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A Guide to WSP formulation in Rural Community Water Supply system

1. Rationale and Purpose

According to NMIP/DWSS 2010 data, there are more than 38,000 completed water supply schemes covering more than 80 % water supply coverage in Nepal. Of these schemes, only 18 % schemes are well functioning and managed, 51 % schemes are requiring minor to major repair. Furthermore more than 75 % existing schemes run without VMW, 79 % schemes have no O & M fund, 72 % schemes have inadequate tools and 68 % WUSCs are not registered.

The effects of failing water supply schemes are directly felt by their users, notably women and girls who need to spend more time collecting water from far away and often unreliable water sources, and deprived groups who tend to loose out in accessing reduced water availability. Users become prone to water borne diseases, affecting productivity and socio-economic development (*position paper, functionality of water supply services, final draft JSR 2010*).

The goal 7, target 7C of Millennium Development Goal (MDG) stresses the need for sustainable access (quantity) to safe drinking water (quality), but this is not possible if the non functional schemes remain ignored. There is greater tendency in completing new schemes but there is lack of backstopping in maintaining the functionality of completed schemes.

Ensuring the safe quality water to users in remote rural area is very challenging in terms of finance, availability of skilled human resources and acceptable instruments and its reagents for water quality check. The Operation and Maintenance of all rural water supply schemes are performed by Water Users and Sanitation Committee members of the community with limited skill, technical knowledge and equipments. Community can/are commit limited time and voluntarily contribution only. The trainings and logistics related to water quality are seldom provided to them. Water quality examination and equipments handling and testing by WUSC in remote area is far that cannot be realistic now. The remoteness and the inaccessibility further aggravate the water quality examination and monitoring processes. Water quality examination at sources or one time before commissioning does not guarantee safe quality water; it is often at the point of consumption ie at home where lack of hygienic practice of handling and usage of water further deteriorates the quality of water.

Rural Community should own and manage their water supply system by themselves, ensuring the delivery of safe and reliable drinking water to users. Water Safety Plan (WSP) is the management tool to assist in actually meeting targets through systematic steps. ***“The most effective means of consistently ensuring the safety of a drinking water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from catchment to consumer, such approaches are termed water safety plan (WHO 2011:45).*** WSP represents an approach of assessing and managing risks that ensures the safety of a drinking water supply from

catchments to consumers through multiple barrier approach. Joint Sector Review (JSR) recommended that water safety plans be mainstreamed and test results validated.

Thus, WSP is more preventive than curative actions and is applicable from small community water supply schemes to large scale water supply utilities, rain water harvesting schemes and point sources. The WSP help the users/supporting agency in:

- identifying the possible contamination or risks
- developing effective solutions (control measures)
- Monitoring and preventative maintenance and
- Effectiveness of the control measures applied.
- Management and supportive program

The purpose of this guide: There are numerous publications about of WSPs but all most all focuses on larger systems or meant for highly skilled personals. In Nepal, DWSS has published WSP hand book. Based on that hand book and experiences gained through the trainings conducted to SO/SPs in 9 districts, this guide further simplify the steps to be carried out in rural community managed water systems by community themselves to have safe sustainable water quality.

Thus the purpose of this guide is to assist the support organizations, support persons and district stakeholders working in water supply and sanitation projects, in facilitating rural community beneficiaries in formulating their own WSPs. The guide is meant for facilitators to be used in WSP training to WUSCs/team in rural area. WSP shall be aligned and implemented along with O & M plan in all existing water supply projects in RVWRMP project VDCs but can be introduced as standalone also.

2. National Drinking Water Quality Standard (NDWQS) and Implementation Directives 2062

Though the basic service level water supply coverage in the country is approximately 80 % and sanitation coverage is just 43 % (NMIP/DWSS 2010), safe quality water service is not ensured due to absence of sustainable water quality programs.

National Water Resources Strategy 2002 and National water Plan 2005 envisages providing drinking water of basic quality (biologically safe) to all population of Nepal by 2017 as a minimum standard.

