones in some areas. Table 10 presents the existing stormwater drains and their conditions. There are mainly two drain systems that are discharging the town. The drain with larger network is Central Drain. This drain serves Gansa Tole, Epa Tole, Lagan Tole, Tupicha Tole and Balachhi Tole and ultimately find its way to western road. The second longest drain is the Eastern Drain that serves Lagan Tole, Yapa Tole and follows the eastern road. Both the drains join near Nandimata Stream near its confluence to Punyamata. The shorter drain is the Northern Drain which collects dispersed houses and east of Bhagwati Temple and



C Office area. All of the drains are constructed in brick masonry with mud mortar. In the inner town some of them are covered by stone, which however are not regular stones. Otherwise, the rest of them are uncovered. The depth of the drains inside the settlement is within 250mm while the downstream part along road is 500mm. These deeper drains are the roadside drains along the two roads leading to Nala.

The conditions of drains are poor due to poor management of the drains. The traditional system collapsed as the life style has changed. Moreover, street sweepings like paper, plastics and agricultural waste land in the drains. Therefore there is a need for looking into the stormwater drains in totality and establishing a management plan. Some part of these drains need rehabilitation while others need minor improvement.

Walkways

The clustered settlement of Nala has good network of traditional walkways and lanes. Most of these walkways are paved with brick or stone. In Newar settlements these types of expanded areas are part of urban design where people socialise, children play and farmers process their agricultural products. During festivities these are the performance platforms. Because of the vehicular movements the pavements require frequent maintenance. The outer roads linking Nala are mostly gravelled, except one paved road from Banepa.

The paving of most of the inner lanes are in broken condition, mainly due to the movement of vehicles. When these ways are excavated for laying pipes or similar work they are not reinstated properly. This is yet another reason for the poor pavement in Nala. The poor and undulated pavement, poor solid waste managing habits and storing of agricultural products make most of the lanes dirty. Therefore there is a need for improving the road surface for improving the environment in Nala. At present there is 1618m of walkways covering about

5045 square meters of area. This does not include walkways in the inner courtyards. Table 11 (annex IV) shows the condition of walkways in Nala.



The traditional stone paved lanes are mostly broken in many places

Solid waste management

Solid waste management in Nala is becoming one of the major concerns of local people. In earlier time there was limited waste produced, most of which used to be organic waste. The traditional practices of Saa Gah (the manure pit) and Nau Gah (the ash pit) are the places where people used to throw their organic waste for composting. This Newari system of waste management is somehow maintained in households which remain connected to agricultural activities. There are 61% households which still have some sort of Saa Gah and even 7% still have a Nau Gah (see Table 12).



Plastics are the main culprit for the filthy environment



Composting organic waste including animal waste is a normal practice in Nala

Plastics from food wrapping, polyethylene bags, etc. collect as waste on the streets. All these plastics are blown by the wind and collect in drains and drain outlets. When asked about these wastes, 54% of the households said that they burn these wastes, while 19% sell these to scrap collectors. A quarter disposes of this waste on roads and the riverside. Therefore, there is a need for educating on proper solid waste management.

3. WATER AND ENVIRONMENTAL SANITATION IMPROVEMENT PLAN

The existing situation of water availability in Nala is currently satisfactory. However, with the given quality of water and the water management practices, there is need for further improvements. Moreover, additional sources may be considered as people will be demanding more and more individual connections along with the urbanisation of the area. These issues are analysed and improvement plans are proposed in this chapter. The activities to improve the situation are guided by integrated water resource management (IWRM) principles, where water and sanitation are considered in a holistic way. Guided by the scope of work of the programme, proposed activities will be more focused on sanitation.

Water supply management plan

Three issues of water supply management may be discussed for future plans, viz. quantity of water made available, quality of water and institutional arrangements for the management of water. Map 1 shows the distribution of water points in Nala. These arrangements will be considered under Water Safety Plan. Followings will be the components of the proposed water safety plan for Nala.

Traditional water sources

There are 4 stone spouts and 8 public wells in Nala. One spout and 2 wells are not in use. Others are mostly used for irrigation purposes. During the focus group meetings much interest on these sources were not shown. However, for several reasons these sources need to be maintained. Traditional sources have their importance in the case of emergencies. These are the sources next door. The experiences of improving these water sources in similar settlements like Lubhoo and Machchhegaun in Kathmandu showed very positive results. Therefore, conservation of these sources should be part of the water supply management system in Nala.

One of the reasons that people are hesitant to use the wells is the effort of lifting the water. Instead people wait on queue to fetch water from stand posts. Another problem with the existing wells is the need of repair and maintenance. Some of the wells need minor improvements like cleaning the well, repair of the platform, and maintain the drainage to flow waste water produced. Improvement of wells can help the population, especially the women by reducing burden of carrying water from the stand posts.

The water quality in the wells is inadequate for drinking purposes. People do not like it because of the taste also. There are wells contaminated with nitrate and ammonia. But most of the wells have only microbial contamination. The sources of these contaminations may be a) contamination from the pit latrines constructed nearby; b) contamination from the unlined and not cleaned open drains; c)

throwing of garbage and other materials by children into the well when the wells are not much in use; and d) lack of regular maintenance of the well, as people have shifted their water source from well to tap water.

Therefore following three activities are proposed to improve the wells:

- Repair and maintain the wells and stone spouts as per need.
- Provide hand pumps so that the contamination of water by water fetching pots can be avoided and the wells can be covered.
- Empower the local community to oversee the well management.

Jaljale Community Water Supply System

The intake of Jaljale source is about 6 KM from Nala. This is a simple intake used to collect water from the spring. No treatment facilities are installed. Considering the quality of water delivered, there is a need to improve the intake and provide an appropriate filtration system at the source. Moreover, most of the tap stands and their platforms need maintenance.

Thuloban Water Supply System

Operated by Nepal Water Supply Corporation, this system is not locally owned. Since water scarcity is going to be a growing problem, Nala may claim more water from this source as Banepa and the other three municipalities downstream are considering larger water supply system for their areas. It is recommended that the community should try to bring at least their part of the system under community management.

Water quality

From the water quality tests conducted for various sources of water in Nala, water from all the sources are found to be contaminated including water from Jaljale and Thuloban. As people are using various sources of water for different purposes, and there are good chances of contamination due to their water collection and drinking pots, it is suggested that while providing water treatment facilities in existing systems, point of use treatment is recommended. Following point-of-use alternatives are recommended to improve water in Nala.

- Boiling
- Solar disinfection (SODIS)
- CS filter
- Bio-sand filter

- Chlorination at household level.

