Capacity Building training on Climate-Resilient Water Safety Plan

CR-WSP training participants at Adigrat Town, photo Osman WHO 21 Dec 2015

CR-WSP training participants at Fatsi Town, photo Osman WHO 28 Dec 2015

19-30 Dec, 2015

Adigrat & Fatsi towns, Tigray Region

1. Introduction:

The National Drinking Water Quality Standard Speciation issued in 2001 and revised in 2013 covering microbiological and physicochemical parameters. However, in Ethiopia, systematic and comprehensive water quality assessment is lacking. Around 12 institutions involved on water quality activities including Ministry of Water, Irrigation and Electricity (MoWIE) and Ministry of Health. Nonetheless, continuous and comprehensive water quality monitoring and surveillance activities have done in none of these organizations and institutions. Joint Technical Review on Water Quality and Safety in Oromia Regional State, Ethiopia was conducted in May 2012 in preparation for WASH Ethiopia 5th Multi-stakeholders Forum. The outcome of this joint technical review was presented on the 5th WASH Multi-stakeholders Forum meeting organized 29-30, Nov 2012 in Addis Ababa.

Among the five major undertaking of the forum Water and Sanitation Safety Procedure, capacity and process were major action points which includes : Revise the guidelines, standards and procedures and establish a system for water and sanitation Safety Management for Ethiopia; Prepare national level plan to support regions on water and improved sanitation safety management including linkages of activities between MoWIE, MoH, MoE, Regional Bureaus and the regulator; Include the water and improved sanitation safety management in the region work plans supported by budget, activity and time line; Increased involvement of development partners (donors, CSOs and private sector) in water and improved sanitation safety development as part of on-going WASH sector support in terms of budget and capacity building and pilot risk based management of water quality and safety in utilities and small community water supply. Moreover, GTP II of the MoWIE underlines the importance of water safety plan on Goal 2.6 and 3.4 [GTP II Goal 2.6: Ensure rural water safety through rural water supply water quality monitoring system and water safety plan implementation and GTP II Goal 3.4: Ensure urban water safety through urban water supply water quality monitoring system and water safety plan implementation].

It is obvious that an assessment of water safety should be based on two important indicators: 1) regularity of water quality testing (and testing results), and 2) level of proactive risk management. Ministry of Water, Irrigation and Electricity in collaboration with WHO has conducted capacity building training and risk assessment/management on selected Climate Resilient Water safety Plan implementation sites/ water supply systems to ensure water safety of a drinking water supply, focusing on the key hazards identified from the catchment to the point of use.

2. **Objectives:**
   - Enable participants to understand concepts of Climate Resilient Water Safety Plan
   - Enable participants to use the skill and knowledge gained on Climate Resilient Water Safety Plan to facilitate project implementation and train others in this regard.
   - Encourage participants to present/share their experiences on Water Safety Plan and learn from each other.
   - Develop Plan of Action/incremental improvement plan/ for the implantation of Climate Resilient Water Safety Plan based on the risk assessment.
   - Conduct water quality testing and analysis on pilot Climate Resilient Water Safety Plan implementation sites/ water supply schemes from source to household level to serve as baseline data.
   - Enhance the capacity of pilot implementation sites in establishing/strengthening water quality laboratory and regularly conducting water quality testing and analysis.

- Before the actual training; core facilitators/trainers identified and did adequate preparation for the training including:
  - Training package adopted using the WHO training packages including translating to the local language.
  - Practical group exercises were also adopted to fit the local situation/context including translating to local language.
  - Baseline assessment data for the respective pilot water supply system was used as an input during the theoretical sessions and practical exercises.
  - Five small groups of 5-6 members identified considering to have mixture of different backgrounds including working area, education levels, level of experience and others.
  - Throughout the training participants were encouraged and supported by facilitators to gain the maximum knowledge and practical skill on Climate Resilient Water Safety Plan through:
    - Two ways interactive communication.
    - Theoretical presentations were emanated from the practical aspect of the local situation.
    - Each session is followed by practical group exercises.
    - Presentation of group exercises enables further discussion among participants.
    - Pop Quiz given to participants to assess the level of understanding for which most participants score high results.
- Training participants were critically identified and timely invited through the involvement of the above actors.
- Participation and involvement of government actors including Ministry of Water, Irrigation and Electricity, Tigray Regional Water Resources Bureau, town water supply services and other relevant sectors /partners were achieved.
- All necessary logistic support was timely done to successfully conduct the training as well as water quality testing and analysis.

3. Summary of the achievement:

3.1. CR-WSP training:

- A total of 27 participants successfully attended the capacity building training on Climate-Resilient Water Safety Plan from 19-22 December 2015 at Adigrat town, Tigray Region. The participants were drawn from Regional Bureau's (Water Resources Bureau, Health Bureau, Agriculture Bureau, Environmental Protection & Land Administration Bureau, Urban Trade & Investment Bureau, Education Bureau, Meteorology), Mekele University, Drop of Water, Adigrat University, Adigrat town water supply and sewerage service, relevant sector Offices from Adigrat town including, Women affairs, Health, Education, Agriculture, Urban trade & investment, Environment protection and land Administration Offices and others (**see list of participants**).
- Similarly, a total of 35 participants successfully attended the capacity building training on Climate-Resilient Water Safety Plan from 25-28 December 2015 at Fatsi town, Tigray Region. Training participants were drawn from Gulomeheda woreda (Fatsi town, & Zalanbesa town), and Enderta woreda (Felegeselam kebele) including Woreda Water Offices, Health Offices, Education Offices, Women Affairs, Environmental Protection & land Administration offices, Agriculture Offices, town water supply services, water services board chair and members, municipality, Felegeselam kebele rural WASHCO members and others (**see list of participants**).
- Participants have acquired the necessary knowledge and skill as to Climate Resilient Water Safety Plan that will enable them to implement the pilot project in their respective water utility.
- Adequate practical experiences gained on Water Safety Plan as a result of utmost participants interaction facilitated by trained facilitators.
- Participants has developed plan of action/incremental improvement plan for both Adigrat, Fatsi and Zalanbesa town water supply services and Felegeselam kebele rural water supply scheme based on the risk assessment completed for the respective town water utilities and rural water supply scheme **(Table 1-8)** .
- Baseline assessment data was also completed for Adigrat, Fatsi and Zalanbesa town water supply services.
- The CR-WSP implementation will benefit 102,156 people of Adigrat, Fatsi and Zalanbesa towns (**see baseline assessment data**).

3.2. Water Quality Testing and Analysis:

- Water quality testing/analysis were also conducted in collaboration with Adigrat, Fatsi and Zalanbesa town water supply services and Tigray region Water and Health Bureau. Both Water supply services have no established laboratory facility to conduct water quality testing and monitoring on regular basis. Nevertheless, Adigrat, Fatsi and Zalanbesa town water utilities reported that sampled water have been collected and taken to Mekele town for test on regular basis. Both physico-chemical and bacteriological water quality testing was done using portable water quality laboratory test kit and other physico-chemical test equipment/apparatus including portable spectrophotometer. Risk level for each sampled source was also rated as high, medium

or low as per the risk assessment identified. Accordingly, the risk level is also compared with the respective water quality test results.