National Drinking Water Quality Standard and implementation directive is effective since 2062 but poor enforcement and compliance has resulted in frequent outbreaks of diarrhoeal diseases in urban and rural area. All together, there are 6 physical, 19 chemical and 2 microbiological parameters to be examined in water supply services. But there is flexibility for rural surface and underground systems (5 physical, 9 chemical and 2 mocabial parameters). The enforcement of this standard is to take place in whole country in three phases, completing in 2073 BS in all existing drinking water supply schemes. Ministry of health and population is given the responsibility of surveillance task.

3. Safe Water and Water Quality management

Water quality management in water service is to ensure that piped water always remains in a hygienic, safe and clean state, thereby creating no problems in its use. Thus **safe water** can be defined as water free from pathogenic organism, Low in concentration of compounds that are acutely toxic, clear, no offensive taste and odor, non corrosive, no encrustation of pipes, and no staining of clothes.

That is, for villagers it should be free of color, odor, taste and absence of stomach disturbance and diarrhea (pathogenic microorganism).

The security of good-quality raw water is the most important foundation of water quality management in water supply facilities. Hence, it is essential to make every effort to conserve the quality of water sources in a clean state as much as possible. The sources of water supply system can be categorized into stream water, rain water and spring water (groundwater). Each water source has its own characteristics.

Stream sources: The water can be colored, turbid, flat taste with suspended materials and pathogenic organism.

Rain Water: The water is soft with dissolved and suspended materials.

Spring sources: The water is clear and hard with dissolve chemicals. If source is unexposed, microbial contamination is minimum or not present.

If the catchment and/or upstream of sources have human cluster or grazing area, then there is every chance of fecal contamination in source water.

4. Climate change and its effect in Water supply services

The climate change can impact rural community gravity (and rain) water supply services mainly through two factors: **[convince the participants about the effect of climate change; need to conserve and protect watershed, sources and preventive actions initiation]**

Changes in precipitation (Rain)

- Reduced rain fall can decrease source discharge or even dry up which means more hardship for water as people go for unreliable sources.
- Reduced rain fall causes less water available for rain water harvesting schemes.
- Reduced rain will have water use conflict with irrigation.
- Increased rainfall can inundate the plain area and access to safe source is made difficult in tarai.
- Increased rainfall can cause flooding which can enter in to source or damage different structures and water quality degraded or service disruption.
- Overflowed water from structures if properly not disposed, may cause outbreaks of infectious diseases and or soil erosion.
- High-intensity rainfall may increase erosion resulting washing of intake, pipe line and degrading of water quality or service disruption.

Changes in ambient air and water temperatures

- Temperature increases may result in a reduction of surface water availability by decreasing runoff and increasing evaporation from small springs or streams.
- Over the short term, the more rapid melting of snow will lead to environmental hazards like flooding and soil erosion.
- Higher temperatures may increase agricultural water demand and dispute with use of water in irrigation resulting in cutting of pipes and service disruption.
- Increases in periods of intense heat may result in higher water demands for domestic uses and taps of higher land area running dry resulting to social conflict.

Both above factors will either

- Increases in the intensity of floods may result in the contamination of water sources and may increase the incidence of waterborne and water-related diseases.
- or**
- Increases in the frequency and intensity of droughts will cause reduced surface discharge and falling groundwater tables, which can lead to increasing source water pollution and to the drying up of wells, extending the distances that must be traveled to collect water.

5. Condition for WSP

Since WSP is a continuous process that ensures the safety of water from source to mouth in terms of quality, quantity and continuity so user participation is vital in every step of the WSP. WSP will be effective only if activities listed below are met.

- Registered UC
- Regular UC meeting
- Commitment of users
- VWASHCC's active support and participation
- General assembly of users, Mass meeting, public hearing,
- Functional O&M fund and O&M Regulation
- Functional VMW
- Functional water tariff collection system
- Regular maintenance and minor repairs done by UC

All tools and fittings remaining after completion of scheme must be collected, recorded and kept properly in UC office or with VMW for future work.