Among the alternatives one can chose one or other. For the poorer community members SODIS could be a good alternative. Training on water quality at several levels is also required to heighten awareness. Moreover, it is proposed to train local people to test the quality of water by themselves at nominal cost. For this, the water testing kit developed by ENPHO or similar kits may be used for testing water.

Sanitation improvement plan

Following the HCES approach of identifying appropriate alternatives, several discussions, workshops and interaction activities were organised. The first discussion was rather indirect, where the study team floated the idea of various alternatives to the community during focus group discussions. The second attempt was an expert team workshop, where WATSAN professionals were brought in for a 1-day workshop. The case of Nala was presented and their inputs were sought to narrow down the possible alternatives. The expert recommended three potential sanitation systems appropriate for Nala. The third interaction was conducted at the community level where 4 ward¹ level discussions were held. The findings of the expert workshop were presented and user's preference and feedback were sought on the recommended sanitation systems. Prior to the community level discussions to identify potential sanitation systems, exposure visits, informal interactions and sanitation bazaar were organized to strengthen community knowledge on different sanitation systems. The main objectives behind these events/activities were aimed at assisting local users take informed decisions while selecting sanitation systems. Please refer to the report entitled "Report on planning phase in Nala" for details on different stages of the planning process.

Based on the results of planning process, the following three wastewater management alternatives are presented.

Proposed Sanitation Alternatives for Nala

Alternative 1 Double VENTILATED IMPROVED pit latrine:

Following this alternative, existing latrines need to be upgraded by adding one additional pit. In the case of existing single pit latrines, an additional second pit is required. Out of the 295 houses having toilets, 241 houses have pour flush toilets including a bathing facility. There are 261 lined pits (so called "septic tanks"), 101 are inside the house and 160 outside. In such case, proposing double VIPs may only be viable for toilets without bathing facilities. Other types of toilets need to improve their existing tanks to a two chamber septic tank standard. For them the difficulty may be availability of space for several houses as they have very limited land. In such cases, multiple user septic tanks may be an alternative, which however demands proper consultation with the users and availability of space for such facilities. Thus, an upgrade to a double VIP standard may be considered for 241 toilets under this alternative.

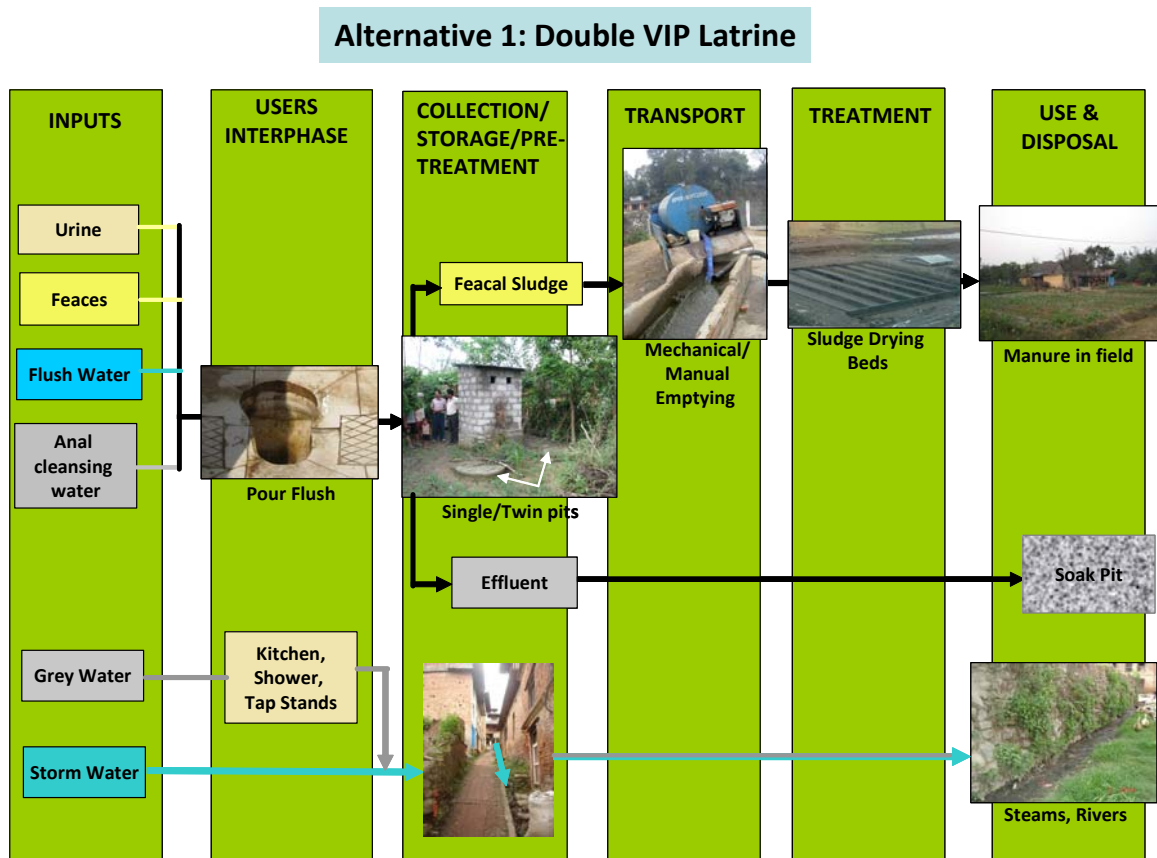
In the case of the 8 temporary toilets, even the toilet superstructure needs to be constructed. 60 new double VIPs need to be considered for those who currently do not have a toilet.

Under this alternative, a proper faecal sludge management mechanism needs to be installed. Along with the infrastructure improvement, awareness building activities need to be designed to prepare the community for the use and management of double VIPs.

Grey water under this system will be mixed with storm water. Currently, almost all houses have their grey water outlet connected to the storm water drains, mostly of temporary type. It is thus easy to improve the existing storm water drains and discharge both together.

User's preferences among the 3 sanitation systems show that this alternative is the least preferred option. Most households from the core area of Nala complained of quick filling of cess pits due to high ground water table. As a result households often needed to empty their pits posing huge financial burden.