- Senior water quality experts were involved in conducting water quality testing and analysis.
- Samples in each implementation areas were taken from different sites in the water supply system including: source of water, reservoirs, public water points and water from households.
- A total of 32 samples [Adigrat (14 samples), Zalanbesa (11 samples) and Fatsi (7 samples)] taken for testing collected from source to household level (T**able 9, 10, 11**).
- Electrical Conductivity (EC), Total Dissolved Solid (TDS), PH, Temperature and Turbidity were included in the physico chemical parameters.
- Chemical testing was also done for fluoride, nitrate, nitrite, hardness and residual free chlorine concentrations.
- Fecal coliform and total coliform was done as bacteriological parameter.
- All physico-chemical parameters water quality testing results except turbidity showed that it is within the range of maximum permissible level as per the Ethiopian compulsory drinking water standards. Turbidity of seven samples (21.8%) was found to be more than 5 NTU. Similarly, chemical analyses for most samples were also found to be within the range of maximum permissible level as per the Ethiopian compulsory drinking water standards. The free residual chlorine at the outlet of the reservoir is found to be 0.5mg/l for Adigrat town. Similarly, the test result at the public Water Point and households were also found to be 0.4 mg/l of free residual chlorine. Free residual chlorine of 0.3mg/l was also seen at the outlet of the reservoir at Fatsi and Zalanbesa town respectively (**Table 10, 11**). Presence of residual chlorine showed that there is community water treatment practice with chlorine solution in the specified towns.
- The bacteriological water quality testing results showed that no E.coli was detected in all samples of Adigrat town. This could be mainly due to consistent community water treatment practice in the town. Five (45.4%) of samples from Zalanbesa town were found to be with total coliform detected which is above maximum permissible level as per the Ethiopian compulsory drinking water standards. Similarly, 4(57.1%) of samples from Fatsi town was also detected with total coliform. The result showed that multiple barrier approach such as community water treatment practice, Household water treatment and safe storage, and availability & utilization of sanitation facilities, improving hygiene condition and others will be vital in ensuring water safety (**Table 9, 10, 11)**.
- In the process of water quality testing it was able to involve and work together in particular with the regional focal persons and water quality technicians in the respective urban water utilities. Hence, it has contributed in enhancing the capacity of pilot implementation sites, to establish mini water quality laboratory [particularly at Adigrat town] and conducting regular water quality testing in their respective areas.

4. Challenges/Gaps:

- A 4 days training schedule was tight to complete all planned activities and shall be stick to 5 days as indicated in the guideline.
- Training venue at Fatsi town (small town) was not convenient to facilitate the training mainly due to the absence of other options in the town.
- Baseline assessment data including water quality testing and analysis for both pilot implementation sites was not completed prior to the training.
- Limited time allocated to collect baseline assessment data and conduct water quality testing and analysis for each implementation sites. However, it was possible to complete the baseline assessment data and water quality testing for both sites during the training period particularly during field visit and through organizing secondary data from sector offices using structured data collection format.
- Absence of mini laboratory to conduct regular water quality monitoring and testing at least at Adigrat town which is capital of Eastern Zone of Tigray region.
- Training participants from Enderta woreda (Felegeselam Kebele rural water supply scheme) was not able to do practical risk assessment field visit to own facility due to long distance from the training site (~180 km). However, they were able to visit Zalanbesa town water supply scheme and develop an incremental improvement plan to Felegeselam kebele rural water supply scheme based on the risks identified using their practical knowledge.
- Baseline assessment data including water quality testing and analysis for Felegeselam kebele rural water supply scheme not done.
- Lack of reagent to test water quality parameters such as sulfate.

5. Lessons:

- Continue the involvement of concerned government actors from top to down level in organizing/facilitating the training.
- Prior identification of proposed participants and timely communication enhance achievement of planned objectives.
- Prior arrangements of all necessary logistics enable efficient utilization of resources and achieving planned outputs.

6. Way forward:

- Revise the plan of action/incremental improvement plan for the respective pilot CR-WSPs implementation sites.
- Detail improvement plan for each site that has been developed based on the risk assessment table need to be included in the annual work plan of the respective water utilities to be supported by the community, water utilities, the region or other WASH development partners operating in the respective area.
- Tigray regional Water Resources Bureau to timely submit cash request to Ministry of Water, Irrigating and Electricity based on the revised plan of action on behalf of the respective water utilities.

- Ministry of Water, Irrigation and Electricity to facilitate timely disbursement of cash to Tigray region Water Resource Bureau based on cash request made considering the revised plan of action.
- Ministry of Water, Irrigation and Electricity and Tigray regional water resources Bureau to provide continuous technical support throughout the project implementation.
- Adigrat town water supply service enterprise needs to establish mini laboratory to conduct water quality monitoring and testing on regular basis.
- Cash transfer modality to implement CR-WSP at Felegeselam kebele water supply schemes through the support of 'Drop of Water' [a local NGO] need to be sorted as soon as possible.
- To complete baseline data assessment and water quality testing at Felegeselam kebele rural managed water supply schemes.

Manager of Adigrat town water supply service delivering opening remarks on CR-WSP Training at Adigrat town, photo Osman, WHO, 19 Dec 20 15

Head, Hulomeheda woreda urban development, trade and industry office and Chair of Fatsi town Water supply service board delivering opening remarks on CR-WSP Training at Fatsi town, photo Osman WHO, 25 Dec 2015

Damaged pipeline and covered with plastic: CR-WSP training, Adigrat town photo Osman WHO, 21 Dec 2015

A deep well water source with cracked/damaged well head Fatsi town, photo Osman WHO, 27 Dec 2015

Community members fetching water at public water point with no fence and sited in the roadside, Adigrat town, photo Osman WHO, 21 Dec 2015

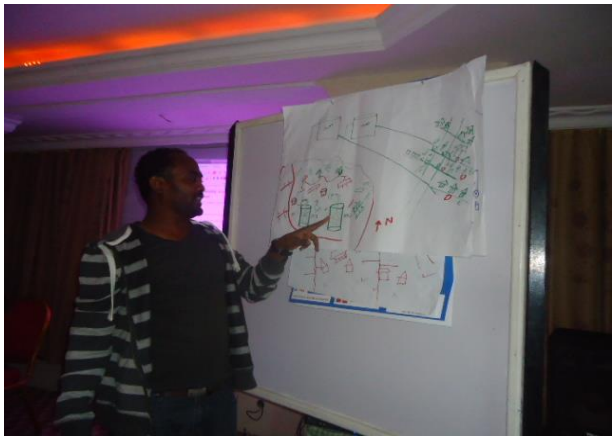
Large gully near to a deep well water source, Adigrat town, photo Osman WHO, 21 Dec 2015

Automatic chlorination system for Adigrat town community water supply photo, Osman WHO, 21 Dec 2015

Community water treatment practice using drop system in the reservoir, Fatsi town, photo Osman WHO, 21 Dec 2015

CR-WSPs training with practical session guided by a facilitator, Adigrat town, photo Osman, 20 Dec 2015

CR-WSPs training with practical session guided by a facilitator, Adigrat town, photo Osman, 20 Dec 2015



CRWSP training, a participant presenting water supply description of Adigrat town water supply system, Photo Osman WHO, 21 Dec 2015

CRWSP training, a participant presenting water supply description of Adigrat town water supply system, Photo Osman WHO, 21 Dec 2015

CRWSP training, a participant presenting risk assessment of Adigrat town water supply system, Photo Osman WHO, 21 Dec 2015

CRWSP training, a participant presenting risk assessment of Felegeselam kebele rural water supply scheme, Photo Osman WHO, 27 Dec 2015

CRWSP training, a participant presenting risk assessment of Fatsi town water supply system Photo Osman WHO, 27 Dec 2015

CRWSP training, a participant presenting risk assessment of Zalanbesa town water supply system Photo Osman WHO, 27 Dec 2015

Table 1: Risk assessment table on Climate-Resilient Water Safety Plan, Adigrat town water supply service, December 2015

				Are controls effective?				Risk assessment				Additional control needed?		
Process Step	**Hazardous Event**	**Hazard Type**	**Existing control measures**	**Yes**	**No**	**Somewhat**	**Validation notes**	**Likelihood**	**Consequences**	**Risk score**	**Risk level**	**Yes**	**No**	**If yes, proposed controls** *(to be further detailed in improvement plan)*
Catchment BH2, BH3, BH6, BH7, BH8, BH9	Contamination of water sources due to human faeces and animal droppings around the water sources.	Microbial	Fence			✓	Based on the observation, the fence partially prevent contamination as protect away animals	2	3	6	H	✓		Repairing the existing fence Elevating the well head and sealed Sensitizing people who live near the water source to keep the water sources safe
	Contamination of water source due to the farm near the water sources use fertilizers.	Chemical	None					2	2	4	M	✓		Constructing diversion ditch and building the well head
	Contamination of water due to the catchment area degraded, the water recharge reduced	Physical	None					3	2	6	H	✓		Carrying out soil & water conservation at the catchment area. Prohibiting animal and human movement at the water catchment area
Catchment BH8, BH9	Presence of gully nearby the water source exposed the water to damage	Physical	None		✓			3	2	6	H	✓		Building check dams Building retaining wall Carrying out soil & water conservation at the upper part of the catchment area

