

WORLD HEALTH ORGANIZATIONCOUNTRY OFFICE NEPAL

Review of Policy Documents on Climate Change, WASH and Public Health in Nepal

For Climate Resilient WASH sector

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This document summaries findings of review of Climate change, WASH and Health in existing policy documents review and recommendations for climate resilient WASH sector of Nepal.

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Acronyms

CBS	Center Bureau of Statistics
CC	Climate Change
DDC	District Development Committee
DHM	Department of Hydrology and Meteorology
DRR	Disaster Risk Reduction
DWSS	Department of Water Supply and Sewerage
EcoSan	Ecological Sanitation
FEDWASUN	Federation of Water and Sanitation Users Nepal
GHG	Green House Gas
GLOF	Glacial Lake Outburst Flood
GON	Government of Nepal
HQ	Head Quarter
ICEM	International Centre for Environmental Management (ICEM)
IPCC	Inter Governmental Panel on Climate Change
IWRM	Integrated Water Resource Management
JSR	Joint Sector Review
LAPA	Local Adaptation Plan of Action
LSGA	Local Self Governance Act
MAF	MDG Acceleration Framework
MDG	Millennium Development Goal
MOE	Ministry of Education
MOFALD	Ministry of Federal Affairs and Local Development
MOHP	Ministry of Health and Population
MoSTE	Ministry of Science, Technology and Environment
MOUD	Ministry of Urban Development
N/R/D/ M / V -WASH-CC	National/Regional/District/ Municipality/ Village WASH Coordination Committee
NAPA	National Adaptation Program of Action
NDWQS	National Drinking Water Quality Standards
NHRC	Nepal Health Research Council
NHSP	National Health Sector Plan
NMIP	National Management Information System (of DWSS)
NWP	National Water Plan
ODF	Open Defecation Free
PCC	Project Coordination Committee
PPCR	Pilot Programme on Climate Resilient
RJSR	Regional Joint Sector Review
RWH	Rain Water Harvesting
RWSS	Rural Water Supply and Sanitation
SAARC	South Asian Association on Regional Cooperation
SDP	Sector Development Plan
SEIU	Sector Efficiency Improvement Unit
SHMP	Sanitation and Hygiene Master Plan
SWAp	Sector Wide Approach
TWG	Thematic Working Group
TYP	Three Year Plan
UNFCC	United Nations Federation for Climate Change
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WECS	Water & Energy Commission Secretariat
WinS	WASH in School
WRS	Water Resource Strategy
WSP	Water Safety Plan
WSS	Water Supply and Sanitation

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Executive summary

Climate Change has affected all countries, including Nepal, despite the fact that it has a negligible contribution to global greenhouse gas (GHG) emission that contributes to the global warming. Nepal is one of the highly vulnerable countries to the adverse impacts of climate change because of its low economic development and complex topography. The change in climate has shown its impacts in different sectors including Health, Water Supply, Sanitation and Hygiene (WASH). Climate Change has caused depletion of surface water sources in a mountainous region and ground water source in Terai, which is affecting sustainability of water supply systems and sanitary systems and hygiene facilities. These all finally affect to the health status of vulnerable population.

One of the measures to reduce potential health impacts due to climate change is the development of resilient WASH. Considering the serious consequences of Climate Change impacts in the country, Government of Nepal with support from different development partners has been implementing various projects to protect public health. The DFID funded project “Building adaptation to climate change in least developed countries through resilient WASH” is one of them. In Nepal, the project has been implemented by the Ministry of Urban Development (MoUD) with the technical support of the World Health Organization (WHO). Project Coordination Committee on Climate (PCC) Change and WASH comprising of related stakeholders have been formed. One of the outputs of the project is to review relevant national level policy documents on climate change, WASH and public health and plan to integrate the findings of review into existing ones. This study is also in line with recommendation Second Joint Sector Review under Thematic Working Group: Climate Change Adaptation and Disaster Risk Reduction The

Existing Policy Plans and Acts in WASH, Health and Environment sector has been reviewed from a climate change perspective and the ways to minimize policy gaps through integration into existing structures has been suggested. The report is mainly based on review of existing policy documents, review of climate change related documents at the national and international level.

Review process and tasks were prepared in line with review criteria developed by WHO Head Quarter (HQ) which requires review of Water, Sanitation, Health and Climate Change policies in view of climate resilient WASH sector. Criteria require that water, sanitation documents reviewed for consideration of climate projections, assessing the scale and nature of the risks, and prioritizing relevant management practices or technologies targeting higher levels of vulnerability. Similarly, health policy is reviewed for the extent to which these documents take account of risks of climate change acting through the WASH pathway to affect disease outcomes and recommendations made to strengthen or adapt disease control programs to address these risks. Similarly, climate change policy to be reviewed for the extent to which these documents identify WASH and health as priorities for adaptation

Water Resource Act (1992), Water Supply Regulations (1998), Rural Water Supply Policy (2005), Urban Water Supply Policy (2009), Design Guidelines (2002), National Drinking Water Quality Standard (NDWQS) and Directives (2005), Water Plan (2005) were the key working policy documents for the WASH sector of Nepal. Documents were felt outdated or insufficient or fragmented. Hence, WASH sector is developing umbrella Act, Policy and Sector Development Plan in line with the decision of WASH sector JSR-II 2014. Similarly, design guideline and NDWQS and Directives are also in the process of revision to meet the current need. There is some concern about environmental issues in each document, but none of the documents speak about climate change which may be because of late highlight of climate change issues only after 2010

in National Policy and Programmes. New Policies and Acts incorporate climate change issues, but have not addressed the issues properly. It is expected that new documents will address the climate change issues in its final version. Water sector in Nepal has been affected mainly in terms of drying up of the water source, but there is no proper investigation on to what extent the climate change factor has caused changes. The country needs to revise its Policy and Acts on WASH sector in line with the climate change prospective. Separate climate change strategy and working guidelines are required for the WASH sector. Key action to be taken are understanding climate change, source monitoring, and source conservations and adapting best options for technology and systems in line with community based adaptation principles. The sector needs to have dedicated Environment and Climate Change Division in its lead department (DWSS) and coordinate with the respective Divisions of the Ministry of Health and Population, Ministry of Science and Technology and Environment, related agencies globally for the update. Ministry of Health and Population need to have a dedicated unit for Environmental Health with a focal person for Climate Change and Ministry of Environment should have a focal unit or person for WASH.

Strategic areas for climate resilient WASH has been identified and defined in the following areas: Climate change projections; Source monitoring, conservation and ecosystem management; Low energy and low carbon technologies; Climate risk assessment of water supply and sanitation systems and adaptation; Community based local adaptation plan; Economic use of water and water demand management; Assessment of the health risks caused by climate change.

The sector needs to take following actions as steps towards climate resilient WASH sector: (1) Prepare climatic zones for rainfall and temperate projections based on current trend and best climate model, i.e reliable representative concentration pathways (RCPs) (2) Develop a system for monitoring flow of surface waters and the level of ground waters which are potentials for future use and reserve sufficient water sources for every community (VDC) and town for 50 years (3) Develop concept and working guidelines for protection and conservation zones for existing future sources and take it as an essential part of water safety plan (3) Categories all technologies and systems used for water supply and sanitations in terms of energy, carbon emissions (5) Develop guideline climate risk assessment, best adaptation plans for water supply and sanitation system in the community context (VDC) for vulnerability assessment in line with LAPA (6) Initiate action or implementation research for information gap for climate resilient WASH sector (7) Establish or strengthen the environment and climate change unit under Ministry of Health and Population and DWSS and develop a business plan.

1. Background

Climate Change has affected all countries, including Nepal, despite the fact that it has a negligible contribution to global greenhouse gas (GHG) emission that contributes to the global warming. Nepal is one of the highly vulnerable countries to the adverse impacts of climate change because of its low level of economic development, complex topography, fragile ecosystem and dependency of majority of people on climate sensitive sectors. The change in climate has shown its impacts in different sectors including Health, Water Supply, Sanitation and Hygiene (WASH). Climate Change has caused depletion of surface water sources in a mountainous region and ground water source in Terai, which is affecting sustainability of water supply systems and operations of sanitary systems and hygiene facilities. The depletion of water sources is also associated with poor sanitary condition of the country. It has increased the risk of diarrhea and other waterborne illnesses. Furthermore, changing climate has posed the risk of vector borne diseases in previously considered non-endemic areas including in mountain regions of Nepal.

One of the measures to reduce potential health impacts due to climate change is the development of resilient WASH. Considering the serious consequences of Climate Change impacts in the country, Government of Nepal with support from different development partners has been implementing various projects to protect public health. The DFID funded project “Building adaptation to climate change in least developed countries through resilient WASH” is one of them. In Nepal, the project is being implemented by the Ministry of Urban Development (MoUD) with the technical support of WHO. Project Coordination Committee on Climate Change (PCC) and WASH comprising of related stakeholders has been formed. One of the outputs of the project is to review relevant national level policy documents on climate change, WASH and public health and plan to integrate the findings of review into existing ones. This study is also in line with recommendation Second Joint Sector Review under Thematic Working Group: Climate Change Adaptation and Disaster Risk Reduction The

1.1 Objectives

The objectives of the assignment are to review relevant national policies, strategies, standards, guidelines, directives, plans and programmes relating to the climate change, WASH and public health and plan to integrate the findings of review into existing policy documents or suggestion made on ways to minimize policy gaps through integration into existing structures.

1.2 Review Process

The followings were the key process:

- A collection of WASH, Health and Climate Change related policy documents, including the Act, Regulations, Periodic Plans, Directives, etc. Total of fifteen WASH documents, two Health documents, three CC documents and six global documents on CC were collected.
- All of the WASH documents were reviewed and key information was captured. Key issues addressed by documents on the environment and climate change were noted. Health documents were also reviewed in terms of inclusion of WASH issues and climate change prospective. Similarly CC documents were reviewed in terms of inclusion of WASH issues.

- Review criteria were developed based on criteria provided by WHO (HQ), Review area was identified, action plan developed and tentative format and content of the report was prepared and compiled as inception report and submitted to WHO.
- All documents were examined in terms of whether the document speaks on following aspects of Environment and Climate Change: (1) *Environmental aspects* (2) *Climate Change aspects* (3) *CC projections and stratification* (4) *Low energy solution, technology and management options* (5) *Community based adaptation plan* (6) *Vulnerability assessment based on Climate Change risk factors* (7) *Monitoring of sources and forecasting of risk* (8) *Resource conservation and economic use*. These aspects have been rated as positive, negative and silent for quick understanding
- Recommendations were prepared for each document and presented in the table.
- The various aspects that will contribute towards climate resilient WASH sector have been identified and summarized in seventeen points. This will help in developing directives and guidelines for the WASH sector.
- Some strategic points for developing climate resilient WASH strategy has been developed which will be helpful in the WASH sector to develop an actual strategy. Climate resilient WASH strategy is necessary to bring all CC considerations required for the WASH sector in a single place instead of looking at various documents. This can be the basis for developing working guidelines. Documents are in line with National Policies, NAPA and LAPA and internationally accepted principles.
- In the process various persons and agencies and meeting forum was used for getting insight information and people working in the fields were also contacted.
- Feedback on concept and report was explored from two important forums, including project coordination committee on climate change (PCC) and thematic working group on climate change and disaster risk reduction of WASH sector.
- The final report was compiled and reviewed by team members and submitted to key persons recommended by the WHO before finalization.
- The report was finalized incorporating the feedback of the reviewers.

2. Introduction

2.1 Country structures:

Nepal is a landlocked country situated in the central part of the Himalaya with area of 147,181km². It is made up of five physiographic regions: High Himalaya, High Mountain, Middle Mountain, Siwalik (Churia) and Terai. Each region has distinct altitudes and climate characteristics that vary from sub-topical to alpine within span of 200km from south to north. Because of this, Nepal harbors extreme spatial and climatic variation ranging from alpine to tropical environments within a 200 km span from north to south, rendering the country rich in biological diversity. Nepal has more than 6000 rivers, largely drawn from north to south of which three mains are Karnali, Narayani (Gandaki) and Saptakoshi. Nine eco-regions, 35 forest types and 118 different ecosystems which are rich in species diversity have been reported in Nepal on the basis of altitudinal, climatic and vegetation data. The bulk of the energy is derived from the biomass mainly fuel wood. Nepal is divided into 75 districts and grouped into five development regions. Districts are sub divided into VDCs and Municipalities.