Figure 1: Schematic representation of sanitation alternative 1

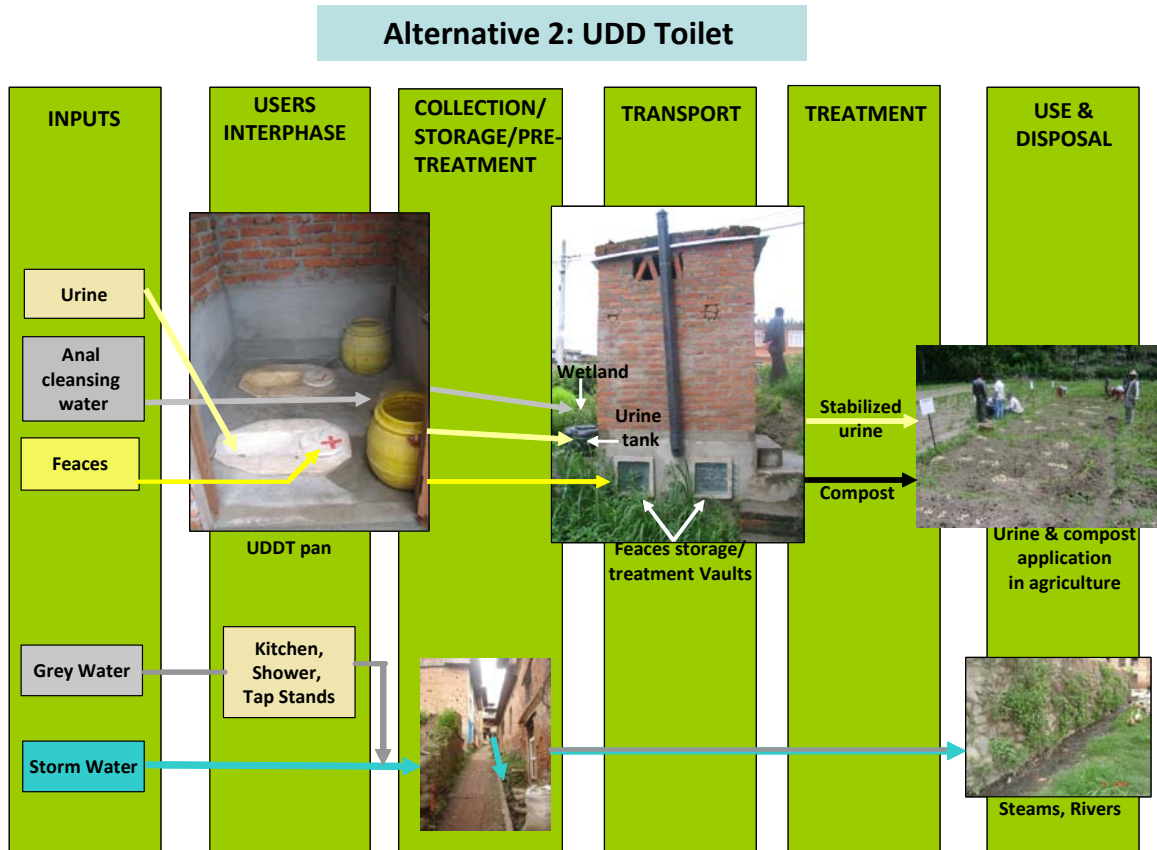


Alternative 2 Ecosan Toilet (Urine Diversion Dehydrating (UDD) toilets)

Vigorous interaction with the community is required for choosing this alternative. The experiences from Lubhoo, Machchhegaun and Siddhipur, other peri urban areas like Nala inside Kathmandu Valley, show that only a limited number of people are attracted to this alternative. Those who are attracted are fond of this technology. It was observed that there are different priorities within a household. To convert existing toilets into an Ecosan toilet is a challenge. As the cost of construction is high with this type of toilet, a subsidy mechanism needs to be introduced as most of the households already constructed their toilet. Since existing toilet structures do not allow faecal/urine separation and the dehydration chambers are missing, new toilet structures need to be constructed. In house UDDT can also be built in housed where the toilet is indoors. A strong training package along with regular supervision and backup for several years may be required to establish this system.

User's preference shows that this is one of the preferred options in Nala among the three alternatives. Many households liked the idea of using compost and urine as fertilizer in their fields, especially households associated with farming. However, this option might not be suitable in all households due to space constraints.

Figure 2: Schematic representation of sanitation alternative 2



Alternative 3 small bore sewer with decentralised waste water treatment plant

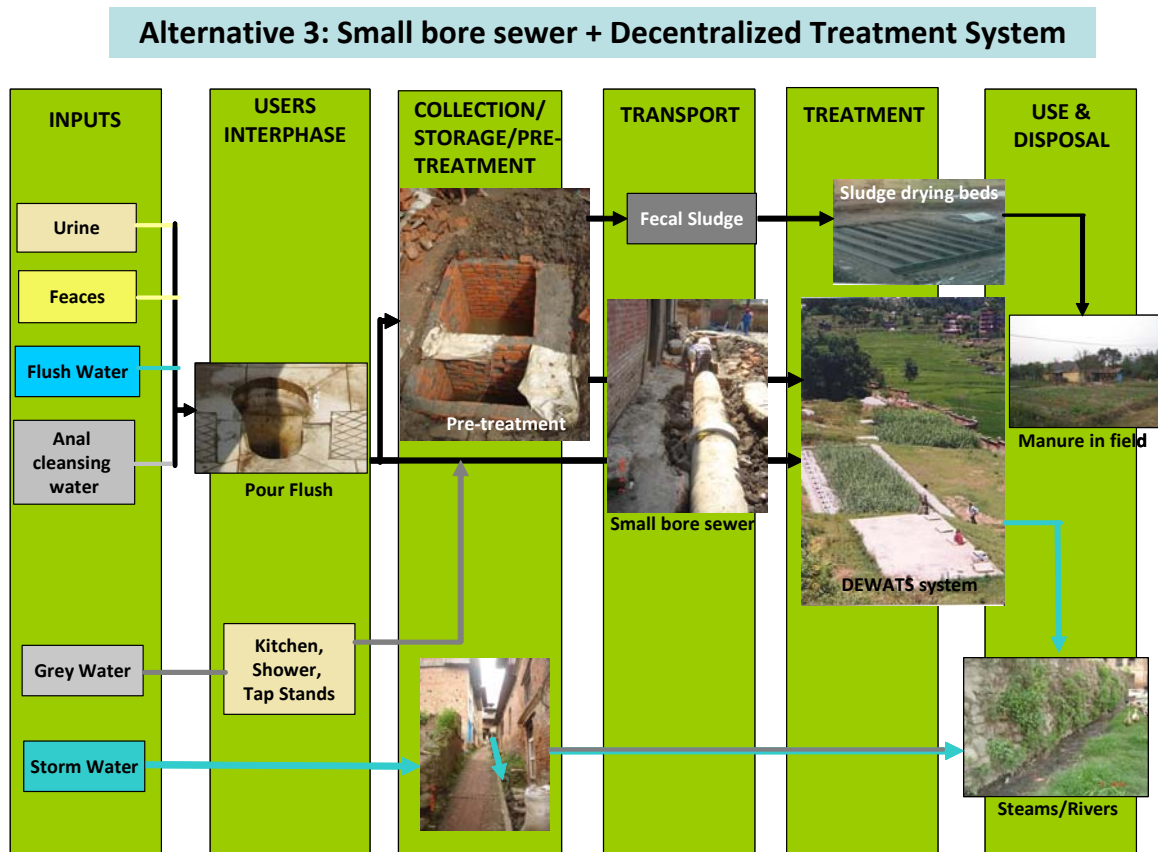
From an implementation point of view, this is the easiest system as the existing superstructure of the toilets can be used. The only intervention at house level will be to add length of pipes that brings the night soil to the laterals. The three main prerequisite for this system are: a) land for central facility to treat the waste; b) cost of construction of laying of the sewer network; and c) the communal management of the system. The cost of construction needs to consider repaving of the walkways and lanes as most of the street pavement will be excavated while laying either the laterals or mains or for the house connection. In addition 68 new toilets need to be constructed for full sanitation coverage in Nala.