May-Mesanu Borehole #4	Contamination of water with chemicals due to nearby pesticides and fertilizers use and runoff from farms	Chemical	Well head casing			√	Based on the observation, the casing of the wellhead is partially preventing contamination that would come by runoff water.	2	2	4	M	√		Making farming practices away from water source based on the standards
	Microbial contamination of water due to animal droppings and human faeces around the water source and runoff	Microbial	Well head casing			√	Based on the observation, the casing of the wellhead is partially preventing contamination that would come by runoff water.	1	3	3	M	√		Making a fence for the borehole Making away animals from the water source Discriminating the habit of open defecation
May-Mesanu Borehole #3	Contamination of water with chemicals due to nearby pesticides and fertilizers use and runoff from farms	Chemical	Well head casing			√	Based on the observation, the casing of the wellhead is partially preventing contamination that would come by runoff water.	1	2	2	L	√		Making farming practices away from water source based on the standards
	Microbial contamination of water due to animal droppings and human faeces around the water source and runoff	Microbial	Well head casing			√	Based on the observation, the casing of the wellhead is partially preventing contamination that would come by runoff water.	2	3	6	H	√		Evacuating households reside close to the water source
Gorno Borehole	The source water is exposed to damage due presence of gully nearby the water source and storm water	Physical Microbial Chemical	None					2	3	6	H	√		Building retention wall and Carrying out conservation works up stream area
Reservoir	Contamination of water due to the reservoir is not well fenced and exposed to microbial contamination and physical damage	Microbial & physical	Fence			✓	Based on the observation, the fence is not strong enough	2	3	6	H	√		Strengthening the fence as well as assigning a guard to keep it well
	The water is exposed to contamination since the cover of manhole of the reservoir is not well fitted,	Microbial & physical	Cover for the manhole Chlorination			√	Since inlet pipe enter above the manhole of the reservoir, it is difficult to close. Since residual chlorine checking is not used, it is difficult to know whether the chlorination was effective	2	3	6	H	√		Sealing the space uncovered with cement Checking residual chlorine regularly

Reservoir	The water is exposed to chemical contamination as the manhole cover and the ladder inside the reservoir were rusted	Chemical	None					1	2	2	L	√		Replacing the manhole cover and paint with anti-rust Making a ladder with rust resistant to material and easily movable one
	The water is liable to microbial and chemical as the dose is low and high respectively as residual chlorine checking is not carried out,	Biological Chemical	Arbitrary chlorination		√			2	3	6	H	√		Checking residual chlorine regularly Providing adequate training on water treatment using chlorine to water quality professionals Preparing SOP of chlorination
	Contamination of water due to no adequate contact time during water treatment process	Microbial Chemical	Chlorination			√	It is observed that adequate contact time not met	2	2	4	M	√		Correcting the contact time for chlorine during water treatment by providing training for employees
	Contamination of water due to chlorine potency reduced because of chlorine stored improperly	Microbial	Chlorine stored in house made of corrugated iron sheet			√	It is observed that chlorine not stored properly	2	2	4	M	√		Storing chlorine in appropriate place
Distribution	The water is exposed to chemical and physical contamination Since the distribution pipe rusted,	Chemical Physical	Some of the distribution pipes replaced with HDPE			√	Based on the observation, there were efforts to replace rusted pipe with rust resistant pipes in some places.	2	2	4	M	√		Replacing rusted pipes with rust resistant one
Distribution	The water is exposed to biological and physical damage as the width of the pipe is not equivalent with the water pressure,	Physical Biological	None					2	3	6	H	√		Replacing these pipes with pipes that could resist the pressure
	Risk of microbial contamination and physical damage as the stand post pipes usually suited nearby roads and had no fence	Microbial Physical	None					2	3	6	H	√		Reshuffling the stand post pipes to where suitable for the stand posts as well as for clients

Distribution	Contamination of water exposed pipelines	Physical Microbial Chemical	None					2	2	4	M	√		Supporting the suspended pipe with concrete stand
	Risk of contamination of water due to supporting wall of the stand post are being demolished as not fenced	Physical Microbial	None					2	2	4	M	√		Fencing the stand post Maintain the supporting wall of this stand post (Bono)
	Risk of contamination of water at public water points due to absence of drainage	Microbial	None					2	3	6	H	√		Constructing drainage to each Public water points
Users	The water is exposed to microbial and physical contamination due to inadequate care and improper utilization of water at home.	Microbial Physical	None					3	3	9	H	√		Conducting public awareness on safe water storage & use at home
	Risk of microbial contamination of water due to cow dung accumulated near to water meter of the tap	Microbial	None					3	3	9	H	√		Removing the cow dung immediately Relocating the pipe and its accessories and put the water elevated from the ground
	Risk of microbial contamination of water due to kitchen and animal pen are in one as well as the water container is not kept clean,	Microbial	None					3	3	9	H	√		Separating kitchen and animal pen - Creating awareness on how to keep water safe and use appropriately at home

Table 2: Risk assessment table on Climate-Resilient Water Safety Plan, Fatsi town Water supply service, December 2015

				Are controls effective?				Risk assessment				Additional control needed?		
Process Step	**Hazardous Event**	**Hazard Type**	**Existing control measures**	**Yes**	**No**	**Somewhat**	**Validation notes**	**Likelihood**	**Consequences**	**Risk score**	**Risk level**	**Yes**	**No**	**If yes, proposed controls** *(to be further detailed in improvement plan)*
Catchment Golgoldaga water source	Risk of contamination of water source due to nearby farm use herbicides and artificial fertilizers washed away by runoff	Chemical	None		√			2	2	4	M	√		Prohibiting the use of herbicides and artificial fertilizers within recommended radius
	Storm water directly overwhelm and affect water source	Physical	Dry mason			√	The existing dry mason protect water storm hardly	2	2	4	M	√		Construct strong mortar retention wall
	Contamination of water source due to cracks at the well head allow storm water carried cow dungs	Microbial	None		√			2	3	6	H	√		Constructing elevated well head with cemented
	Water yield reduced as there are no adequate wet conserving structures	Physical	Water conserving terracing			√	Water conserving terracing need maintenance	2	2	4	M	√		Constructing additional water conserving structures
China Well	Water yield sharply reduced since there are a lot of nearby private wells	Physical	None		√			1	3	3	M	√		Closing nearby private wells Prohibiting digging additional wells close to the China well.
China Well	Risk of contamination of water source due to nearby farm use herbicides and artificial fertilizers washed away by runoff	Chemical	None		√			2	2	4	M	√		Prohibiting to use herbicides and artificial fertilizers within radius
	Storm water directly overwhelm and affect water source	Physical	Dry mason			√	The existing dry mason protect water storm hardly	2	2	4	M	√		Constructing strong mortar retention wall
	Water yield reduced as there are no adequate wet conserving structures	Physical	Water conserving terracing			√	The water conserving terracing need maintenance	2	2	4	M	√		Constructing additional water conserving structures