2.2 Sector status:

According to the latest census 2011, the population of Nepal is 26.5 million. According to latest information(2014) of DWSS, 84% of the total population has access to basic water supply services and 70% has access to basic sanitation facilities. Target of the sector is to provide 100% of the population the basic water supply and sanitation services by 2017. National Multiple Indicator Survey (NMICS), 2014 indicated that 71% of the improved system has bacteriological contamination at the source and 81% at households levels (HH).

2.3 Policy environment:

The main Act related to water supply system development and water use in Nepal is Water Resource Act 1992 which has given top priority for drinking water. Drinking water supply regulations 1898 has been developed based on this Act which defines processes for getting a license for using water source and organizing users organizations. Water resource strategy 2002 provides direction towards environmental friendly water resource development. Design Guideline (12 volumes) developed by DWSS for Water Supply System revised in 2002 provides guideline for design and development and operation of water system involving user community. The Nepal Water Plan developed in 2005 provided target for both basic and improved service levels of water sanitation. Target is to have access of basic water supply and sanitation for all by 2017. Rural water supply policy and strategy provided the basis for development and management of water supply system in rural and semi-urban managed by users committee. Urban Water Supply Policy 2009 provided issued not addressed by the rural water supply policy. National Drinking Water Quality Standard and Directives, 2005 established national standard for drinking water and ways to achieve it. Three year periodic plans also provide strategy and plan incorporating the latest issues in the sectors. WASH sector coordinated by SEIU/MOUD is formulating Umbrella Act, Policy and sector development plan (SDP) in line with 'one policy', 'one plan' and 'one monitoring' system in line with the decision of JSR II. Design guideline is in need of revision to incorporate the current need and NDWQS 2005 is also in the process of revision to address the current situation and in line with Sector Wide Approach (WSAp) concept. All documents speak about environmental concern mainly to minimize potential environmental damage caused by the development of the water supply system. Except water resource strategy none of the document speaks about climate change. Documents currently under formulation have not and to be formulated in the future are expected to address climate change issues. WASH sector is fragmented at center level. There are many responsible agencies in the WASH sector. But at the district level there is some kind of coordination namely D-WASH-CC. Lead agency DWSS has created focal division for climate change.

2.4 Institution:

Ministry of Health and Population (MoHP) has formulated its latest policy in 2014 as an improvement to the National Health Policy of 1991. The policy aims to provide quality health services to all and added environmental health, including water, sanitation and hygiene as essential services. The policy intended to take a leadership role on health impact of climate change in partnership with others. Existing Nepal Health Sector Plan –II (NHSP-II) also includes WASH services as essential health services and intends to establish a knowledge network with academia and practitioners on climate change and a public health. But there are no dedicated units for environmental health or climate change within the institutional structures of MOHP. Nepal Health research Council (NHRC) within MOHP is undertaking various researches on WASH and health impact of climate change in recent years. The MoHP is expected to address climate change issues more clearly in its next NHSP-III starting from 2015.

Ministry of Science, Technology and Environment (MoSTE) has developed National Adaptation Programme of Action (NAPA) in 2010 through consultative process which includes water resource and energy as one of the themes. There is no dedicated theme of water and sanitation, but WASH activities are in priority in adaptation. The MoSTE has also developed a Local Adaptation Plans for Action (LAPA) in 2011 as a national framework to provide the effective delivery of adaptation services to the most climate vulnerable areas and people. The LAPA Framework intends to integrate climate adaptation and resilience into local and national planning. Climate change policy was developed in 2011. Policy intends to form sector wide working group and integrate climate change policy in the sector policies. A pilot programme on climate change resilient (PPCR) program under MoSTE is trying to develop sector wide strategy for adaptation which includes water sanitation sector also.

Ministry of Urban Development (MoUD) comprising of two departments (DUDBC and DWSS) is the lead ministry for the WASH sector. DWSS has its divisions in the 75 districts and regional monitoring and supervision offices in the five development regions.

Ministry of the Federal Affairs and Local Development (MOFALD) comprises of technical department (DoLIDAR) which also looks after water supply and sanitation in the districts and works as technical units of the DDC.

There is existing steering committee (NWASHSC) chaired by the Minister for Urban development. Similarly, there is a coordination committee at center level (NWASHCC), regional level (RWASHCC), District level (DWASHCC) and Municipalities and village level (V/M WASHCC). These coordination committees are chaired by the Secretary (MouD) at center, Regional Administrator at regions, District chair or LDO at districts, Municipal or VDC chair at Municipality and Village. Coordination structure was mainly formed for sanitation activities in line with SHMP and which has been converted as WASH coordination committees by JSR II (2014). Key members in the coordination's committees are key ministries working in the WASH like, MOUD, MOFALD, MOE, MOHP and MOEST. Other members are Development Partners, I/NGO, Civil Society Organizations, CBOs, WUSC, FEDWASUN, etc. based on relevance in the respective areas. WASH CC is being effective for coordination and planning WASH program mainly sanitation program in the respective area. DWASH is being very effective for ongoing ODF movement at national wide.

The WASH sector was established Climate Change Adaptation and Disaster Risk Reduction thematic working group since JST-II. Similarly Project Coordination Committee on Climate (PCC) Change and WASH comprising of related stakeholders have been formed.

3. Review criteria

Building adaptation to climate change in health through resilient WASH requires Climate resilient and health-promoting water and sanitation policies defined and implemented at national level. This calls for an assessment of target national WASH policies and plans and alternative policy options so as to ensure that those become resilient to climate change, and promote health. It also requires review of related climate change, and health policies, to ensure that they are coherent across government. WHO HQ developed criteria and process for review of climate change, WASH and public health policies for climate resilient WASH sector. Process has been summarized below.

3.1 Stakeholder analysis and engagement

The review should include a clear identification of the Government, civil society, technical or other institutions or groupings that should be engaged in the review, and a plan for their consultation through the process. It may be helpful to differentiate between those who should be directly engaged in the review and formulation of recommendations, those that should be consulted to provide viewpoints and information, and those that should be informed of the outcome. The identification of stakeholders should look across groups working on water and sanitation, climate change, and health, with a particular view to ensuring coherence and building synergies across sectors.

3.2 Desk review to identify current gaps and weaknesses

The review should cover the policy documents in the following areas:

Water and sanitation. The review should cover the main national policies, strategies, plans of action and investment plans, and related supporting documentation. The review should examine the extent to which current policies already include consideration of climate projections alongside other determinants of future trends (such as population growth and increased demand), assesses the scale and nature of the risks, and reflect this within the recommended course of actions (e.g. Prioritizing relevant management practices, such as climate resilient water safety plans, or technologies, or targeting of investment towards locations or population groups at higher levels of vulnerability).

Climate change. The review should include national climate change strategies, National Adaptation Programmes of Action (NAPAs), National Adaptation Plans (NAPs), national communications to the UNFCCC, and any existing vulnerability and adaptation assessments covering the WASH and or health sectors. The review should consider the extent to which these documents identify WASH and health as priorities for adaptation, assess climate risks in these specific sectors, recommend actions to address identified risks, and allocate or otherwise prioritize resources to bring about these changes.

Health. The review should cover any overall policy and planning documents for the health sector and any specific plans for control of specific disease outcomes that are associated with WASH, and sensitive to weather and climate conditions. The review should consider the extent to which these documents take account of climate as a determinant of disease rates in space and time, potential risks of climate change acting through the WASH pathway to affect disease outcomes, and any recommendations made to strengthen or adapt disease control programmes to address these risks

Identification and assessment of options to improve policy and practice

Based on the assessment of current gaps and weaknesses carried out above, the review should identify options for revision. This should include:

3.3. Recommendations for policy revision

The report of the review should include recommendations for revisions to the various policy documents under consideration, and the process for their inclusion. This should take into account the governance and ownership of each of the documents, and the potential timing of revisions (e.g. Recommendations for inclusion in a national WASH policy may need to be made in a particular time period, in order to be considered for Government approval).

Review criteria and process describe above can be summarized in the following points for the practical purpose considering WASH, Health and Climate Change aspects:

1. The extent to which current policies already include consideration of climate projections (WASH)
2. The extent to which policy considers projections of determinants of future trends such as population growth and increased demand (WASH)
3. Assess the scale and nature of the risks, and reflect this within the recommended course of actions (WASH)
4. Prioritizing relevant management practices (such as climate resilient water safety plans,) or technologies targeting locations or population groups at higher levels of vulnerability (WASH)
5. The extent to which these documents take account of risks of climate change acting through the WASH pathway to affect disease outcomes and recommendations made to strengthen or adapt disease control programmes to address these risks (Health)
6. The extent to which these documents identify WASH and health as priorities for adaptation, assess climate risks in these specific sectors, and recommend actions to address identified risks, and allocate or otherwise prioritize resources to bring about these changes(CC)

4. Review of CC, Health and WASH documents

Policy documents of WASH sector, Public Health and Climate Change sector has been collected and reviewed. In this section, Introduction, key purpose of the documents and its positions in terms of environment and climate change has been summarized for the further review. Documents have been categorized as Acts/regulations, Policy/strategy/guidelines and Plans

4.1 WASH documents

Act and regulations

Soil and Watershed Conservation Act 1982: Act is mainly for protecting or saving soil and water shade area from any natural disasters such as floods, landslides, and soil erosion, keeping the volume and flow of waters in its normal condition, or maintaining the purity of the flow of water without letting it get muddy. The Act suggested conservation measures like construction and maintenance of dams, check

dams, embankments terrace improvement, irrigation channels, subsidiary irrigation channels or diversion channels, retaining walls, tanks, or similar other structures. Planting of grasses, bushes, or other vegetation, and its protection are also encouraged. The Act needs to be updated in view of climate change and also with priority of conservation for the sources used for drinking.

Water Resource Act, 1992: The Act is to make arrangements for the rational utilization, conservation, management and development of the water resources that are available in the Nepal in the form of surface water, underground water or in whatsoever form, and to make timely legal arrangements for determining beneficial uses of water resources, preventing environmental and other hazardous effects thereof and also for keeping water resources free from pollution. Water resources for collective benefits on an institutional basis requires formation of Water Users Association and registered as prescribed. For utilizing water resources first priority is for drinking, water and domestic use. The user association needs to take a formal license from authority for permanent use of water resources based on economic, technical and environmental studies. No one can pollute water sources and government shall develop quality standards and pollution limits. Water resources can be used without causing adverse effects on the environment. Based on provisions of the Act, the Government of Nepal had developed water supply rules, drinking water quality standards and guideline for environmental assessment which included drinking water.

The Act is very much conscious of local environmental conditions. The Act does not consider current and future trend of climate change scenarios and its relations with utilizing water resources. The document has not noticed risk of potential climate change and course of actions to be taken. There is no mention of any management of technical practices for minimizing vulnerability.

Drinking Water Rules, 1998: This has been framed based on the power offered by Water Resource Act 1992. The rules described the formation of the user's organization of water supply projects and its constitutions. A user's organization needs to be registered in the district water resources committee. Registration will provide right to use water resources for the defined purpose and quantity. The users association needs to get a separate license for carrying survey and utilizing water sources. License can be renewed and amend by the same committee. If there is any dispute in utilizing water resources, source utilization dispute settlement committee chaired by DDC chairperson can resolve the problem. Water supplier needs to maintain water quality, avoid pollution and significant adverse effect on the

environment. A users' organization needs to maintain the system and provide water to users with priority to health, education, users and constructions works and industries. The water supplier can make conditions for accepting as consumer in line with the Act and consumer need to pay charges. District water supply office can nominate inspector to inspect condition of projects.

Water Supply Rules are mainly for utilizing water resources for the drinking purposes. Rules have ensured efficient use of available sources. There is no provision of considering water supply projects from present and future trend of climate changes and its potential impacts on sources system and people. Water supply rules have not noticed risk of potential climate change and course of actions to be taken. There is no mention of any management of technical practices for minimizing vulnerability. But the rules have taken measures for avoiding unwanted use of water resources by the provision of license specifying flow capacity and users.

National Water Supply, Sewerage and Sanitation Act, 2014 (Draft): The Act is under process of formulation. It is a new and umbrella Act for water and sanitation sector in order to regulate regular safe water and sanitation services so as to provide safe water for all and protect the health of people and the environment from the negative impact of waste water. The Act has recognized all water resources as national resources and made local bodies to protect, conserve and avoid pollution of sources in their respective territories. Act intends to regulate both surface and ground water sources through license. Agencies including local bodies can develop water supply, sewerage and sanitation projects in coordination with DWSS. Technical, economic and environmental feasibility study of the projects will be based on service areas/scope. Projects can be developed in public private partnership and handed over to users committee or local based utilities for operation management. Supplier need to ensure drinking water quality taking appropriate charge. The Act has provisioned penalty for any act that does not comply standard of service or act that may cause a threat to water sources and its quality and also for the act that cause pollution of water sources by the water supply and sanitation services. The government will define the quality of drinking water, effluent standard, service standard and design standard for water supply sewerage and sanitation services. The Act is mainly for regularizing water supply, sewerage and sanitation services, ensuring quality and service standards. The act is aware of the impact of human activities on WSSS services and potential impacts of services on local environments. But the Act has not envisioned anything from climate prospective, climate trend and potential impacts on WSSS and sustainability of the services.