6. WSP Process

Stage I: Preparation

Before going for formulation of WSP, some basic things have to be defined and agreed by community. Such defined things and agreement/commitment from users, plays vital role in future maintaining the system for water security and quality. One such thing is the basic condition for effective O & M for the sustainability of the scheme as in item 5. The following things also need attentions for their definition

and commitments. The following points need to be made clear in mass meeting (including item 5 above) and commitments are sought from users. The WSP team is formed and approved from mass meeting.

6.1.1 Team Formation

The whole community is to be mobilized for safety of water but this will be very haphazard if properly not planned and monitored. So small representative of community should be formed to assess, plan, mobilize, implement, monitor and evaluate the steps implemented. Since UC is the registered institution in the community at focus involved in construction of system, it should be given responsibility for WSP. Some key stakeholders should be included in the team. The probable team could be:

- Water & Sanitation User Committee members
- Working Village maintenance Worker (VMW)
- Health worker/Health volunteer preferably female
- VDC technician
- School teacher and child club member if school exists or resident of supply area.

The UC chairperson will be the coordinator of the WSP team and rest will be members. As far as possible, the team should be GESI friendly.

6.1.2 Defining Safe Water, WSP and Health based Target

Before proceeding ahead in formulation of WSP, the users must know about safe water and water safety like continuity, reliability, quantity and quality. People must know what constitutes the safe water? What is the people's version of safe water? What are the implications of unsafe water consumption? This needs to be linked with their past experiences.

- Why people go for "Open defecation?" start the session with this topic.
- Exercise on "defecation practices" (pocket chart). This exercise will give the idea where the children, female and male members of the locality go for defecation any time of the day. Link the "feces mobility "with transmission route.
- Exercise on Fecal Oral transmission route can be done to have clear idea about how water and other are contaminated by feces (human, animals and birds) and ultimately who are the victims. Let them tell story based on that exercise.
- Ask them if they like to drink other parameters like muddy (turbidity), colored water, algal water or other and what happens if such waters are consumed?
- Demonstrate that a transparent glass full of water, if dipped a small amount of soil, will they drink? This exercise will have positive effect and triggers then to think for quality water.
- Tell them the different pathogens (and their effects) that may be in dirty water which we cannot see by our eyes. Narrate the salt or sugar dissolve in water, which cannot be found unless tasted.
- Request aged people to narrate the situation in source and quality of water.
- Also discuss about the effects or past experiences of consuming dirty water like diarrhea, stomach disturbance, worms or other visible symptoms.
- Discuss and summarize: What is clean water and why do we need to drink clean water and use ? Link with personal hygiene.

- Define and agree on health based targets. What happens or happened when drinking dirty water? What was the area that it disturbed? like nos. of diarrhea events, nos. days absent from school due to diarrhea or disruption of system.
- These health based targets (indicators) are to be visible and measurable so that after WSP, they can be measured for effectiveness.

Facilitate the meeting to conclude what is safe water and how it can be achieved. Define the WSP's role in having uninterrupted safe and clean water from taps.

6.1.3 Water Quality Parameter

From above exercise, the present status of water quality situation is identified. We also know what are the foreign materials in water that they drink and its impact (diseases). So what parameters we need to focus or reduce in supply water is known. This is the monitoring and check for intervention effect evaluation. The general parameters to be checked/examined in water could be (from RVWRMP experience):

- Turbidity: water is muddy and dirty
- p_H :
- Ammonia: Signifies recent pollution by decomposition of organic matters.
- Fecal Coliform (through P/A vial and del aqua or wagtech sets): Microbial contamination

These parameters are examined before WSP and after intervention work completed to validate the effectiveness.

Formulating of WSP: From RVWRMP's past experience of water quality study (Turbidity 11/145 scheme, Ammonia 25/293 sources, Fecal coliform 142/293 Sources), physical and chemical contaminants are not of that bothering but microbial contamination is alarming in rural hill water supply services. Thus, WSP must focus more on checking entry of fecal materials in to the supply system along with regular O & M activities.