Reservoir	Contamination of water due to open vent pipe, not fitted with screen mesh and access birds	Microbial	None					3	3	9	H	√		Cover the vent pipe with wire mesh
	Risk of water contamination due to manhole situated just level of the ground and dirty filth	Microbial	None					3	3	9	H	√		Reconstructing the manhole with cement in a way it situated above ground
	Water contaminatyin due to perforated chlorine mixer	Microbial	None					2	3	6	H	√		Replacing with a new one
	Water may be contaminated due to cracked reservoir and access of dirty matter	Microbial	None					2	2	4	M	√		Plastering with cement after glazing the reservoir wall
Distribution	Water may be contaminated due to the pipe pass under residential houses and broken pipes	Microbial	None					2	3	6	H	√		Changing the path way of the pipe
	Contamination of water due to exposed and broken pipelines	Microbial Physical	None					2	2	4	M	√		Covering exposed pipe (underground)
	Contamination of water due to pipe leakage	Microbial	None					2	3	6	H	√		Repairing leaking pipes
Distribution	Water may be contaminated due to pipelines pass underneath residential houses and may be broken	Microbial Physical	None					3	3	9	H	√		Replacing these pipes passed under residential houses
	Water contamination as water points have no good fence that access animals	Microbial	Fence			√	It is observed that public water point is not well fenced	2	3	6	H	√		Fencing the public water point with iron bar
	Water may be contaminated due to absence of drainage at public water points	Microbial	None					3	3	9	H	√		Constructing a drainage
	Water may be contaminated due to dirty hose used to convey water to Jerican	Microbial	None					2	2	4	M	√		Washing it or replacing with new one
Users	Contamination of water due to dirty jerican stained and flourished with algae,	Microbial	None					3	3	9	H	√		Creating community awareness on water safety

Table 3: Risk assessment table on Climate-Resilient Water Safety Plan, Zalanbesa town water supply service, December 2015

				Are controls effective?				Risk assessment				Additional control needed?		
Process Step	**Hazardous Event**	**Hazard Type**	**Existing control measures**	**Yes**	**No**	**Somewhat**	**Validation notes**	**Likelihood**	**Consequences**	**Risk score**	**Risk level**	**Yes**	**No**	**If yes, proposed controls** *(to be further detailed in improvement plan)*
Borehole Military Camp (BH # 2)	Water is contaminated with storm water during rainy season due to water pipelines not well covered	Physical Microbial	None					3	2	6	H	√		Covering pipes with soil Constructing manhole of gate valve that control water supplied to military building Covering the well head
	Water source exposed to damage due to gully near to the water source	Physical	None					1	3	3	M	√		Building retain wall with barbed wire &stones
May liham borehole (BH # 5)	Water is contaminate due to use of pesticides and fertilizers in nearby farms and practice of open defecation	Chemical Microbial	None					1	3	3	M	√		Evacuating farmer by providing compensation/or convincing to plant permanent fruit vegetation without using fertilizer
May kurquah Borehole (BH # 3)	Water is contaminated as no fence and access animal	Microbial	None					1	3	3	M	√		Fencing the water source
Gundufduf Reservoir (R #1)	Contaminated water due to outlet gate valve immersed & covered with mud	Microbial physical	None					1	3	3	M	√		Excavating the accumulated mud and plastering the manhole with concrete mortar
Reservoir #2	Contaminated water due to rusted discharge pipe	Physical	None					1	1	1	L	√		Maintaining the manhole with concrete for steadily flow
Reservoir #1 & #2	Water is exposed to contamination due absence of fencing around the reservoir	Microbial	Cover to manhole			√	Protects dust entering to reservoir on its top	2	3	6	H	√		Fencing the reservoir

Public Water Points	Contamination of water due to poor drainage and the surrounding became muddy	Physical Microbial	Existing canal			√	It is observed that drainage system in the public water point filled with mud	1	1	1	L	√		Excavating the filled solid from drainage and maintaining it.
Users (HHs)	Contamination of water due to un hygienically dipping practice in to wide mouth container	Microbial	Cover			√	It protects dust entering to water container	2	2	4	M	√		Sensitizing people to use narrow mouth container cleaning regularly the water container

Table 4: Risk assessment table on Climate-Resilient Water Safety Plan, Felege Selam Kebele Rural Water Supply Scheme, December 2015

				Are controls effective?				Risk assessment				Additional control needed?		
Process Step	**Hazardous Event**	**Hazard Type**	**Existing control measures**	**Yes**	**No**	**Somewhat**	**Validation notes**	**Likelihood**	**Consequences**	**Risk score**	**Risk level**	**Yes**	**No**	**If yes, proposed controls** *(to be further detailed in improvement plan)*
Catchment (Hand pump)	Contamination of water due cattle grazing nearby water source	Microbial	Fence around the source of water			√	Cattles enter to the hand pump as it had no door	2	3	6	H	√		Fitting with a door and strengthen the fence with better materials
	Contamination of water source due to use of fertilizers and pesticides to the nearby agriculture farm	Chemical	None					1	2	2	L	√		Diverting the runoff water came from farming area
	Water source may be damaged due to flush flooding and existing gorge on the two sides	Physical	Check dam			√	Though constructed check dam reduced the runoff water impact on the hand pump, it couldn't completely stop the runoff water to the water source	2	3	6	H	√		Strengthening the water and soil conservation works there and covering with indigenous plants
	Contamination of water source due to open defecation practice near to water source	Microbial	Expanding latrine construction			√	There is still practicing of open defecation	2	3	6	H	√		Sensitizing community to use latrine and to prohibit open defecation
Users	Contamination of water due to water storage containers are not washed frequently and not kept clean	Microbial	Practice of Jerican washing			√	It is observed that the water containers were not kept clean	1	2	2	L	√		Creating community awareness and monitoring to keep water containers clean

Table 5. Plan of action on Climate Resilient Water Safety Plan, Adigrat town water supply service, December 2015

S.NO	Specific improvement action	Arising from *(relevant hazardous event)*	Responsible party	Implementation Timeline	Implementation Cost(BIRR)	Remark
1	Conduct technical training on CR-WSP to operators, care takers, water quality technicians, environmental health workers, education experts, natural resource experts & others	Risk of different types of water and sanitation related diseases due to inadequate /poor capacity at all level.	Adigrat town Water Supply Service	Feb-March 16	20,000.00	
2	Conduct sensitization and awareness creation to stakeholders on CR-WSP	Risk of different types of water and sanitation related diseases due to inadequate /poor capacity at all level.	Adigrat town Water Supply Service	Feb-March 16	15,000.00	
3	Creating public awareness on safe water storage & use at home	Water is exposed to microbial and physical contamination due to inadequate care and improper utilization of water at home.	Water & Health sector Health Extension Workers	March-June 16	-	
4	Building check dams and retaining wall	Water source exposed to damage due to the presence of gully nearby the source	Environmental Protection, Water utility, Agriculture & Urban development Sectors	March-May16	1,250,000.00	Involving community participation
5	Carrying out soil & water conservation at the upper part of the catchment area	Water recharge reduced due to degraded catchment area	Agriculture Office Water Utility Environmental protection	10/08-11/08	100,000.00	Involving community participation
6	Providing adequate training on water treatment using chlorine to water quality professionals and checking residual chlorine regularly	Water is liable to microbial and/or chemical contamination as the dose is under and/or over due to residual chlorine checking is not carried out	Regional Water Bureau Water Utility	March 16	3,000.00	
7	Preparing SOP of chlorination	Water is liable to microbial and/or chemical contamination as the dose is under and/or over due to residual chlorine checking is not carried out	Water Utility Office	March 16		
8	Repairing the existing fence at water source , elevating and sealed the well head in sources such as Agazi borehole	Water is contaminated due to human faeces and animal droppings around the water sources.	Water Utility Office	March-April 16	85,000.00	

9	Evacuating households resided close to the water source and sensitizing people who live near the water source to keep the water sources safe	Water is contaminated due to human faeces and animal droppings around the water sources.	Water Utility and Health sector Agriculture Urban development, land admin, Municipality Sectors	March-Aug. 16	1,200,000.00	
10	Reshuffling the stand post pipes to where suitable for the stand posts as well l as clients	Water stands exposed to damage and microbial contamination as the stand post pipes usually placed nearby roads and had no fence	Water Utility, Urban Development office, Municipality and other supporters	March-July,16	80,000.00	
11	Covering the manhole with tight fitted cover and fencing the reservoir	Risk of water contamination due to improper manhole cover and fencing around the reservoir	Water Utility Office	March-April 16	60,000.00	
12	Replacing rusted pipelines with rust resistant (HDPE) , supporting suspended pipes with concrete stand and bury exposed pipes	Water is exposed to chemical and physical contamination due to exposed and rusted pipelines	Water Utility and other supporters	March-June 16	500,000.00	
13	Fencing public water points and constructing drainage to each public water stands	Risk of water contamination due to public water points are not fenced and have no proper drainage system	Water utility office	March-April 16	450,000.00	
14	Monitoring and Evaluating the implementation of CRWSP				20,000.00	
	Total				**3,763,000.00**	