Local Infrastructure Development Policy, 1999: The policy was formulated for implementation of rural infrastructure development works in coordination with various line agencies. The policy focuses on implementation of physical facilities and quality monitoring and use. One of the components of the local infrastructure defined by the policy is water supply, sewerage and sanitation which covers local environmental improvement program also. This also covers solid waste management for urban and semi-urban areas. The policy has not touched on any kind of environmental concern and potential climate change and its impacts on design and use of infrastructure development.

National Water Resource Strategy, 2002: One of the objectives of the strategy was to provide access of safe and adequate drinking water and sanitation for ensuring health security considering population growth and increased demand. Guiding principle of strategy formulation was sustainable water utilization to ensure conservation of the resource; decentralized water service in a manner that involves autonomous; development of water sector with participation of and consultation with all the stakeholders; wider adoption of the best existing technologies and practices, and rapid innovation and adaptation; integration of water resource projects with social development, wherever possible; information to people and made responsible for managing water efficiently; conserving water, preserving/protecting water sources from degradation and maintaining water quality.

The strategy has set separate action plans for environmental sustainability besides action plans for various uses of water. Few point of importance in the context are: Environmental and ecological considerations should be integrated at every level of the development process from policy setting and

strategy formulation through project planning, design, implementation and operation; increased environmental awareness, local knowledge and public participation in environmental protection, conservation and management; adequate water quantity and quality is fundamental to human and ecosystem health.; sustainable development of watersheds and water resources should result in reduced incidence of natural and manmade environmental impacts and disasters such as Glacial lake Outburst Flood (GLOF), landslides, siltation, flooding, pollution and global warming; an ecosystem approach to watershed management that includes consideration of direct and indirect biophysical and social effects and compliance with participatory, comprehensive and rigorous environmental assessment and management should be adopted for sustainable water resources development.

The WRS has not indicated potential risk of climate change trend and necessary actions. A strategic document has indirectly made clear provision for adopting appropriate technology and management to minimize the potential threat to climate change. The strategy also stress of source conservation, best use of resources and best adaptation.

Rural Water Supply and Sanitation Policy, Strategy and Strategic Action Plans, 2005: The policy has been formulated with target to provide access to water supply and sanitation facilities to all people of Nepal by 2017. The policy has accepted water resources as limited resources with economic value and emphasized on participatory service delivery and public ownership with the involvement of women. Policy has indicated that measure should be taken to minimize environmental impact while implementing water sanitation projects. Policy stresses for involvement of local body in all stages of the program and local capacity development. Strategy includes maximizing community benefit through environmentally sensitive approach and minimizing environmental damage. The policy has indicated concern on environmental aspects of water supply system development works, but not clearly spelled any concern on the risk of climate change and adaptation in that direction.

National Urban Water Supply and Sanitation Sector Policy, 2009: Urban policy has been formulated to address historical imbalances and the hazards nature of urban and its specific link considering The Local Self Governance Act (LSGA) and existing water supply and sanitation policy for rural. The main objectives of the policy are to ensure availability of safe and adequate water supply and sanitation facilities to all by 2017 with higher service facilities to one third with due attention for protecting surface and ground waters. Strategy to meet environmental protection targets has emphasized on preserving traditional sources, setting effluent standards, examination of potential impacts, use of environmental friendly technologies and environmental management. While rural water supply stresses on participatory approach urban policy stress of public and private involvement on the financial sustainability of the services.

Urban policy has mentioned environmental concern in line with the Act and Strategy mainly for minimizing impact of development works on the existing environment. The policy has not recognized potential impacts of climate change and adaptation required. The policy does not go into depth of urban issues in terms of solid and wastewater management and its relation to climate change.

Water Supply and Sanitation Policy, 2014 (Draft): The policy is under formulation as a national umbrella policy for the WSS sector consolidating existing all policies and strategies. The main objective of the policy is to ensure access to safe water and sanitation services for all with priority to people in need. Environmental subjects have been included in the technical approaches of policy development. The policy has realized following points relating to the environment: Water sources are drying as a result of climate change by which small water supply systems are mostly affected. Suppliers are unable to protect water sources from deforestation and pollution due to lack of provision for source protection and zoning. Ground and surface water sources are being polluted due to lack of proper management of waste water in the town areas. Environmental aspects are neglected while developing water supply and sanitation systems. These aspects of the environment and source protection have been reflected in the policy statements and strategies as well. Policy stresses on sector wide approach, local capacity

development, coordination among sector agencies and monitoring. Policy and strategy have realized the impact of climate change in water sources. Policy and strategy have ensured the conservation of sources through zone protection. But policy and strategy have not covered aspect all aspects of potential impacts of climate change factors and necessary adaptation measures for sustainability of the services.

Water Supply Design Guidelines, 2002: DWSS developed design guideline in 12 volumes in 1998 and revised in 2002. Twelve volumes consist of: (1) Process (2) Design Criteria (3) Drawing (4) Rate analysis (5) Estimate (6) Materials (7) Formats (8) O&M Policy (9) O&M Manual (10) Specification (11) Tubewell (12) Pipe and Fittings. Revised documents were never published in printed form, but are in use. The guideline is in need of review and revision and updating in the current context. This guideline outlines the procedures to be followed in the implementation of gravity flow rural water supply schemes with the participation of the beneficiaries. Volume I describes design process. Guideline requires that water source selected for a scheme should be protected to minimize the chances of contamination and to maintain its safe yield. Conservation works should be undertaken in collaboration with the District Forest Office. The community should be motivated and mobilized for implementation of the conservation activities. Community need to select a source location near to the community, without dispute, sufficient water and less likely to contaminate. The request for a water scheme should come from the actual beneficiaries. They must discuss the request among themselves in the village meeting and minute the decision. The request should be then submitted to the VDC for approval. With recommendation from the VDC, the beneficiaries should submit the request to the DDC. Volume II design criteria provide criteria for intake design, demand calculations and design of components. The main intent of design guideline is to maintain standard in the process and design of water supply system development with protection of sources. Systems are designed to fulfill demand of 20 years. The guideline has taken care of source protection, protection of source area and efficient use of available water. But guideline has not realized climate change prospective and potential impact of climate change on sources and sustainable use of the services.

National Drinking Water Quality Standards and Implementation Directives, 2005: Government of Nepal formulated NDWQS and implementation directives under the provision of Water Resources Act 1992. The standard has been set for six physical parameters, nineteen chemical parameters and two microbiological parameters in line with WHO guideline and regional experiences. The standard requires water supply to meet national standards or prepare a water quality improvement program on time frame. Directives has made respective supplies for maintaining water quality standard and operational monitoring where as a responsibility of institutional monitoring lies with sector ministry and surveillance with the health ministry. Standard has released some of the physical and chemical parameters for rural water supply and ground water systems.

NDWQS and directives are mainly concerned with maintaining sustainable safety of drinking water in the normal situation. Directives have not recognized the potential impact of climate change on water quality and required measures during climate induced emergency and impact of potential climate change.

National Water Resource Plan (NWRP) 2005: Recognizing the need for comprehensive management and development of water resources for realizing optimal benefits, Government of Nepal started formulating Water Resources Strategy and in order to implement the activities identified by the WRS, the Water and Energy Commission Secretariat (WECS) formulated National Water Plan (NWP) in September 2005. The Plan was expected to be reviewed periodically to address the emerging development needs and the experience gained during the process of its implementation. The Plan has recognized varying climatic condition of Nepal from South to North and population projections in those settings.

The major river systems of Nepal, which originate in the Himalayas are Koshi, Narayani (Gandaki), Karnali and Mahakali and there are more than 6000 rivers, which provide a dense network of rivers with steep topographic conditions. The hydro-geological mapping indicates that the Terai has a tremendous potential of groundwater resources. The Terai, with a thick sequence of saturated detritus sediments of alluvial and colluvial origin is one of the most productive aquifers in the subcontinent. The Plan has realized Need for Integrated Water Resources Management (IWRM) and River Basin Management (RBM). Guiding principles for NWP implementation are: Integration, Decentralization, Coordination & Management, Stakeholder Participation, Equity, Gender & Social inclusion. NWP defined service standard for water and sanitation and set target to cover the whole country with a basic water supply and sanitation by the year 2017 and 27% population access to medium and high level of water supply. NWP set road map to implement water supply projects and anticipated economic benefit ratio at rural (2.75), small town (1.58), major town (1.51) and Kathmandu valley (0.67) level and stand alone sanitation at community level. Water plan considered potential risk of environmental damage by the construction of water resource use structures and developmental steps for the systematic environmental management plan, monitoring and auditing. The plan could not realize the impact on water resources itself and potential impact on the use by the potential climate changes. Hence, NWP does not have any plan for adaptation to the risk of climate change directly.

Periodic Plan, 2013-2016: Periodic plan started from 1956 and current periodic plan (three year plan) is 13th plan. First nine plans were five years long and after then plans are three years long. Current periodic plan is formulated in the view of upgrading country from a status of least developed countries and in the view of its commitment to SAARC, human right, sustainable development and climate change. The plan aims to increase coverage of basic water supply services from 85% to 96% and sanitation from 60% to 90%, in line with cent percent coverage by 2017. One of the strategy of TYP is to implement development activities with view of climate change adaptation and minimizing risk of climate changes through decentralization and local capacity building. Development of water and sanitation facilities and conservations of the natural resources and environment are the key priority areas. Water supply and sanitation has been recognized as one of the basic needs of human beings under social development sectors. In line with national targets, there is a strategy to use alternate source like RWH, solar pumping system, hydro-ram for the dry area. The plan also has set strategy to develop WSS sector with the concept of sector development and use local technology which are environmentally friendly and resilient to climate change. Strategic action plan also stresses on climate resilient and preserving traditional sources, but it has not been reflected in the programs directly. But sector agencies have implemented a climate change program with the support of international agencies without mainstreaming the national sector program.

TYP has clearly recognized environmental sustainability, need to water and sanitation system to be climate change resilience and reflected in sector strategy and strategic action plan. But there is no any program for projection of climate change in view of WSS sector and CC resilient program and program supporting local adaptation. In line with the strategy of TYP sector agencies have practiced some program for CC resilient without being mainstreaming.

Sanitation and Hygiene Master Plan of Nepal, 2011: The Master Plan largely focuses to Open Defecation Free (ODF) with universal access to toilet in both the urban and rural context through the total sanitation approach. Master Plan aims to achieve ODF country by 2017 in line with national targets. Key objectives of the Master Plan are to create an enabling environment for harmonizing the efforts of stakeholders through unified planning and the implementation process; to develop the necessary mechanism for maintaining uniformity and standards in approaches and modalities; and to optimize effort of all stakeholders under the leadership of the local body. The master plan requires Local Bodies to Lead for Participatory Planning, Implementation and Monitoring of Hygiene and Sanitation Program. The master plan is mainly for creating sanitized community with the provision of sanitation facilities managed by communities. The master plan indicated potential risk of climate change on sustainability of water

supply and sanitary system. Master plan indicated need of source protection, promotion of water conserving sanitary facilities and mass awareness to adopt climate change at local level. This needs to be materialized through a guideline.

MDG Acceleration Framework, 2012: MAF for sanitation was developed in the context that MDG target to half the population without access to improved sanitation was not on track till 2010. The MAF identifies and analyses the bottlenecks (or constraints) that are causing some MDGs to veer off track, as their rate of progress is insufficient to achieve specific targets. MAF becomes supporting document to MHMP to accelerate the rate of progress in the sanitation. As a joint result of SHMP and MAF and national movement of ODF sanitation progress was brought on track. MAF focus is on disparities of sanitation coverage and trend among urban and rural; poverty quintile, ethnic and caste groups, schools, districts, ecological belts. MAF intends to intervene through coordination; systematic and uniform approach and implementation of WASH in School (WinS). The MAF bottleneck analysis includes categories: Policy and planning; Budget and financing; Service delivery (supply side); Service utilization (demand side) and cross cutting. The main focus of MAF is on accelerating ODF movement and continuation of total sanitation in the post ODF phase. The document has not mentioned anything of environmental concern. MAF has not realized the potential impact of climate change on the sustainability of sanitation facilities and its use.