So brief the team that this training will help you to prepare WSP so that safe water is made available to community continuously. The plan you will prepare keeps water clean (safe) from source to mouth. It makes sure that water is available in sufficient quantity to all community. We will prepare the plan with following process:

- We have already discussed what safe water is and why we need safe water.
- We are visiting our different components of the water system and source. We will observe how water gets contaminated (routes) while its journey from source to mouth.
- We are going to consider how these routes can be blocked or intervened.
- We are going to consider coordinating with other stakeholders.
- We are going to plan how these "blocks" or interventions can be implemented by allocating responsibilities and timing at local level.
- We are going to develop participatory monitoring chart to know the status of the plan.
- We are going to verify the interventions effectiveness through community satisfaction, water quality examination and agreed health based targets.
- We will document, report the status and coordinate for future cooperation with VDC, DDC, DTO, WSSDO and other stakeholders for further support.
- These entire "going to do things" make a Water Safety Plan (WSP).

Stage 2: System Assessment and Problem Identification

6.2.1 Describing the system

The team should be taken to a transect walk of the water system from source to tap and household. The team members assess and identify the problems in their system visually and triggered to do "something" in coming days to improve the situation.

Brief the team about the need of this trip. Do not advice (for correction) to the team what to do?
Let the team assess the situation in source, pipeline, reservoirs, taps and water usage and storage in HHs and write the status/situation of the structures in check list.
Let the team shows these "weaknesses" on the layout plan.
The team members should be provided with layout map of water system. The members write or draw what they see on the map (plan). Check list provided is also filled by the team members.
P/A vial test is performed at this point. (Other tests are formed earlier and have the data ready). Let the P/A vial be kept in user's house for maturation.

6.2.2 Identifying Problem or Route of Contamination

After the scheme transect walk, the team members observe the status and condition of different structures in their scheme. They will also record the physical condition in layout provided on possible problems they observed in different structures. They will also mark on the check list provided. Based on their observation, they will identify the problems and possible risks.

Exercise: Identifying the problem: *Discuss and Facilitate the team on hazards affecting different structures that could vary seasonally (drying up or flooding of sources). In any systems, only hardware hazards are not considered for WSP, there are also social (ie throwing waste around the source), cultural (many religious requirements are done in and around water) and behavioral practices (ie defecating near water and cleaning) that could contaminate the supply water and forms a risk.*
Catchment - source (Intake) – Pipelines – Reservoirs – Taps – Household use
Problems are identified and written up in bullets (verified through the check list also).

6.2.3 Assessing Risks

A long list of the problems or "weak points" is identified from above exercise. The list is to be prioritized based on the impact or risk to community if left as it is. Discuss on the effect of certain weak point in the system if nothing is done to check or correct the problem. While discussion, consider the frequency of problem to assess the impact and accordingly rank for correction activities. Quantifying the risk is not necessary in rural community water supply schemes but prioritizing the risk (based on nature and location) and having the knowledge of the consequences is important.

6.2.4 Identifying Appropriate Control Measures

Till now we have identified and prepared the prioritized "weak points" or hazards that could threatened the water quantity, quality degradation and limiting to disruption of the supply. Now the team is ready for planning the solution activities to minimize the risks of contamination.

Exercise: Identify Control measures: Based on the transect walk layout record, check list and prioritized weak points, the team identify the possible solutions to check the contamination entering the system. The solution is sought structure wise if possible considering local resources.

-What are the weak points in catchment or source.

-What could be done to correct the weak points.

Picture sorting for GOOD and BAD practices in keeping the quality of water clean in source and tap/HHs. Pictures of different structures are drawn and weak points are written in meta cards and paste adjacent to the structure. Now facilitate what could be done to correct weak points and by write up and paste in along the route to block the entry of contamination.

Stage 3: Planning

After having the solution for weak points, planning is done. Planning mainly focuses on weak points, critical limits and monitoring (what, when and who will be responsible). Planning chart will be used. Apart from hardware correction, social and behavioral practices will also be targeted in planning through supportive programs.