The slopping terrain in Nala is suitable for settled sewers. Taking advantage of the available slope sewers will be designed as 'small bore sanitation'. The existing drains show that the wastewater can easily be brought to the confluence of Nanyamata and Punyamata streams. The community is ready

to buy a parcel of land required for treatment plant. Alternatively, smaller units may be proposed on the down stream part of each neighbourhood for the construction of ward-level waste treatment facilities.

This alternative is the most preferred option among the three alternatives proposed. Most users like this system due to the convenience of treating waste. Although installation costs are expected to be on the higher scale, most users are willing to make financial plus contribution in kind to set up this system.

Figure 3: Schematic representation of sanitation alternative 3



Alternative 4 Combination of onsite sanitation and decentralised systems

The alternatives presented above (and details in annex) have shown that there are pros and cons for all three alternatives and their adaptability. Considering the settlement of Nala; a combination of alternatives may be adopted. For example, for the scattered houses surrounding Nala, it may not be practical to cater all the houses by a sewer network from technical as well as cost reasons at present. For this area, covering 42% of the houses, on-site sanitation would be the most appropriate solution. In these areas double VIPs or Ecosan toilets should be promoted. In the northern and western part of Nala there are 33 houses that do not have toilet or are using temporary toilets. These households may be given the choice between Ecosan or double VIPs.

In remaining areas also, if people are willing to go for Ecosan toilet the project should encourage as it supports their livelihood, while recycling the wastes. Considering the shallow water table and use of wells, double VIPs may not be encouraged in the core settlement area of Nala. They will be served

by the separate sewer network. These sewers will collect waste from the core area covering some 58% of the houses.

Similarly, Ecosan toilets may not be adopted by all the households for various reasons. Therefore, combination of alternatives would give a better solution. The northern and western part of the settlement (as shown in the map) may be suggested for onsite sanitation where as for the denser central and eastern part of the settlement, the settled sewer system is most suitable. Moreover, the given topography is very much in favour of a small-bore sewer system as there is adequate slope for the flow. The community owns some land near the confluence of the two streams bordering the settlement. It is proposed to construct either waste stabilization ponds or an anaerobic reactor that will treat the wastewater from the sewer line. This unit will be developed as a community bio-gas unit where the energy generated by the plant will be sold to houses nearby and raise funds for the management of the system. Besides, monthly (or annual) charge will be collected by the users for the operation and maintenance of the sewer system and the treatment unit. The sludge generated from the plant will be composted and then used in agriculture.

Cost comparisons of the sanitation alternatives

One of the significant considerations to the selection of alternatives discussed above is their respective costs. Under this study CIUD analysed cost for each alternatives. Following table presents indicative costs with respect to the alternatives proposed.

Comparative Costs of Sanitation Alternatives*							
		No	Rate	Amount	Community contribution	Project	
			Rs	Rs	Rs	Rs	Rs
Alternative 1: Onsite sanitation							
1	New Double pit latrine construction	68	25000	1,700,000	1,224,000	7,000	476,000
2	Improvement of existing pit latrine to double pit latrine	241	6500	1,566,500	1,084,500	2,000	482,000
3	Fecal sludge management	LS		200,000	-		200,000
Total				3,466,500	2,308,500		1,158,000
Alternative 2 Ecosan toilets							
1	Ecosan toilet construction	150	26000	3,900,000	2,550,000	9,000	1,350,000
Alternative 3 Small bore sewer and decentralised waste water treatment system							
1	Construction of new latrines	68	15000	1,020,000	544,000	7,000	476,000
2	Connection of pit latrine to sewer line	352	3500	1,232,000	1,232,000	-	
3	Construction of sewer system		3352000				

			3,352,000	670,400		2,681,600
4	Construction of biogas & sludge drying bed ¹	2,000,000	2,000,000	400,000		1,600,000
	Total		7,604,000	2,846,400		4,757,600

1. Cost of land not included.

Alternative 4 Combination of Onsite and decentralised system

1	Construction of Ecosan toilets	15	26000				
				390,000	255,000	9,000	135,000
2	Construction of pit latrines	18	25000				
				450,000	324,000	7,000	126,000
3	Construction of latrine super structure in new toilets	35	15000				
				525,000	402,500	3,500	122,500
4	Connection of latrines to sewer line	184	3500				
				644,000	644,000		-
5	Construction of sewer system						
				2,775,632	555,126		2,220,506
6	Construction of biogas & sludge drying bed ¹	1500000					
				1,500,000	300,000		1,200,000
	Total			6,284,632	2,480,626		3,804,006

* these costs are indicative and include only hardware costs. Software costs like training, capacity building and management costs need to be added on top.

Greywater management

The settled sewer system will dispose of blackwater as well as greywater, which however depends on the type of treatment suggested. Adding greywater in the system rather helps the flow of the waste as there is very little use of water in the existing system. In case of waste stabilisation through bio-gas reactor, greywater must be separated from the blackwater because of the excess flow of soapy and acidic substances which are used for cleaning toilets, washing cloths, etc. In such cases an easier solution would be to provide soak pits in each house for greywater discharge. This is also true in the case of the on-site sanitation alternative. For the greywater generated at public taps or wells, the stormwater drain may be utilised for discharge.