WASH Sector Development Plan (SDP), 2014 (Draft): The Second Joint Sector review 2014 endorsed for the formulation of SDP. Process has been initiated and SDP is in outline stage now. The development of WASH SDP presents a unique opportunity for the sector in a coherent and strategic programming and management for sector development in Nepal led by the Government, fully backed by development partners and owned by the stakeholders. By providing a shared vision and coherent strategy around national priorities, the Plan provides a clear programming framework and direction for action to all the stakeholders in the realization of universal access to safe water and sanitation services by 2017 through improved coordination, harmonization and alignment. The SDP will gradually lead the sector towards a Sector Wide Approach to planning (SWAp) in line with GoN's intention. Since, one of the themes of JSR2 was DRR and CC, current outline of SDP also included these aspects as one of the implementation strategy. How the SDP comes in terms of climate change aspects is yet to be seen

4.2 Climate Change documents

Climate Change Policy, 2011: Climate Change Policy of Nepal has been formulated in the situation that the country has been affected by climate change even though it has a negligible contribution to climate change in terms of GHG emissions. Nepal will be affected disproportionately, especially from increasing atmospheric temperature. Changes in the annual rainfall cycle, intense rainfall and longer droughts. But national effort to make the country climate resilient has been challenged due to the lack of knowledge, scientific data and information related to the science of climate change and likely impact of climate change and vulnerable group. The policy has been formulated mainly to inform parties of UNFCCC about the implementation of the convention, to promote climate adoption mitigation and restoration of the carbon level and to make natural resource management climate-friendly for socio-economic development and climate-resilient infrastructure development.

Policy intends to integrate climate change aspects into plan and development programs and implementation, to establish climate change center; to reduce GHG emissions, promoting renewable energy; to enhance adaptation in and climate resilient capacity and initiate community based local adaptation plan in line with NAPA; to enhance the capacity to forecast present and future impact of climate change; to promote climate friendly technologies, manage solid waste as a resource. Policy is mainly for generally strategy. Policy intends to form sector wide working group and integrate climate change policy in the sector policies.

National Adaptation Programmes of Actions (NAPA) to Climate Change, 2010: NAPA, through a consultative process, has been prepared as strategic tools to assess climate vulnerability and systemic responses by climate change adaptation measures. NAPA document has been summarized into six thematic groups: Agriculture and food; Climate induced disasters; Urban settlement and infrastructures; Public health; Forest and diversity; and Water resources and energy.

Vulnerability analysis and work of TWG came out with a long list of adaptation option options under each theme. Prioritization exercise was done for inclusion in the NAPA. Among nine areas of project profile one is empowering vulnerable communities through sustainable management of water resources with high priority for drinking water and sanitation. Vulnerability assessment: Assessment was carried by overlaying climate risk/exposure map, climate sensitivity map and adoptive capacity map in line with IPCC framework. According to district wise analysis districts have been grouped as Very High, High, moderate, low and very low ranking. Impacts: Too much and too little water, which affect on water supply and sanitation. Climate induced disasters affect sanitation. NAPA has not analyzed water supply and sanitation and separate theme, but it has been positioned as a high priority area under water resource and energy.

National Framework on Local Adaptation Plans of Action (LAPA) 2011: LAPA was formulated in line with NAPA as a national framework to provide the effective delivery of adaptation services to the most climate vulnerable areas and people. The LAPA Framework ensures that the process of integrating climate adaptation and resilience into local and national planning. LAPA actions include: Identify the most climate vulnerable communities; identify and prioritize adaptation; prepare LAPA and integrate it into local, national plans in accordance with the LSGA; Identify and mobilize appropriate service delivery agents; adopt and or implement adaptation actions sequentially; conduct monitoring and evaluation by ensuring effective implementation of the plan. LAPA requires that all sectors integrate local adaptation plan of action for climate change adaptation into sector development plan at the local level. LAPA mainly provides process.

4.3 Health documents

National Health Policy, 2014: New Policy has been developed as an improvement to National Health policy of 1991 for ensuring quality health services to the people of Nepal without any discrimination. This aims to ensure the right of people to quality services. The main objectives of the new policy are universal coverage of health services to all. The policy also includes one component to ensure right to people to live in a clean environment through effective control of environmental pollutions. The policy has formulated a strategy to take a leadership role on regulation of pollution and adverse effect of climate change for health protection and promotion. There is a strategy to enforce existing law for scientific management of health care waste. There is a strategy to manage radiation caused by health services in line with international standard

Second National Health Sector Plan (NHSP-II), 2010-15: This is a continuation of NHSP-I (2004-10) extending plan for 2011-15). The plan has been prepared with the vision to improve health and nutritional status of the Nepali population, especially poor and excluded people. It has the objective to improve the health system to achieve universal coverage of essential health services including communicable disease control. NHSP-II has added oral health for school and sanitation and hygiene for community as one of the health promotion activities and environmental health (water, air quality, sanitation, hygiene, waste disposal,) as one of the components of essential health services for piloting and scaling up with inter sector partnership. Action also includes establishing a knowledge network with academia and practitioners on climate change and a public health response team for climate change. But environmental health or climate change activities has not been incorporated into the institutional framework explicitly.

4.3 Summary review table

Review of the documents in line with review criteria has been summarized in the table below for quick observation. Documents have been categorized as Positive, Silent, Negative or Not applicable (NA) based on how the documents address climate change review criterion.

S N	WASH Documents	General Environ ment	Climate Change Projecti ons	Projecti on of determi nants of future	Risk assessm ent and course of actions	Prioritiz e CR manag ement proacti ve and technol ogy	Source conserv ation and econom ic use	Risk of disease through CC and WASH pathway s.	WASH and health as priority for adapta tion
1.	Soil and Watershed Conservation Act 1982	Positive	Silent	Silent	Silent	Positive	Positive	NA	NA
2.	Water Resource Act, 1992	Positive	Silent	Silent	Silent	Silent	Positive	NA	NA
3.	Drinking Water Regulations, 1998	Positive	Silent	Silent	Silent	Silent	Positive	NA	NA
4.	Water Supply, Sewerage and Sanitation Bill, 2014 (Draft)	Silent	Silent	Silent	Silent	Silent	Positive	NA	NA
5.									
	Local Infrastructure Development Policy, 1998	Silent	Silent	Silent	Silent	Silent	Silent	NA	NA
6.	Water Resource Strategy, 2002	Positive	Positive	Silent	Positive	Positive	Positive	NA	NA
7.	Rural WSS policy, strategy and strategic action plan 2005	Silent	Silent	Silent	Silent	Silent	Positive	NA	NA
8.	Urban Water Supply and sanitation Policy, 2009	Silent	Silent	Silent	Silent	Silent	Silent	NA	NA

9.	<i>Water Supply and Sanitation Policy, 2014 (Draft)</i>	<i>Positive</i>	<i>Positive</i>	<i>Silent</i>	<i>Silent</i>	<i>Positive</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>
10	<i>National Drinking Water Quality standard and Directives 2005</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>NA</i>	<i>NA</i>
11	<i>Design Guidelines for Water Supply System, 2002 (12V)</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>
12	<i>Nepal Water Plan, 2005</i>	<i>Positive</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Positive</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>
13	<i>Sanitation and Hygiene Master Plan of Nepal 2011</i>	<i>Positive</i>	<i>Positive</i>	<i>Positive</i>	<i>Positive</i>	<i>Positive</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>
14	<i>MDG Acceleration Framework, 2012</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>NA</i>	<i>NA</i>
15	<i>Periodic Plan (TYP 13-16)</i>	<i>Positive</i>	<i>Positive</i>	<i>Silent</i>	<i>Positive</i>	<i>Silent</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>
16	<i>WASH Sector Development Plan, 2014 (draft)</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>Silent</i>	<i>NA</i>	<i>NA</i>
17	<i>Climate Change Policy, 2011</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Positive</i>
18	<i>NAPA, 2010</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Positive</i>
19	<i>(LAPA) 2011</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Positive</i>
20	<i>National Health Policy, 2014</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Positive</i>	<i>NA</i>
21	<i>Second National Health Sector Plan (NHSP-II), 2010-15</i>	<i>Positive</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Positive</i>	<i>NA</i>

5. Climate resilient WASH prospective

Climate Change Perspective on WASH requires assessment of climate risk, best adaptation options and community managed adaptation process in place within WASH sector. Based on review of policy documents following essential elements have been identified and described in the context of Nepal.

5.1 Observation and projection of climate change parameters

Climate change will have impact on climate parameters like rainfall patterns and temperatures which have linkages with catchment infiltration flow in the sources of water supply systems and biochemical process in the water treatment, waste water treatment and solid waste decomposition process. Hence, the sector needs to observe present trends of these climate factors and make projections for the future value in view of climate changes. Climate value needs to be observed and projected at national level for the various climatic regions in coordination with Department of Hydrology and Meteorology (DHM) and community need to understand actual trends in the local climates and impacts on water sources.

General climate

Climate of Nepal is influenced by Himalayan mountain range and South Asian monsoon. Average rainfall is 1800mm. Monsoon rain decreases from west to east and winter rain decrease from North- West to Southeast. Highest rainfall occurs in central and mid hill around Pokhara and east of Kathmandu. Temperature decreases from South to North with a rise in attitudes. There are four seasons: Pre monsoon (Mar-May), monsoon (Jun-Aug), post monsoon (Sep-Nov) and winter (Dec-Feb). Winter is coldest, with the highest temperature during pre-monsoon.

Present trend

Temperature: Data indicated that the observed warming trend is not uniform across the country. Warming is more pronounced in the high altitude regions compared to the Terai and Siwalik regions. Rise in the maximum temperature is 0.04-0.06 °C/year.

Pre monsoon precipitation: Precipitation is declining in far and mid western region with few pockets of western, center and eastern regions. In the rest of the country, it is increasing. Monsoon precipitation is declining in Midwestern and southern part of the western regions with few pockets of center and eastern regions and increasing in the rest of the country. Post monsoon precipitation is increasing in most part of Midwestern and southern part of eastern, center and western regions. It is declining in the far-western and north part of the western, center and eastern regions. Winter monsoon precipitation is increasing except the northern part of the Midwestern, center and western regions.

Projections

Temperatures: General circulation model (SRES B2) projects mean annual temperature increase: 1.2°C by 2030, 1.7°C by 2050 and 3°C by 2100. Regional model projects: 1.4°C by 2030, 2.8°C by 2060 and 4.7 °C by 2090. The projection shows higher temperature increments during winter as compared to the monsoon seasons. Higher temperatures are projected in western and center Nepal as compared to eastern Nepal.

Precipitation: precipitation projection shows no change in western Nepal and up to 5-10% increase in eastern Nepal during winter. During summer seasons precipitations are projected to be increased by 15-20% in the whole Nepal

5.2 Stratification of regions based on climate change prospective

Impact of climate change on climate factors are not uniform across the country. Climate change may pose both positive and negative changes on climate factors. The sector in coordination with DHM needs to stratify the country in terms of climate regions based on increasing and decreasing trend of rainfall pattern and temperatures. This will help the local planning based on climate or none climate change factors. This will help to predict future water supply in the sources in view of climate change and capacity to meet water demands. Stratification can be done based on both temperatures and rainfall patterns.

5.3 Monitoring existing and potential water sources like springs, streams and ground waters for flow and water levels

Water flow from the springs, streams and levels in the underground waters varies with the seasons of the years and also depends on rainfall patterns. Climate can also vary from year to year with some return cycle. Climate change can cause a permanent change in the flow conditions. The sector needs to make an inventory of existing and potential sources and continuously monitor flow and level in the sources to understand the impact of climate change and need to relate with climate change data in terms of rainfall and temperature factors. Regular monitoring is the responsibility of the local bodies and users committee using sources. Sector agencies need to make records at district and national level.

5.4 Longer term planning for water supply

The present trend of water demand calculation is based on 15-20 years demand for the community. In addition, there is a risk of decreasing flow of water from the sources because of climate change which poses more risk on future water demands. Community and town need to identify the sufficient sources to meet demand of 50-100 years and potential population growth. The flow of water in the sources should be assumed in view of the potential impact of climate change. If there are no feasible sources found around a community, expansion of community or town should be limited based on anticipated water limits. Community need to identify and monitor all of the water sources and make water use plan in view long term need for water supply and sanitation.