Table 6. Plan of action on Climate Resilient Water Safety Plan, Fatsi town water supply service, December 2015

S.NO	Specific improvement action	Arising from *(relevant hazardous event)*	Responsible party	Implementation Timeline	Implementation Cost(BIRR)	Remark
1	Cover the vent pipe with wire mesh	Contamination of water due to open vent pipe, not fitted with screen mesh and access birds	Fatsi Water Utility	March 16	500.00	
2	Reconstructing the manhole with cement in a way it situated above ground	Risk of water contamination due to manhole situated just level of the ground and dirty filth	Fatsi Water Utility	March-April 16	2,000.00	
3	Replace 600 meter long pipelines that pass under residential houses	Water may be contaminated due to pipes pass underneath residential houses, and may be broken	Fatsi Water Utility	March-June 16	150,000.00	Involving community participation
4	Constructing additional water conserving structures	Water yield reduced as there are no adequate wet conserving structures	Fatsi Water Utility	March-April	20,000.00	Safety net & Green Ethiopia Funds
5	Creating community awareness on water safety	Contamination of water due to dirty jerican stained and flourished with algae	Woreda Health Office	Feb 16 onward		
6	Constructing elevated well head with cemented	Contamination of water source due to cracks at the well head allow storm water carried cow dungs	Fatsi Water Utility	March-April 16	1,000.00	
7	Replacing damaged chlorine mixer with a new one	Water may be contaminated due to perforated chlorine mixer	Fatsi Water Utility	March 16	-	
8	Repairing leaking pipes	Contamination of water due to pipe leakage	Fatsi Water Utility	March 16	1,000.00	
9	Fencing the public water point with iron bar	Water contamination as public water points have no good fence that access animals	Fatsi Water Utility	March-April	80,000.00	
10	Constructing strong mortar retention wall at source water	Storm water directly overwhelm the water source and demolish the water source	Fatsi Water Utility	March-May 16	200,000.00	
11	Prohibiting the use of herbicides and artificial fertilizers within recommended radius	Risk of contamination of water source due to nearby agriculture farm use herbicides and artificial fertilizers washed away by runoff	Woreda Agriculture Office	ASAP		

12	Properly cover exposed water pipelines	Contamination of water due to exposed and broken pipelines	Fatsi Water Utility	March-May 16	Free labour of community	
13	Washing the water hosepipe or replacing with new one	Water may be contaminated due to dirty hosepipe used to convey water to Jerican	Fatsi Water Utility	March 16	500.00	
14	Plastering with cement after glazing the reservoir wall	Water may be contaminated due to cracked reservoir and access of dirty matter	Fatsi Water Utility	March-April 16	50,000.00	
15	Closing nearby private wells to china well water source and prohibiting digging such additional wells close to this well.	Water yield sharply reduced since there are a lot of nearby private wells	Woreda Water Development Office	March-June 16	Free labour of community	
16	Monitoring and Evaluating the implementation of CRWSP				8,000.00	
	Total				**505,000.00**	

Table 7. Plan of action on Climate Resilient Water Safety Plan, Zalanbesa town water supply service, December 2015

S.NO	Specific improvement action	Arising from *(relevant hazardous event)*	Responsible party	Implementation Timeline	Implementation Cost(BIRR)	Remark
1	Covering exposed pipelines of military camp	Water may be contaminate d due to water pipelines overwhelmed by runoff	Defense force Zalanbesa Water Utility	March-April 16	20,000.00	
2	Building up of manholes	Water may be contaminated with microbes as the gate valves are exposed to runoff	Zalambesa Water Utility	March-April 16	3,000.00	
3	Conduct sensitization and awareness creation to stakeholders on CR-WSP	Risk of different types of water and sanitation related diseases due to inadequate /poor capacity at all level.	Zalanbesa town Water Utility	March 16	20,000.00	
4	Sensitizing people to use narrow necked Jericans	Risk of water contamination due to most people pour water by dipping dirty cup	Zalambesa Water Utility Health Office	March 16 onward		
5	Making terracing with gabion and stones	Water source damaged by over flush water from the nearby gully	Zalambesa Town Adminstration	March-May 16	20,000.00	
6	Abandon agriculture activities there by providing compensation or convincing the farmer to plant fruits which don't use fertilizer or any chemical for agriculture	Risk of water source contamination due to fertilizers and herbicides use for agriculture purpose just near to the water source,	Zalambesa Water Utility	June 16- June 17	40,000.00	
7	Strengthening the fencing of water sources	Risk of water contamination due to water sources are not well fenced and access animal	Zalambesa Water Utility	March-April 16	12,000.00	
8	Excavating the soil covered the gate valve and construct the manhole with concrete cement	Contamination of water due to the gate valves of reservoir is covered with mud	Zalambesa Water Utility	March-April	10,000.00	
9	Fencing Reservoirs with barbed wire or blocks	Microbial contaminations of water as reservoirs are not fenced.	Zalambesa Water Utility	March-April 16	60,000.00	
10	Correcting drainage system in public water points	Risk of contamination of water due to poor drainage system in the public water points.	Zalambesa Water Utility	March-April 16	15,000.00	
11	Monitoring and Evaluating the implementation of CRWSP				8,000.00	
	Total				**208,000.00**	

Table 8. Plan of action on Climate Resilient Water Safety Plan, Felege Selam kebele rural water supply December 2015

S.NO	Specific improvement action	Arising from *(relevant hazardous event)*	Responsible party	Implementation Timeline	Implementation Cost(BIRR)	Remark
1	Sensitizing community to use latrine and to prohibit open defecation	Water source is contaminated due to open defecation practice near to water source	Health Extension Worker Tabia Administrator	March-April 16		
2	Conduct sensitization and awareness creation to stakeholders on CR-WSP	Risk of different types of water and sanitation related diseases due to inadequate /poor capacity at all level.	Enderta Health Office Enderta Water Office	March 16	20,000.00	
3	Fitting with a secured gate and strengthen the fence with better materials	Water is contaminated with microbes due to nearby cattle grazing, absence of secured gate and poor fencing of water source.	Water source development and energy sector	March-April 16	5,000.00	
4	Strengthening the water and soil conservation works there and covering with indigenous plants	Water source could be damaged due to flush flooding and presence of gorge on the two sides of the hand pump	Agriculture sector	March-April 16	10,000.00	Involvement of community participation
5	Creating community awareness and monitoring to keep water containers clean	Water is contaminated due to water containers were not washed frequently and were not kept clean	Health Extension Worker Women association	March 16 onward		
6	Diverting the runoff water came from farming area	Water is contaminated with chemicals due to use of fertilizers and pesticides nearby the water source	Tabia Administrator	March-June 16	Community labour	
7	Providing support and monitoring the tasks		Water source development and energy sector together with health extension worker		8,000.00	
	Total				**43,000.00**	

Table 9: Summary of Bacteriological and Physico-Chemical Water Quality Test Results, MoWIE in collaboration with WHO
Region: Tigray Zone: Eastern Woreda: Adigrat town Town: Adigrat town Date of Analysis: 23 December, 2015 Source: Bore hole