WSP with emergency repair (previously completed scheme): Planning and monitoring sheet will have due completion date and monitored from team and VWASHCC as verification of completion of activities.

WSP with newly completed scheme: No external budgetary support needed and all is voluntary contribution. This type of scheme will plan WSP with preventive nature and division of works. This will be day to day activities of the team.

6.3.1 Preventive and Urgent control measures

Discussion and exercise: What do they do (personal and institutional) when muddy and contaminated water is coming from tap? How long does this come? How do they know that water is contaminated? Relate with PoU and safe behavioral practices.

Now segregate the personal and institutional interventions. Institutional interventions are those of preventive and curative nature like cut off drain made before monsoon or leakage pipe jointing. Personal interventions are those performed at household level for emergency control measure. If the hazard has high frequency, preventive structures need to be proposed otherwise PoU technology can be applied.

Emergency Plan:

An emergency plan, if system fails shall also be prepared with identifying local water points and its maintenance. The tools and PoU materials shall be collected and kept in safe hands.

6.3.2 Community Action Plan for WSP

Control measures could be preventive as well as curative nature. From above identified control measures, assess what community themselves can do and cannot do (Resource mapping). A WSP community Action Plan is prepared as per chart by the team and later get endorsement from mass meeting.

Include social and behavioral practice related actions also in the plan. It could be HWTS, age long practice followed and preaching not to defecate or throw rubbish around the water bodies etc. The plan is to be endorsed by mass meeting. *This plan is endorsed and owned by users from mass meeting for implementation.*

Stage 4: Monitoring

The beauty of the WSP is the monitoring. Monitoring in WSP is the compliance type with agreed activities. The whole WSP moves around "who does what" principal and hence it is the focal activity that community undertakes to maintain its water quality. WSP action plan for immediate curative & preventive maintenance and monitoring are grouped in a doable and simple format that communities understand. Monitoring is the ensuring of doing some activity already agreed from previous sections. Monitoring also links gender in "who does what" to maintain the safe water from source to mouth. *Exercise on gender role may be useful here.* VWASHCC could be given third party monitoring role.

6.4.1 Institutionalization Monitoring

Since the WSP is a continuous process, the monitoring must also be continuous to maintain safe water in the system. The monitoring formats and checklist must be updated as required and allocate the responsibility. WUSC or team along can do nothing if community doesn't own the plan. So community must agree on the WSP plan and own it. The team must play vital role to aware, warn and trigger the time of action for safe water.

School teachers, child club, priests, leader farmers and CO level leaders can support WSP by discussing and keeping water quality, safety topics in their respective meetings or classrooms etc for better hygienic behavior and enabling environment.

6.4.2 Verifying Effectiveness of Control Measures

Once the emergency curative action and preventative maintenance have been completed as agreed and planned, the effectiveness of the intervention needs to be checked and verified. Verification can be done either by water quality examination or user satisfaction or agreed health based targets.

Many contaminants can be observed reduced through noticeable positive changes but microbial contamination needs some special indicators or instruments. For microbial contamination, P/A vial is used to confirm safeness of the water. Local school will be mobilized and capacitated for this test.

User satisfaction shall also be useful for checking effectiveness of the interventions. The communities "like or dislike" of the water is also an indicator to confirm the safeness of the water. This can be with interview, questionnaire, feed back or checklist or from secondary data like health post.

6.4.3. Evaluation, Review and Follow up of plan

The evaluation of the WSP plan needs to be done after every monitoring and implementation whether planned activities were effective or any improvement is necessary. The plan is then reviewed and updated. Follow up of the plan with the help of VWASHCC or facilitating organization must be done regularly whether the community is continuing the monitoring and preventive measures as agreed.

Stage 5: Management and Communication

This is the regular general activity of the WUSC for O & M. of the scheme.

6.5.1 Record Keeping, Documentation and Reporting

All activities and correspondence performed while formulation and implementation of WSP must be documented along with minutes and reported to concern stakeholders like DDC, VDC, WSSDO, DTO and V/D WASHCC, FEDWASUN. The WUSC office must have the plan in big chart and activities completed or monitored marked with color (*or in public office*).