5.5 Economic use of water and water demand management

Fresh water is the precious economic resources. Future water demand is likely to increase due to increased populations and increased water based activities, whereas the impact of climate changes is likely to reduce the capacity of existing water sources in many parts of the country. This will result water stress. The current way of using water for domestic activities including sanitation is not efficient. The sector needs to develop the ways to efficient use of water and promote consumer education in that line. There are various tools, techniques and technologies which help reduce water needs. The technique can be adopted in terms of cleaning kitchen utensils, bathing, toilet flushing, hand washing, etc. Even the toilets needing low water like EcoSan toilet or dry toilet can be designed. The sector needs to prepare

guidelines and promote technologies and suggest community to apply in response to water scarcity beyond capacity of the sources. Community need to promote reuse of water.

5.6 Promotion of low energy and low carbon emissions technologies for the WASH facilities

Technologies used for water supply and sanitation systems may use a lot or no energy to high energy which indirectly contributes to carbon emissions. Similarly, biochemical processes involved in the wastewater and excreta treatment may cause emission of Green House Gases (GHG).

A water supply system using pumps consumes energy. A water supply system with WSP avoids the potential consumption of energy or wood fuels that people might use for boiling water and avoids energy and carbon emissions. Source conservation and protection can avoid needing of treatment plants conserving energy. There are various ways of system operation optimizing energy requirements.

There are various ways of excreta and waste water management ranging from on site sanitation, natural oxidation, oxidation pond, extended oxidation, an anaerobic process, biogas etc. A on-site sanitation can be simple pit, composting pit, ecological sanitation. An anaerobic process of waste water treatment releases less carbon equivalent in comparison to an anaerobic process. But if methane is captured and used as fuel the case may be just the opposite. Hence, biogas plant using human faces can be more efficient in terms of energy and carbon emissions.

The sector needs to prepare criteria for selecting various technologies and process in view of energy consummation and carbon emissions. This will minimize carbon emission and contribute to controlling climate change to some extent. Selection of technologies and process should be also based on carbon equivalent in addition to prevailing criteria. The sector needs to promote and encourage making use of low energy and low carbon technologies.

5.7 Source conservation, protection and promotion of local ecosystem

The flow of water from the sources like rivers and spring, and ground water level in the underground reservoirs are the functions of rainfall and infiltration. The amount of rainfall and its pattern can be impacted by the climate change. Climate change can also impact on vegetation around catchment areas which has linked to infiltration. In addition, high flood caused by the changing climate can relocate eye points of the springs, course of flow in the streams and can block infiltration areas. Proper understanding of the mechanism and linkage with climate change make help to predict climate and none climate change factors posing risks. To minimize the risk of climate change, community can improve the infiltration capacity of the catchment areas, avoid floods and enhance recharge of ground reservoirs. The sector needs to develop guidelines for assigning specified zones in the catchment areas for conservation of ecosystems and protections from pollutions. Protection and conservation zones can be marked at three levels needs various degrees of protection and conservations based on the nature of the sources. The sources need to be protected near intake points with high precisions, in the same area in the catchment with low precessions. The whole catchment area needs to be conserved. Groundwater reservoirs need to be conserved in its most efficient recharging points and need to be protected from all areas where it is likely to be polluted. Infiltration can be also enhanced by engineering interventions like a gully cutting, pond construction, construction of check dams etc.

5.8 Equitable distribution of WASH facilities with focus to vulnerable group under adverse impacts of climate change

Diverse groups of the society will have different level of capacity to adopt under the adverse effect of climate change. WASH facilities should be equitably distributed among diverse groups. Diverse groups should be benefitted by the adaptation plan and people with diverse capacity should be involved for the common benefit. The adaptive capacity of the diverse group should be calculated considering capacity to use alternate water supply and sanitation system, availability of alternate options and affordability. Diverse group can be based on people living in different geographical locations, social groups, gender groups, age groups, wealth groups, differently able, professional groups, etc. Based on criteria groups can be ranked in terms of adaptive capacity as Very High (4), High (3), Medium (2) and low (1).

5.9 Climate risk assessment of water supply and sanitation systems

Climate change can pose various degrees of risk on water supply and sanitation system. Climate risk can be expressed in terms of multiplication of (X) Likelihood of actual happenings of hazards caused by climate change (Y) Likelihood of impact of hazards on functioning of water supply and sanitation system and (Z) severity of impacts of hazards in terms of population affected. Examples:

- Because of climate change, changing rainfall pattern might dries up the source (X) causing insufficient flow for water supply (Y) for many people (Z)
- Because of climate change, loss of vegetations might reduce infiltration to catchment areas (X) causing insufficient flow for water supply (Y) for many people (Z)
- Because of climate change, changing flood pattern (X) may cause pollution of sources (Y) impacting drinking water quality for many people (Z)
- Because of climate change, changing rainfall pattern dries up the sources (X) causing insufficient water for the sanitation (Y) for people using flush toilets (Z)
- Because of climate change, reduced temperature (X) caused the slow rate of reaction in biogas plant and low production of methane gas (Y) for the whole system (Z)

X, Y and X used in the risk assessment can be expressed in terms of score range of very high (4), High (3), Medium (2) and Low (1).

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change. Different systems may experience different level of vulnerability. Vulnerability depends on climate risk and adoptive capacity or ability of a system to adjust to climate change. A system which can function under changing climate is called climate resilient. Best adoptive technologies and system can be selected to become more resilient. Vulnerability can be expressed as multiplication of likelihood of impact of hazards over the adaptive capacity of the system and can be expressed as very high (4), High (3), Medium (2) and Low (1).

Vulnerability = likely hood x severity/adaptive capacity.

5.10 Plan for alternate options and climate resilient management system

Climate resilient is a way of functioning of a system under changing climate. The water supply system is always vulnerable to a changing climate because key impact of climate change will on rainfall pattern and temperatures, which will have a direct impact on water supply and sanitation systems. Water supply and sanitation system face various risks affecting current and future service systems. The system can be made climate resilient under adverse conditions by minimizing risks, adopting best adoptive technologies, adopting best adopting management system, enhancing adaptive capacity of the peoples and or by designing the system in consideration of future climate conditions or designing the community and town development in line with the expected impact of climate change on water sanitation systems. Assessment of current vulnerability, future climate risk and development of adaptation plan and programs are necessary for the system to become resilient.

5.11 Community based Plans for Action (LAPA) to provide the effective delivery of adaptation services to the most climate vulnerable areas and people on WASH

The National Framework for Local Adaptation Plans for Action (LAPA) guideline requires communities to prepare Local Adaptation Plans of Action and integrate it into local plans. Similarly sector needs to ensure integration and implementation of climate adaptation and resilience actions into sectoral plans, program and project, and ensure people, community and their resources are adapting to climate change. The LAPA Framework consists of the following seven steps:

- 1) Climate change sensitization
- 2) Climate vulnerability and adaptation assessment
- 3) Prioritization of adaptation options
- 4) Developing Local Adaptation Plans of Action
- 5) Integrating Local Adaptation Plans for Action into planning processes
- 6) Implementing Local Adaptation Plans of Action
- 7) Assessing progress of Local Adaptation Plans of Action

Water users and sanitation committees and V-WASH CC are the central point to take over the LAPA process for the WASH sector at local level. Guideline defines VDC as units for local planning.

5.12 Research and information update on climate resilient WASH sector and health

There is abundant evidence from observational records and climate projections that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change. Better observational data, model projections, are a prerequisite for adaptive management required under different scenarios of climate change. Several gaps in knowledge exist in terms of observations and research needs related to climate change and water. Current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability. Climate change affects the function and operation of existing water infrastructure as well as water management practices. Climate change poses a major conceptual challenge to water managers, water resource users as well as to policy makers in general, as it is no longer appropriate to assume that past climatic and hydrological conditions will continue into the future.

The sector needs to conduct scientific and operational research for better understanding. Community need to prepare scenario and situations in their local situation and find best adoptions for them. The sector needs to develop appropriate technologies and management model which is resilient to climate change. Research may be required for linking rainfall and source flow, especially on small springs; source conservation and protections; low energy technology, efficient management system, etc. The sector needs to develop criteria for risk assessment, vulnerability assessment and best resilient systems.

5.12 Strategy for water safety in view of climate change

Climate change induced floods affect water quality and water infrastructure integrity, and increase fluvial erosion, which introduces different kinds of pollutants to water resources. Droughts affect water availability and water quality. Lower water quality is caused by flow variations.

The protection of water sources is an important, cost-effective strategy for facing future problems concerning water quality. While this is a common practice in some countries, new and innovative approaches to water quality management are required around the world. One such approach is the implementation of water safety plans (WSP) to perform a comprehensive assessment and management of risks from the catchment to consumer, as proposed by the WHO. Climate resilient WSP needs to focus preventing pollution at sources and representing at the systems and households level. The WSP team should have dedicated people in the conservation and protection of the sources and specified areas should be separated in the catchment area as safe zones. People living in the source areas, forest groups, agriculture focus and people using water will have a greater role in the conservation and protection works. People benefiting from conservation need to reciprocate the people involved in the conservation.

5.13 Visible units for climate change in the sector institution and coordination with ministry of environment and then globally

Sector ministry or lead department should have visible units for dealing with climate change prospective of the WASH sector. This unit needs to undertake all actions to integrate climate change prospective on water, sanitation and hygiene activities and make the sector climate resilient. This unit needs to review policy, plan, program, directives used in the sector from CC prospective, carry out research, develop a process for risk assessment and vulnerability analysis and develop technologies and management system for the climate resilient systems at local level. This unit should coordinate with respective focal points of the ministry of Environments and other ministries and make linkage with agencies dealing with climate change and water in the regional and global level up update the information.

5.14 Sensitization and awareness on linkage of water, sanitation with climate change

Effective adaptation planning that addresses the potential impacts of climate change requires information on climate induced impacts, potential adaptation options and challenges and information on how to access resources for adaptation. Community, local bodies and people need to be aware about how climate change will have differential impacts on different group so that climate change resilience can be integrated into development planning. Various tools can be used for sensitizing the people: Shared learning dialogue; Hazard and risk analysis; Envisioning climate scenario; School and community level awareness program.

The community can explore possible changes in climate in the future and impact scenario: Scenario of climate parameter (P), Effect (E), and Impact on community, service and environment (I) and vulnerable groups (V). Example: Reduced monsoon rainfall (P), reduced infiltration (E), impacted flow in the water supply system (I) to the whole community (V)

The community or group envisions 10 or 20 years ahead. They imagine what high adaptive capacity in their household and their community or in the water supply and sanitation system would look like. The community can prepare a time line on climate factors and impact events.

5.15 Surveillance of water related disease and correlation with climatologically data and regions

Nepal like other countries is experiencing public health impact caused by climate change. There is increasing trend of vector borne and water borne diseases in some part of the country. Vector-borne disease like Malaria, dengue, visceral leishmaniasis (kala-azar) rapidly expanding their geographical range including in mountain regions of the country and water borne disease like diarrhea and cholera outbreak are frequently increasing and with increasing trend of their incidences in many part of the country. The Percentage of children under age 5 with diarrhea in the last 2 weeks is reported 12% in the latest multiple indicator survey conducted by CBS. But it is difficult to relate existing and changing prevalence of such disease in absent of appropriate surveillance of disease and climatological data. Although, long-term studies are not found in Nepal, recent short term studies conducted by the Nepal Health Research Council (NHRC) indicated a significant relationship between climatic data and vector-borne diseases. The Health Management Information System (HMIS), as the Ministry's principal monitoring system, reports on utilization of health services. It disaggregates patient data by age, sex and by target groups at district hospitals and caste or ethnicity. Special surveys of health facilities and household surveys will always be needed to supplement the HMIS' routine facility-based data. Analysis of disease by climate factors will reveal the impact of climate change. In addition MoHP need to conduct special surveys in target or suspected areas. This will help develop adaptation to changing patterns of disease caused by climate or climate change. The MoHP can prepare risk maps of various types of the climate sensitive diseases using both observed and future climate change projections..

5.16 Assessment of the risk of health problems caused by climate change acting through the WASH pathway and strategy developed

WASH related diseases like water borne diseases; sanitation related diseases and vector borne diseases is responsive to the environment and climate conditions. WASH sector is affected by climate sector, which will impact on public health. The MoHP needs to prepare tools for assessment of risk of health problems caused by climate change through WASH pathways. Risk assessment tools need to be responsive to climate regions, the vulnerability of wash system and vulnerability of people in the places. Adaptation to climate change risk of health problems should be based on risk of present and future climate change scenarios.

There should be strategy for protecting health from climate change in Nepal is to empower and equip health system institutions, from the national to the local level, to protect population health from current and projected risks due to climate change. Increased awareness of health consequences of climate change, health systems strengthened to provide protection from climate-related risks. Decisions on climate change in other key sectors enhance public health.