Sample Code	Physical Parameters					Chemical Parameters(mg/l)							Bacteriological Parameters		Risk Level
	EC (µs/cm)	TDS (mg/l)	PH	Temp (o_C)	Turbidity (NTU)	Fluoride	Nitrate	Nitrite	Ammonia	Hardness	Sulphate	Free Residual Chlorine	Total coliform (CFU/100ml)	Fecal coliform (CFU/100ml)	
AB1	688.5	338.5	6.05	26.7	4.25	0.397		0.006		-		Nil		Nil	High
AB2	668.5	335.0	6.25	22.1	1.61	0.370		0.008		-		Nil		Nil	High
AB3	854.0	375.5	6.33	21.1	1.10	0.475		0.021		64.1		Nil		Nil	High
AB4	674.5	338.0	6.39	22.4	0.94	0.430		0.004		91.6		Nil		Nil	High
AB5	635.0	313.0	6.42	21.1	6.75	0.392		0.008		74.1		Nil		Nil	High
AB6	623.5	315.5	6.37	19.5	1.08	0.492		0.007		38.9		Nil		Nil	Low
AB7	636.0	316.5	6.57	19.1	0.95	0.517		0.007		60.6		Nil		Nil	High
AR1	738.5	368.0	6.69	20.0	6.10	0.413		0.018		61.2		0.5		Nil	low
AB8	890.5	393.5	6.86	16.2	2.42	0.484		0.010		85.2		Nil		Nil	High
AR2	710.5	370.0	7.30	20.9	3.89							0.5		Nil	Low
AR3	827.5	427.5	7.27	20.6	11.2							0.5		Nil	Low
AP1	614.5	312.0	6.12	21.6	4.70	0.343		0.013		65.7		0.4		Nil	High
AH1	765.0	380.0	7.14	19.0	3.16							0.4		Nil	Low
AH2	870.5	440.0	7.25	18.6	1.96							0.4		Nil	Low

AB1= Adigrat,AbuneAregawi Borehole #3
AB2= Adigrat,AbuneAregawi Borehole #6
AB3= Adigrat,AbuneAregawi Borehole #2
AB4= Adigrat,AbuneAregawi Borehole #7
AB5= Adigrat, AbuneAregawi Borehole #8
AB6= Adigrat, Mai-Mesanu Borehole #4
AB7= Adigrat, Mai-Mesanu Borehole #3
AR1= Adigrat, EnboyKolkalay Reservoir
AB8= Adigrat, Agazi Borehole
AR2= Adigrat, New built Adua Hotel Reservoir
AR3= Adigrat, Adua Hotel Old Reservoir
AP1= Adigrat Public Water Point
AH1= Adigrat HH #1 Kebelle 05, MebrahtuKidu
AH2= Adigrat HH #2 Kebelle 05, Kahsa

Risk Score = Likelihood X Consequence
Likelihood 1 to 3
Consequence 1 to 3
Risk Score ≤2 = Low Risk Level
Risk Score 3-5 = Medium Risk Level
Risk Score ≥6 = High Risk Level

Table 10: Summary of Bacteriological and Physico-Chemical Water Quality Test Results, MoWIE in collaboration with WHO
Region: Tigray Zone: Eastern Woreda: Gulomeheda Town: Fatsi town Date of Analysis: 28 December, 2015 Source: Bore hole

Sample Code	Physical Parameters					Chemical Parameters(mg/l)							Bacteriological Parameters		Risk Level
	EC (µs/cm)	TDS (mg/l)	PH	Temp (o_C)	Turbidity (NTU)	Fluoride	Nitrate	Nitrite	Ammonia	Hardness	Sulphate	Free Residual Chlorine	Total coliform (CFU/100ml)	Fecal coliform (CFU/100ml)	
FB	574	237	6.75	22.9	0.65	0.355		0.018		88.6		Nil	NTC		High
FR1	570	278	6.84	24.9	1.50							0.3	Nil		Medium
FP3	563	286	7.12	21.9	4.59							Nil	2		High
FH1	631	316	6.91	19.4	0.56							Nil	1		Medium
FH2	644	322	7.15	19.3	0.70							Nil	Nil		Medium
FH3	558	279	7.20	18.1	0.26							Nil	14		High
FR2	559	284	6.81	21.7	1.58							0.3	Nil		Medium

FB = Fatsi Shallow Well
FR1= Fatsi Reservoir #1(old)
FP3= Fatsi Public Water Point at Martha
FH1= Fatsi Household near to FP3
FH2= Fatsi town Household #2
FH3= Fatsi town Household #3
FR2= Fatsi town Reservoir #2(new)

Risk Score = Likelihood X Consequence
Likelihood 1 to 3
Consequence 1 to 3
Risk Score ≤2 = Low Risk Level
Risk Score 3-5 = Medium Risk Level
Risk Score ≥6 = High Risk Level
NTC=Numerous To Count

Table 11: Summary of Bacteriological and Physico-Chemical Water Quality Test Results, MoWIE in collaboration with WHO
Region: Tigray Zone: Eastern Woreda: Gulomeheda Town: Zalanbesa town Date of Analysis: 27 December, 2015 Source: Bore hole

Sample Code	Physical Parameters					Chemical Parameters(mg/l)							Bacteriological Parameters		Risk Level
	EC (µs/cm)	TDS (mg/l)	PH	Temp (o_C)	Turbidity (NTU)	Fluoride	Nitrate	Nitrite	Ammonia	Hardness	Sulphate	Free Residual Chlorine	Total coliform (CFU/100ml)	Fecal coliform (CFU/100ml)	
ZB1	388	189	6.66	21.1	10.33	0.241		0.007		50.0		Nil	Nil		Medium
ZB2	325	162	6.60	22.8	13.5	0.319		0.012		66.8		Nil	29		High
ZB3	395	196	6.48	24.1	2.58	0.289		0.017		67.6		Nil	NTC		High
ZR1	330	165	6.49	20.7	0.89							0.3	Nil		Low
ZR2	372	188	6.49	20.9	6.85							0.3	Nil		Low
ZP1	349	174	6.59	28.3	18.21							Nil	Nil		Medium
ZP2	370	183	6.95	23.9	1.72							Nil	5		Medium
ZP3	395	197	7.11	18.7	2.82							Nil	Nil		Medium
ZH1	329	165	6.78	21.4	1.37							Nil	NTC		High
ZH2	328	166	7.08	17.4	1.18							Nil	2		Medium
ZH3	395	197	7.11	19.6	2.54							Nil	Nil		Low

ZB1= Zalanbesa Borehole #5
ZB2= Zalanbesa Borehole #3
ZB3= Zalanbesa Borehole #2
ZR1= Zalanbesa Reservoir at Military Camp
ZR2= Zalanbesa Reservoir near to school
ZP1= Zalanbesa Public Water Point at Mebrahtom
ZP2= Zalanbesa Public Water Point at Edega
ZP3= Zalanbesa Public Water Point at AddisAlem
ZH1= Zalanbesa Household near to ZP1
ZH2= Zalanbesa Household near to ZP2
ZH3= Zalanbesa Household near to ZP3

Risk Score = Likelihood X Consequence
Likelihood 1 to 3
Consequence 1 to 3
Risk Score ≤2 = Low Risk Level
Risk Score 3-5 = Medium Risk Level
Risk Score ≥6 = High Risk Level
NTC=Numerous To Count

Summary of baseline data assessment on Climate Resilient Water Safety Plan; Adigrat town water supply and sewerage service, December 2015.