Health and hygiene issues

From the discussions in previous chapter it is clear that Nala is in need of awareness in health and hygiene issues. Organising community trainings, exposure visits and thematic group initiatives may help in bringing the behavioural change in the long run. To encourage these activities along with others, school level eco-club and women group mobilisation is suggested. Moreover, Female Community Health Volunteers may be further trained on the subject matter and utilised for the training and supervision purposes.

Neighbourhood environment improvement plan

Most of the initiatives to address sanitation in Nepal are limited to toilet facilities. In the peri-urban context, the toilet is a part of sanitation where equally important aspects are neighbourhood environment improvement which contributes in the quality of environment in a larger extent. Under neighbourhood environment improvement several components can be addressed, including stormwater management, open space management, solid waste management and management of wastes that affect the environment of the area. Therefore, these issues are discussed here as it is pertinent to Nala programme area.

Stormwater management

From the engineering survey it was found that there are 1953m of existing stormwater drains in Nala, of which 310 m are covered. A major part of existing drains need maintenance. Moreover, all the drains need regular cleaning. Apart from maintenance (or in some cases rehabilitation) of the existing drains, there is also need of collecting the stormwater safely from these drains and discharging it into the streams. If the Alternative 3 (small-bore sewers) is adopted for wastewater management, there will be need of reconstructing these drains in most of the cases as it will damage the drain along with the road pavement in most of the places.

As discussed in previous chapter, there is a need of a drainage management system. It is recommended to add this issue to the scope of the water management committee. Considering that the side drains along the outer roads are relatively in good shape these are proposed for cleaning only. In the inner city, it is proposed to improve all the drains. These will be shallow brick drains on cement concrete mortar constructed over 75mm PCC bed laid over brick on edge. Therefore, of the total length 726m drains need to be rehabilitated or new constructed. Refer Table 10 for details.

Solid waste management

In the absence of solid waste management system, Nala is suffering from the waste thrown in public places. Wind and the rain are responsible for blowing and 'managing' the wastes. The encouraging fact however, is the large number of households are still practicing manure pit (Saa Gah) for composting organic wastes. Since these pits are not managed properly, trainings is required to improve the pit composting thereby improve the quality of manure. Awareness and training can also help to add more households to composting the organic waste.

In case of inorganic waste, 54% of the households reported that they are burning the waste. Although the volume of this waste is low, this is not a good practice. On the other hand, most of these plastics are not very attractive for recycling as the quantity is low. Therefore, proper collection or burying could be the simplest way of handling the plastics that are not sellable. The littering of plastics and papers on the streets of Nala suggests that there is a need of awareness building to take care of these wastes.

Walkway improvement

Based on the study following activities are proposed.

Total length of the roads and lanes in Nala is about 1618m and tentative surface area is about 5045 square meters. The old important lanes use to be stone paved, of area which requires surface improvement. This includes paving and side drain construction. The community should prioritise the area to be improved based on the need and available resources.

With the given resources, brick paving would be the affordable solution. However, from the durability and management point of view other alternatives like stone paving, inter-locking concrete tiles are better options. Since water supply mains and other service lines are laid, black-topping should get less priority with some exceptions. Local level community organisation needs to own and maintain the open spaces.

Institutional development

One of the foundation stones of this initiative is the ownership and execution of the activities by the local community. Therefore, strengthening the community, awareness building, meaningful participation of all the people of Nala including women and deprived communities is one of the important components of the whole initiative. Therefore, this plan proposes the below mentioned activities for the sustainability and equity-based development plan implementation.

Nala Integrated Development Committee

While CIUD was preparing for this programme, the local community was organised under the banner of the "Nala Integrated Development Committee". This committee helped in the process of data collection, mobilisation of local people and participated in all activities of water and sanitation improvement. This committee is coordinating with the VDC and DDC and other line agencies. To further encourage grass roots involvement in Nala, four sub committees were formed in each ward.

Gender mainstreaming

From the beginning of the activities it was noted that the participation of women in all the activities is quite active in this settlement. However, to bring the women front from the back seat and to encourage their participation in decision making, gender issues need to be addressed where men and women come together for the betterment of the settlement. Therefore, it is suggested to have a women's division under the main committee. Separate awareness programmes may be required to bring the women to the forefront.

School and community level activities

To bring awareness in the community, school children and local clubs in the settlement will be utilised. Several promotional and awareness building activities will be performed in schools and in the community so that ownership of the activities are gained and further enhanced.

Financing Mechanism

Financing the activities in Nala will be based on following guidelines:

1. Cost-sharing is a prerequisite for financing new infrastructure.
2. Additional external funding will be provided to accelerate the activities by meeting fund gaps to the extent possible.
3. As software activities are less valued by local community, external financing will be provided for these activities as a priority.
4. When financing individual toilets, priority will be given to the needy and poor households. Context-specific subsidy mechanisms will be developed with the participation of the community and based on the poverty mapping done under the social survey.
5. External financial contributions by UN-Habitat and Eawag will be spent on above items 3 and 4 with a priority.

Further important points for funding and implementation:

- Local funds like funds from VDC/DDC, and other local funds will be sought wherever possible.
- Community contributions will be sought in kind or in cash based on their preference, ability and availability.
- Wherever possible, local financing institutions like local cooperatives and micro-credit groups will be utilised for fund management.
- Transparency will be maintained in the implementation of activities, including financial management.

Implementation Mechanism

An implementation plan will be prepared based on the UESS plan. Currently, as there is not enough budget to implement all the activities as determined by UESS plan, the project in consultation with locals will prioritise activities. The overall target will be to implement sanitation improvement activities in a phase wise manner. A phase wise implementation will also provide enough time to seek for local, national and international support for the project activities.

4. ACTION PLAN

Based on the discussions above the following activities are identified for Nala.

Training on well/spout management and maintenance
Training on CWRM
Training on water safety plan
Followup training on water safety plan
Training on water quality to school children and teachers
Training on PoU to the communities

Water supply improvements proposed for Nala			
Activity title		Activities	
		Hardware	Software
1	Water Management		
1.1	Conventional water sources	Improvement of 8 wells	Establishment of well management committees.
		Repair and maintenance of wells as per need	Training on well management and maintenance
		Install hand pumps	Establishment of well maintenance fund
		Improve platforms	
1.2	Stone spout improvement	Improvement of 4 stone spouts	Establishment of spout management committees
			Training on spout management and maintenance
1.3	Jaljale water supply system	Improve public stand posts and pipelines to avoid contamination	Capacity building of users committee on water management
		Improve distribution network	Train the community on Water Safety Plan
		Improvement of intake structures	Adaptation of WSP in Nala
			Followup training on WSP
1.4	Thloban water supply system	Improve public stand posts and pipelines to avoid contamination	Establish formal coordination mechanism with NWSC on water management
1.5	Water quality	Equip the community with water testing kit	Train locals to test water quality at site
			Train the community on importance of water quality
			Train the community on various simple alternatives to improve water quality
			Demonstrate PoU techniques like use of SODIS, CS filter, Piyush, etc.