6. Recommendations for policy update

5.1 General recommendations

Based on the review and current status recommendations have been made on following documents to incorporate climate change responsive WASH sector. Recommendations have not been made for the documents which has either been replaced by new ones or periodic documents which will not be continued.

SN	Documents	Recommendations
1.	<i>Soil and Water shade Conservation Act 1982</i>	<i>The Act is mainly for conservation of water shade area to protect flow and purity of water. The Act has not considered climate change prospective. The Act need to be revised in view of climate change prospective and with provision of priority of conservation for the water shade where water sources are used for the water supply</i>
2.	<i>Water Resource Act 1982</i>	<i>The Act is not aware of climate change. Hence, none of its provisions are guided by the climate change prospective. Act in its new version needs to direct for making projections of future climate factors caused by climate change and develop guidelines for climate resilient water supply and sanitation systems</i>
3.	<i>Drinking Water Regulations, 1998</i>	<i>Regulation is not aware of climate change. Hence, none of its provisions are guided by the climate change prospective. New version needs to direct for making projections of future climate factors caused by climate change and divide countries based on the degree and direction (+ve/-Ve) of changes. It needs to direct for assessing vulnerability of the water supply and sanitation system vulnerable people and take necessary action plan. It needs to direct to preserve and conserve water sources in view of local ecosystem based management and adaptation within defined zones. It needs to direct to adopt technologies with low energy systems for the water and sanitation and involve people at local level for the best use of resources and maximize benefits in the all situations. Regulations need to make provision for penalties for the violation of rules mainly in terms of protection and conservation of the catchment areas.</i>
4.	<i>National Adaptation Programme of Action (NAPA), 2010</i>	<i>NAPA is mainly for adaptation plan in six thematic areas. Water supply and sanitation has been addressed within TWG water resources and energy. There is no clear subgroup. In terms of programs water and sanitation get priority, but not implanted as CC resilient. Hence, NAPA in its new version needs to develop water and sanitation specific strategy for climate resilient and adaptation plan</i>
5.	<i>National Framework on Local Adaptation Plans of Action (LAPA), 2011</i>	<i>LAPA is mainly for the community based adaptation plan at the local level. LAPA needs integration of CC adaptation in the local developments. LAPA in its new version need to describe processes for integrating CC prospective in the water and sanitation system considering present sector positions and its linkages. LAPA guideline needs to provide all potential risk with respects to water and sanitation service systems and best adaptation plan.</i>
6.	<i>Climate Change Policy, 2011</i>	<i>Climate change policy was formulated after development of NAPA/LAPA. The CC policy has addressed general aspects of CC in the country. The policy does not cover all of the development sector. Policy in its revision needs to include all developments sectors, and coordination mechanism with them. Water and sanitation sector need to be addressed in the view of the potential impact on sources, system and uses and necessary adaptations.</i>
7.	<i>Design</i>	<i>Design guideline is mainly for guiding water supply and sanitation sector</i>

	<i>Guidelines for Water Supply System 2002 (12V)</i>	<i>agencies for developing system, design and management of the system with a focus on the key role of the users. The guideline is not aware of the CC issues and document is mostly silent. The guideline in its new version needs to incorporate CC prospective in the project development process and provide alternate technologies in the view of low energy system and resilient to climate change factors. Guideline need to define conservation and protection zones in the source areas and its process, develop the most adaptive design. Design need to consider longer term vision considering potential changes in water sources by the impact of climate change and its factors.</i>
8.	<i>Water Resource Strategy 2002</i>	<i>Water resource strategy mentioned environmental management very nicely. However, the strategy has not addressed strategies to address risk likely to be posed by climate change. Strategy needs to address climate risk on to water supply and sanitation with respects to water resources.</i>
9.	<i>Nepal Water Plan 2005</i>	<i>The Nepal water Plan focuses on providing water supply and sanitation to all people by 2017 and increasing service level in terms of increasing water quantity, quality and service hours. The plan does not assume any potential risk and necessary measures. Plan need to indicate the need of maintaining climate date linked to water supply and sanitation, give direction to preserve sources, plan for water need for longer term beyond current practice and economic use of water and carry out research for developing low energy technologies which is climate friendly.</i>
10.	<i>National Drinking Water Quality standard and directives, 2005</i>	<i>Standard focusses only of maintaining water quality. The directives do not assume potential risk posed by climate change on water quality. Directives need to give direction for preserving catchment areas in terms of protection and conservation zones. Need to define additional water safety hazards caused by climate change. Directives need to define ways and process for maintaining water qualities during disasters and emergencies with the support of local communities. Need to define the involvement of diverse group in the WSP team covering climate sensitive group. Need to analyze the vulnerability of water supply system mainly for water quality and vulnerable groups. Need to describe process for risk assessment and vulnerability assessment for climate change prospective. Directives need to indicate potential technologies and management process in the view of climate change risks in the various situations.</i>
11.	<i>Sanitation and Hygiene Master Plan of Nepal, 2011</i>	<i>The sanitation master plan is mainly for ODF community and clean village with the provision of sanitation facilities. The master plan indicated potential risk of climate change on sustainability of water supply and sanitary system. Master plan indicated need of source protection, promotion of water conserving sanitary facilities and mass awareness to adopt climate change at local level. This needs to be materialized through a guideline.</i>
12.	<i>MDG Acceleration Framework, 2012</i>	<i>To be addressed in the SHMP</i>
13.	<i>Periodic Plan (TYP 2013-16)</i>	<i>Periodic plan is mainly for implementing programs for the three year period. The Plan does not address potential risk or action required to do from cc prospective. Plan need to include strategies for knowledge management, operational research, data management, integrating CC prospective in the water sanitation program. Plan to update the projection of climate factors, monitor water sources used for water supply, collect climate scenario as case studies, pilot programs to develop climate resilient technologies, management</i>

		<i>systems and process tools.</i>
14.	<i>Water Supply, Sewerage and Sanitation Bill, 2014 (Draft)</i>	<p><i>The Act covers three aspects water, sewerage and sanitation. The Act is silent about potential risk of climate change. Act need add the following point appropriately to address climate change issues in the sector.</i></p> <ul style="list-style-type: none"> <i>• Demarcation of catchment conservation and source protection as integral part of water supply projects with the provision of penalty for violation</i> <i>• Longer-term (at least 50 years) for water supply for the intended community in view of climate change and development of community in view of water supply capacity.</i> <i>• Inclusion of risk assessment and adaptation plan as integral part of project development.</i> <i>• Plan for climate resilient water supply system, including water safety plan</i> <i>• Consideration of projected climate factors for the design of wastewater treatment and SW management system.</i> <i>• Selection of best adoptive technology and management system for water WW and sanitation with less energy consumption and least GHG emissions.</i> <i>• Plan for efficient water use and pollution reduction, waste reduction</i>
15.	<i>Water Supply and Sanitation Policy, 2014 (Draft0</i>	<p><i>This policy covers water and sanitation for both rural and urban contexts. Draft policy and strategy intends to protect the source area from pollution. Policy need to incorporate all water and sanitation policies to be climate resilient. Monitoring need to include monitoring for climate factor and climate impact assessment. Climate change aspect need to be incorporated in the overall planning, design and management of the water supply and sanitation systems. Policy need to develop CC strategy for the water sanitation sector.</i></p>
16.	<i>WASH Sector Development Plan, 2014 (Draft)</i>	<p><i>The WASH Development plan is in the outline stage. Plan has recognized DRR and CC as one of the strategic area of development. Under this them Plan need to incorporate following plan: Projection of climate factor relevant of WSS; Defining climate risk in the WSS system; Integration of CC prospective since planning stage of WSS development; Vulnerability assessment of climate change on source, system, operations and services and best adaptation measures; Selection of technological options with least energy, least GHG emissions and best adoptions.</i></p>
17.	<i>National Health Policy,2014</i>	<p><i>The policy aims to provide access to quality health services to all including environmental health. Policy indicated strategy to take leadership for the health impact of climate change through partnership. Policy needs to give the way to formulate detailed strategy and guideline to materialize the intent of the policy.</i></p>
18.	<i>NHSP II (2011-2015)</i>	<p><i>NHSP-II has added an environmental health (water, air quality, sanitation, hygiene, waste disposal) as one of the components of essential health services for piloting and scaling up with inter sector partnership. Action also includes establishing a knowledge network with academia and practitioners on climate change and a public health response team for climate change. But there is no institutional framework for implementing environmental health and climate change within MOHP. Health impact of climate change need to be incorporated in NHSP-III with supporting institutions.</i></p>

6.2. Specific recommendations

Government is formulating national Act, Policy and Sector Development Plan (SDP) for the WASH sector in parallel. Formulation process has been undertaken by Sector Efficiency Improvement Unit (SEIU) of MoUD. In the context, specific recommendations have been made for the three documents to add climate change prospective. Drafting team has agreed to include these points appropriately in the final version of the documents.

Water Supply, Sewerage and Sanitation Bill, 2014:

The Act is silent about potential risk of climate change. Act need add the following point appropriately to address climate change issues in the sector.

- ❖ Project implementer/service providers to define source conservation and protection zones as integral part of WSS system and WSP
- ❖ *Sector agencies and Users committee to monitor existing and potential sources regularly and reserve sources for long term need.*
- ❖ *Inclusion of risk assessment and community based adaptation plan as integral part of project development.*
- ❖ *Sector agency to develop a plan and a design guideline for climate resilient water supply system*
- ❖ *Sector to promote low energy and carbon technology and system*
- ❖ *Sector to develop strategy and guideline for climate resilient and community based adaptation plan.*

Water Supply and Sanitation Policy 2014

This policy covers water and sanitation for both rural and urban contexts. Draft policy and strategy intends to protect the source area from pollution. Water, sanitation and hygiene program need to review since the planning process in view of climate change prospective considering changing scenarios of climate, potential risk and best adoptive options in terms of technologies, management system. Policy need to incorporate all aspects that leads to climate resilient sector, including following points

- ❖ System for climate projection Will be developed and stratify country based on rainfall and temperature change pattern
- ❖ *Monitoring system for flow pattern of existing and potential sources will be developed.*
- ❖ *The Sector will adapt climate resilient water supply system based on risk assessment*
- ❖ *The guideline will be developed for local community based best adaptation practices.*
- ❖ *Catchment area will be conserved and protected to augment source capacity*
- ❖ *A low energy and carbon system will be encouraged*
- ❖ Climate change aspect in the overall planning, design and management of the water supply and sanitation systems will be incorporated

- ❖ Climate change strategy for the water, sanitation sector will be developed

WASH Sector Development Plan, 2014:

It was agreed to develop SDP in the second joint sector review. The plan targets to water supply and sanitation for all by 2017. Water supply is Safe, sufficient, accessible, acceptable and affordable. SDP will address diverse group. Service standard will be defined for both urban and rural. SDP will be developed based on the work of eight thematic groups during JSR II, which include Disaster Risk Assessment and Climate Change (DRR-CC) as one theme. The Sector Development Plan needs to include the following points in view of climate change. Currently SDP is in outline stage and consultation is going on.

- ❖ Projection of climate factor relevant to WSS
- ❖ Defining climate risk in the WSS system and people
- ❖ Integration of CC prospective since planning stage of WSS development
- ❖ Vulnerability assessment of climate change on source, system, operations and services and best adaptation measures
- ❖ Selection of technological options with less energy, least GHG emissions and best adoptions.
- ❖ Developing respective thematic group as guiding and review body from CC prospective.
- ❖ Make a plan for carrying key research on climate change and WASH, including that mentioned in this document.

NHSP-III 2016-20:

NHSP-II has added an environmental health (water, air quality, sanitation, hygiene, waste disposal) as one of the components of essential health services. Plan intends to establish a knowledge network with academia and practitioners on climate change and a public health response team for climate change. But there is no institutional framework for implementing environmental health and climate change within MOHP. Health impact of climate change needs to be continued in NHSP-III with supporting institutions. Following points are specifically recommended to incorporate in the NHSP-III which is under formulation.

- ❖ Plan for establishing environmental health units, including climate change and environmental health coordination committees, within MOHP. Unit can be strengthened utilizing resources scattered in various locations like management division (HCWM and urban health), EDCC (WQS), NHEICC (EH communication), Population division (Climate Change) etc. Unit can have various focal points: WQS, Sanitation, Vector control, Air qualities, Food Safety, Safe working place and climate change with overall theme of healthy community.
- ❖ Plan for preparing strategy and guideline for climate resilient health sector including water sanitation and vector control.
- ❖ Plan to generate more evidence utilizing capacity of NHRC for the decision making and promote local adaptive knowledge.
- ❖ Climate change aspects should be integrated into overall health system.
- ❖ Establish surveillance of diseases which can be impacted by climate change through WASH media.