6.5.2 Supportive Program Formulation and implementation

Along with WSP planning, a plan for supportive program shall also be prepared for continuity and ownership of the plan. The supportive plan could be:

- Promotion of sani/water mart for availability of basic sanitary, fittings & pipe materials from project: Matching fund (NRs. 20-25 K) for VWASHCC who will loan the amount to local trader for emergency stock of the frequently required materials.
- Awareness campaigns to general public and specifically to those nearer to source (ie through IEC materials, stop vandalism, No to urinating & defecating near water sources etc)
- Celebrating days like IWD, WWD, NSAW, WTD etc.
- Water sources, points sweeping and cleaning campaigns.
- All water system structures cleaning program
- Tap stand cleaning and sweeping activities.
- Human resource development (training) request
- Good hygienic practices on work.
- No Grazing zone declaration in around the source area.
- ODF declaration
- Source protection, conservation and plantation campaign
- PoU technology
- Reward and punishment policy
- Demonstrative type of activities ie hand washing with soap, cleaning pots etc.

6.5.3. PoU: Advocacy, Information and Communication

Normally, drinking water supplies need to be treated during and after an emergency to make them safe and acceptable to the user. Treatment at the point of use is generally quicker and less expensive to implement than a centralized system, where it can be more difficult to manage. Only water used for drinking and preparing food needs to be treated. PoU options are integral part of WSP and should be promoted. Some of the most common and simple treatment options suitable for house use or during an emergency are:

Sedimentation: Though "Fitkiri (Aluminum sulphate) and other coagulants" are effective coagulants, Chemical use shall not be promoted in hills. When water is allowed to stand undisturbed and in the dark for a day, more than 50 per cent of most harmful bacteria die. Additionally, the suspended solids and some of the pathogens will settle to the bottom of the container, removing further risk (*Emergency treatment of drinking water at point of use, WHO/WEDC 2011*). Thus, traditional copper gagri (vessel) is recommended to be filled at night time and consume water at daytime. The definition of "Taaja pani" needs to be changed from safety point view.

Filtration: From simple clean cloth screening to advance micro filters are in use for physical separation of suspended materials from water. The filter media blocks the particles while passing the water through. Filtration may be: Straining by clean cloth or through sand media or ceramic filters.

Disinfection: Disinfection destroys all harmful organisms present in water and makes it safe to drink. Disinfection can be done with following ways:

Boiling water: Boiling water is very effective way for destroying micro organisms in the water but is costly as energy is used for boiling. The water should be boiled up to "rolling" condition for 1 minute (sea level) to 3 minutes (high altitude) depending upon the altitude. The boiled water must never be added with other cold water making cooler for drinking. The boiled water must be let cool by itself before consumption.

Chlorine Use: Chemicals like chlorine is used to kill all virus and bacteria if used properly in water but handling and care should be taken in using chlorine as it is poisonous. Pius and water guard are the chlorine compound available in the market for water disinfection. Instruction must be read before using such compound available on the label. For chlorine compound at least 30 minutes is required for time to kill and vigorously mixing is necessary. The water must be pre treated if turbidity is high (muddy).

Solar Disinfection (Sodis): Harmful micro organisms present in water will be destroyed by ultra violet rays of sun. Transparent Plastic bottles of capacity 1 or 2 liters, filled with water exposed to sun for at least for 5 hours (bright sunny day) to 2 consecutive days (cloudy days) can kill harmful micro organisms. The water must be clean and if dirty straining is necessary.

Safe water storage: There is no point in treating water if it becomes contaminated again afterwards. The storage and use of treated water is just as important as the treatment process. Treated water should be kept in a clean, covered vessel and kept in a cool dark place. Hygienic drawing of water is very important so wide necked; tight lid vessel with tap is the best option for safe storage. Never place treated water filled soil vessel touching the wall plaster with cow-dung. Water can be contaminated with hands so washing hands with soap is very important before handling water.