Sanitation improvements proposed for Nala			
	Activity title	Activities	
		Hardware	Software
2	Sanitation improvements		
2.1	Alternative 1	Construction of new double pit latrines	Pre construction design stimulation training.
		Improvement of existing toilets to double pit latrine	Training on operation and maintenance of toilets
2.2	Alternative 2	Construction of ecosan	Pre construction design stimulation training.
		Construction of new ecosan toilets	Training on operation and maintenance of toilets
2.3	Alternative 3	Construction of small bore sewer system	Training on operation and maintenance of decentralised ww management system
		Construction of decentralised wastewater treatment system	Pre construction design stimulation training.
		Construction of ecosan/double pit latrines in uncovered HHs	Training on operation and maintenance of toilets
			Training on operation and maintenance of decentralised waste water system
			Follow up training on operation and maintenance of decentralised ww management system
		Construction of double pit latrines	
2.4	Alternative 4	Construction of small bore sewer system	Training on operation and maintenance of decentralised ww management system
		Construction of decentralised wastewater treatment system	Pre construction design stimulation training.
		Construction of ecosan/double pit latrines in uncovered HHs	Training on operation and maintenance of toilets
			Training on operation and maintenance of decentralised waste water system
			Follow up training on operation and maintenance of decentralised ww management system
3.0	Health and hygiene issues		
			Training to FCHV on health hygiene
			Door to door awareness campaign for sanitation behavioural change through FCHV
			Childrens' Eco-club activities
			Mass hand washing campaign
			H&H awareness through focus group meetings

Urban environmental improvements proposed for Nala			
	Activity title	Activities	
		Hardware	Software
4	Neighbourhood environment improvement plan		
4.1	Stormwater management	Construction / maintenance of existing stormwater drain	Strengthen users committee on stormwater drain management
		Cleaning of existing drains	Prepare stormwater drain management plan
4.2	Solid waste management	Design household level solid waste management system	Training on organic waste management including Saa Gaa improvement
		Demonstrate solid waste management systems	Training on inorganic waste management
			Use of Eco club for solid waste management
			Organise cleaning campaign in Nala
4.3	Walkway improvement	Construction / improvement of existing paving	Strengthen users committee on management of the pavements
5	Community organisation strengthening		
		Providing necessary cleaning accessories to promote community activities	Capacity building trainings
			Establish children's club for children mobilisation
			Organise women groups at central and neighbourhood levels
			Exposure visits to similar activities in other areas
6	Promotional activities		
			Production of relevant posters
			Production and distribution of environment friendly gifts with promotional messages
			Production of introductory brochures
			Publication of informative news, etc.
*Includes only external support required. There will be community contribution different for various activities.			

ANNEXES

Annex I	Experts Meeting findings for Nala
Annex II	List of social infrastructure and organisations in Nala
Annex III	Data presentation
Annex IV	Maps

Participants:

- Experts from DWSS
- Experts from NGOs
- Experts from university
- Freelance experts

Basis for wastewater management

- Topography: Flat or slopy terrain, condition of catchment and drainage, ground water depth, etc.
- Settlement pattern: scattered or clustered, houses and open spaces, etc.
- Water source conservation: Up stream area, downstream area, ground water

Other conditions

- Large population is dependent on agriculture. There will be need for manure and irrigation facilities.
- About 80% of the houses have normal toilets.
- Most of the houses are dependent on stand posts; use of water (and thus subsequent wastewater generation) is relatively less.
- There is community feeling and social harmony and established culture of participation and leadership in community activities.

Waste generated in Nala

- Faeces
- Urine
- Cleansing water from toilet
- Greywater: from kitchen, bath room and laundry
- Stormwater
- Wastewater generated from animal husbandry
- Etc.

Alternatives proposed:

Alternative 1 Double VENTILATED pit latrine

Benefits

- Existing toilets use this system. Therefore small improvements to existing toilets can help.
- Easy management
- Less investment
- Individual ownership makes O&M easy

Limitations

- Several houses are of very small size where land availability is a problem.
- In several places, the ground water table is relatively high which hinder composting process of the waste in the pits. They fill up in short time.
- Potential source for groundwater pollution.

Precondition

- Space availability for toilet and pits.
- Willingness to manage own waste (faeco-friendly habits).
- Possibility of the manure from the waste to be used in field or disposed of.
- Willingness to empty (effort or cost) the pits twice a year.

Adoptability in Nala

- This is not a new type of toilet in Nala.
- Simplicity in use.

CONSTRAINTS

- Burden and cost of regular emptying of the pit.

Alternative 2 Ecosan Toilet

Benefits

- Recycling of organic resource, soil productivity increased.
- Innovative
- Less water use/minimal pollution
- For areas with high water table, there is less chance of water pollution and no problem of filling of the pit by ground water.
- Individual ownership helps to simplify management
- Waste is managed within the premises

Limitations

- During the slack period of the year for manure need, storing urine could be a problem.
- Training new users, especially guests and children.
- Relatively high entry cost at the beginning.

Precondition

- Relatively larger space required outside the house.
- Faeco-friendly habits.
- Possibility of the manure from the waste to be used in field or disposed of.
- Willingness to empty the dried faeces once a year.

Adoptability in Nala

- Agriculture based households could be easily attracted to this type of toilet.
- Cost and burden of emptying pits is minimized.
- None-agriculture based households or households with only elderly may find it a burden.

Alternative 3 Settled sewer system

Benefits

- The users do not need to take the responsibility directly.
- Space availability for toilet inside or outside is sufficient. No need of digging pits.
- As the sewer lines will transport the waste, there is less of a problem of smell and treatment inside the settlement.
- Less chance of ground water pollution.

Limitations

- Demands well functioning community level management, thus complex.
- Community must pay management fee regularly.
- Possibility of sewer clogging if not maintained.

Precondition

- Space availability for community septic tank (treatment unit).
- Willingness to participate in community management.
- Willingness to pay the cost of operation & maintenance.