7.0 Mechanism to implement review findings

Health and Climate Change policy document indicated that there is need of integrating climate change aspects of WASH policy and linking the WASH sector appropriately with both health and Climate Change sector. To materialize the update of policies and formulate climate change strategy and guideline for the WASH sector following mechanism and responsible agencies or team has been suggested.

SN	Mechanism	Responsibilities
1.	Write policy statements and strategic points in the umbrella policy for the WASH sector which is under formulation now	SEIU and policy drafting team
2.	Write clauses on what sector agencies and people need to do and what need not do in view of climate change Umbrella Act of WASH sector which is under formulation now.	SEIU and policy drafting team
3.	Address appropriately climate change aspects and give clear direction on how to integrate CC aspects on sector development plan which is under formulation now. Thematic area on DRR-CC is the appropriate section, to explain in detail	SEIU and SDP drafting team
4.	Incorporate climate change aspects in the health policy documents to develop system to protect public health from climate change.	MOHP/DWSS/CC division
5.	Incorporate climate change aspects in the climate change policy documents to address and coordinate WASH sector in view of climate change.	MoSTE/DWSS/CC division
6.	Incorporate or review from climate change prospective on design guidelines and NDWQS and directives which are expected to update shortly.	DWSS
7.	Develop National strategy for integrating climate change aspects in the WASH sector	MOUD/DWSS/TWG
8.	Develop guideline for climate resilient water supply and sanitation systems in line with the community based adaptation approach.	MOUD/DWSS/TWG
9.	Establish the environment and climate change division under lead department (DWSS) and develop a mechanism to link with related units in MOHP and MOEST and agencies at the regional and global level.	DWSS
10.	Develop ToR for CC units and gradually carry out gradually the tasks recommended in this document. The units also need to take leadership or coordinating role among agencies working in the WASH sector.	MOUD/DWSS/TWG
11.	Develop an annual report on status and plan for next year and short and long term in the future.	DWSS/CC division
12.	Organize national conference on climate resilient WASH sector on the annual basis in view of sensitizing the issues, gathering information and recognizing the best practices.	MoUD/DWSS CC division/TWG

In addition, MoUD need to coordinate with different ministries for updating policies from climate change prospective. Followings are specific recommended actions for inter-sectoral coordination.

SN	Ministries	Recommended actions
1	MOUD	Integrate climate prospective on national WASH policy, Act and SDP as suggested in this documents which is under formulation. Incorporate CC prospective on design guidelines and NDWQS when revised. Develop strategy and guideline for CR WASH sector
2	MOFALD	Revise <i>Local Infrastructure Development Policy, 1998</i> and incorporate climate change prospective on water supply and sanitation part in line with main policy of WASH sector and recommended strategy.
3	MOHP	Establish environmental health unit within MOHP to look after environmental health including WASH and CC. Develop strategy for climate resilient health sector including WASH. Incorporate climate prospective in its NHSP-III.
4	MOSTE	Establish WASH focal points in its institution, incorporate WASH focal area in NAPA. Incorporate WASH prospective in LAPA guideline.
5	WECS	Revise water resource strategy with climate change prospective, revise water resource act 1992 with CC prospective. Revise national water plan with CC prospective
6	MOFSC	Revise soil and water shed conservation act 1982 and incorporate CC prospective with priority for conservation for the water shed used of water supply by the communities.

8. Conclusion

Water Resource Act (1992), Water Supply Regulations (1998), Rural Water Supply Policy (2005), Urban Water Supply Policy (2009), Design Guidelines (2002), NDWQS and Directives (2005), Water Plan (2005) are the key working policy documents for the WASH sector of Nepal. Documents are felt outdated or insufficient or fragmented. Hence, WASH sector is developing umbrella Act, Policy and sector development plan in line with the decision of WASH sector JSR II 2014. Similarly, design guideline and NDWQS and Directives are also in the process of revision to meet the current need. There is some concern about environmental issues in each document, but none of the documents speak about climate change may be because climate change issues were highlighted after 2010 in national policies and programs. New Policies and Acts understand climate change issues, but have not addressed the issues properly. It is expected that new documents will address the climate change issues in its final version. Water sector in Nepal has been affected mainly in terms of drying up of the source; however, there is no proper investigation on to what extent the climate change factor has caused changes. The country needs to revise its Policy and Acts in line with the climate change WASH sector. Separate climate change strategy is required for the WASH sector and working guideline. Key action to be taken are understanding climate change, source monitoring, and source conservations and adapting best options for technology and systems in line with community based adaptation principles. The sector needs to have dedicated environment and climate change division in its lead department (DWSS) and coordinate with the respective division of the MoHP and MoSTE and related agencies globally for the update. MoHP needs to have dedicated units for environmental health with a focal person for climate change and Ministry of environment should have focal units or persons for WASH.

Annex A: Policy related document reviewed

WASH Documents

1. Sector Development Plan (Draft), 2014
2. National Water Supply and Sanitation Sector Policy (Draft), 2014
3. Water Supply and Sanitation and Sewerage Act (Draft), 2014
4. Periodic Plan (2013/14 - 2015/16)
5. Millennium Development Goal Acceleration Framework, 2012
6. Sanitation and Hygiene Master Plan (SHMP), 2011
7. Urban Water Supply and Sanitation Policy (UWSSP), 2009
8. National Drinking Water Quality Standard, 2005
9. National Water Plan, 2005
10. Rural Water Supply and Sanitation Policy (RWSSP), 2004
11. Local Infrastructure Development Policy, 2004
12. National Water Resource Policy, 2002
13. Water Supply Design Guidelines (12 volumes), 2002
14. Water Supply Regulation, 1993
15. Water Resource Act, 1992
16. Soil and Watershed Conservation Act 1982

Health Documents:

17. Nepal's Health Policy, 2014
18. Nepal Health Sector Plan (NHSP-II)

Climate Change Documents:

19. Local Adaptation Plan of Action (LAPA) Framework, 2012
20. Nepal's Climate Change Policy, 2011
21. Nepal's National Adaptation Programme of Action (NAPA), 2010

Climate Change Documents (Global):

22. IPCC Technical Paper IV on climate-change water energy
23. Local government perspective on adapting water management to climate change, IUCN
24. Summary for Policy Makers (SPM) of IPCC fifth assessment
25. Climate change, water resources and WASH, scoping study by British Geography Study

26. Criteria for review of relevant policies, strategies, plans and programs related to WASH, climate change and health, WHO HQ
27. A Review: Climate Change Impacts on WASH Sector, UNICEF Nepal 2013

Annex B: Strategic actions for CC resilient WASH

The sector needs to have its own strategy for climate resilient water and sanitation sector. The MoSTE in coordination with DWSS is in the process of developing a sector wide strategy plan. This section of the report helps developing such strategy and further guideline for implementation.

Background:

Nepal will be affected by climate change, especially from increasing atmospheric temperature, changes in the annual rainfall cycle, intense rainfall and longer droughts. These changes will have an impact on the quality and availability of water supply and its systems and processes including sanitation. A national effort to make the country climate resilient has been challenged due to the lack of knowledge, scientific data and information related to the science of climate change and likely impact of climate change and vulnerable group. Climate change policy has been formulated mainly to promote climate adoption mitigation and to be resource management towards climate friendly. National Adaptation Programme of Action (NAPA) has been prepared as strategic tools to assess climate vulnerability and systemic responses by climate change adaptation measures. The LAPA Framework ensures that the process of integrating climate adaptation and resilience into local and national planning. Policy intends to form sector wide working group and integrate climate change policy in the sector policies. Review of existing policies, strategies, plans indicated that documents are silent on climate change aspects. Policies and strategic documents are in need of revision in line with climate resilient Water and Sanitation sector. This is general strategies for the climate resilient water and sanitation sector.

Vision

Water, sanitation has been identified as one of the most vulnerable sectors to climate change. There is links between both natural and anthropogenically induced climate change, its impacts, and adaptation and mitigation response options. In this context ***climate resilient water and sanitation system*** for future generation is the vision of the country.

Policies

Water, sanitation and hygiene program will be reviewed since the planning process in view of climate change prospective considering changing scenarios of climate, potential risk and best adoptive options in terms of technologies, management system.

Strategies

Climate change projections: Climate change will have an impact on climate parameters like rainfall patterns and temperatures, which have linkages with catchment infiltration flow in the sources and biochemical process in the water treatment, waste water treatment and solid waste decomposition process. Hence, climate value will be observed and projected at the various climatic regions and country will be divided into various climate change zones in terms of rainfall and temperature scenario.

Source monitoring, conservation and ecosystem management: In addition to seasonal variations flow conditions of the sources can change permanently due to climate change can cause a permanent change in the flow conditions. The sector will make an inventory of existing and potential sources and continuously monitor flow and level in the sources to understand the impact of climate change. All sources will have conservation and projection zones and local community will develop the catchment

areas as ecosystem management. Community need to identify all of the water sources and make prepare water use plan in view of long term need for water supply and sanitation.

Low energy and low carbon technologies: Different technologies will have different energy requirement for operations and carbon emission (direct or equivalent) potentialities. In view of minimizing carbon missions one of the criteria of project design will be energy and carbon efficient and such technologies will be encouraged to apply.

Climate risk assessment of water supply and sanitation systems and adaptation: Climate change can pose various degrees of risk on water supply and sanitation system. Climate risk can be expressed in terms of multiplication of (X) Likelihood of actual happenings of hazards caused by climate change (Y) Likelihood of impact of hazards on functioning of water supply and sanitation system and (Z) severity of impacts of hazards in terms of population affected. The best adaptation plan will be developed in view of climate risk and vulnerability of the community. Community based adaptation plan will be adopted.

Community based local adaptation plan: The sector will ensure integration and implementation of climate adaptation and resilience actions into sectoral plans, program and project, and ensure people, community and their resources are adapting to climate change. People will be sensitized using various tools. Water users and sanitation committees and V-WASH CC are the central point to take over the LAPA process for the WASH sector at local level.

Economic use of water and water demand management: Fresh water is the precious economic resources. Future water demand is likely to increase due to increased populations and increased water based activities, whereas the impact of climate changes is likely to reduce the capacity of existing water sources in many parts of the country. This will result water stress. The sector will develop the ways to efficient use of water and promote consumer education and promote reuse of water.

Plan for equitable distribution of WASH facilities: Sector will assess the vulnerability of diverse group in the society and address by best adaptation in involving capacity of the diverse groups.

Assessment of the risk of health problems caused by climate change: The sector will assess the risk of health problems caused by climate change acting through the WASH pathway and develop appropriate measures. The Ministry of Health will develop surveillance of waterborne disease and correlation with climatological data and regions.

Nepal like other countries is experiencing public health impact caused by climate change. There is increasing trend of vector borne and waterborne diseases in some part of the country. Climate related disease like Malaria, dengue, kala-azar and water borne disease like diarrhea are found in many parts of the country that were not found before. But it is difficult to relate existing and changing prevalence of such disease in the absence of appropriate surveillance of disease and climatological data. Adaptation to climate change risk of health problems should be based risk of present and future climate change.

Institutions: Sector ministry or lead department will have visible units for dealing with climate change prospective of the WASH sector. The unit will be named as “Environment and Climate Change”. This unit will undertake all actions to integrate climate change prospective on water, sanitation and hygiene activities and make the sector climate resilient. This unit will review policy, plan, program, directives used in the sector from CC prospective, carry out research, develop a process for risk assessment and vulnerability analysis and develop technologies and management system for the climate resilient systems at local level. This unit will coordinate with respective focal points of the ministry of

Environments and make technical linkages with agencies dealing with climate change and water in the regional and global level up update the information.

Strategic actions:

For the climate resilient WASH system the sector needs to take strategic actions in the following area:

1. Prepare climate zones for rainfall and temperate projections based on current trend and best climate model.
2. Develop a system for monitoring flow of surface waters and the level of ground waters which are potentials for future use and reserve sufficient water sources for every community (VDC) and town for 50 years considering the multiple use of water sources.
3. Develop concept and working guidelines for protection and conservation zones for existing future sources and take it as an essential part of the water safety plan
4. Categories all technologies and systems used for water supply and sanitations in terms of energy, carbon emissions.
5. Develop guideline climate risk assessment, best adaptation plans for water supply and sanitation system in the community context (VDC) for vulnerability assessment in line with LAPA.
6. Initiate research action research for information gap for climate resilient WASH sector.
7. Establish or strengthen the environment and climate change units under DWSS and develop a business plan.