6.5.4. Linkage: Coordination and Cooperation

Consistence support is needed from stakeholders in maintaining safe water in the water supply system so continued communication and linkage should be made as far as possible. All reports, documents and monitoring reports must be provided regularly to concern agencies especially VWASHCC and DWASHCC.

7. Capacity Building Activities

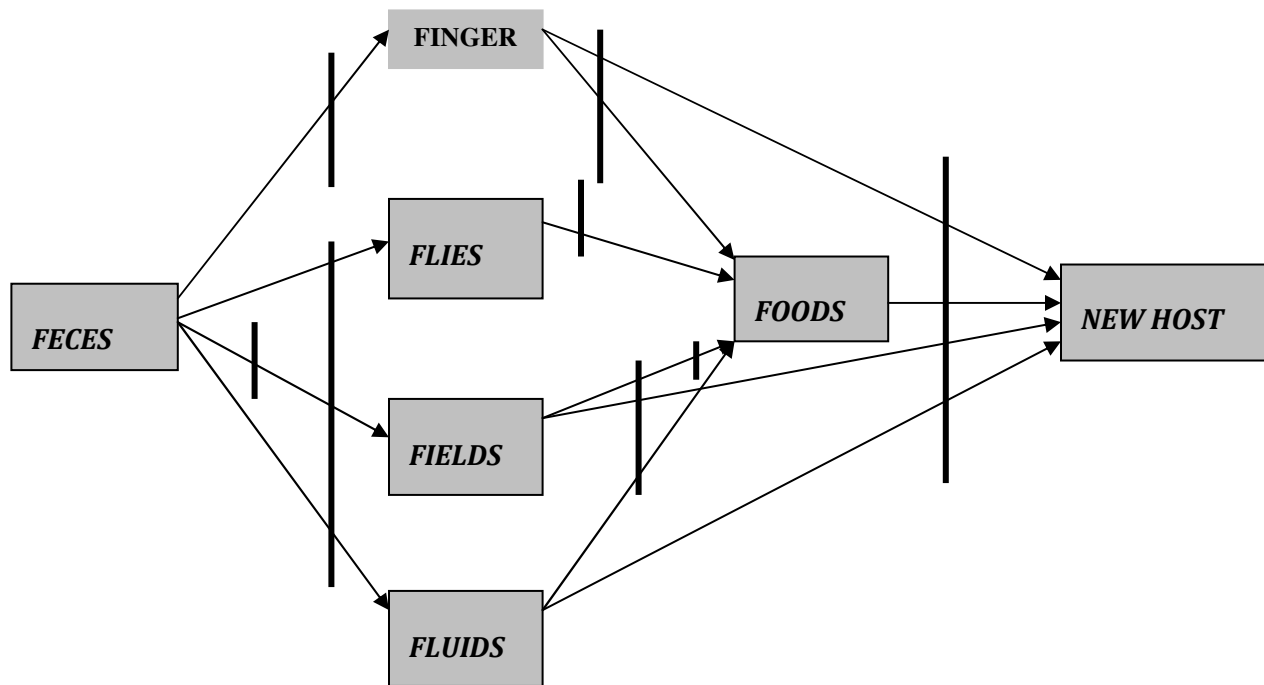
ToT Training on WSP will be imparted to the SO/SP along with line agencies staffs so they can later facilitate and guide WUSC to form their own WSP.

Similarly WSP team will be provided with WSP training facilitated and guided by SO/SPs at local level. This guide will be supportive /reference materials for facilitaton

8. References

- *WSP Hand book: DWSS 2067*
- *Water Safety Plans for communities: Guidance for adoption of Water Safety Plans at community level: Tearfund 2011*
- *Sector Briefing on Climate Change Impacts and Adaptation: WATER SUPPLY AND SANITATION: ADB Publication Stock No. ARM124237 January 2012*
- *Emergency treatment of drinking water at point of use, WHO/WEDC 2011*
- *Community water safety monitoring guideline (draft) RVWRMP II*