Adoptability in Nala

- Adaptable for the houses without sufficient land for other types of toilets.
- Protects possibility of ground water pollution from pits.
- Burden of regular maintenance fee.
- Availability of land at appropriate place, or bear the cost of land for the purpose.

Annex II List of social infrastructures and organisations in Nala

Social organisations in Nala

	1. Guthies in Nala		2. Clubs		3. Women organisations	
	Guthies	Activities	Clubs	Activities	Organisation	Activities
Ward no. 1	See Guthi 9no.	For funeral management	CID Nepal	Saving group	CID Nepal Cooperative	Saving for organic farming-200
	Brahmayani Guthi	Shrestha families cultural trust				
	Ganesh Guthi	Jyapu (Suwal/Maharjan) families cultural trust				
	Bhairav Guthi	Jyapu (Prajapati/Awal) families cultural trust				
	Bhimsen Guthi	Shrestha families cultural trust				
Ward no. 2	Shee Guthi	For funeral management	Bhagwati Youth Club		Bhagwati Bachat Tatha Rin	35 members provide loan only
	Brahmyani guthi	26 families Brahmayani Jatra	Glochan Club		Ugrachandi Bachat Tatha Rin	470 members saving and credit
	Bhimsen guthi	20 families For Bhimsen Jatra				
Ward no. 3	Brahmyani guthi		1 Siddhi Ganesh Bhajan Mandal		Aama Chhori Samuha	70 members newly formed
	Bhimsen guthi		2 Karunamaya Bhajan Mandal		Karunamaya Samuha	21 members
			3 Ma:chhen Tole		Shree Ganesh Bachat samuha	20 members
					Buhari Samuha	5 members
Ward no. 4	See guthi(bhramhayani guthi)		1 Briddha Samaj		Ugrachandi Mahila Sashaktikaran Samuha	351 members, saving and credit activities
	Maju Guthi(bhagwati puja)		1 CID Nepal- social organization	120 membs		
	Shivaratri Guthi		3 star Nepal youth club	13 members		
	Indra Jatra Guthi		4 Nawa Sangam youth club	15 members		
	Bimarsha guthi		5 lal mohare bhajan mandal	6 members		
	Kanya Puja Guthi		6 shree Ram bhajan mandal	13 members		
			7 Nala Nawa pucha	25 members		

List of public structures in Nala

	1. Temples and shrines		2. Public buildings		3. Public land		4. Public water sources	
Ward no. 1	1	Mahadev Temple	1	Ganesh Falcha	1	Open ground (6~7 Annas)	1	Pond (6~7 Annas)
	2	Ganesh Temple	2	Mahadev Falcha				
	3	Bhairav Temple	3	Narayan Falcha				
	4	Narayan Temple	4	Falcha				
Ward no. 2	1	Saraswoti Temple	1	Bhimsen Falcha	1	Bhimsen Chaur (>1 Ropani)	1	Mahadev Pokhari (15ft x 15ft)
	2	Mahadev Temple	2	Bhimsen Falcha	2	Lama Tokcha (~3 Anna)		
	3	Bhimsensthan	3	Bhagwati Bhoyechhen				
	4	Bagwati Temple						
	5	Ganesh Temple						
Ward no. 3	1	Karunamaya Temple	1	Karunamaya Satal	1	Public land infrot of Karunamaya		
	2	Mahadev Temple	2	Epatole Pati	2	Bhuikhel (~9 Ropanies)		
	3	Laxmi Temple	3	Laxmi Dyochhen	3	Dabali		
	4	Surya Binayak Temple						
	5	Narayan Temple						
	6	Ganesh Temple						
Ward no. 4	1	Ugrachandi Bhagwati Temple	1	Sorakhutte pati	1	Etala Chaur- 5 Ropani, Red cross-5 Ropani		
	2	Bhramhayani Temple	2	Tugha falcha	2	Elaja Ganeshsthan- 2~3 Ropani		
	3	Mahakali Temple	3	Ganesh pati	3	Dabali		
	4	Yudhisthir	4	Dokacha pati				
	5	Ganesh Temple	5	Bhramhayani falcha				
	6	Natyaswor Temple	6	Deula Community Building				
	7	Mahadev						
	8	Surya Binayak						
	9	Bhairav Temple						
	10	Sugandha Kutu Bihar						
	11	Sai Baba Temple						
	12	Ceon Rofaka Mandali (Church)						

List of public structures in Nala

	5. Schools		6. Health facilities		7. Important heritage and cultural structure/places/festivals	
Ward no. 1	1					Ashyatithi Jatra (MahaLaxmi Jatra),Tritiya tithi of Falgun
						Karunamaya jatra (Bhagwati jatra)Before Dashain
						Karunamaya jatra (Bhagwati jatra)Before Dashain
Ward no. 2	1	Shree Shristi Kanta LSS	1	Health Post without doctor		
Ward no. 3					1	Ashya Tihi Jatra
					2	Karunamaya Jatra (Falgun Purnima)
					3	Laxmi Dyo Jatra
Ward no. 4	1	Ugrachandi Seconary School			1	Krishna Jatra
	2	Spring Hill Boarding School				

Table 1. Traditional Water Sources in Nala

Stone spouts		Remarks
1	Bhagbati Temple Stone spout	
2	Eepa Tole Stone spout	
3	Menchhen Tole Stone spout	
4	Yapa Tole Stone spout	Source damaged
Public wells		
1	Menchhen Tole Well	
2	Tupicha Tole Well	
3	Tupicha Tole Well (2)	
4	Bijapati Tole Well	
5	Yapa Tole Well	
6	Koipa Tole Well	Not in use
7	Eepalachhen Tole Well	Not in use
8	Eepalachhen Tole Well	

Table 2. Source of water for various domestic uses

Source of water	Purpose of water use in %							Total
	Drinking	Cooking	Washing pots	Bathing	Washing cloths	Toilet use	Animal feeding	
Private Tap	16.0	16.0	16.2	16.0	15.5	14.7	2.1	16.2
Neighbour Tap	1.3	1.3	1.5	1.5	0.5	0.8	0.3	2.3
Public Tap	92.3	92.3	89.4	87.9	77.6	73.2	19.8	91.2
Well	1.8	2.1	6.7	6.7	13.1	9.3	2.6	15.5
Kuwa	0.0	0.0	0.0	1.0	3.4	0.3	0.0	3.6
River	0.0	0.0	0.0	1.5	8.2	1.8	0.3	9.3