Annex C: Guideline for climate resilient water safety plan

Nepal will be affected by climate change, especially from increasing atmospheric temperature, changes in the annual rainfall cycle, intense rainfall and longer droughts. These changes will have an impact on the quality and availability of water supply and its systems and processes. There are many cases that water sources are drying mainly small sources. Potential impact of climate change on rainfall and temperature is not uniform over the country.

The delivery of the safe drinking water is vital for protecting public health. Concept of safe water is guided by health based targets and overseen through drinking water supply surveillance system. Water Safety Plan (WSP) will be applied for continuous safety of drinking water by meeting physical, chemical and biological parameters set by the country. The most effective means of continuous safety of the drinking water tends to prevent contamination at the source, remove or reduce contamination during the treatment process and prevent re-contamination during storage, distribution and handling of the drinking water and maintain at home. WSP is based on risk management through principle of hazard analysis and control measures. It applies a multiple barrier approach from catchment to consumer. Participation of diverse users is vital for its success. Active management team and well managed system is a precondition for effective application of WSP.

Climate change can pose various degrees of risk on water supply systems. Climate risk can be expressed in terms of multiplication of (X) Likely hood of actual happenings of hazards caused by climate change (Y) Likely hood of impact of hazards on functioning of water supply system and (Z) severity of impacts of hazards in terms of population affected. The impact can be realized in various ways.

A working guideline is required for climate resilient WSP which address both quality and availability of the water. Basic tasks for climate resilient water safety plan

1. Identify catchment area of the source used for water supply system in view of climate change.
2. The separate catchment area is to three zones intake zones (near intake points to avoid access), protection zones (to avoid pollutions), conservation zones to conserve and plantation.
3. Install arrangement for measuring total flow in the source and water used in the system and measure on a monthly basis.
4. Construct intake area so that water is efficiently flown in the system and local pollution is completely avoided (Intake construction, fencing, surface drain)
5. Form source conservation team.
6. Make sure that water is safe at source if it is unavoidable during rainy season use chlorine.
7. Identify all hazards also in view of CC factors: below source at distribution systems and control properly
8. Identify all hazards at HH levels in terms of use practices and sanitary behaviors of the people and develop appropriate behavior change campaign
9. Conduct regular monitoring at system and HH level by a trained team for control of hazards
10. Test water quality at source, taps and HH on monthly basis
11. Record rainfall in the catchment area and relate to source flow
12. Improve infiltration capacity of the catchment area and measure increased flow with respects to rainfall.

Annex D: Key points from Climate change documents

This annex includes key points from the three documents related to climate change at national and international level: NAPA, LAPA and IPCC-IV

D1. Climate Change and Water: IPCC technical report IV

Water has been identified as one of the most vulnerable sectors to climate change, and the IPCC has produced a technical paper on water and climate change. Main objective of the paper is to improve our understanding of the links between both natural and anthropogenically induced climate change, its impacts, and adaptation and mitigation response options, on the one hand, and water-related issues, on the other; to inform policymakers and stakeholders about the implications of climate change and climate change response options for water resources, as well as the implications for water resources of various climate change scenarios and climate change response options, including associated synergies and trade-offs.

Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems.

Observed warming over several decades has been linked to changes in the large-scale hydrological cycle, such as: increasing atmospheric water vapor content; changing precipitation patterns, intensity and extremes; reduced snow cover and widespread melting of ice; and changes in soil moisture and runoff

Climate model simulations for the 21st century are consistent in projecting precipitation increases in high latitudes (very likely) and parts of the tropics, and decreases in some subtropical and lower mid-latitude regions and water availability are projected to increase as a result of climate change at high latitudes and in some wet tropical areas, and decrease over some dry regions at mid-latitudes and in the dry tropics.

Increased precipitation intensity and variability are, projected to increase the risks of flooding and drought in many areas.

Water supplies stored in glaciers and snow covers are projected to decline in the course of the century, thus reducing water availability during warm and dry periods.

Higher water temperatures and changes in extremes, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution.

- ❖ Globally, the negative impacts of future climate change on freshwater systems are expected to outweigh the benefits (high confidence). By the 2050s, the area of land subject to increasing water stress due to climate change is projected to be more than double that with decreasing water stress.
- ❖ Climate change affects the function and operation of existing water infrastructure, including hydropower, structural flood defenses, and drainage and irrigation systems – as well as water management practices
- ❖ Current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability
- ❖ Climate change challenges the traditional assumption that past hydrological experience provides a good guide to future conditions. The consequences of climate change may alter the reliability of current water management systems and water-related infrastructure

- ❖ Adaptation options designed to ensure water supply during average and drought conditions require integrated demand-side as well as supply-side strategies
- ❖ Mitigation measures can reduce the magnitude of the impacts of global warming on water resources, in turn reducing adaptation needs. However, they can have considerable negative side effects, such as increased water requirements for the reforestation activities or bio-energy crops, if projects are not well located
- ❖ Water resources management clearly impacts on many other policy areas, e.g., energy, health, food security and nature conservation.
- ❖ Several gaps in knowledge exist in terms of observations and research needs related to climate change and water. Observational data and data access are prerequisites for adaptive management,

Climate change poses a major conceptual challenge to water managers, water resource users (e.g., in agriculture) as well as to policy makers in general, as it is no longer appropriate to assume that past climatic and hydrological conditions will continue into the future. Water resources management clearly impacts on many other policy areas (e.g., energy, health, food security, nature conservation). Thus, the appraisal of adaptation and mitigation options needs to be conducted across multiple water-dependent sectors.

Climate-change-induced effects on water pose a threat to human health through changes in water quality and availability. Although access to water supplies and sanitation is determined primarily by non-climate factors, in some populations, climate change is expected to exacerbate problems of access at the household level. Appropriate disaster planning and preparedness need to be developed in order to address the increased risk of flooding due to climate change and to reduce impacts on health and health systems.

Low-income countries and regions are expected to remain vulnerable over the medium term, with fewer options than high income countries for adapting to climate change. Therefore, adaptation strategies should be designed in the context of development, environment and health policies. Many of the options that can be used to reduce future vulnerability are of value in adapting to current climate and can be used to achieve other environmental and social objectives.

There is abundant evidence from observational records and climate projections that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change. Better observational data and data access are necessary to improve understanding of ongoing changes, to better constrain model projections, and are a prerequisite for adaptive management required under different scenarios of climate change.

D2. LAPA Guideline

The National Framework for Local Adaptation Plans of Action (LAPA Framework) aims to integrate climate change resilience into local-to-national development planning processes and outcomes. The VDC and the Municipality have been identified as the most appropriate unit for integrating climate change resilience into local-to-national development planning processes and outcomes

The LAPA Framework will support decision-makers from local-to-national level in following ways.

- a) Identify the most climate vulnerable VDC's, wards and people and their adaptation outcomes and actions.

- b) Prioritize adaptation actions in easy ways whereby local people make the prioritization decisions.
- c) Prepare and Integrate local adaptation plans for action into local-to-national planning in accordance with the Local Self Governance Act.
- d) Identify appropriate service delivery agents and channels for funding to implement local adaptation plans for action. The LAPA Framework can thus ensure that the best sequence of adaptation actions is carried out by the most appropriate service providers in a timely and resource efficient manner.
- e) Assess the progress of LAPA to ensure effective planning and delivery.
- f) Provide cost-effective options for scaling out local-to-national adaptation planning.
- g) Provide the understanding of how gender and social exclusion exacerbates the impact on women and excluded groups and provides information that support decision makers to make gender sensitive and inclusive processes in all stages of adaptation interventions.

The steps involved in preparing and implementing local adaptation plans for action are:

1. Climate change sensitization
2. Climate vulnerability and adaptation assessment
3. Prioritization of adaptation options
4. Developing Local Adaptation Plans of Action
5. Integrating Local Adaptation Plans for Action into planning processes
6. Implementing Local Adaptation Plans of Action
7. Assessing progress of Local Adaptation Plans of Action

LAPA has developed various tools to facilitate these steps.

Envisioning climate change scenario, Climate hazard risk assessment, Community based vulnerability assessment and adaptive actions. Climatic hazards trend analysis (Hazard, impact and responses)

Definitions:

Adaptation: Adjustment in natural or human systems in response to actual or expected climatic variability and its impact

Adaptive Capacity: The ability of a system to adjust to climate change

Resilience: A way of functioning of system under changing climate.

Vulnerability: Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change

Vulnerability Assessment: Process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system.

Vulnerability= likely hood x severity/adaptive capacity

Risk assessment: Multiplication of the likely hood of actual happening x severity of impact of hazard x risk of impact happening. Because of climate change, hazard events (X) might happen impacting service system (Y) with severity (Z)

Because of climate change, changing rainfall pattern might dries up the source (X) causing insufficient flow for water supply (Y) for many people (Z)

Because of climate change, loss of vegetations might reduce infiltration to catchment areas (X) causing insufficient flow for water supply (Y) for many people (Z)

Because of climate change, changing flood pattern (X) may cause pollution of sources (Y) impacting drinking water quality for many people (Z)

Exploring possible changes in climate in the future and impact scenario: Scenario of climate parameter (P), Effect (E), Impact on community (I) (service and environment) and vulnerable (V)

Example: Reduced monsoon rainfall (P), reduced infiltration (E), impacted flow in the water supply system (I) to the whole community (V)

Creating vision: Having used other tools to understand climate change impacts, local vulnerability and adaptation response mechanisms, the community or group envisions 10 or 20 years ahead. They imagine what high adaptive capacity in their household and their community would look like. The facilitator helps them envisage beyond daily constraints to a positive state of being able to adapt and thrive in the face of climate change impacts. The community can prepare a time line on climate factors and impact events.

D3. NAPA 2010

Government of Nepal has prepared the NAPA 2010 through a consultative process. NAPA is a strategic tool to assess climate vulnerability, and systematically respond to climate change adaptation issue by developing appropriate adaptation measure. NAPA document has been summarized into six thematic groups: Agriculture and food; Climate induced disasters; Urban settlement and infrastructures; Public health; Forest and diversity; and Water resources and energy

Climate of Nepal is influenced by Himalayan mountain range and South Asian monsoon. Average rainfall is 1800mm. A monsoon rain decreases from west to east and winter rain decrease from north-west to southeast. Highest rainfall occurs in central and mid hill around Pokhara and east of Kathmandu. Temperature decreases from South to North with a rise in altitudes. There are four seasons: Pre monsoon (Mar-May), monsoon (Jun-Aug), post monsoon (Sep-Nov) and winter (Dec-Feb). Winter is coldest, with the highest temperature during pre monsoon.

Data indicated that the observed warming trend is not uniform across the country. Warming is more pronounced in the high altitude regions compared to the Terai and Siwalik regions. Rise in the maximum temperature 0.04-0.06 °C/year.

Pre monsoon precipitation: Declining in far and mid western region with few pockets of Western, Center and eastern regions. In the rest of the country, it is increasing.

Monsoon precipitation is declining in Mid-Western and southern part of the western region with few pockets of center and eastern regions and increasing in the rest of the country.

Post monsoon: Increasing in most part of Mid-Western and southern part of Eastern, Center and western regions. Declining in the Far-Western and the north part of the Western, Center and Eastern regions.

Winter monsoon: Overall, increasing except the northern part of the Mid-Western, Center and Western regions.

Himalayan glacier outbreaks and retreat has been documented and monitored.

Projections:

Temperatures: General circulation model (SRES B2) projects mean annual temperature increase: 1.2°C by 2030, 1.7°C by 2050 and 3°C by 2100. Regional model projects: 1.4°C by 2030, 2.8°C by 2060 and 4.7°C by 2090. The projection shows higher temperature increments during winter as compared to the monsoon seasons. Higher temperatures are projected in western and center Nepal as compared to eastern Nepal.

Precipitation: precipitation projection shows no change in western Nepal and up to 5-10% increase in eastern Nepal during winter. During summer seasons precipitations are projected to be increased by 15-20% in the whole Nepal

Vulnerability analysis and work of TWG came out with a long list of adoption options under each theme. Prioritization exercise was done for inclusion in the NAPA. Among nine areas of project profile one is empowering vulnerable communities through sustainable management of water resources with high priority for drinking water and sanitation.

Vulnerability assessment: Assessment was carried by overlaying climate risk/exposure map, climate sensitivity map and adoptive capacity map in line with IPCC framework. According to district wise analysis districts have been grouped as Very High, High, moderate, low and very low ranking.

Impacts: Too much and too little water, which affect on water supply and sanitation. Climate induced disasters affect sanitation.