9. Annex.



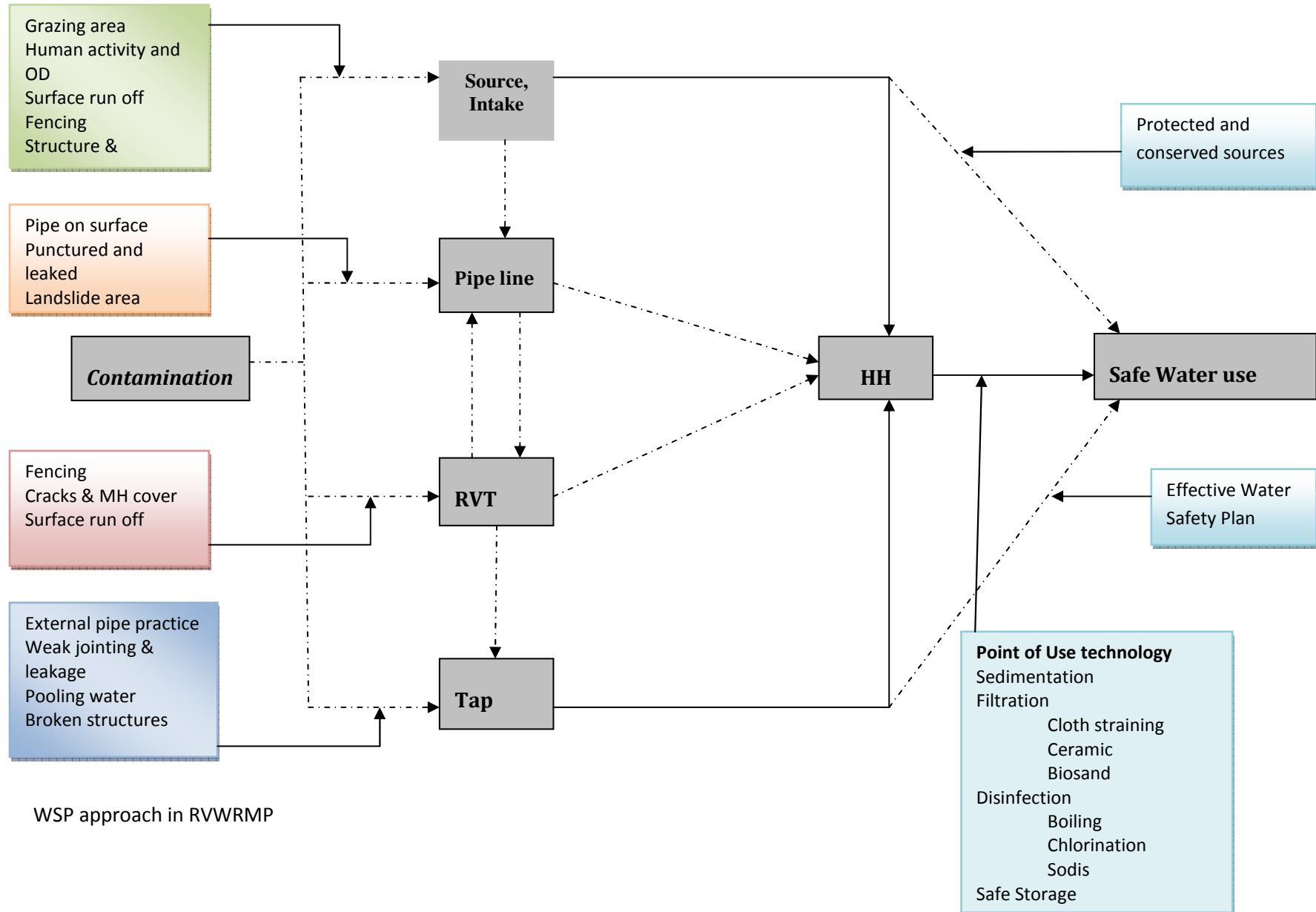
Fecal Oral Transmission

Interventions

Factors to consider

Point of Entry

Point of Use



WSP approach in RVWRMP