- It is estimated that more than 86,094 people (Male: 40,633 and Female: 45,461) served by the water supply.
- It is located in midland agro ecological zone
- Source of water is from ten deep wells.
    - ABrBH2 Abunaregawi Borehole with 90 m depth and yield of 5.27 lit/sec established in 1996 EC
    - ABrBH3 Abunaregawi Borehole with 90 m depth and yield of 3.6 lit/sec established in 1990 EC
    - ABrBH6 Abunaregawi Borehole with 90 m depth and yield of 5 lit/sec established in 1996 EC
    - ABrBH7 Abunaregawi Borehole with 150 m depth and yield of 5.55 lit/sec established in 1998 EC
    - ABrBH8 Abunaregawi Borehole with 136 m depth and established in 2004 EC
    - Agazi Borehole with 82 m depth and yield of 5.7 lit/sec established in 1975 EC
    - Gorno Borehole with 110 m depth and yield of 5 lit/sec established in 2005 EC
    - MM BH1 MaiMesanu Borehole with 120 m depth and yield of 3 lit/sec established in 1998 EC
    - MM BH3 MaiMesanu Borehole with 113 m depth and established in 2003 EC
    - MM BH4 MaiMesanu Borehole with 144 m depth and established in 2003 EC
- Three Boost stations
    - Boos station #1 pump 9 lit/sec with 3kw: Chlorination in place
    - Boos station #2 & #3 each pump 16.5lit/sec with 22kw: chlorination in place
- Five reservoirs made of concrete
    - Three reservoirs each with capacity of 200 m^3, and two reservoirs each with 100 m^3
- A total of 27 public water points, out of these, 13 public water points are functional, the other 14 are not functional because of household pipeline connection/access.
- A total of 9,357 households (46,785 people) are customers each with household taps
- No plan exists as to operations and management practices including:
    - Operational monitoring plan such as sanitary inspections, water quality monitoring
    - Standard operating procedures
    - Emergency response plan
    - Operator or caretaker training programs
    - Consumer education/training programs
    - Equipment maintenance/calibration schedules
    - Compliance monitoring plan
- No consumer satisfaction monitoring plan is in place
- Annual operating costs per unit of water produced is 11,494,940.07 Birr / 728,539 m^3 = 15.77 Birr
- Annual operating costs per # of consumers is 11,494,940.07 Birr / 86,094 consumers = 133.51 Birr
- Total revenue collected per consumer over past 12 months is 7,725,327.32 Birr/86,094= 89.73 Birr
- Total revenue as a % of total operating costs over past 12 months is 7,725,327.32 Birr /11,494,940.07 Birr = 67.2%
- No budget received from government for current year for water supply system operations, maintenance, management and improvements.
- No water safety training or awareness raising events conducted. Moreover, water safety meetings within water supply and other relevant organizations in past 12 months was not also conducted.

- Understanding of water supply system, hazards and hazardous events that threaten the water supply system is found to be poor
- No data or records available on the extent to which equity is considered by water supplier.
- Water supply coverage of the town is about 75%.
- Unaccounted water loss is reported to be 21.5%. A total of 156,635.88m^3 water lost in the last 12 months out of 728,539 m^3 water produced.
- Community Water treatment practice in place
- There are records and/or data available regarding water sample tasted for microbial, physical and chemical parameters over past 12 months.
- No customer satisfaction analysis index and records available/shown.
- No data available on proportion of HHs practicing correct use of recommended HWT technologies
- A total of 15,553 households(out of 16,905 HHs) have latrine facility in Adigrat town with coverage of 92%
- Hygiene practice of the community is reported to be also 92%.
- No data available on Diarrhea disease prevalence for the town
- It is indicated that diarrheal disease is one of the top 10 diseases in the area. A total of 1,585 diarrhea cases reported out of 26,439 cases that account about 5.9 % of cases in the last 12 months. No reported outbreaks of water-related illness for the past 12 months.
- Adigrat town water supply and sewerage service has 104 employees
  - Manager 01
  - Core process owner 04
  - Electrician 01
  - Mechanic 01
  - Water Quality expert 01
  - Plumbing Forman 01
  - Plumber 11
  - Pump Operators 40
  - Geologist 01
  - Others 44
- Adigrat town water supply and sewerage service has an established and active board with 8 members represented from relevant sectors cabinet members in the town and community representatives. The board is chaired by mayor of the town.
- Ato Wolday Kahsay is manager of Adigrat town water supply and sewerage service.
  Office No: +251344450106; Cell phone +251914784301

Summary of baseline data assessment on Climate Resilient Water Safety Plan: Fatsi town water supply service, December 2015.

- It is estimated that more than 5,562 people served by the water supply.
- It is located in midland agro ecological zone
- Source of water is from one motorized shallow well with 34 m depth and yield of 3 lit/sec established in 1988 EC. One new deep well drilling with 65 m depth and yield of 7 lit/sec is also completed but civil work yet to be completed.

- Two reservoirs made of concrete
    - Two reservoirs each with capacity of $25m^3$ and $50m^3$
- A total of 7 functional public water points.
- A total of 720 households(3,600 people) are customers each with household taps
- No plan exists as to operations and management practices including:
    - Operational monitoring plan such as sanitary inspections, water quality monitoring
    - Standard operating procedures
    - Emergency response plan
    - Operator or caretaker training programs
    - Consumer education/training programs
    - Equipment maintenance/calibration schedules
    - Compliance monitoring plan
- No consumer satisfaction monitoring plan is in place
- Annual operating costs per unit of water produced is 631,382.40 Birr / 38,463 m^3 = 16.41 Birr
- Annual operating costs per # of consumers is 631,382.40 Birr / 5,562 consumers = 113.52 Birr
- Total revenue collected per consumer over past 12 months is 456,169.59 Birr/5,562= 82.02 Birr
- Total revenue as a % of total operating costs over past 12 months is 456,169.59 Birr /631,382.40 Birr = 72.25%
- No budget received from government for current year for water supply system operations, maintenance, management and improvements.
- No water safety training or awareness raising events conducted. Moreover, water safety meetings within water supply and other relevant organizations in past 12 months was not also conducted.
- Understanding of water supply system, hazards and hazardous events that threaten the water supply system is found to be poor
- No data or records available on the extent to which equity is considered by water supplier.
- Water supply coverage of the town is about 81%.
- Unaccounted water loss is reported to be 15.4 %. A total of 5,924 m^3 water lost in the last 12 months out of 38,463 m^3 water produced.
- Community Water treatment practice in place
- No records and/or data available regarding water sample tasted for microbial, physical and chemical parameters over past 12 months. However, it is reported that ad hoc microbial water quality testing is done
- It is reported that customer satisfaction analysis index done but records was not shown.
- No data available on proportion of HHs practicing correct use of recommended HWT technologies
- A total of 635 households (3,608 people) have latrine facility in Fatsi town with coverage of 97 %

- Hygiene practice of the community is reported to be 15%.
- Diarrhea disease prevalence for adult and under five is reported to be 3.3% and 35.5% respectively.
- It is indicated that diarrheal disease is one of the top 10 diseases in the area. A total of 380 diarrhea cases reported out of 3,478 cases that account about 10.9 % of cases in the last 12 months. No reported outbreaks of water-related illness for the past 12 months.
- Fatsi town water supply service has 13 employees
    - Manager 01
    - Operator 01
    - Plumber 01
    - Others 10
    - No water quality technician
- Fatsi town water supply service has an established and active board with 8 members represented from relevant sectors cabinet members in the town and community representatives. The board is chaired by woreda urban development head.
- Ato Berhane Mebrahtu is manager of Fatsi town water supply service.
    - Office No 0344320220, Cell phone +251914777483

Summary of baseline data assessment on Climate Resilient Water Safety Plan: Zalanbesa town water supply service, December 2015.

- It is estimated that more than 10,500 (Male: 5,350 and Female: 4,650) people served by the water supply.
- It is located in midland agro ecological zone
- Source of water is from three deep wells:
    - Borehole #1 with 108 m depth and yield of 8 lit/sec established in 1986 EC
    - Borehole #2 with 70 m depth and yield of 10 lit/sec established in 1989 EC
    - Borehole #3 with 108 m depth and yield of 19 lit/sec established in 2005 EC
- Three reservoirs made of concrete
    - Two reservoirs each with capacity of $100m^3$ and one reservoir with capacity of $70m^3$
- A total of 14 public water points, out of these, 08 public water points are functional, the other 06 are not functional.
- A total of 1,400 households(7,000 people) are customers each with household taps
- No plan exists as to operations and management practices including:
    - Operational monitoring plan such as sanitary inspections, water quality monitoring
    - Standard operating procedures
    - Emergency response plan
    - Operator or caretaker training programs
    - Consumer education/training programs
    - Equipment maintenance/calibration schedules
    - Compliance monitoring plan
- No consumer satisfaction monitoring plan is in place
- Annual operating costs per unit of water produced is 904,979.27 Birr / 41,900 m^3 = 21.59 Birr
- Annual operating costs per # of consumers is 904,979.27 Birr / 10,500 consumers = 86.18 Birr
- Total revenue collected per consumer over past 12 months is 816,113.15 Birr/10,500= 77.72 Birr
- Total revenue as a % of total operating costs over past 12 months is 456,169.59 Birr /631,382.40 Birr = 90.18%
- No budget received from government for current year for water supply system operations, maintenance, management and improvements.
- No water safety training or awareness raising events conducted. Moreover, water safety meetings within water supply and other relevant organizations in past 12 months was not also conducted.
- Understanding of water supply system, hazards and hazardous events that threaten the water supply system is found to be poor
- No data or records available on the extent to which equity is considered by water supplier.
- Water supply coverage of the town is about 76.07%.
- Unaccounted water loss is reported to be 2.97 %. A total of 1248 m^3 water lost in the last 12 months out of 41,900 m^3 water produced.
- Community Water treatment practice in place
- No records and/or data available regarding water sample tasted for microbial, physical and chemical parameters over past 12 months. However, it is reported that ad hoc microbial water quality testing is done