Table 3. Water quality of public water sources

SN	Source code*	Type	Location	Microbial con.	pH	Ammonia (mg/l)	Nitrate (mg/l)	Iron (mg/l)	Chloride (mg/l)	Hardness (mg/l)	Phosphorus
			WHO guideline	A	6.5 - 8.5	1.5	50	0.3	250	500	
1	J1	Tap	Balachhete Tole	P	6.5	0-0.2	10	0-0.3	3.92	16	0.05
2	O1	Natural Spring	Thulo Ban (Wata) Balachhi Tole	P	6.5	0.5-1	10-25	0	11.76	24	0-0.05
3	J2	Natural Spring	Epatole Galli	P	7.5	3	10	0-0.3	11.76	16	0.05
4	O2	Wata	Epatole	P	6.5 - 7.5	>3	10-25	0-0.3	15.68	32	0.5
5	W1	Ground water	Eplachhe	P	6	>3	50-75	0.00	19.6	40	1
6	J3	Jaljale	Eplachhe	P	6.5 - 7.5	0.2-0.5	10-25	0-0.3	27.44	16	0-0.05
7	T	Tukuchha-tank	Karunamai	P	6	0.2-0.5	75-100	0.00	15.68	32	0.5

8	D1	Stone Spout	Mhech he Tole	P	6-6.5	0.2-0.5	75-100	0	27.44	88	>1
9	W2	Ground water	Mhech he Tole	P	6-6.5	>3	75-100	0-0.3	54.88	120	>1
10	D2	Stone Spout	Epatole	P	6-6.5	0.5-1	75	0	19.6	80	>1
11	W3	Ground water	Tupicha Tole	P	6-6.5	1.5	100	0	78.4	144	>1
12	W4	Ground water	Tupicha Tole	P	6-6.5	0-0.2	>100	0	152.9	288	>1
13	D3	Stone Spout	Lagan tole Bhagwati templ	P	6.5	1	50-75	0	19.6	32	0.5
14	W4	Ground water	Lachhi	P	6.5	1.5-3	10-25	0-0.3	121.5	152	>1
15	W5	Ground water	Thapa Tole	P	6.5	>3	75	0	98	56	0.5
16	O3	Wata thulo ban	Ganesh sthan Thapa Tole	P	6.5	0.2	10-25	0	11.76	40	0.2-0.05

Note: * Please refer to MAP-1 for the location

Table 4. Distribution of toilet in Nala

Type of toilet	No.	%
WC with bathing facility	7	2.37
Flush toilet with pan and bathing facility	36	12.20
Pour flush toilet	241	81.69
Bio gas toilet	1	0.34
Temporary toilet	8	2.71
Others	2	0.68
Total	295	100

Table 5. Wastewater disposal from the toilets in Nala

Disposal of wastewater from toilet	No.	%
Drain	6	2.03
Septic tank inside house	101	34.24
Septic tank outside house	160	54.24
Pit	17	5.76
Pit with ring	10	3.39
others (Bio gas)	1	0.34
	295	100

Table 6. Frequency of emptying collection pit/septic tank in Nala

Duration	No.	%
6 months	49	18.01
1 Year	77	28.31
2 Year	41	15.07
more than 2 year	32	11.76
Even more	73	26.84
	272	100.00

Table 7. Greywater disposal

	No of HH	%
Stormwater drain	246	63.40
Backyard pit	40	10.31
No proper place	84	21.65
Others	18	4.64
Total	388	100.00

Table 8. What people understand by good personal hygiene practices?

	%
Brushing teeth every day	57
Cutting nails regularly	42
Taking bath regularly	97
Wearing clean clothes	80
Washing hand after defecation	39

Table 9. Diseases caused last year and its treatment

	Hospital	Health Post	Clinic	Medicine Shop	Home	Witch doctor	Ayurvedic treatment	No treatment	Total
Disease	Count	Count	Count	Count	Count	Count	Count	Count	
Common cold	20	25	115	104	33	0	3	3	303
Diarrhoea	4	13	41	55	11	1	3	0	128
Typhoid	10	5	19	15	0	0	0	0	49
Pneumonia	6	1	3	1	0	0	0	0	11
Malaria	0	0	1	1	0	0	0	0	2
Intestinal worms	0	3	2	6	0	0	0	0	11
Hepatitis A	5	0	3	1	0	0	2	0	11
Dysentery	1	2	7	10	3	1	1	0	25
Trachoma	11	4	6	7	0	1	0	4	33
Skin Diseases	4	3	7	7	0	0	0	11	32
Others	72	4	59	24	2	3	3	1	168
Others	17	3	7	4	1	0	0	2	34

Table 10: Existing stormwater drain in Nala

Starting**	Ending**	Name of street/lane	Avg length (m)	Avg width (m)	Avg depth (m)	Drain made of		Drain structure		Maintenance	
						Brick wall	Cover	Good	Poor	Good	Poor
A	B	Gansa Tole	67.5	0.3	0.25	X	X		X		X
B	F	Epa Tole	90	0.3	0.25	X			X		X
F	I		121	0.3	0.25	X	X		X		X
I	Stream		475	0.55	0.5	X		X		X	
E1	U1	Bhimsen Road	516	0.55	0.5	X		X		X	
R	U	Lagan tole	53	0.1	0.15	X			X		X
UB2	R1G	Tupicha Tole	110	0.15	0.15	X	Stone		X		X
VW	R1	Balachhi	90	0.15	0.15	X			X		X
P	O	Lagan tole	61.5	0.3	0.25	X	X		X		X
N	LE1	Yapa Tole	90	0.3	0.25	X		X		X	
P	H1	Lagan tole	43	0.3	0.25	X			X		X
H1	VDC	Tel Pokhari	90	0.55	0.5	X		X		X	
4	H1		146	0.55	0.5	X		X		X	
Total length			1953								

Note: ** Please refer to MAP 4 for the Starting and Ending point

Table 11. Road surface in Nala

S.No.	Road Type	Units	Area
1	New pavement required	Sq.m	1648
2	Black-topped	Sq.m	5354
3	Brick paved	Sq.m	568
4	Gravel road	Sq.m	1003
5	Earthen road	Sq.m	1603
6	Brick paved but required maintenance	Sq.m	1472

Table 12. Waste Management Practices in Nala

Organic waste management			Inorganic waste management		
	No. of HHs	%		No. of HHs	%
Backyard garden	91	23.45	Kawad	73	18.81
Road	45	11.60	River side	63	16.24
Feed to domestic animal	10	2.58	Roadside	31	7.99
Compost	216	55.67	Burn	209	53.87
Others	26	6.70	others	12	3.09
Total	388	100.00	Total	388	100.00