- It is reported that customer satisfaction analysis index done but records was not shown.
- No data available on proportion of HHs practicing correct use of recommended HWT technologies
- A total of 1519 households (8,582 people) have latrine facility in Zalanbesa town with coverage of 89 %
- Hygiene practice of the community is reported to be 87%.
- Diarrhea disease prevalence for adult and under five is reported to be 5.92% and 13.4% respectively.
- It is indicated that diarrheal disease is one of the top 10 diseases in the area. A total of 216 diarrhea cases reported out of 1,179 cases that account about 18.32 % of cases in the last 12 months. No reported outbreaks of water-related illness for the past 12 months.
- Zalanbesa town water supply service has 18 employees
    - Manager 01
    - Operator 04
    - Plumber 03
    - Water quality technician 01
    - Others 09
- Zalanbesa town water supply service has an established and active board with 7 members represented from relevant sectors cabinet members in the town and community representatives. The board is chaired by urban development head.
- Ato Tsigie G/Selassie is manager of Zalanbesa town water supply service.

  Office No 0347790410, Cell phone +251914207534

Annex A: List of CR-WSP training participants; Adigrat town

S/N	Name of Participant	Organization	Email	Telephone
1	Mezgebe Teka	Women's Affairs, Adigrat town	mezgebeteka@gmail.com	0914127168
2	Hiwot Desta	Bureau of Agriculture	hiwotdb11@yahoo.com	0911825950
3	Abdilah Berihun	Environmental protection (EPLAUA)	abdilah.berihu@yahoo.com	0913646686
4	Yosef Hailu	Urban Trade and Industry, Adigrat town	yosi946@yahoo.com	0923300592
5	Welday Kahsay	Adigrat town Water Supply Service	wk.aws2@gmail.com	0914784301
6	Tewlede Hailu	Adigrat town Water Supply Service		0914091665
7	Sr. Alganesh G/Kidane	Health Office, Adigrat town		0914264307
8	Hailay G/Yesus	Adigrat town Water Supply Service	hailaygg1421@gmail.com	0914577679
9	Kahasse G/Mariam	Adigrat town Water Supply Service		0914289268
10	Goytom Asefa	Urban Trade and Industry, Adigrat town		0914765865
11	Hiwet G/Tsion	Urban Trade and Industry, Tigray Region		0942741784
12	Tefera Hadgu	Regional Education Bureau	meshesha2006@gmail.com	0914722905
13	Elias Jigar	Adigrat University	eliasjig@yahoo.com	0920716439
14	Melaku Estifanos	Water Resources Bureau	melakest@gmail.com	0914771092
15	Hagos Gigar	Water Resources Bureau	hagoshalisa55@gmail.com	0914759278
16	Solomon Meles	Water Resources Bureau		0914805511
17	Desalegn Abadi	Meteorology, Tigray Region	desalegnabadi21@yahoo.com	0914438467
18	Yisfalem Ayele	Regional Health Bureau	yisfa19@gmail.com	0932053853
19	Elfaz Kassa	Drop of Water	theelfaz@gmail.com	0911707455
20	Dr. Yohannes Asfaw	Mekele University	nattyohannes@gmail.com	0914755659
21	Tewodros Asgele	Water Resources Bureau	tewodros_a2006@yahoo.com	0914437944
22	Tewodros Mulu	Regional Health Bureau	tewmulu21@yahoo.com	0914722595
23	Ghermai Tesfai	COWASH (Water Resources Bureau)	ghe_tes@yahoo.com	0914720999
24	Tesfamichael Birhane	Regional Health Bureau (Regulatory)	tesfamichael07@gmail.com	0914776233
25	Hagos Gebreselassie	MSC(Micro and Small Cooperatives)	hagosgeb10@gmail.com	0932035252
26	Alem Zeru	Education Office, Adigrat town		0914104653
27	Goitom G/Medhin	Trainer /WHO	goitomgab@gmail.com	0914728687
28	Balew Yibel	Trainer/ Ministry of Water, Irrigation & Electricity	balewy1@gmail.com	0911561829
29	Belachew Eshetu	Trainer/ Ministry of Water, Irrigation & Electricity	belachewaregash27@gmail.com	0913796596
30	Osman Yiha	Trainer /WHO	osmanyiha@gmail.com	0911876059

Annex B: List of CR-WSP training Participants; Fatsi town

S/N	Name of Participant	Organization	Email	Telephone
1	Mulu Tsegay	Enderta Water Office		0914729179
2	Abrehet G/her	Zalanbesa Health Center		0927750249
3	Yonas Haileselasse	Rural development, Fatsi town		0921886317
4	Yibrah Tewelde	Environmental protection		0910619897
5	Teklay Yaecob	Water Board Member, Fatsi town		0923493227
6	Yohannes Shifare	Urban development, Fatsi town		0910456645
7	Tsigie G/Selassie	Zalanbesa town Water supply Service		0914207534
8	Keshi Bizen Niway	Zalanbesa Kebele Leader		0914135005
9	Kibrom G/her	Zalanbesa Water Service		0926705140
10	Akberet Belay	Zalanbesa Women Affair		0914207557
11	H/Selassie Hadush	Zalanbesa Water Supply Service		0914207546
12	Yemane Legesse	Gulomeheda woreda Water Resource &Mine Office		0914039461
13	Mebraht G/Hiwet	Gulomeheda Woreda Women Affair		0914616893
14	Legese Kahsay	Zalanbessa town Water Supply Service		0912416179
15	Birhane Alem	Gulomeheda Woreda Water Resource &Mine office		0914207206
16	Hailu Asfaw	Fatsi town Water Supply Service		0934197103
17	Selemun Tesfa	Fatsi town Water Supply Service		0914103651
18	T/Hiwet T/manot	Enderta woreda Water Office		0914890515
19	Kahsay G/Medhin	Gulomeheda Woreda Education office		0914162071
20	Amene Fsahaye	Fatsi town Yemane. S.S School		0914012820
21	Tesfaselassie H/Mariam	Fatsi town Municipality		0914146463
22	Berihun H/Selassie	Fatsi town Municipality		0939189109
23	Gebreyesus Berhe	Gulomeheda Health Office		0914262196
24	Masresha Belay	Gulomeheda Health Office		0914744420
25	Elfaz Kassa	Drop of Water		0911707455
26	Hagos Gigar	Water Resources Bureau		0914759278
27	Brehane Mebrhatu	Fatsi town Water Supply Service		0914777483
28	Abera Adhana	Education		0914422584
29	Dawit Atsbaha	Enderta Woreda health Office		0925047586
30	Tigist Birhanu	Enderta Woreda health Office		0914110361
31	Atsede Kiros	Health office		0914113413
32	Asefa Girmay	Felegeselam Kebele Administration		0914027385
33	Harife Tadesse	WASHCO member, Felegeselam		0914873209
34	Mana Hadush	Womain Affair, Felegeselam		0919067496
35	Nigsti Emabaye	Felegeselam Kebele manager		0914096529
36	Balew Yibel	Trainer/ Ministry of Water, Irrigation & Energy	balewy1@gmail.com	0911561829
37	Belacwe Eshetu	Trainer/ Ministry of Water, Irrigation & Energy	belachewaregash27@gmail.com	0913796596
38	Goitom G/Medhin	Trainer /WHO	goitomgab@gmail.com	0914728687
39	Osman Yiha	Trainer/ WHO	osmanyiha@gmail.com	0911876059